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PROMOTING INDIVIDUAL ADAPTATION TO EXTREME HEAT WEATHER
EVENTS: THE ROLE OF AFFECTIVE AND SOCIO-COGNITIVE FACTORS IN
SITUATIONAL APPRAISALS OF CHALLENGE OR THREAT

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To my family, those who are with us
and those that stay in our heart and live forever in our thoughts

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Demands and Resources; Threat and Stress; Adaptation and Resilience; Heat Waves

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2300 Human Experimental Psychology

 2360 Motivation & Emotion

3000 Social Psychology

 3040 Social Perception & Cognition

3300 Health & Mental Health Treatment & Prevention

 3365 Promotion & Maintenance of Health & Wellness

4000 Engineering & Environmental Psychology

 4070 Environmental Issues & Attitudes

RESUMO

Eventos climatéricos de calor extremo, como as ondas de calor, representam uma preocupação crescente para agências e autoridades de saúde, principalmente devido aos impactos destes eventos na saúde e bem-estar. Num cenário de alterações climáticas, espera-se que as ondas de calor se tornem mais frequentes, intensas, e duradouras, com maior probabilidade de ocorrência de crises de saúde pública. Para promover intenções e comportamentos de proteção face ao calor, e facilitar a resposta institucional, é necessário um melhor entendimento sobre o modo como as pessoas percebem esses eventos.

Neste contexto, a presente Tese de Doutoramento teve como objetivo explorar e compreender melhor as percepções de exigências face a ondas de calor e recursos para lidar com estas, os efeitos que fatores cognitivos, afetivos, e sociodemográficos têm nessas percepções, e o seu efeito combinado nas intenções de proteção face ao calor.

Após uma Introdução no Capítulo I, no Capítulo II reportamos o desenvolvimento de uma abordagem baseada na teoria e na evidência científica para recolher e codificar expressões relativas à percepção de exigências e recursos face a ondas de calor, permitindo identificar essas percepções, e conceções enviesadas das mesmas. Este trabalho permitiu ainda criar escalas de exigências e recursos percebidos usadas nos estudos seguintes.

No Capítulo III reportamos os efeitos que diferentes pistas emocionais (i.e., pensar sobre eventos climatéricos de calor extremo com pista emocional positiva, negativa, ou sem pista) tiveram nas: 1) estimativas de temperatura e agradabilidade; 2) intenções de proteção face ao calor; 3) avaliações de recursos e exigências face a ondas de calor; e 4) descrições – número – associadas a percepções de exigências e recursos. Isto permitiu ainda compreender se resultados obtidos em estudos no Reino Unido seriam replicados em Portugal.

No Capítulo IV reportamos a identificação de preditores cognitivos (e.g., percepção de risco face ao calor), afetivos (e.g., afeto positivo), e sociodemográficos das percepções de exigências e recursos, bem como o seu efeito combinado nas intenções de proteção face ao calor durante uma onda de calor em Portugal. Isto permitiu propor um modelo de análise de trajetórias baseado na teoria, ilustrativo das interligações entre fatores.

No Capítulo V reportamos a identificação de variações sazonais nas percepções de exigências e recursos face a ondas de calor em localizações geográficas de Portugal com diferentes níveis de suscetibilidade à ocorrência desses eventos, bem como de preditores dessa variação. A relação entre exigências e recursos percebidos foi usada como um indicador do sentimento de ameaça e stress face a ondas de calor.

No geral, este trabalho permitiu um melhor entendimento das percepções de exigências e recursos face a ondas de calor, enquanto indicador de ameaça e stress, ao longo do tempo e em diferentes localizações geográficas de Portugal. Este representa assim um primeiro passo para a criação e implementação de uma abordagem integrada para monitorizar percepções de exigências e recursos ao nível individual e social, ao longo do tempo e em diferentes contextos. Isto pode ter impactos práticos e teóricos relevantes, para que eventos futuros possam ser avaliados mais como um desafio.

ABSTRACT

Extreme hot weather events such as heat waves have been an increasingly growing concern for health agencies and authorities over the last years, mainly due to its severe impacts on human health and wellbeing. In a scenario of climate change, heat waves are expected to become more frequent, intense, and long lasting, with greater probability of public health crisis emerging as result of changing environmental factors. As such, better understanding of how people perceive these events is needed to promote protection intentions and behaviours and facilitate current and future institutional responses.

In this context, the current Doctoral Thesis aimed to explore and better understand the perceived demands associated with heat waves and the perceived resources to cope with these, the effects that cognitive, affective, and sociodemographic factors have on such perceptions, and their combined effects on heat protection intentions.

After an Introduction in Chapter I, in Chapter II, we report the development of a theory-driven framework to collect and code expressions of demands and resources perceptions in the context of heat waves, allowing the identification of these perceptions, as well as potential misconceptions held by participants in Portugal, a country highly susceptible heat waves occurrence. This work allowed creating demands and resources perceptions scales used in subsequent studies.

In Chapter III, we report the effects that emotional prompts (i.e., thinking about extreme hot weather events with a positive emotion prompt, negative emotion prompt, or without an emotion prompt) had on: 1) temperature estimates and perception of pleasantness associated with extreme hot weather events; 2) heat wave protection intentions; 3) extreme hot weather events demands and resources appraisals; and 4) the number of verbal descriptions of demands and resources perceptions made by the participants. This further enabled understanding if the results obtained in studies in the United Kingdom would replicate in Portugal.

In Chapter IV, we report the identification of cognitive (e.g., heat wave risk perception), affective (e.g., positive affect about heat), and sociodemographic predictors of demands and resources perceptions and their combined effects on heat protection intentions during a heat wave in Portugal. In doing so, we propose a broader theory-driven path analysis model further illustrating the interconnections between factors.

In Chapter V, we report the identification of seasonal variations in heat wave demands and resources perceptions, across different heat wave geographical susceptibility locations of Portugal, as an indicator of heat wave feelings of threat and stress, as well as predictors of such variation.

Overall, this work enabled better understanding of perceived demands and available coping resources, as indicators of threat and stress, associated with extreme hot weather events such as heat waves, over time and across different geographical susceptibility locations in Portugal. Moreover, it provided a first step at creating and implementing an integrated approach for monitoring demands and resources perceptions at the individual and social levels, and across different contexts. This may have relevant impacts for theory and practice, so that future events can be appraised more as a challenge.

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Chapter I

Introduction and Overview

The Threat of Climate Change and the Challenge of Heat Waves

In May 2018 at the R20 Austrian World Summit, a long-term global gathering that brings together key stakeholders to promote and facilitate the implementation of the Sustainable Development Goals and help meet the Paris Agreement objectives (R20 Austrian World Summit [R20AWS], 2018), the United Nations Secretary-General António Guterres declared that “climate change is, quite simply, an existential threat for most life on the planet – including, and especially, the life of humankind; that is why we must use all our resources to build a sense of urgency” (Guterres, 2018). These words highlighted the emergence of a climate crisis, where the demands posed by climate change start to outweigh the available resources to mitigate, cope with, and build resilience to the impacts of climate change on human life, health, and wellbeing (Gaspar & Godinho, 2022; Ripple et al., 2020). This was a vision already shared by science (e.g., Ahmed & Wei, 2010; Clayton et al., 2015, 2014; Reser & Swim, 2011; Santos, 2006; Spence et al., 2009, 2012; Swim et al., 2009, 2011b), and relevant global institutions (e.g., Intergovernmental Panel on Climate Change [IPCC], 2014, 2022; World Economic Forum [WEF], 2017; World Health Organization [WHO], 2020). In that regard, demands can be defined as conditions, added pressures or constraints posed by a given situation at the individual or social level, whereas resources can be defined as individual and social assets or strengths that are available and are used by individuals or groups of individuals (e.g., organizations) to help them in responding and coping with the situational conditions and its added pressures or constraints (American Psychological Association [APA], 2022; Blascovich & Mendes, 2000, 2010; Domingos et al., 2020; Swim et al., 2009).

The mobilization of resources urged by the United Nations Secretary-General António Guterres requires collaborative responses from governments, businesses, industries, citizens, and academics, implying a mobilization of formal, physical, natural, and social sciences to promote co-produced knowledge (i.e., context driven, problem-focused, participatory and transdisciplinary research joining academic and non-academic actors) about climate change (Norström et al., 2020). This includes gaining better understanding about geophysical and meteorological impacts (e.g., heat waves; heat stress; wildfires; droughts; cold spells; storms; flooding; rising sea level; landscape change) on human systems (e.g., urban and rural infrastructure; transportation networks; energy infrastructure; economy and services; food security and crop production), and their combined impacts on human health and wellbeing (e.g., mental, psychological, physical, and community). Doing so requires assessing psychological

processes such as related social perceptions, intentions, motivations, emotions, and behaviours in face of such impacts (Clayton et al., 2015, 2014; Swim et al., 2009, 2011a, 2011b).

In line with the concept of systemic risks (Renn, 2021), this implies that climate systems and human systems now interact in new and often unpredictable ways, magnifying old problems, and creating new ones (Domingos et al., 2018). For example, not only extreme weather events are expected to become more frequent, intense, and long lasting as result of climate change (e.g., Clayton et al., 2015; Corner et al., 2017; IPCC, 2014, 2022; Steentjes et al., 2017), but there is also a greater probability for the emergence of future public health crisis (physical and mental), disease outbreaks, epidemics, or even pandemics as result of changing environmental factors (Clayton et al., 2014, 2021; IPCC, 2014, 2022; Swim et al., 2009; WHO, 2015, 2020). Moreover, research suggests that this probability of future public health crisis, particularly mental health related, can be greater than what was initially estimated. For example, Hickman et al. (2021) recently conducted a large-scale global study involving 10,000 participants, with ages between 16 to 25 years old, living in 10 countries (including Portugal). In their study, they found that more than half of the participants (60%) reported that they felt “very” or “extremely” worried about climate change, and nearly half of the participants (45%) reported that these feelings about climate change negatively affected aspects of their daily lives, such as sleeping, socializing, school, and work, which can be a source of additional distress that leads to mental health problems such as anxiety and depression (Hickman et al., 2021).

Given the complexity of climate change and its geophysical and meteorological impacts, this requires that related perceptions, intentions, motivations, emotions, and behaviours are analysed not only in relation to climate change as a whole or as a single (un)consensual phenomenon (e.g., Bertoldo et al., 2019; Capstick & Pidgeon, 2014; Capstick et al., 2015; Devine-Wright & Batel, 2017; Lorenzoni & Pidgeon, 2006; Pidgeon, 2012a, 2012b; Poortinga et al., 2019; Steentjes et al., 2020, 2017; van Valkengoed & Steg, 2019a), but also in relation to the different geophysical and meteorological phenomenon’s (i.e., extreme weather events) that are expected to become more frequent, intense, and long lasting as result of climate change, such as heat waves, droughts, wildfires, cold spells, storms, and floodings (e.g., Clayton et al., 2015, 2014, 2021; Corner et al., 2017; IPCC, 2014, 2022; Steentjes et al., 2017). For example, more than just focusing all the resources on the scientific consensus, length, breadth, and depth of climate change, it is also important to focus resources on understanding and finding solutions to tackle the impacts and consequences that most directly and visibly impact people’s livelihoods (Clayton et al., 2014, 2021; Corner et al., 2017; Kause et al., 2021; Steentjes et al.,

2017). This should be done before, rather than after, the demands outweigh the resources, and continued distress turns into anxiety and depression.

The prospect of climate change may seem psychologically distant for some, but its specific impacts and consequences in the form of experienced extreme weather events, injuries, diseases, and infrastructure loss often are not (Ballard & Lewandowsky, 2015; Clayton et al., 2014, 2021; Corner et al., 2017; Demski et al., 2017; Dutt & Gonzales, 2012; Howe et al., 2014; Jones et al., 2017; Løhre, 2018; Spence et al., 2011, 2012; Steentjes et al., 2017; Swim et al., 2009). As noted by Clayton et al. (2021, p. 23), “to avoid polarization, discussions of actions that benefit individual and community health can focus on specific impacts such as flooding or heat waves, they do not have to center on climate change”.

Extreme hot weather events, such as heat waves, are among the weather extremes that are expected to become more frequent, intense, and long lasting as result of climate change, and are considered to be one of the most dangerous natural environmental hazards for humans (Clayton et al., 2015, 2021; Fischer & Schär, 2010; Hajat et al., 2014; Howe et al., 2019; IPCC, 2014, 2022; Lefevre et al., 2015; Luber & McGeehin, 2008; Meehl & Tebaldi, 2004; Mora et al., 2017; Santos 2006; Steentjes et al., 2017; WEF, 2017; WHO, 2015). Although heat wave definitions may vary across countries, according to the World Meteorological Organization (WMO, 2001) these events can be defined as a period of six or more consecutive days with maximum daily temperatures 5°C above the average value for the reference period. Yet, and as noted by Instituto Português do Mar e da Atmosfera (IPMA, 2022), this definition is more related with the study of climatic variability than with the impacts that extreme temperatures may have on public health, which can happen in shorter time periods if maximum daily temperatures are higher (e.g., three consecutive days with maximum daily temperatures 10°C above the average value for the reference period may have greater impact on health). Heat waves lack the visual and immediate impacts of other natural environmental hazards such as tropical cyclones, flash floods, or landslides, and as such rarely receive adequate attention (WHO, 2015). Yet, these events can result in short- and long-term negative effects on health and wellbeing, affecting not only particularly vulnerable groups (e.g., elderly; children; people with comorbidities; people in risk of poverty or homeless; people with substance-use disorders) but also the active adult population (Agüero, 2014; Charlson et al., 2021; Gasparrini & Armstrong, 2011; Hajat et al., 2014; Kaltsatou et al., 2018; Kovats & Hajat, 2008; Laurent, 2021; Laurent et al., 2018; Liu et al., 2021; Ma et al., 2015; Wang et al., 2020; Yu et al., 2012). Heat waves direct negative effects on health and wellbeing can range from ‘minor symptoms’

such as headache, nausea, malaise, sweating, weakness, experience of negative emotions, impaired cognition, and loss of productivity, to severe complications such as heat stress, heat exhaustion, heatstroke, dehydration, anxiety, depression, and even death (Bouchama & Knochel, 2002; Clayton et al., 2021; Gasparrini & Armstrong, 2011; Glazer, 2005; Hajat et al., 2010, 2014; Hancock & Vasmatazidis, 2003; Hass et al., 2021; Kjellstrom et al., 2016; Laurent, 2021; Liu et al., 2021; Luber & McGeehin, 2008; McGregor et al., 2007; Oray et al., 2018; Thompson et al., 2018). Besides direct effects, heat waves have also indirect effects on health and wellbeing, not only due to lagged effects (Gasparrini & Armstrong, 2011) but also due to the increased risk of collapse of health emergency response systems, increased community disruption and social instability, increased violence and crime (including interpersonal aggression and domestic abuse), and disrupted sense of continuity and belonging due to the experience of such negative impacts (Baron & Bell, 1975; Bose-O'Reilly et al., 2021; Clayton et al., 2015, 2014, 2021; Cohn, 1990; Cruz et al., 2020; Laurent, 2021; McGregor et al., 2007; Oray et al., 2018; Suh et al., 2021; Swim et al., 2011b). In that regard, recent studies further showed that higher temperatures were associated with increased risk of suicide and mental health related hospital admissions (Thompson et al., 2018), and that for each degree of increase in temperature the risk of mental health related mortality and morbidity also increased (Liu et al., 2021). Moreover, worry and stress arising from the lack of resources to cope with extreme hot weather demands can compromise mental health, which has been shown to be an important facilitator of protective behaviour decisions during weather extremes (Clayton et al., 2021; Hickman et al., 2021; Swim et al., 2009; Wong-Parodi & Feygina, 2018). This further increases the potential negative effects of heat waves on health and wellbeing, highlighting the need to provide people with the resources they are still needing or missing to effectively cope with heat wave demands.

There is evidence that people can reduce their susceptibility and vulnerability to heat wave related demands and adapt over time when they perceive the risk and the necessary resources to act (Arbuthnott et al., 2016; Howe et al., 2019; Luber & McGeehin, 2008). For example, when they see the situation more as a challenge by perceiving not only demands but also sufficient resources to cope with such demands. Yet, research also suggests that more frequent and intense exposure to extreme heat, especially when coupled with other factors such as age or belonging to a risk group, can deplete individuals physical, psychological, and social resources (Arbuthnott & Hajat, 2017; Hajat et al., 2014; Hancock & Vasmatazidis, 2003; Kovats & Hajat, 2008). As we have seen, when perceived demands largely outweigh perceived

resources, the effects of extreme hot weather events such as heat waves on health and wellbeing can be dramatic, a trend that, unfortunately, has become more common during the last two decades in several countries. For example, it has been estimated that the 2003 heat wave in Europe was directly responsible for approximately 35,000 excess deaths throughout the continent (Robine et al., 2008). Since then, health reports and research across Europe keeps showing a trend of heat-related illness, emergency hospital admissions, and mortality associated to heat waves (e.g., Arbuthnott & Hajat, 2017; Direção-Geral da Saúde [DGS], 2013, 2021; Johnson et al., 2005; Kovats et al., 2004; Oray et al., 2018; Pascal et al., 2018; Public Health England [PHE], 2018, 2019; Smith et al., 2016; Sousa et al., 2022; van Loenhout et al., 2018; Williams et al., 2019; WHO, 2015). In Portugal, a report from the Portuguese Directorate-General for Health regarding the effects of the heat wave that affected the country in 2013, estimated an increase of approximately 8% in emergency hospital admissions, and 1684 excess deaths during that extreme hot weather event (DGS, 2013). More recently similar observations have been made in northern European countries such as the United Kingdom, where it was estimated that the 2016 heat wave led to an increase of approximately 5% in emergency hospital admissions, and 908 excess deaths for that period (PHE, 2018). In countries such as the United States and Australia the same trends of heat-related illness, emergency hospital admissions, and mortality associated to heat waves are seen (Anderson & Bell, 2011; Carey et al., 2017; Knowlton et al., 2009; Semenza et al., 1999), being estimated that these extreme hot weather events have been responsible for more deaths than any other natural environmental hazard in the last 30 years (e.g., National Oceanic and Atmospheric Administration [NOAA], 2020; Scalley et al., 2015). This reality, particularly coupled with a rapidly aging world population (WHO, 2017), emerging public health crisis such as the COVID-19 pandemic, the worldwide impacts of war in Ukraine, and an uncertain geopolitical future, strains not only the economic and healthcare systems, but also the social and community systems, with multidimensional impacts on human health and wellbeing (Clayton et al., 2015). For example, Sousa et al. (2022) found that during the first year of COVID-19 pandemic in Portugal, heat-related mortality reached magnitudes not experienced since the 2003 heat waves, probably due to the disruption of healthcare systems and the fear of the population in going to healthcare facilities.

Nevertheless, there is evidence that the negative effects of extreme hot weather events, such as heat waves, on health and wellbeing vary across time, individuals, communities, populations, and geographical locations (Hass et al., 2021; Koppe et al., 2004; Mayrhuber et al., 2018). In that regard, research identified several factors that can help explain how people

mitigate and cope with such negative effects (Arbuthnott et al., 2016; Bakhsh et al., 2018; Bose-O'Reilly et al., 2021; Hancock & Vasmatazidis, 2003; Hass & Ellis, 2019; Hass et al., 2021; Marinucci et al., 2014; Mayrhuber et al., 2018; Rodrigues, 2019; Rodrigues et al., 2020; Swim et al., 2011a; Widerynski et al., 2017). Examples include: sociodemographic factors (e.g., age; gender; education level; ethnic group; minority status); geographical factors (e.g., frequency and intensity of exposure); acclimation and adaptation processes (e.g., physiological adaptation; habituation); health condition (e.g., absence of mental or physical illness, comorbidities, and other impairments); lifestyles (e.g., healthy eating habits; regular physical activity); living conditions (e.g., housing and thermal insulation; clothing and other material goods); economic security (e.g., stable income; employment); available protective equipment (e.g., access to air conditioning units and other cooling equipment); existence of social support networks (e.g., living with others; being integrated in the community); existence of local interventions and community infrastructures (e.g., public health interventions; community recreative centres that can work as cooling centres); appropriate infrastructure and regional/municipal plans (e.g., quality of construction; urban design and planning); and existence of environmental control and mitigation processes (e.g., pollution prevention and mitigation; monitoring and control of air, water, and other environmental factors). Although important, these factors are not enough for promoting adaptation and mitigation of heat wave negative effects on health and wellbeing. That is, adaptation and mitigation of heat wave negative effects on health and wellbeing also requires perception of heat wave risk and demands, perception of available coping resources, heat protection intentions and motivations, and the actual implementation of such intentions into protective behaviours (Clayton et al., 2015; Hajat et al., 2010, 2014; Howe et al., 2019; Kalkstein & Sheridan, 2007; Lefevre et al., 2015; Swim et al., 2009, 2011b). In that regard, psychological research has a history of contributing with rigorous theoretical and empirical methods to investigate and advance the understanding not only about individual and collective perceptions, intentions, motivations, emotions, and behaviours, but also about how to change, facilitate, or hinder them (Clayton et al., 2015; Spence et al., 2009; Swim et al., 2009, 2011a, 2011b). This research frequently incorporates the interplay between physiological, cognitive, affective, and interpersonal processes, and include social, cultural, biophysical, and environmental factors (Blascovich & Mendes, 2010; Clayton et al., 2015; Clayton & Myers, 2009; Fischhoff & Furby, 1983; Gardner & Stern, 2002; Gifford, 2008; Kazdin, 2009; Koger & Winter, 2010; Morgan et al., 2002; Nickerson, 2003; Reser & Swim, 2011; Schmuck & Schultz, 2002; Sjöberg, 1989; Spence et al., 2009; Stern, 1992, 2011; Stokols et al., 2009; Swim et al., 2009, 2011a, 2011b; Wong-Parodi & Feygina, 2018).

Psychology's Role in Promoting Adaptation to Heat Waves

Psychological science provides a strong theoretical and empirical background for understanding human psychological processes (e.g., perceptions; intentions; motivations; emotions; decision making), psychological and physiological responses (e.g., threat; stress; anxiety; happiness), and coping behaviours (e.g., implementing preventive and protective actions; seeking support from others; helping others) in face of several natural environmental hazards (e.g., heat waves; wildfires; flooding; sea level rise; coastal erosion; landscape changes). This theoretical and empirical background is comprised by research focused both on the individual and social levels, and conducted across a variety of contexts, situations, and settings (Clayton et al., 2015, 2014, 2021; Gardner & Stern, 2002; Hothersall & Lovett, 2022; Kazdin, 2009; Morgan et al., 2002; Reser & Swim, 2011; Spence et al., 2009; Swim et al., 2009, 2011a, 2011b; van Valkengoed & Steg, 2019b; Wong-Parodi & Feygina, 2018).

The research interface between psychological functioning, social context, and environmental setting, enabled Psychologists, through their research and multidisciplinary interactions, for example: 1) better understanding about how people think and feel about a variety of natural environmental hazards, which in turn influences their perceptions, intentions, motivations, attitudes, evaluations, and behaviours towards those hazards; 2) better knowledge about what different people and groups of people currently know and believe about different natural environmental hazards, the gaps in their knowledge, their misconceptions, the wording and terminology that they prefer to use to describe, talk about, and discuss such hazards, and what they are still missing to be able to implement protective action; 3) the development of instruments capable of assessing psychological processes and responses, associated behaviours, and physiological correlates at the individual and social levels, including beliefs, values, and emotional reactions to different natural environmental hazards across a variety of contexts; 4) the identification of factors capable of predicting, influencing, and changing psychological processes and responses, and associated behaviours in the face of different natural environmental hazards across a variety of situations; 5) the creation of tailored and evidence-based interventions, mitigation strategies, communications, and materials aimed at managing and facilitating individuals and communities adaptation and resilience to a variety of natural environmental hazards; and 6) advising policymakers and authorities in matters related to sustainable behaviour change and psychological health and wellbeing in the face of different natural environmental hazards, and even help in mediating environmental conflicts between individuals and groups of individuals arising from the competition for increasingly scarce

resources, aggravated by such hazards (Batel et al., 2016; Bostrom et al., 1994; Bruine de Bruin & Bostrom, 2013; Clayton et al., 2015; Fischhoff, 1990; Gaspar et al., 2015; Gifford, 2008; Hothersall & Lovett, 2022; Kazdin, 2009; Koger & Winter, 2010; Morgan et al., 2002; Reser & Swim, 2011; Spence et al., 2009; Stern, 2011; Swim et al., 2009, 2011a, 2011b).

Research in the context of heat waves is relatively more recent when compared to other natural environmental hazards such as floods for example (Clayton et al., 2021). Existing studies focus mostly on heat wave impacts on health and wellbeing, heat wave risk perception, heat wave protection intentions and behaviours, and on the implications for policymaking and public health interventions (Abrahamson et al., 2009; Akompab et al., 2013; Ban et al., 2019; Beckmann & Hiete, 2020; Bruine de Bruin et al., 2016; Campbell et al., 2018; Esplin et al., 2019; Hajat et al., 2010; Hass & Ellis, 2019; Hass et al., 2021; Howe et al., 2019; Khare et al., 2015; Lefevre et al., 2015; Mayrhuber et al., 2018; Palutikof et al., 2004; Taylor et al., 2014; Wolf et al., 2010a, 2010b). Studies, that were conducted mainly with North European, North American, and Australian samples, suggested that the negative health effects associated with heat waves can be countered with heat protection behaviours, given that people are aware of the risk and are able to implement heat protection behaviours such as increasing fluid intake during periods of hot weather or stay in a cool or air-conditioned environment during periods of extreme hot weather (Campbell et al., 2018; Hajat et al., 2010; Koppe et al., 2004; Kovats & Hajat, 2008). Yet, studies also reported a tendency for people not to consider themselves at risk from the negative effects of heat waves on health and wellbeing, or to consider others to be more at risk from such negative effects of heat waves than themselves. This was found even among populations considered more susceptible heat waves (e.g., elderly). The same studies also highlighted that participants who were able to recall heat protection recommendations, described uncomfortably hot weather and the consequences for their daily tasks and health, and had experienced health issues during heat waves in the past (e.g., temperature interference in daily life), were more likely to perceive heat waves as dangerous, reporting higher intention to take actions to reduce heat exposure, and reporting more heat protection behaviours (Abrahamson et al., 2009; Akompab et al., 2013; Ban et al., 2019; Bruine de Bruin et al., 2016; Esplin et al., 2019; Hass & Ellis, 2019; Hass et al., 2021; Howe et al., 2019; Kalkstein & Sheridan, 2007; Khare et al., 2015; Lefevre et al., 2015; Palutikof et al., 2004; Wolf et al., 2010a, 2010b). For example, in a sample of United Kingdom residents, Lefevre et al. (2015) found that participants who reported having heard heat protection recommendations also reported having implemented more heat protection behaviours, greater perceived effectiveness

of heat protection behaviours, and greater intention to implement protection behaviours in future hot summers. Interestingly, they also found evidence that positive affect about heat could hinder heat protection intentions and behaviours. In another study, Bruine de Bruin et al. (2016) found that asking a sample of United Kingdom residents to recall high summer temperatures elicited thoughts of pleasantly hot summer weather, whereas asking participants to recall the most unpleasant summer temperatures elicited thoughts of unpleasantly cold summer weather. In that study, a strategy that combined these two approaches (i.e., recall high and unpleasant summer temperatures) succeeded in evoking thoughts of unpleasantly hot summer weather, increasing participants' expressed heat protection intentions. Yet, they also found that the effect of the temperature recall condition "most unpleasant highest" on heat protection intentions was better explained by the (un)pleasantness of remembered temperature. This study not only provided evidence of affective (i.e., pleasantness) and cognitive (i.e., availability) processes influencing heat wave protection intentions, but also provided evidence of heat waves as "extreme natural environmental hazards capable of evoking positive affect". In doing so, they further showed that the perception of potentially risky situations is shaped not only by what people already know and think about the risk, but also by their feelings about it (Breakwell, 2010; Bruine de Bruin & Bostrom, 2013; Domingos et al., 2018; Finucane et al., 2000; Forgas, 2008; Kahneman, 2011; Kaspersen et al., 1988; Loewenstein et al., 2001; Morgan et al., 2002; Slovic et al., 2004; Tversky & Kahneman, 1974; Zajonc, 1980). The study also suggested that the effect of the magnitude of recalled temperature (e.g., temperature feeling) on heat protection intentions could be better explained by other factors such as heat wave risk perception or temperature interference in daily life. In fact, Esplin et al. (2019) in a study with a sample of United States residents, found that rather than actual exposure to heat waves, factors such as the subjective experience of heat-related health symptoms (e.g., temperature interference in daily life) and heat wave risk perception were more important predictors of reported heat protection intentions and behaviours. Moreover, results from a recent scoping¹ literature review conducted by Hass et al. (2021) revealed a consistent track of heat wave risk perception as a predictor of heat protection intentions and behaviours. Yet, their review also highlighted potential geographical variations in heat wave risk perception (e.g., urban vs. rural), and the fact that heat wave risk perception tends to be higher among vulnerable subgroups such as those with low-income or poor health, because these often have less access to protective resources

¹ According to Munn et al. (2018, p. 5), "a key difference between scoping reviews and systematic reviews is that in terms of a review question, a scoping review will have a broader "scope" than traditional systematic reviews with correspondingly more expansive inclusion criteria".

and thus may not be able to protect themselves adequately. In that regard the authors concluded that more research is needed – in particular research employing longitudinal or quasi-experimental designs and advanced statistical techniques – to better understand the relations between geographical location, heat wave risk perception, protective resources, and heat protection intentions and behaviours (Hass et al., 2021).

Appropriate risk perception is a necessary condition for people to be motivated to take precautions, protect themselves and others, follow protection recommendations, and adopt the necessary risk mitigating behaviours (Barnett & Vasileiou, 2014; Breakwell, 2010; Ferrer & Klein, 2015; Joffe, 2003; Kalkstein & Sheridan, 2007; Renner et al., 2015; Schweizer et al., 2021; Sheeran et al., 2014; van der Pligt, 1996). Yet, the challenges posed by heat waves are not limited to factors such as heat wave risk perception, temperature interference in daily life, temperature feeling, and positive affect about heat, among others. This is because these and other natural environmental hazards also encompass a broader set of demands such as danger, effort, and uncertainty (Swim et al., 2009). Moreover, when the goal is to build ‘resilience’² to heat waves the consideration of coping resources, such as the knowledge, dispositions, and social support necessary for adaptation to situational demands are fundamental, so that people can adopt the necessary risk mitigating behaviours, cope, and recover (Blascovich, 2007; Bonanno, 2004; Haggerty et al., 1994; Luthar, 2003; Masten, 2001; Reser & Swim, 2011; Rutter, 1987; Schoon, 2006; Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2009, 2015; Swim et al., 2009; Zimmer-Gembeck & Skinner, 2016). This means that it is also important to analyse the effects of perceived demands in relation to perceived resources.

Taken together the reviewed studies suggest that the effects of heat wave risk perception, and other factors such as temperature interference in daily life, temperature feeling, and positive affect about heat on heat protection intentions and behaviours are relatively well known. However, less known is: 1) how people perceive the broader spectrum of heat wave demands (i.e., the dangers, the efforts, and the uncertainties posed by heat waves) and resources (i.e., the knowledge, ability, and skills, the dispositions, and the external support available to cope with heat wave demands); 2) how other factors such as heat wave risk perception, temperature interference in daily life, temperature feeling, and positive affect about heat relate with and

² According to Swim et al. (2009, p. 105) resilience (climate change, disaster context) can be defined as “the ability of a system to respond and recover from disasters. It includes inherent conditions that allow the system to absorb impacts, cope with an event, re-organize and change in response to a threat”. Moreover, “within psychology, in the case of individuals, the construct of ‘resilience’ typically refers to inner strengths and coping resources for necessary adaptation to situational demands” (Swim et al., 2009, p. 60).

influence heat wave demands and resources perceptions; and 3) the relations and combined effects that those factors, together with heat wave demands and resources perceptions, may have on heat protection intentions and behaviours.

Heat wave risk perception operationalizations found in the reviewed literature may relate and sometimes even have some degree of overlap with the concept of heat wave demands perceptions, particularly when pertaining to the dangers posed by heat waves to human health and wellbeing. Yet, the consideration of demands perceptions as an additional factor, in combination with resources perceptions, may help uncover a broader set of perceptions and beliefs that people may have in relation to heat waves (e.g., efforts; uncertainties; knowledge; dispositions) and provide new opportunities for understanding, explaining, and intervening in the context of heat waves.

Demands and Resources Perceptions Role in Promoting Adaptation to Heat Waves

Demands perceptions can be defined as conditions, added pressures or constraints posed by a given situation, and involve the perception and assessment (i.e., individual or public subjective evaluation/appraisal) of danger (e.g., to one's own health and to others'), required effort (e.g., tiredness; psychological effort), and uncertainty (e.g., what to do and how to mitigate risks), inherent to that situation (APA, 2022; Blascovich & Mendes, 2000, 2010; Domingos et al., 2020; Swim et al., 2009). Differently, resources perceptions can be defined as individual and social assets or strengths that are available and are used by people to help them in responding and coping with the situational conditions and its added pressures or constraints. This involves the perception and assessment (i.e., individual or public subjective evaluation/appraisal) of knowledge, abilities, and skills (e.g., what to do and how to mitigate risks), dispositions (e.g., motivations; optimism), and external support (e.g., help from others) inherent to that situation (APA, 2022; Blascovich & Mendes, 2000, 2010; Domingos et al., 2020; Swim et al., 2009).

Theoretical approaches in the field of demands and resources perceptions, threat, and stress, posit that people's psychological and behavioural responses during performance situations are shaped by the appraisal of the demands (e.g., primary appraisal – danger; effort; uncertainty) they perceive in such situations and the resources (e.g., secondary appraisal – knowledge, abilities, and skills; dispositions; external support) they perceive to have available to cope with such demands (Blascovich & Mendes, 2000, 2010; Demerouti et al., 2001;

Domingos et al., 2020, 2022; Gaspar et al., 2015, 2021a, 2021b, 2022a, 2022b; Putwain et al., 2017; Reser & Swim, 2011; Skinner & Brewer, 2002; Skinner et al., 2003; Swim et al., 2009, 2011b; Theorell & Karasek, 1996; Uphill et al., 2019). These performance situations can range from situations where one's performance or productivity is evaluated to situations in which action is needed for continued wellbeing. For example, during a heat wave people may perceive greater danger of dehydration and/or greater effort in performing tasks and use resources they perceive to have available at that moment to cope with those demands, such as drinking a glass of water and/or asking for help to finish their tasks.

The effects of demands and resources perceptions on intentions, motivations, behaviours, and stress responses, have been target of extensive empirical research by distinct theoretical approaches in Psychology, that share similar roots (e.g., Dienstbier, 1989; Folkman, 1984; Lazarus & Folkman, 1984), but typically focus on different settings (e.g., experimental; educational; environmental; risk management; work and organizational; sports; decision making). Examples are the Biopsychosocial Model of Challenge and Threat (Blascovich, 2007, 2008; Blascovich & Mendes, 2000, 2010; Blascovich & Tomaka, 1996; Tomaka et al., 1993, 1997), the Norm Deviation Approach (Gaspar et al., 2015), the Crisis Layers and Thresholds Model (Gaspar et al., 2021a), the Theory of Challenge and Threat States in Athletes (Jones et al., 2009; Meijen et al., 2020), the Families of Coping theory (Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2009, 2015; Zimmer-Gembeck & Skinner, 2016), the Job Demands-Control-Social Support approach (Karasek, 1979; Theorell & Karasek, 1996), the Job Demands-Resources Model (Bakker & Demerouti, 2007; Demerouti et al., 2001), the Appraisal Model of Fear Appeals (Putwain & Symes, 2014, 2016; Putwain et al., 2017), and the model explaining the Processes of Adaptation to and Coping with Climate Change (Reser & Swim, 2011; Swim et al., 2009). Moreover, the concept of demands and resources perceptions also has strong connections with theoretical approaches that focus on decision making, risk perception, and on the influence of cognition and emotion in such processes (Finucane et al., 2000; Kahneman, 2011; Slovic, 1987; Slovic et al., 2004, 2007; Slovic & Peters, 2006; Tversky & Kahneman, 1973, 1974; Zajonc, 1980). This is because demands and resources perceptions can also influence such psychological and behavioural processes (Blascovich & Mendes, 2000, 2010; Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2015).

These approaches have systematically provided evidence that intentions, motivations, and coping behaviours are processes influenced by situational constraints (demands) and available personal and social resources (Reser & Swim, 2011; Skinner et al., 2003; Skinner &

Zimmer-Gembeck, 2007, 2009, 2015; Swim et al., 2009; Zimmer-Gembeck & Skinner, 2016). Moreover, these approaches have shown that the relation between demands and resources has impact on cognitive (e.g., arithmetic tasks; message processing; decision making), affective (e.g., emotional experience and expression), behavioural (e.g., motor action coordination; protecting oneself from harm), and social (e.g., interactions with others; helping others) related tasks (Blascovich et al., 1993, 2003, 1999; Brimmell et al., 2018; Fazio et al., 1992; Fonseca et al., 2014; Garcia-Marques et al., 2015; Mendes et al., 2002; Moore et al., 2012; Norris et al., 2010; Putwain et al., 2017; Reser & Swim, 2011; Skinner & Brewer, 2002; Swim et al., 2009; Tomaka et al., 1993, 1997; Uphill et al., 2019).

Taken together, the empirical evidence suggests that demands and resources perceptions and the resulting appraisals constitute one of the core mechanisms leading to intention, motivation, coping behaviour, and psychological responses of threat, stress, and safety (Blascovich, 2007; Blascovich & Mendes, 2000, 2010; Demerouti et al., 2001; Domingos et al., 2022; Fredrickson, 2004; Gaspar et al., 2015, 2021a, 2021b, 2022a, 2022b; Gonzalez-Mulé & Cockburn, 2017; Gonzalez-Mulé et al., 2021; Jenny et al., 2019; Karasek, 1979; Li et al., 2013; Skinner & Brewer, 2002; Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2015; Theorell & Karasek, 1996). These demands and resources perceptions and the resulting appraisals have been traditionally operationalized and assessed in the literature as a function of psychophysiological patterns of cardiovascular responses (for a review see Blascovich & Mendes, 2010; Theorell & Karasek, 1996), but also, as a function of different self-reported measures of demands and resources perceptions (e.g., Blascovich & Tomaka, 1996; Demerouti et al., 2001; Gonzalez-Mulé & Cockburn, 2017; Gonzalez-Mulé et al., 2021; Jenny et al., 2019; Tomaka et al., 1993, 1997; Uphill et al., 2019). For example, early studies grounded on the Biopsychosocial Model of Challenge and Threat conducted by Blascovich, Tomaka and collaborators (e.g., Blascovich & Tomaka, 1996; Tomaka et al., 1993, 1997), combined psychophysiological measures of cardiovascular responses with a self-reported measure of demands and resources perceptions. In their study they asked participants “How stressful do you expect the upcoming task to be?” (demands – primary appraisal), and “How able are you to cope with this task?” (resources – secondary appraisal). Yet, other operationalizations of self-reported measures of demands and resources perceptions are found in the literature. For example, theoretical approaches in the field of work, stress, and health with roots close to the Biopsychosocial Model of Challenge and Threat, such as the Job Demands-Control-Social Support (Gonzalez-Mulé & Cockburn, 2017; Gonzalez-Mulé et al., 2021; Karasek, 1979;

Theorell & Karasek, 1996) and the Job Demands-Resources Model (Bakker & Demerouti, 2007; Demerouti et al., 2001; Jenny et al., 2019; Lesener et al., 2019), frequently employ self-reported measures of demands and resources perceptions. These are typically based on scales of perceived job demands (e.g., time pressure; work interruption; uncertainty at work) and perceived job resources (e.g., job flexibility; peer support; planning capability). Other studies (e.g., see Skinner & Brewer, 2002) also used cognitive appraisal scales comprised of items focused on ability to cope with stressful or demanding situations, and the anticipation of success and positive outcomes in such situations.

Findings arising from this research have additionally associated the relation between demands and resources perceptions to specific psychological, physiological, and behavioural outcomes (e.g., see Blascovich & Mendes, 2000, 2010; Demerouti et al., 2001; Esplin et al., 2019; Fonseca et al., 2014; Gomes, 2021; Gonzalez-Mulé & Cockburn, 2017; Lesener et al., 2019; Putwain et al., 2017; Skinner & Brewer, 2002; Skinner et al., 2003; Swim et al., 2009; Theorell & Karasek, 1996; Uphill et al., 2019). When demands perceptions (D) are significantly higher than coping resources perceptions (R), that is when perceived demands significantly outweigh perceived coping resources, has been associated to psychophysiological states of ‘threat’ ($D > R$). These are characterized by feelings of threat and loss, higher stress (i.e., distress³), higher anxiety, worry and exhaustion, greater experience of negative emotions, poorer mental and physical health, sleep disorders, lower work productivity, and more pernicious cardiovascular response patterns (e.g., vasoconstriction and greater total peripheral vascular resistance). Psychophysiological states of ‘threat’ are also characterized by passive⁴ coping strategies, and avoidance rather than approach behaviours (e.g., withdrawal; freeze). When demands perceptions (D) are significantly lower than coping resources perceptions (R), that is when perceived demands are significantly outweighed by coping resources, has been associated to psychophysiological states of ‘safety’ ($D < R$). These are characterized by feelings

³ According to the American Psychological Association ‘distress’ is defined as “the negative stress response, often involving negative affect and physiological reactivity – a type of stress that results from being overwhelmed by demands and losses. It has a detrimental effect by generating physical and psychological maladaptation and posing serious health risks for individuals” (APA, 2022).

⁴ According to the American Psychological Association ‘passive coping’ is defined as “a stress-management strategy in which a person absolves himself or herself of responsibility for managing a stressor and instead relinquishes control over its resolution to external resources, such as other people and environmental factors. Individuals who cope passively often withdraw from interpersonal relationships and instead engage in such activities as hoping, praying, or avoiding the stressor. This type of coping strategy generally is considered maladaptive, having been associated with increased depression, poorer psychological adjustment, and other adverse consequences. It is similar to the earlier conceptualization of emotion-focused coping but distinguished by its focus on external factors and abdication of personal responsibility” (APA, 2022).

of safety, security, confidence, and freedom, lower stress (i.e., distress and eustress), lower anxiety, worry and exhaustion, greater experience of positive emotions, better mental and physical health, work productivity, and less pernicious cardiovascular response patterns (e.g., vasodilation, lower total peripheral vascular resistance, and greater peripheral blood flow). Psychophysiological states of ‘safety’ are also characterized by lower motivation for protection and proactivity (e.g., unawareness; underestimation). When demands perceptions (D) do not significantly differ from resources perceptions (R), that is when perceived demands do not significantly outweigh perceived coping resources and vice-versa, has been associated to psychophysiological states of ‘challenge’ ($D \approx R$). These are characterized by feelings of challenge and fulfillment, higher eustress⁵, lower anxiety, worry, and exhaustion, greater experience of positive emotions, better mental and physical health, higher work productivity, and less pernicious cardiovascular response patterns (e.g., vasodilation, lower total peripheral vascular resistance, and greater peripheral blood flow). Psychophysiological states of ‘challenge’ are also characterized by active⁶ and proactive⁷ coping strategies, approach rather than avoidance behaviours, and higher motivation for protection (e.g., prevention; planning), making this an ‘optimal motivational state’, that is when the relation between demands and resources perceptions promote protective action, without inducing damaging levels of stress, withdrawal/freeze behaviours, or low motivation for protection.

However, research also found that demands and resources perceptions and the possible associated psychological and behavioural phenomena are context dependent (Blascovich & Mendes, 2000; Theorell & Karasek, 1996). For example, psychological principles are often

⁵ According to the American Psychological Association ‘eustress’ is defined as “the positive stress response, involving optimal levels of stimulation – a type of stress that results from challenging but attainable and enjoyable or worthwhile tasks (e.g., participating in an athletic event, giving a speech). It has a beneficial effect by generating a sense of fulfillment or achievement and facilitating growth, development, mastery, and high levels of performance” (APA, 2022).

⁶ According to the American Psychological Association ‘active coping’ is defined as “a stress-management strategy in which a person directly works to control a stressor through appropriately targeted behavior, embracing responsibility for resolving the situation using one’s available internal resources. This type of coping strategy may take various forms, such as changing established habits. Active coping generally is considered adaptive, having been associated with fewer mood disturbances, enhanced self-efficacy, and other favorable consequences. It is similar to the earlier conceptualization of problem-focused coping but distinguished by its focus upon one’s internal resources” (APA, 2022).

⁷ According to the American Psychological Association ‘proactive coping’ is defined as “a stress-management strategy that reflects efforts to build up resources that facilitate promotion toward challenging goals and personal growth. Proactive individuals are motivated to meet challenges, and they commit themselves to their own high standards. They see demands and opportunities in the distant future and initiate a constructive path of action toward meeting them. Stress is interpreted as eustress, that is – productive arousal and vital energy – and coping thus becomes goal management instead of risk management. Proactive coping does not arise from any negative appraisals, such as harm, loss, or threat” (APA, 2022).

established in ‘narrowly’ defined contexts such as laboratory experiments, small-scale field experiments, and surveys with specific samples and populations, and as such, we must consider how demands and resources are perceived and apply in other contexts and situations (Swim et al., 2011b). As suggested by the extensive research by the American Psychological Association’s Task Force on the Interface Between Psychology and Global Climate Change coordinated by Swim et al. (2009, p. 56), the relations between demands and resources perceptions (e.g., threat and challenge) and their impacts on protection intentions and behaviours have not yet been fully studied in the context of climate change. These may play an important role in promoting future human adaptation and resilience to natural environmental hazards such as heat waves. For example, in the context of disasters and terrorism, the concept of resilience given by the relation between inner strengths and coping resources for necessary adaptation to situational demands has already become the principal theme in the American Psychological Association web-based help line and brochures relating to psychological advice and guidance (e.g., Newman, 2005; Swim et al., 2009).

Research in the context of heat waves suggests that factors such as heat wave risk perception, positive affect about heat, temperature feeling, temperature interference in daily life, and awareness of heat protection recommendations may play an important role in shaping heat wave demands and resources perceptions and their potential impacts on heat protection intentions and behaviours, although their role and relations are still unclear in this context (Beckmann & Hiete, 2020; Bruine de Bruin et al., 2016; Hajat et al., 2010; Hass et al., 2021; Kalkstein & Sheridan, 2007; Lefevre et al., 2015). Moreover, heat wave demands and resources perceptions can be influenced by multiple cultural, individual, and sociodemographic factors (e.g., age; gender; education level), being still unclear how these are perceived, and whether or how they vary across individuals, communities, and geographical locations in the context of heat waves in general. Knowing more about this may be particularly important to promote adaptation and resilience to heat waves in the Portuguese context, as example of a country highly vulnerable to the negative effects of climate change and heat waves (Naumann et al., 2020; Rocha et al., 2020; Rodrigues et al., 2021; Schleussner et al., 2019), and with known inequities and inequalities in the access to physical, psychological, and mental healthcare (Di Meglio et al., 2018; Mauritti et al., 2019; Moreira, 2011; Ordem dos Psicólogos Portugueses [OPP], 2020a; Rego et al., 2013; Rodrigues, 2019; Rodrigues et al., 2020, 2021; Silva, 2012).

Doctoral Thesis' Objectives and Overview of Empirical Chapters⁸

In this Doctoral Thesis we aimed to explore and better understand demands and resources perceptions in the context of heat waves, the effects that cognitive, affective, and sociodemographic factors (e.g., positive affect about heat; heat wave risk perception; temperature interference in daily life) have on such perceptions, and their combined impacts on heat protection intentions, particularly among the Portuguese population. The research work conducted included the: 1) development of a theory-driven mixed-method framework to collect and code expressions of demands and resources perceptions in the context of heat waves, enabling the identification of common heat wave demands and available coping resources perceptions, as well as potential misconceptions in the Portuguese context, while serving as the basis for the creation of demands and resources scales used in follow-up studies; 2) identification of the effects that emotional prompts (i.e., thinking about extreme hot weather events without an emotion prompt, with a negative emotion prompt, or with a positive emotion prompt) have on temperature estimates and perception of pleasantness associated with extreme hot weather events, on heat wave protection intentions, on extreme hot weather events demands and resources appraisals, and on the number of verbal descriptions of demands and resources perceptions produced by the participants, enabling to determine if the results obtained with United Kingdom residents would replicate in a Portuguese sample, thus allowing for a cross-cultural comparison between Portuguese and United Kingdom residents; 3) identification of cognitive, affective, and sociodemographic predictors (e.g., positive affect about heat; heat wave risk perception; temperature interference in daily life) of heat wave demands and resources perceptions, and their combined effects on heat protection intentions during a heat wave in Portugal, allowing the proposal of a broader theory-driven and evidence-based path analysis model, further illustrating the interconnections between factors; and 4) identification of seasonal variations in heat wave demands and resources perceptions (i.e., in the spring before the summer, during a heat wave in the summer, during the summer, and in the autumn after the summer), across different heat wave geographical susceptibility locations in Portugal (i.e., low, moderate, high), as an indicator of heat wave feelings of threat and stress, as well as predictors of such seasonal and geographical variation.

Because perceptions of demands and resources are context dependent, Chapter II reports the first step in the development of a theory-driven framework to collect and code expressions

⁸ As a general introduction to the current Doctoral Thesis, Chapter I has overlapping information with the remaining chapters.

of demands and resources perceptions in the context of heat waves, the DeCodeR framework. This initial work was crucial to identify and better understand common heat wave demands and available coping resources perceptions people held in the Portuguese context (e.g., either in disagreement or in agreement with experts and health authorities' views), serving as basis for the creation of heat wave demands and resources perceptions scales, later used in follow up studies. Moreover, during the COVID-19 pandemic this framework was revised and adapted to the pandemic context, enabling monitoring COVID-19 demands and resources perceptions as an indicator of COVID-19 systemic risk appraisal, threat, and stress, and the identification of COVID-19 crisis templates evolution across different pandemic waves (e.g., Arriaga et al., 2020, 2021; Domingos et al., 2022; Gaspar et al., 2021b, 2022a, 2022b; OPP 2020b).

Chapter III builds on the studies conducted by Bruine de Bruin et al. (2016) and Lefevre et al. (2015), with United Kingdom residents and, using a sample of Portuguese residents, reports the effects that thinking about extreme hot weather events without an emotion prompt, with a negative emotion prompt, or with a positive emotion prompt have on: 1) temperature estimates and perception of pleasantness associated with extreme hot weather events; 2) intentions for protection against extreme hot weather events; 3) extreme hot weather events demands and resources appraisals; and 4) the number of verbal descriptions of extreme hot weather demands and resources perceptions produced by the participants. Using the Preacher and Hayes (2008) PROCESS macro, 5) we also report whether the effect of emotion prompts on intentions for protection against extreme hot weather events were better explained by other factors such as extreme hot weather demands and resources appraisals, number of verbal descriptions of demands and resources perceptions, among others. Lastly, 6) it reports how the results from Bruine de Bruin et al. (2016), who showed that UK residents tend to have positive emotions about hot weather, which seems to undermine their intentions to protect against heat waves, replicate in countries more exposed to heat waves occurrence and their risks, such as Portugal, a country identified as vulnerable to the impacts of heat waves due to climate change.

Because previous studies were conducted outside of heat wave situations, Chapter IV reports findings from a study conducted with a sample of Portuguese residents during a heat wave in the summer. This study used scales of heat wave demands and resources perceptions developed from the findings reported in Chapter II and III, and reported: 1) factors predicting heat wave demands and resources perceptions during a heat wave (e.g., positive affect about heat; temperature interference in daily life; heat wave risk perception); 2) factors predicting heat protection intentions during a heat wave (e.g., heat wave risk perception; heat wave

demands perceptions; heat wave coping resources perceptions); and 3) a broader theory-driven and evidence-based path analysis model illustrating the effects of factors such as temperature feeling, temperature interference in daily life, heat wave risk perception, reports of having heard heat protection recommendations, need for cognition, positive affect about heat, among other factors, on heat wave demands and resources perceptions, and their combined effects on heat protection intentions, during the heat wave in Portugal.

Chapter V reports on a longitudinal study, conducted with a sample of Portuguese residents living in different heat wave geographical susceptibility locations of Portugal, that took place across four survey waves: a) in the spring before the summer; b) during a heat wave in the summer; c) during the summer; and d) in the autumn after the summer. In this study demands and resources perceptions were used as an indicator of feelings of threat and stress (distress), and reported: 1) seasonal variations in heat wave feelings of threat within the groups of participants living in the different heat wave geographical susceptibility locations of Portugal; 2) seasonal variations in heat wave feelings of threat between the groups of participants living in the different heat wave geographical susceptibility locations of Portugal; and 3) factors (e.g., heat wave risk perception; positive affect about heat) predicting heat wave feelings of threat across different seasons and different heat wave geographical susceptibility locations of Portugal.

Lastly, Chapter VI⁹ resumes the main findings arising from the work reported on Chapters II to V, and provides a general discussion of such findings, together with limitations, future research possibilities, and an outline of relevant implications for professional practice, including the application of the developed work to the context of the COVID-19 pandemic in Portugal.

⁹ As a general discussion of reported findings, Chapter VI has overlapping information with Chapters I to V.

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Chapter II

DeCodeR Framework: Data Collection and Coding for Heat Wave Demands and Resources Appraisal in Extreme Weather Events

Chapter based on:

Domingos, S., Gaspar, R., Fonseca, H., & Marôco, J. (2020). DeCodeR framework: data collection and coding for demands and resources appraisal in extreme weather events. *PsyEcology*. 11, 90-103. <https://doi.org/10.1080/21711976.2019.1643988>

Abstract

With the increased frequency, intensity and duration of extreme weather events potentiated by climate change, a better understanding of social systems' resilience and adaptation strategies to these events has been established as a research priority at the individual and community levels. Because such events have the potential to interfere with individuals' current needs and goals, this motivates them to evaluate the demands posed by the events and the available resources to cope with them. In turn, this evaluation greatly determines the implemented coping strategies' effectiveness. Exploring these demands and resources perceptions and appraisals by coding their indicators and decoding their functions is an important step in promoting resilience and adaptation strategies, in face of future extreme weather events. As a contribution, we propose a theory-driven data collection and coding framework (DeCodeR) for analysing such perceptions and appraisals, grounded on the Biopsychosocial Model of Challenge and Threat (BPS Model). This framework was pilot tested with a sample of 159 participants (33 male; 126 female), and further specified in terms of sub-categories of Demands (Danger; Effort; Uncertainty) and Resources (Knowledge, Abilities, and Skills; Dispositions; External Support) that may emerge in extreme weather events. Policymakers, practitioners, and researchers can capitalize on this work to develop evidence-based strategies to promote human resilience and adaptation to extreme weather events, based on identified demands and resources categories. This can be achieved by enhancing individual's personal and social/community resources to cope with the demands posed by present and future extreme weather events.

Keywords

Stress; Appraisal; Coping; Extreme Weather Events; Resilience

Climate Change and Extreme Weather Events

Climate changes. In fact, it has changed naturally and dynamically across the Earth's geological time (The Geological Society, 2010). What is new to this process of change is the impact that results from human activity (e.g., greenhouse gas emissions, fossil fuel consumption). This impact is so relevant that during the past century human activity has become a significant driver of climate change (Swim et al., 2009, 2011). As a result from human interference in the natural cycle of climate change and in the natural geological driven climate change process, we are now witnessing an increase in frequency, intensity, and duration of extreme weather events (Intergovernmental Panel on Climate Change [IPCC], 2014; Lefevre et al., 2015; Santos, 2006; Spence et al., 2009; World Economic Forum [WEF], 2017; World Health Organization [WHO], 2015). This aggravation is so significant that it was already suggested to be one of the major societal risks to humankind (Ahmed & Wei, 2010; Spence et al., 2012; Swim et al., 2009, 2011; WEF, 2017). Resulting from this, understanding human adaptation strategies to extreme weather events, and finding ways of incrementing their effectiveness and potential to promote resilience to future events, has been established as a worldwide practical and research priority (Clayton et al., 2015; WHO, 2015).

To promote such understanding at an individual and community level, it is important to explore how individuals perceive and evaluate extreme weather events, namely indicators of their perception and appraisal of the demands posed by those events and the personal and social resources available to cope with such demands (e.g., D/R appraisals, given by the relation or ratio of perceived demands to perceived resources¹⁰). In this regard, "demands appraisals involve the perception or assessment of danger, uncertainty, and required effort inherent in the situation", while "resources appraisals involve the perception or assessment of knowledge and skills relevant to situational performance" (Blascovich & Mendes, 2000, p. 63). The latter "include but are not limited to dispositions, knowledge, abilities, and external support" (Blascovich & Mendes, 2010, p. 207).

The importance of studying these perceptions of demands and resources comes from the acknowledgement that people's coping strategies are shaped by their appraisals of the stressful situation, namely its demands and available personal and social resources (Skinner & Zimmer-Gembeck, 2015). This is in line with Lazarus and Folkman (1984, p. 141) definition of coping

¹⁰ The relation of perceived demands to perceived resources has been quantified using different algorithms (e.g., subtracting demands from resources perceptions). Under the Biopsychosocial Model of Challenge and Threat, the ratio method (D/R) was preferred because it provided the clearest conceptual distinction (Tomaka et al., 1993).

as the “constantly changing cognitive and behavioural efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources (personal and social) of the person”. Knowing the characteristics of these perceptions and D/R appraisals may allow not only a better understanding about actual human resilience building and adaptation processes to extreme weather events, but also allow the development of evidence-based strategies, interventions, and risk communications to promote social systems resilience and adaptation to these events in the future.

In this regard, we propose a data collection and coding framework for analysing indicators of human demands and resources perceptions and D/R appraisals about extreme weather events and ‘decoding’ the different functions of its associated sub-dimensions, focused not only on self-reported and psychophysiological quantitative indicators, but also on qualitative indicators (e.g., perceptions associated with D/R appraisals). We name it the DeCodeR framework, for coding Demands (D) and Resources (R) perceptions indicators and decoding their role/functions as threat appraisals (i.e., when demands perceptions significantly outweigh resources perceptions), challenge appraisals (i.e., when resources are enough to meet the situational demands, existing a balance and interaction between demands and resources perceptions), or safety appraisals (i.e., when resources perceptions significantly outweigh demands perceptions). For creating this framework, we focused on extreme hot weather events, commonly known as heat waves, as an example of an extreme weather event that has been target of increasingly concern and attention in the last years (IPCC, 2014; WHO, 2015).

Exploring Human Perceptions and Appraisals about Extreme Weather Events

With the goal of better understanding human perceptions and D/R appraisals about extreme weather events, and actual mitigation and adaptation strategies to these events, we grounded the methodological framework proposal and development on the Biopsychosocial Model of Challenge and Threat (BPS Model; for a review see Blascovich, 2008; Blascovich & Mendes, 2000, 2010). Although the BPS Model has been target of extensive research in diverse contexts, like for example, social psychophysiology, neurophysiology, embodiment, judgment and decision-making, self-control and self-regulatory processes, information processing, persuasion, ethnicity and status, social interactions and interpersonal processes, intergroup interactions, influence in vocal tone, pet stress management, perceived pain, body perception, responses to hazard diffusion through social media, among other (e.g., Blascovich, 2008;

Blascovich & Mendes, 2000, 2010; Blascovich & Tomaka, 1996; Fonseca et al., 2014; Garcia-Marques et al., 2015; Gaspar et al., 2015; Tomaka et al., 1993, 1997), to our knowledge it has never been applied in the field of climate change adaptation or in the study of extreme weather events, as motivated performance situations (e.g., potentially stress-inducing situations, ranging from situations where one's performance or productivity is evaluated to situations in which action is needed for continued wellbeing). In that regard, Swim et al. (2009, p. 56) suggests that "although threat versus challenge responses have not been studied in the context of climate change, the difference between threat and challenge appraisals may have important implications for instance, whether individuals avoid versus approach problems".

According to the BPS Model, when faced with a motivated performance situation (i.e., potentially stress-inducing situation) which interferes with individuals' current goals and needs, they tend to appraise the perceived demands that are posed by that situation and the perceived available resources (individual and social) to cope with such demands. When individuals perceive the existence of demands but also perceive the existence of insufficient personal and social resources (R) to cope with the situation-imposed demands (D), the situation tends to be appraised as a threat to cope with ($D > R$), for example, a stressor that individuals believe they are unable to or will have trouble in mastering, experiencing distress, and avoidance rather than approach. When individuals perceive the existence of demands but also perceive the existence of sufficient personal and social resources (R) to cope with the situation-imposed demands (D), the situation tends to be appraised as a challenge to cope with ($D \approx R$), for example, a stressor that individuals believe that they can master, experiencing eustress, and approach rather than avoidance. When individuals perceive the existence of demands but also perceive the existence of highly exceeding personal and social resources (R) to cope with the situation-imposed demands (D), the situation tends to be appraised as safe situation ($D < R$), for example, a situation where individuals experience no eustress nor distress. From this, and as suggested by the work of Tomaka et al. (1993, 1997), the appraisal can be quantified as a function of the relation or ratio between demands and resources perceptions (D/R appraisal ratio).

In turn, this appraisal process is mediated by an interaction between socio-cognitive (e.g., thoughts; social norms) and affective (e.g., emotions; feelings) factors, which may also be influenced by situational (e.g., specific characteristics of the context where the situation occurs) and dispositional factors (e.g., personality traits and states; Blascovich & Mendes, 2000, 2010). For example, during an extreme weather event, people may, on a cognitive dimension, think about what is happening, about what they did in past situations, or about what they are

doing in that specific situation/moment. On an affective dimension, people may also feel more or less positively or negatively about what is happening, about what they are doing, and about what they are thinking. As such these thoughts and feelings co-occur and are frequently driven by the context and even previous experience, dynamically interacting and buffering or hindering each other. Following the example, during an extreme weather event, thinking that what is being done or what was done in the past is not sufficient to enable adequate protection may further increase negative emotions and feelings. In turn, for example, these emotions and feelings can serve as information and lead into further thoughts that may include losses or failure to protect oneself in that situation. Thus, this relation will determine how and what demands and resources are perceived and appraised in that specific situation, and the implemented coping responses (e.g., approach or avoidance; not having enough resources to cope with the demands, freezing, fleeing, etc.). This also means that a variety of outcomes are possible, and that these outcomes depend on the relations between contextual, cognitive, and affective variables, together with dispositional variables (e.g., self-motivations and goals).

Moreover, it should be noted that the D/R appraisal process can also vary in its level of consciousness. In other words, individuals may make ‘nonconscious D/R appraisals’, arriving at a state of challenge, threat, or safety (e.g., by just feeling nervous or calm in a given situation) without having any awareness of the underlying/inherent appraisal process (Blascovich & Mendes, 2000; Fonseca et al., 2014).

Research on the BPS Model suggests that challenge, threat, or safety appraisals greatly determine the implemented coping strategies (Blascovich, 2008; Blascovich & Mendes, 2000, 2010; Gaspar et al., 2015). These include cognitive (e.g., planning; abstraction), emotional (e.g., fear; anxiety; optimism), and behavioural responses (e.g., moving away; doing something). Usually, challenge appraisals lead to approach-based coping strategies (e.g., problem-solving strategies), whereas threat appraisals lead to avoidance-based coping strategies (e.g., information avoidance or social withdrawal). Traditionally, the research using the BPS Model studies D/R appraisals based on psychophysiological indicators (e.g., cardiovascular indexes of challenge and threat) and primary versus secondary subjective self-reported appraisal ratings (e.g., Blascovich & Mendes, 2000, 2010; Blascovich & Tomaka, 1996; Tomaka et al., 1993, 1997). We aim to contribute to this research by considering the role of qualitative indicators of D/R appraisals, based on data collection through individual’s verbal and textual reports.

Next, we propose a data collection and coding framework (DeCodeR framework) that aims to complement such traditional approaches with a qualitative exploration of human

demands and resources perceptions and D/R appraisals, as well as the qualification of such perceptions (personal and social). Differently from the psychophysiological approach, that has limitations for its applicability in the field (e.g., movement and other constraints that can make the measure unreliable), the DeCodeR framework may enable an easier way to assess demands and resources perceptions and D/R appraisals, providing scientific evidence for practical applications. Although this easiness of application could also be achieved with self-reported measures that have been shown to correlate with psychophysiological measures of D/R appraisals (e.g., Tomaka et al., 1993, 1997), the DeCodeR framework has the added advantage of also producing qualitative evidence, enabling better contextualization of the underlying perceptions. That is, besides providing a framework that can be applied in the field or within an affected community with relative ease, it also enables providing instances of demands and resources perceptions for different individuals and groups of individuals, particularly among the most vulnerable populational groups (e.g., elderly), which the perceptions may be more difficult to assess with other methodologies, enabling evidence to tailor risk communications for example (Diniz & Amado, 2014; Gaspar et al., 2016a, 2016b). The focus on such instances may enable, for example, customized interventions and communications directly focused on what resources perceptions should be promoted and which demands perceptions should be adjusted, in a given social context, to enable extreme weather events to be perceived more as a challenge, than a threat to cope with.

Developing a Framework to Explore Extreme Weather Demands and Resources

Focusing on extreme hot weather events (EHWEs) as an example, we developed a data collection protocol and procedures to explore human demands and resources perceptions and D/R appraisals about these events, and a data coding protocol and procedures to allow qualitative exploration of such perceptions and appraisals. The data collection protocol is comprised by three main steps and was pilot tested on a sample of 159 (33 male; 126 female) Portuguese participants, with ages between 18 and 88 years old ($M = 41.86$; $SD = 25.48$), recruited through non-random sampling procedures. Analysis of this data enabled the creation of the data coding protocol and procedures. Based on this, the proposed data collection protocol and procedures, and the proposed data coding protocol and procedures are presented next, serving as a framework for exploring human demands and resources perceptions and appraisals about extreme weather events such as heat waves, that can be adapted to other events.

Data Collection Protocol and Procedures (see Appendix A, p. 67)

Step 1 – study introduction, initial instruction and task. The procedure starts by requesting participants to think about a ‘given’ typical extreme weather event (extreme hot weather event in the pilot). At this point, psychophysiological measures of D/R appraisals can also be collected. Because there can be emotional/affective differences in how people experience and think about extreme weather events (e.g., extreme hot weather events can be evocative of positive affect; Bruine de Bruin et al., 2016), people can naturally think about these events in a more positive or negative way, and as such it is important that, when giving this initial instruction, any references to valence are avoided (i.e., not referencing the event as an inherently positive/pleasant or negative/unpleasant situation), unless the intent is to explore affective framing effects on D/R appraisals, for example. Moreover, the initial instruction and task can be adapted to request for a recall of past events or the simulation of future events, as well as to explore events in real time. Additionally, the task can be modified to guide participants through the process of thinking. For that, guided induction procedures (i.e., Miller et al., 1987) delivered by computer-controlled methods (e.g., E-prime software) in written (e.g., reading), audio (e.g., listening), or image (e.g., viewing pictures or videos) formats can be used. For example, a first instruction can request participants to think about an extreme weather event, a second can request participants to think about the demands they perceive in such situation, and a third can request participants to think about the resources they perceive to have available to cope with the demands, thus guiding them through the process of thinking. Likewise, other aspects can be focused on this task, like for example guiding the participants through the behaviours (e.g., think about what you are doing), the feelings (e.g., think about what you are feeling), and/or other research relevant characteristics that could be experienced in such situation. All these can then be explored after the task, during Step 2.

Step 2 – exploration of situations, demands, and resources. The initial instruction and respective tasks can then be followed by a set of questions based on structured or semi-structured interview methods, for example, with open-ended questions (e.g., asking participants to describe what they thought about or experienced) and closed questions (e.g., asking participants to rate aspects of what they thought about or experienced using Likert type scales or visual analogue scales). Thus, after the initial instruction and task (e.g., either thinking about, experiencing, or other) participants can be requested to best describe the situation they thought about or experienced (description task one) and, if applicable, to rate aspects of that situation. These follow-up questions can be made, for example, to explore norm deviation (qualitative

and quantitative), that is the perception or detection that a new situation has emerged and starts to deviate from what it is considered to be ‘normal’ or ‘status quo’ (see Gaspar et al., 2015). These can also allow, for example, to check if participants thought about an extreme weather event as opposed to normal/regular versions of the event, and/or explore their evaluation about how much that event deviates from normal or regular everyday life. Likewise, it may also be important to control frequency of exposure to the extreme weather event, as the exposure to past events tends to influence the response to future events (Knuth et al., 2014), among other variables. Next, participants are requested to describe the demands they perceived in the situation they thought about or experienced (description task two), if there were any. If applicable, follow-up questions can be made to clarify or further explore the descriptions made by the participants, for example, these can simply probe participants to talk more about it, ask about the consequences that the situation could have for them and for others, and/or include questions related with demands applicability (e.g., to self vs. others). After this, participants can then be asked to rate the level of demands posed by the situation they thought about or experienced (primary appraisal measure). Following this, participants are requested to describe the resources they perceived having to cope with the demands posed by the situation they thought about or experienced (description task three), if there were any. If applicable, follow-up questions can be made once again to clarify or further explore the descriptions made by the participants, these can simply probe participants to talk more about it, ask about what they did in that situation, include questions related with resources accessibility/availability (e.g., to better understand if participants have access to all the resources they mentioned, or if there are other resources they know about but that they do not have access to), and/or applicability (e.g., to self vs. others), or even explore ‘idiosyncratic’, ‘less usual’, or ‘odd’ resources that participants may refrain to mention in the first question (e.g., self-developed behaviours and strategies that are not usual or socially shared). After this, participants can then be asked to rate the level of resources they have to cope with the demands posed by situation they thought about or experienced (secondary appraisal measure). In the pilot study, the primary and secondary appraisal measures were adapted from the work developed by Tomaka et al. (1993, 1997) and Blascovich and Tomaka (1996), by simply asking participants to rate the level demands and the level of resources they considered to have in such situation.

Step 3 – additional measures. Lastly, other measures can also be included. For example, participants can rate their intentions to implement protective behaviours against the target event, or how much they implemented each protective behaviour during the target event. In the pilot

study, a heat protection intentions measure was also included, based on the work developed by Lefevre et al. (2015) and Bruine de Bruin et al. (2016), and the Portuguese Directorate-General for Health recommendations for heat protection (Direção-Geral da Saúde [DGS], 2015). Other measures that the researcher sees fit can also be included here. The proposed data collection protocol and procedures can be seen in Appendix A (p. 67), where we also provide several examples of additional measures that can be used.

Following these three steps the procedure allows data collection to build a qualitative D/R appraisal measure (e.g., by dividing the number of mentions to demands perceptions by the number of mentions to resources perceptions) and the exploration of personal and social perceptions about extreme weather events and its associated components (e.g., danger; effort; knowledge; external support), as well as data collection of more traditional quantitative appraisal measures (e.g., primary vs. secondary D/R appraisal ratings and psychophysiological measures indicative of D/R appraisals). It is our contention that the proposed methodology for data collection protocol and procedures is flexible, for example, by being open to the inclusion of other measures, or being quickly adapted to better fit practical needs (e.g., including only key questions for enabling a given research or intervention objective). Moreover, there is also flexibility regarding the data collection target groups/samples. For example, in another study (see Fonseca, 2017), a version of this protocol was applied to a sample of first-line public and health professionals (e.g., firefighters, civil protection agents, police officers, physicians, and nurses that have direct contact with the population during heat waves). In this study, the questions were framed as ‘meta-cognitive indicators’ (i.e., these professionals’ perceptions about the heat wave demands and resources perceptions of citizens). In line with Morgan et al. (2002) and Bruine de Bruin and Bostrom (2013), assessing the perceptions that first-line public and health professionals’ have about what they think to be citizens heat wave demands and resources perceptions, and assessing actual heat wave demands and resources perceptions held by citizens, may enable comparison and identification of gaps in knowledge and misconceptions between both, enabling effective risk communications and interventions to address such gaps and misconceptions.

Data Coding Protocol and Procedures (see Appendix B, p. 74; Appendix C, p. 75)

Using the data collection protocol and procedures presented above in the pilot study, a theory-driven content analysis procedure was implemented with the goal of: 1) creating a

manual for coding extreme hot weather demands and resources perceptions; 2) allowing for the qualitative exploration of the appraisal process through the identification and qualification of participants demands and resources perceptions associated with extreme hot weather events; and 3) creating a qualitative D/R appraisal measure of such events.

The coding process considered expressions produced by the participants with explicit or implicit mentions to extreme hot weather demands or coping resources perceptions, as based on these concepts' operationalizations found in the BPS Model literature (e.g., Blascovich & Mendes, 2000, 2010). In that regard, demands appraisals 'involve the perception or assessment of danger, uncertainty, and required effort inherent in the situation' (Blascovich & Mendes, 2000, p. 63), and resources appraisals 'involve the perception or assessment of knowledge and skills relevant to situational performance' (Blascovich & Mendes, 2000, p. 63), and 'include but are not limited to dispositions, knowledge and abilities, and external support' (Blascovich & Mendes, 2010, p. 207).

The main source of demands expressions produced by the participants, as indicative of their extreme hot weather demands perceptions, was the description task two of the procedure, and the main source of resources expressions produced by the participants, as indicative of their extreme hot weather coping resources perceptions, was the description task three of the procedure. To lesser extent, description task one was also used as a source for both. These expressions were screened based on the interviews transcripts as phrases that in their content represent a single coding unit (i.e., a unit of meaning). The cut-off point for each coding unit was considered when the expression of one meaning ended, and another different meaning started being expressed. This ensured that each coding unit referred to only one demand or one resource, while also helping in identifying repetitions, as participants often tended to repeat the same demands and resources across the interview. Thus, considering demands and resources expressions as single units of meaning helps in identifying patterns and repetitions, gathering them in a common structure. In this way, duplications can be avoided (i.e., counting the same demand or resource twice for the same participant), while preserving the repetitions, which adds the advantage of identifying the most common and/or most significant or cognitively accessible demands and resources perceptions in the participants point of view (i.e., those that are repeated more often).

It should be noted that in the coding phase, all expressions produced by the participants that explicitly or implicitly refer to demands or resources perceptions should be coded regardless of it being an actual demand or resource (e.g., from expert point of view). That is,

coding should occur regardless of the unit of meaning being considered or not as a valid or effective demand or resource by experts or public health authorities. For example, if the participants express a demand or a resource that health authorities do not consider to be a demand or a resource associated with extreme weather events, or even not a demand or a resource at all, it should be coded as a demand or resource respectively, as perceived by the participants. Likewise, if the participants express demands or resources that they perceive to apply to others but not to themselves, it should be coded as well. After the initial coding process there can be more detailed data analysis processes that allow, for example, the differentiation between ‘valid demands vs. invalid demands’ and ‘effective resources vs. ineffective resources’ from expert or public health authorities perspective, as well as the differentiation between demands and resources that participants perceive as applying only to them, to them and others, or only to others. Thus, the initial coding phase should allow for a listing of all the demands and resources perceptions regardless of their target, validity, or effectiveness, while the data analysis phase should allow the identification of appropriate demands and resources perceptions to the self and context, as well as potential misconceptions, and relevant terminology used by the participants.

Given this, after coding the expressions of demands perceptions obtained from the description task two and one, and the expressions of coping resources perceptions obtained from the description task three and one, in the respective higher-order categories identified in the BPS Model literature (i.e., Demands; Resources), each coding unit was then coded into one of three second-order categories of demands (Danger; Effort; Uncertainty) and one of three second-order categories of resources (Knowledge, Abilities, and Skills; Dispositions; External Support) respectively. These second-order categories operationalizations were also based on BPS Model and coping literature (see Blascovich & Mendes, 2000, 2010; Gaspar et al., 2015, 2016b; Skinner & Zimmer-Gembeck, 2015). The coding process was performed by two independent judges followed by the assessment of their interrater reliability level (Stemler, 2004). After coding all the coding units into their higher-order and second-order categories and upon achieving acceptable levels of interrater reliability (Cohen’s $\kappa = .91$), the independent judges jointly identified third-order categories. The goal was to solve minor divergencies in the coding process and allow for a better specification of the type and nature of the expressed demands and resources perceptions (i.e., different functions and qualities inside the same category level). This also allowed to move forward from the objective of identifying participants demands and resources perceptions associated with extreme hot weather events and

creating a qualitative D/R appraisal measure, to a better discrimination of such demands and resources perceptions, further strengthening the coding manual. Thus, after the identification and creation of third-order categories, and defining them in the coding scheme, the coding units were also coded into third-order categories by two independent judges, achieving acceptable levels of interrater reliability (Cohen's $\kappa = .96$). The proposed coding schematic for analysing demands and resources perceptions and D/R appraisals in extreme hot weather events can be seen in Appendix B (p. 74). The codebook with definitions, example quotations produced by the participants, and exemplars (i.e., key words associated to mentions made by participants) associated with the identified categories can be seen in Appendix C (p. 75).

It should be noted that, in future works using this framework the coding process can be simplified according to the research or intervention goals. For example, if aiming for a greater level of detail (i.e., third-order categories) the coding units can be coded directly into their third-order categories of demands or resources perceptions, as coding in one of these categories automatically qualifies the unit of meaning into its respective second- and higher-order category. If a higher level of detail is not needed (e.g., if the goal is just obtaining a qualitative D/R appraisal measure by dividing the total count of expressions of demands perceptions by the total count of expressions of resources perceptions; or if the goal is understanding the prevalence in each second-order categories) the coding can also be done directly into those groups of categories, given that, if needed, it is always possible to further specify the coding in the future. Future coding processes should also always include a 'non-categorizable' category (i.e., for coding units that are not categorizable as a demand or resource perception), and a 'others' category (i.e., for coding units that can be categorizable as a demand or as a resource perception, but do not fit in any of the existing second- or third-order categories), so that these can also be target of analysis after the initial coding.

Qualitative Overview of Extreme Hot Weather Demands and Resources Perceptions

In Appendix B (p. 74) we present the coding schematic together with the number of expressions of demands and resources perceptions, in each respective categories and subcategories, made by the participants. In Appendix C (p. 75) we present the codebook with definitions, example quotations produced by the participants, and exemplars associated with the identified categories (i.e., key words associated to mentions made by participants). An overview of these results shows that overall participants tended to perceive more resources than

demands, suggesting an inclination for appraising extreme hot weather events more as a challenge or safe situation than as a threat ($D < R$; $D/R = .64$).

Regarding demands perceptions participants produced more expressions of effort, followed by danger, and comparatively fewer mentions to uncertainty. Psychological effort (e.g., difficulty in thinking, in concentrating, or in emotional regulation) and health danger (e.g., broad consequences to health) were the most perceived demands. Yet, there was also evidence for a broad spectrum of demands perceptions such as, for example, physical or life-threatening danger (e.g., dying), social danger (e.g., conflict with others and social withdrawal or isolation), ecological danger (e.g., fear of impacts on fauna and flora, and occurrence of forest fires and droughts), metabolic effort, symptoms, and 'nuisances' (e.g., annoyance with sweating and accelerated heartbeat), effort in implementing heat protection behaviours or strategies (e.g., feeling bad when using air conditioning units or fans, feeling bad when drinking water, difficulty in preventing the household to warmup and in cooling it down) and/or in doing everyday activities (e.g., tiredness and fatigue), and financial effort and expenditures with protection (e.g., costs with energy, with the acquisition of equipment such as air conditioning units, and with adaptations in the household to make it more energy efficient).

Regarding resources perceptions participants produced mostly expressions of knowledge, abilities, and skills, and comparatively fewer expressions of external support (e.g., support from institutions, friends, or family members) and dispositions (e.g., personal goals and motivations, or patience and optimism). Tangible resources (e.g., material resources and equipment such as climatization devices or even having money to invest in heat protection), behavioural skills (e.g., knowledge about specific behaviours and strategies to face extreme hot weather such as staying hydrated, or looking for a climatized space to stay), and protective and restorative places (e.g., households, pools, beaches, dams, forests and natural parks, and even having a backyard with shade or owning a water well) were the most perceived resources. Although with comparatively fewer mentions there was also evidence for a broad spectrum of resources perceptions such as, for example, cognitions and motives for heat protection (e.g., positive attitudes and views leaning towards protection, and protection-oriented goals such as staying healthy or maintaining autonomy), traits and response tendencies (e.g., patience, flexibility, acceptance, optimism), institutional support (e.g., help and support specifically provided by authorities and institutions), informational support (e.g., access to and availability of information), and psychological skills (e.g., the ability to recognize and control one's emotions, or the ability to plan ahead and around the effects of extreme hot weather).

Discussion

The proposed data collection and coding framework aims to complement traditional challenge and threat approaches, allowing for qualitative exploration of extreme weather events demands and resources perceptions, and D/R appraisals. In that regard, it accounts for the role of qualitative indicators of D/R appraisals, based on data collection through individual's verbal or written reports.

Although the data collection and coding procedure here presented is centred around the evocation/imagination of extreme hot weather events in a laboratory setting, and not the actual experience of the event itself, there is a clear link between thinking about and experiencing a situation (Bruine de Bruin et al., 2016; Lefevre et al., 2015). In fact, thinking about a situation may function as a cognitive simulation of the general experience people have when faced with such events (Domingos et al., 2018). Nevertheless, the procedure allowed for the development of a flexible data collection and coding procedure focused on the qualitative exploration of demands and resources perceptions and D/R appraisals, while also allowing for the inclusion of more traditional measures (e.g., rating scales) and psychophysiological measures if needed, based on a theory-driven mixed-method quantitative and qualitative approach. This procedure can be applicable in practice, before (i.e., appraisal of future demands and resources perceptions), during (i.e., appraisal of current demands and resources perceptions), and/or after (i.e., retrospective appraisal of demands and resources perceptions) extreme weather events. Nevertheless, the validity should be higher when applied during an event occurrence, due to individuals' cognitive limitations in making retrospective appraisals and future estimations of the associated coping responses (Mattarella-Micke & Beilock, 2012; Skinner et al., 2003).

Even though this procedure was developed in the context of extreme hot weather events, it was developed with the goal of enabling a scaffold for adaptation and application not only to other extreme weather events but also to natural and man-made extreme events in general (e.g., extreme cold weather events; disease outbreaks; technological accidents; terrorist attacks). Accordingly, the identified higher-order and second-order categories of demands and resources perceptions are considered to be qualitative universal indicators of D/R appraisals across different types of 'motivated performance situations' (Blascovich & Mendes, 2010), although they may vary quantitatively in terms of prevalence of specific demands and resources perceptions across events (e.g., perception of danger, effort, and uncertainty may vary across events, depending on the events magnitude and severity). Differently, the third-order categories may not only differ in terms of prevalence, but may also be qualitatively expressed in different

ways across different types of events (e.g., the sub-category of ‘ecological danger’ may be more common in natural and man-made extreme events such as droughts or nuclear accidents, but not as much in other extreme events such as floods or terrorist attacks, and/or be expressed differently in different situations), or even not be expressed at all. Although more research is needed to properly extend the framework to other extreme events, we believe that it already provides researchers and practitioners with a guideline and the basic building blocks for a universal categorization system of demands and resources perceptions and appraisals, where new categories may emerge, and existent ones can be adjusted depending on the context of the targeted extreme event and on the research or intervention goals.

It is our contention that the proposed framework allows bridging the gap between research and practice, as it provides a theoretically driven data collection and coding approach, that may allow identifying demands and resources that can be acted upon (i.e., gaps in knowledge and misconceptions). This may allow public health authorities and policymakers to promote citizens resilience and adaptive potential in face of current and future extreme events, through the development of tailored communications to address identified gaps in knowledge and misconceptions (Bruine de Bruin & Bostrom, 2013; Morgan et al., 2002). In that regard, having the possibility for further qualitative distinctiveness between categories may be important, that is, specifying the demands and resources perceptions in greater depth through the identification of third-order categories and exemplars, allowing for example better qualitative distinction within second- and higher-order categories (e.g., danger demands may have physical and psychological consequences on individuals and communities, and as such it may be helpful to better distinguish between the prevalence of both). This distinctiveness can also enable better contextualization of the qualitative value of expressed demands and resources perceptions, allowing for example, policymakers grasping its significance for the population (e.g., knowing that there is greater perception of demands related with psychological effort may enable a more targeted intervention or communication to provide people resources to cope with such demands, instead of a generic approach addressing demands perceptions as a whole). Considering this, qualitative distinctiveness may also allow for better identification of misconceptions about demands and resources perceptions, which again can be of great value when developing evidence-based risk prevention strategies, interventions, and communications to promote human resilience and adaptation to extreme events.

In that regard, our qualitative overview of extreme hot weather demands and resources perceptions suggested that there may be some misconceptions on how participants perceive

these events. For example, participants expressed physiological and metabolic symptoms mostly in terms of effort or nuisance (e.g., annoyance with sweating and accelerated heartbeat), yet these may represent the first signs of more insidious and dangerous health consequences, both physical and psychological, as feeling or having awareness of symptoms related with heat stress is generally an indicator of danger to health (Hajat et al., 2010; Kovats & Hajat, 2008; Kovats et al., 2004). Another common misconception identified, was the association between heat exposure and sunlight or ultraviolet radiation exposure, as participants often mentioned the need to avoid the sun or to use sunscreen protector. Although the association is understandable, as heat protection recommendations often are accompanied with sun protection recommendations (e.g., DGS, 2015; Hajat et al., 2010; WHO, 2015), this may also have the potential to lead to the implementation of inappropriate risk protection behaviours such as applying sunscreen to prevent sunburn but not drinking enough water to prevent dehydration (Taylor et al., 2014). One last example of potential misconceptions was identified in the category ‘protective and restorative places’, as participants often mentioned places such as the beach, the countryside, and their houses as resources to cope with extreme hot weather events. Yet, outdoor places can also be particularly risky during extreme hot weather events, particularly when people do not go prepared or are ‘caught off-guard’ (WHO, 2015), signalling that it may be important to communicate and highlight that these events are different from regular hot summer days, and their outcomes can be uncertain (e.g., associating uncertainty demands, that were less mentioned, to better planification of activities and dispositional resources). Moreover, although participants frequently mentioned their houses as a resource to cope with extreme hot weather events, there were also mentions to effort in cooling down the houses during these events, and there is evidence that fatalities attributable to heat waves often happen at home before people have the chance to seek emergency help (Fouillet et al., 2006; Vellei et al., 2017), which signals the importance of identifying and addressing cases where these misconceptions are identified (e.g., where people perceive their houses as a resource but in fact lack the conditions to keep them fresh during actual extreme hot weather events).

Having qualitative expressions of demands and resources perceptions also allows re-analysis of the qualitative content. For example, it can allow distinguishing between demands and resources perceptions for self, for others, and for self and others, which can have implications when creating D/R appraisals (e.g., more general vs. more specific operationalizations). It can also allow for linguistic and semantic analysis of the expressions and words used by the participants to describe demands and resources perceptions, to better

understand, for example, when they use words conveying certainty or uncertainty, or words conveying greater or lower abstraction levels (e.g., Coenen et al., 2006). These types of analysis can serve as a starting point for the development of future computer-based approaches that can enable automated monitoring of indicators of demands and resources perceptions, threat, challenge, and safety.

The data collection and coding framework here proposed can also be used as part of other methodological approaches, and in the development of new instruments. For example, it can be modified and expanded to allow for its use in the scope of a Mental Models Approach, by allowing the exploration and identification of perceptions, misconceptions, and relevant wording, as well as by allowing a tool for comparing between lay and expert decision models (e.g., integrated in step 2 and step 3 of the Mental Models Approach; Bruine de Bruin & Bostrom, 2013; Morgan et al., 2002). Likewise, it can be used to develop instruments for follow-up surveys with larger samples, by using the qualitative content as the starting point to build items and scales. For example, third-order categories of demands and resources perceptions can be used to develop scales to assess such perceptions prevalence in larger samples (Bruine de Bruin & Bostrom, 2013).

From a more fundamental point of view, the proposed framework also adds the possibility for comparing D/R appraisal processes occurring at ‘different levels of consciousness’, for example, by enabling comparison between deliberative D/R appraisals (i.e., qualitative), self-reported appraisals (i.e., response scales), and/or psychophysiological measures (e.g., Blascovich & Mendes, 2010). Another research opportunity can be a better specification of behavioural strategies reported by the participants in future studies (e.g., approach vs. avoidance). For example, participants frequently expressed behavioural strategies as resources (e.g., looking for shade; avoiding the heat; avoiding places with others). Further exploration of specific behavioural strategies, or even better understanding about the demands and resources involved in the implementation of such strategies, can help us further understanding the interconnection between situations, cognitions, emotions, and psychological and behavioural responses (e.g., Skinner & Zimmer-Gembeck, 2015).

Lastly, the framework can be improved to consider possible changes in the way extreme weather events are conceptualized and experienced. Typically, extreme weather events are conceptualized as episodic, but because these events are expected to become more frequent, intense, and long lasting as result of climate change (IPCC, 2014; Lefevre et al., 2015; Santos, 2006; Spence et al., 2009; WEF, 2017; WHO, 2015), it is conceivable that in the future they

can also be conceptualized more often as chronic. In that regard the framework proposed here can be further adjusted in future studies to better capture not only indicators of initial appraisals of extreme weather events (e.g., the first time an event is perceived to deviate from normal) but also indicators of the re-appraisal of such events (e.g., the second, third, ..., time that the event is perceived to be different from normal), including capturing indicators about how these appraisal/re-appraisal processes evolve, change, and/or 'crystalize' with time (e.g., when the non-normal becomes the new normal). This could be implemented, for example, with sequential social media analysis of data collected during frequently occurring extreme weather events (e.g., heat waves or cold waves), 'traditional' longitudinal studies, or even studies where participants are asked to recall past events (e.g., how was it for you, how is it for you now).

Overall, we propose a flexible, adaptive, and open data collection and coding procedure focused on the exploration of demands and resources perceptions and D/R appraisals, that enables combining qualitative and quantitative approaches. The DeCodeR framework structure is flexible and easy enough to adapt and apply, enabling its use in the field, within affected communities, as extreme events unfold, allowing researchers and practitioners to obtain contextualized information. For example, this may enable timely identification peoples' perceptions of demands and resources, enabling tailored interventions and communications directly focused at adjusting demands perceptions (e.g., reducing socially amplified demands perceptions or increasing underestimated demands perceptions), and at providing the resources that people are still missing to be able to implement protective behaviours (e.g., addressing knowledge gaps or unawareness of available resources). As such, with this proposal, we aim at providing tools for advancing the understanding about the human adaptation and resilience processes to extreme events. With this framework it is our intent to potentiate the development of evidence-based strategies (e.g., crisis and risk interventions and communications) that can help promote human resilience and adaptation to natural and man-made extreme events, while promoting the understanding of human coping processes at a more fundamental level, so that future events can be appraised more as a challenge than a threat to cope with.

Appendix A

DeCodeR Data Collection Protocol and Procedures for Exploring Demands and Resources Perceptions and Appraisals about Extreme Events

Step 1 – study introduction, initial instruction and task

1. Study introduction

Present the study and obtain the informed consent. Upon acceptance present a general description about subsequent tasks.

Instructions/Questions

1.1. [Obtain Informed Consent]

1.2. *I am going to ask you to think about a situation. During this task, please concentrate only on what is requested and avoid distractions or thinking about other things.*

Procedures and alternatives

- If suitable for the research goals more information can be included here. For example, if the goal is to focus on retrospective appraisals the interviewer may add additional information, such as: *“I am going to ask you to think about a situation that you have experienced in the past, so that we can understand what you think about it”*. If not sure that the participants already experienced such situation in the past, the instruction can be further adapted, for example: *“I am going to ask you to think about a situation that you may have experienced or not in the past, so that we can understand what you think about it”*. If the goal is to focus on future appraisals the instruction can be, for example: *“I am going to ask you to think about a situation that you may experience in the future, so that we can understand what you think about it”*. If the goal is to focus on appraisals during the event the instruction can be, for example: *“I am going to ask you to think about a situation that is happening [e.g., today; now], so that we can understand what you think about it”*.

2. Initial instruction and task

Accordingly with the research goals, deliver the initial task instructions with the objective of evoking, making salient, and promoting participants thought process about a typical

(abstract/general) or specific (concrete) extreme event and its associated features. During the initial task psychophysiological measures of D/R appraisals can also be collected.

Instructions/Questions

2.1. *Please think about what it is for you a typical [insert extreme event]. Please think about it for a few minutes.*

Procedures and alternatives

- The selected ‘extreme event’ should be named here by the interviewer and allow time for the participant to think about it (note: standardize the duration of the task for all participants). Examples: extreme hot weather event; heat wave; extreme cold weather event; cold spell; tornado; thunderstorm; hurricane; flash flood; wildfire; terrorist attack; disease outbreak; technological incident.
- The instruction can also be adapted to include more specific (concrete) rather than typical (abstract/general) events, for example: *“Please think about the [insert extreme event] that occurred in [location and date]”*. Other alternatives include, for example: *“I am going to ask you to think about the last [insert extreme event] you have experienced”*; *“I am going to ask you to think about how it would be for you to experience an [insert extreme event] in the future”*. Similarly, an example of an extreme event may be presented in video, textual, or graphical formats, depending on the research goals. However, it should be noted that framing the situation in more concrete terms and focusing on a specific example, may limit the perceptions of demands and resources to that specific situation instead of the broader situation (e.g., demands and resources related to a specific geographically and time bound extreme event, instead of demands and resources related to that extreme event in general).
- If the instruction needs to include qualifiers/adjectives that convey meaning related with the events magnitude, choose terms with ‘a more neutral valence’, such as extreme or heavy. If it is not the goal of the research, avoid affective framing effects from using valence qualifiers/adjectives that may prime negative or positive affect (e.g., severe; hard; strong; good; bad; negative; positive; pleasant; unpleasant), unless their use is needed for the research goals.
- If needed the task can be modified to guide participants through the process of thinking about the situation (e.g., now think about the situation, now think about the

demands, now think about the resources you have to deal with the demands), or to focus participants on specific facets or components within the situation (e.g., behaviours: now think about what you are doing in that situation; feelings: now think about what you are feeling in that situation). This can be achieved by dividing the initial task in stages or sub-tasks. These sub-tasks can be introduced using computer-controlled methods (e.g., E-prime software).

- Allow a maximum time of 3 minutes (can vary according to the research goals and specifications) for each participant. Ensure that the mental elaboration task has the same duration across all participants. If the data collection process also involves psychophysiological measures, the initial task should be divided into guided sub-tasks, and allow for more overall task time, so that the psychophysiological measures can be properly acquired. Sub-tasks should be introduced using computer-controlled methods, so that the moment when each sub-task is introduced can be accurately identified and mapped on the psychophysiological output.

Step 2 – exploration of situations, demands, and resources

3. Exploration of situations (description task one)

After the initial task, if applicable, the situation participants thought about and their associated features can be explored. If exploration of the situations participants thought about is not needed for the research goals, the interviewer can jump directly to the exploration of demands and resources perceptions. Below are some examples of questions that can be made to explore the situation participants thought about.

Instructions/Questions

3.1. *Thank you. Now I am going to ask you some questions regarding what you thought about. Please remember that there are no right or wrong answers, and that what is important is that your answers best reflect what you thought about and your feelings about it. Can we proceed?*

3.2. *Can you please describe to me, as well as you can, the [insert the extreme event] you thought about?*

Procedures and alternatives

- Depending on the research goals, further exploration questions can be made here, focusing on different components and dimensions of the situation participants

thought about. For example: *“In that situation, can you please describe to me, what [did you do / what did you feel / etc.]”*. Simple probing questions can also be made, for example: *“Can you tell me more about that”*; *“How was that for you”*; *“How did you feel”*. When making probing questions care should be taken to not provide additional content that may influence participants descriptions, or hint in a given direction.

- Perceived norm deviation questions (qualitative and quantitative) can also be included, for example to explore their perceptions about that deviation, or to check if the participants thought about an extreme event as opposed to thinking about a ‘normal or regular version’ of that event (e.g., heat wave vs. hot summer day). Qualitative questions in that regard can include, for example: *“How does the [insert extreme event] you thought about, deviates from a normal/regular [insert regular event]”*; *“What takes you to say that the situation you thought about is deviates from [insert regular event]”*. Participants can also be asked to rate *“How much does the [insert extreme event] you thought about, deviate from a [insert regular event], followed by a response scale (e.g., Likert type scale or visual analogue scale).*
- Questions can also be made to control exposure frequency to the extreme event, by asking for example: *“In the last 6 months [or another temporal period] how frequently where you exposed to situations like the one you thought about”*, followed by a response scale (e.g., Likert type scale or visual analogue scale).

4. Exploration of demands (description task two)

Explore the demands that participants perceived in situation they thought about.

Instructions/Questions

4.1. *Can you please describe to me, as well as you can, the demands that are posed by the [insert the extreme event] you thought about, if any?*

Procedures and alternatives

- If applicable, other questions can be made to further explore the demands participants perceived in the situation they thought about. These can include questions framed as ‘consequences’, for example: *“What are the consequences that the [insert extreme event] you thought about may have to you”*. These can also include simple probing questions, for example: *“Can you tell me more about that”*.

When making probing questions care should be taken to not provide additional content that may influence participants descriptions, or hint in a given direction.

- Questions related with demands applicability (e.g., to self vs. others) can also be made in this section. For example, participants may mention demands that apply to them but not to other people and vice-versa. Therefore, optionally, complementary questions may be added to explore this, for example: “*Are you affected by all the demands you mentioned*”; “*Which of the demands you mentioned apply [e.g., only to you; to you and to other people; only to other people]*”
- After requesting participants to describe the demands they perceived in the situation they thought about, an additional primary appraisal measure can be included, for example: “*Overall, how do you classify the level of demands posed by the [insert extreme event] you thought about*”, followed by a response scale (e.g., Likert type scale or visual analogue scale). Because demands appraisals are based on the degree of perceived danger, effort, and uncertainty, as well as on the feelings of threat and distress, alternative questions can include for example: “*Overall, how [e.g., dangerous; effortful; uncertain; demanding; stressful; threatening] is the [insert extreme event] you thought about*”, followed by a response scale (e.g., Likert type scale or visual analogue scale). Rather than single item measures, this can also include a small composite measure (e.g., comprised by 3 items: how dangerous; how effortful; how uncertain).
- Please note that if needed for research purposes, the order of the description and rating tasks in the protocol can be altered (e.g., first asking participants to rate the level of demands and then asking participants to describe the demands they perceived in the situation they thought about).

5. Exploration of resources (description task three)

Explore the resources that participants perceived having to cope with the perceived demands in situation they thought about.

Instructions/Questions

5.1. *Can you please describe to me, as well as you can, the resources you consider having to deal with the demands posed by the [insert the extreme event] you thought about, if any?*

Procedures and alternatives

- If applicable, other questions can be made to further explore the resources participants perceived having to cope with the situation they thought about. These can include questions framed as ‘behaviors’, for example: *“In the [insert extreme event] you thought about, what did you do to deal with the demands posed by that situation”*. These can also include simple probing questions, for example: *“Can you tell me more about that”*. When making probing questions care should be taken to not provide additional content that may influence participants descriptions, or hint in a given direction.
- Questions related with resources accessibility/availability (e.g., to better understand if participants have access to all the resources they mentioned, or if there are other resources they know about but that they do not have access to), and/or applicability (e.g., to self vs. others), can also be made in this section. For example, participants may mention resources they know about, but that they do not have access to. They may also mention resources that they have but that others may lack, and vice-versa. Participants may have also developed specific idiosyncratic strategies to cope with the event that are not usual or socially shared. As such, additional questions can include, for example: *“Do you have access to all the resources you just mentioned”*; *“Are all the resources you just mentioned available to you”*; *“Are there additional resources you know about but that you do not have access to or are unavailable to you”*; *“Why you do not have access to some of the resources you mentioned”*; *“Are there resources you have but that others may lack”*; *“Are there resources others have but that you may lack”*; *“Do you have any personal strategy or strategies that you follow or developed to deal with the [insert extreme event] you thought about? [if yes] Which?”*.
- After requesting participants to describe the resources they perceived to have to cope with the demands perceived in the situation they thought about, an additional secondary appraisal measure can be included, for example: *“Overall how do you classify the level of resources you consider having to deal with the [insert extreme event] demands you thought about”*, followed by a response scale (e.g., Likert type scale or visual analogue scale). Because resources appraisals are based on the degree of perceived knowledge, abilities, and skills, dispositions, and external support, as well as on the feelings of challenge and ability to cope with the situation, alternative

questions can include for example: “*Overall, how [e.g., knowledgeable, able, capable, skilful, motivated, supported] were you to deal with the demands posed by the [insert extreme event] you thought about*”, followed by a response scale (e.g., Likert type scale or visual analogue scale). Rather than single item measures, this can also include a small composite measure (e.g., comprised by 3 items: how able; how motivated; how supported).

- Please note that if needed for research purposes, the order of the description and rating tasks in the protocol can be altered (e.g., first asking participants to rate the level of resources and then asking participants to describe the resources they perceived having in the situation they thought about).

Step 3 – additional measures

6. Inclusion of additional measures

Explore and control moderators, mediators, antecedents or consequents of extreme event-related demands and resources perceptions and appraisals.

Procedures

- In this step, other measures related with the target extreme event can be included, like for example relevant behavioural intentions, risk perception, knowledge (factual or subjective) about the event’s characteristics (e.g., average temperatures; temperature feeling; precipitation values; affected locations; environmental consequence; interpretations of specific event terminology), interference with daily personal, social, and work routines, pleasantness/unpleasantness estimates, attitudes, sociodemographic and individual characteristics (e.g., age; gender; health habits; known illnesses), among others.
- Other control questions can also be included in this step. For example, depending on the instruction a control measure can be included to check if participants thought about the extreme event in a more typical (abstract/general) or specific (concrete) way. This may allow for example distinguishing between general and event-specific demands and resources perceptions, that may enable creating general and specific ‘event templates’ (i.e., prototypical overviews of the extreme event in general vs. specific events within that category of extreme event), enabling comparison between event templates, and monitorization of such templates evolution over time.

Appendix B

DeCodeR Coding Schematic for Higher-order, Second-order, and Third-order Categories of Demands and Resources Perceptions, and Number of Coded Expressions

Categories and Sub-categories of Demands and Resources Perceptions			
Higher-order		Higher-order	
Second-order	<i>n</i>	Second-order	<i>n</i>
<i>Third-order</i>		<i>Third-order</i>	
Demands	889	Resources	1395
Danger	354	Knowledge, Abilities & Skills	1317
<i>Health Danger</i>	210	<i>Tangibles</i>	557
<i>Psychological Danger</i>	20	<i>Protective & Restorative Places</i>	317
<i>Physical Danger</i>	49	<i>Physical Skills</i>	9
<i>Social Danger</i>	34	<i>Psychological Skills</i>	71
<i>Ecological Danger</i>	15	<i>Behavioural Skills</i>	363
<i>Vulnerability Danger</i>	26	Dispositions	26
Effort	522	<i>Traits & Response Tendencies</i>	8
<i>Metabolic Effort</i>	138	<i>Cognitions & Motives</i>	18
<i>Behavioural Effort</i>	103	External Support	52
<i>Psychological Effort</i>	272	<i>Emotional Support</i>	6
<i>Financial Effort</i>	9	<i>Informational Support</i>	11
Uncertainty	13	<i>Instrumental Support</i>	13
<i>Situational Uncertainty</i>	7	<i>Spiritual Support</i>	5
<i>Response Uncertainty</i>	6	<i>Institutional Support</i>	17

Appendix C

DeCodeR Codebook with Categories and Subcategories Definitions, Example Quotations, and Exemplars

1. Demands Perceptions

Demands perceptions can be defined as perceived conditions, added pressures, or constraints posed by a given situation, and involve the perception and assessment (i.e., individual or public subjective evaluation/appraisal) of danger (e.g., to health), required effort (e.g., tiredness), and uncertainty (e.g., what and how to do), inherent to that situation.

1.1. Danger

Coding units representing the implicit/explicit perception and assessment of the situations' potential direct and/or indirect consequences to individuals/communities' safety, security, and physical and psychological health, expressed in affective (e.g., fear; anxiety), cognitive (e.g., perceived severity; perceived risk), and behavioural (e.g., uncontrollable fear reactions; panicking) dimensions.

1.1.1. Health Danger

Coding units representing the implicit/explicit perception and assessment of the situations' potential direct and/or indirect consequences to individuals/communities' general physical health (e.g., illnesses; disease outbreaks).

- **Example quotations.** *“For now, at the health level, if we have six or seven days at forty degrees it can harm our health”; “I do not drink much water, and then the evil begins, I get a little bit dehydrated, and with the heat even more, and then mouth becomes something inexplicable”; “My legs and feet start swelling and my health gets immediately worst”*
- **Exemplars.** *“migraines; body swelling; body pain; flu/colds; falling; diarrhoea; hypertension; hypotension; heart conditions; skin diseases; skin scaling; sunburns; cancer; poor health; mild health complications; aggravation of existing illnesses; dehydration; appetite loss; respiratory difficulty”*

1.1.2. Psychological Danger

Coding units representing the implicit/explicit perception and assessment of the situations' potential direct and/or indirect consequences to individuals/communities' psychological health (e.g., loss of self-esteem; negative affective experience; anxiety; depression).

- **Example quotations.** *“Hallucinations can also happen, it would have to be extreme, but it could happen”; “I get very distressed with the heat”; “Those days are so sad, I stay at home sitting on the couch and don’t go out for a walk, feels like I don’t want to do anything, then I start thinking about the past and I feel my sanity slipping away”*
- **Exemplars.** *“stress; anxiety; insomnia; psychological pain; depression; sadness; anger; hate; feeling low and disconnected; rumination; hallucinations; deep/strong negative feelings”*

1.1.3. Physical Danger

Coding units representing the implicit/explicit perception and assessment of the situations' potential physical harm, and danger to integrity and existence (e.g., organ failure, severe injuries, and other severe consequences) or death of individuals/communities.

- **Example quotations.** *“Well, it can harm me, the heat can even kill me, I can die due to the heat [laughs], the same way we can die from cold we also die from heat”; “If I cannot cool my body, there is no other expression, but my brain will start to fry”; “I can go into coma or even die”*
- **Exemplars.** *“overheating; fainting; coma; heatstroke; heart stroke; vascular stroke; death”*

1.1.4. Social Danger

Coding units representing the implicit/explicit perception and assessment of the situations' potential direct and/or indirect consequences to individuals/communities' social life and social context (e.g., social withdrawal; isolation).

- **Example quotations.** *“I’m there alone, and it is hot, and I do not get on so well, and it seems that I do not see anyone”; “Because I would like to be able to participate in things that I could do, and I am afraid of not being able to do them because of the heat, and then I will not go”; “Seems that on those days people get more impatient, in the*

coffee shop across the street there is always some kind altercation on those extreme hot days”

- **Exemplars.** *“becoming intolerant to others; increased social isolation; interference social activities; social withdrawal; interpersonal conflict; aggression; impoliteness”*

1.1.5. Ecological Danger

Coding units representing the implicit/explicit perception and assessment of the situations’ potential direct and/or indirect consequences to individuals/communities’ physical natural environment (e.g., loss of flora and fauna, wildlife, or ecosystems).

- **Example quotations.** *“The rivers will dry out, at least some, others maybe not, but meanwhile we will start having lack of water, and the plants will dry up”; “Have you ever seen the damages that the temperatures make now, they damage everything, these temperatures are bad for people, animals, and plants”; “Some of the plants on my balcony start to die with that hot weather, and the birds with their beaks open, poor fellows”*
- **Exemplars.** *“plants withering; animals in distress; forest fires; droughts; fountains and rivers drying out; polar ice melting; environmental degradation; dust in the air; bad air quality; climate change”*

1.1.6. Vulnerability Danger

Coding units representing the implicit/explicit perception and assessment of other individuals/communities’ vulnerability to the situations’ potential direct and/or indirect consequences and the severity of such consequences.

- **Example quotations.** *“I think that when the heat is intense, so, it will affect a set of people for whom that intense heat is not easy, so it is not just me having difficulties”; “I’m not seeing how to tell you, the older people, those people more elderly they are more frail and less able to withstand the heat”; “Those that already have some illness suffer a lot with the heat, my mother has diabetes and I think it’s hard for her sometimes”*
- **Exemplars.** *“vulnerable populational groups; elderly; children; people with illnesses; poor or homeless people; outdoor workers; farmers”*

1.2. Effort

Coding units representing the implicit/explicit perception and assessment of situation induced burdens (e.g., physiologic; behavioural; emotional; cognitive; financial) posed to individuals/communities, with synergistic or cumulative effects over the ‘normal’ everyday burdens.

1.2.1. Metabolic Effort

Coding units representing the implicit/explicit perception and assessment of situation induced physiological and metabolic burdens posed to individuals/communities (e.g., physiological and metabolic symptoms perceived as ‘nuisances’).

- **Example quotations.** *“Sometimes I sweat a lot, a lot of sweat, and that also bothers me both physically and mentally”; “Feeling so ill-disposed with the heat, sometimes it almost seems that I have to vomit due to that heat, I do not feel well, I feel bad”; “Sometimes it seems that my heart starts racing and pounds and pounds, it’s annoying”*
- **Exemplars.** *“sweating; skin rash; pimples; dizziness; accelerated heartbeat; chills; feeling hot; physical discomfort; soreness”*

1.2.2. Behavioural Effort

Coding units representing the implicit/explicit perception and assessment of situation induced physical burdens posed to individuals/communities (e.g., fatigue).

- **Example quotations.** *“If for example I need to go somewhere, it is something very hard for me, if for example I need to walk, to go on foot, on foot for a few miles, it is very difficult, I feel a lot more tired”; “The person is more, well, it is with less strength because the heat is too strong”; “It’s hard for me to do my daily chores and take care of the house, it’s even difficult for me to cool down the house on those days”*
- **Exemplars.** *“tiredness; fatigue; mobility difficulties; difficulty in doing physical activities; difficulty in doing daily chores; difficulty in drinking water; difficulty staying in an air-conditioned room; difficulty in preventing the household to warmup; difficulty in cooling the household down”*

1.2.3. Psychological Effort

Coding units representing the implicit/explicit perception and assessment of situation induced cognitive and emotional burdens posed to individuals/communities (e.g., impaired cognition; mood swings).

- **Example quotations.** *“The heat also makes thinking a lot harder, making it more difficult and much slower, thinking becomes extremely slower than normal”; “It implies that I change my life to be able to deal with the heat, and that is a bit demanding for me”; “It’s hard to think properly, and I get so much more irritated because of that”*
- **Exemplars.** *“worry; loss of will; thinking difficulty; concentration difficulty; disorientation; nuisance; mood swings; psychological discomfort; difficulty in mental/cognitive activities and tasks; changes in routine; irritation; mild negative feelings”*

1.2.4. Financial Effort

Coding units representing the implicit/explicit perception and assessment of situation induced financial burdens posed to individuals/communities (e.g., added monetary costs).

- **Example quotations.** *“I have to be constantly spending money on water”; “The energy expenditure, the light is too expensive, is it not, and the wages are low”; “Our houses are hot in the summer and cold in the winter, it’s something that is not cheap to fix. We could buy an air-conditioning, but they are expensive, and then there is the electricity bill”*
- **Exemplars.** *“economic costs and losses; energy bills; difficulty in purchasing equipment; costs with house maintenance and adaptation”*

1.3. Uncertainty

Coding units representing the implicit/explicit perception and assessment of insufficient, ambiguous, inconsistent, or incomplete information/knowledge about the situation and its associated characteristics (e.g., novel and unfamiliar features) and/or about the appropriate responses from individuals/communities (e.g., what to do; where to get protection).

1.3.1. Situational Uncertainty

Coding units representing the implicit/explicit perception and assessment of individuals/communities' uncertainty concerning the situation itself and its associated characteristics (e.g., its causes and consequences).

- **Example quotations.** *“It will create limitations to which I may not even be able to adapt”; “I do not know what that could bring to me”; “We never know how it will turn out to be and how many days it will last”*
- **Exemplars.** *“uncertain weather; uncertainty about the future; novelty; unfamiliarity; uncertain causes and consequences”*

1.3.2. Response Uncertainty

Coding units representing the implicit/explicit perception and assessment of individuals/communities' uncertainty concerning the appropriate responses (e.g., what to do; where to get protection).

- **Example quotations.** *“I would need more resources, which is what I do not have, but I am not sure what those resources could be”; “If it is too hot, I do not know, I do not know what I could do more, with the heat I cannot take my skin, I cannot”; “I don't really know what to do on those days, it is so hot, we can't do nothing can we? We have to take the heat”*
- **Exemplars.** *“uncertainty about resources usability, availability, and efficacy; uncertainty about protective measures; uncertainty about what to do; uncertainty how to implement heat protection behaviours”*

2. Resources

Resources perceptions can be defined as perceived individual and social assets or strengths that are available and are used by people to help them respond and cope with the situation conditions and its added pressures or constraints (i.e., demands), involving the perception and assessment (i.e., individual or public subjective evaluation/appraisal) of knowledge, abilities, and skills (e.g., what and how to do), dispositions (e.g., motivations), and external support (e.g., help from others) inherent to that situation.

2.1. Knowledge, Abilities, & Skills

Coding units representing the implicit/explicit perception and assessment of individuals/communities' own or contextually available knowledge (e.g., know-how related with protective behaviours and strategies; knowledge about tangible material resources; knowledge about protective places and other resources) and own abilities and skills (e.g., physical ability to perform protective behaviours and/or endure physical stresses; problem-solving and planning skills).

2.1.1. Tangibles

Coding units representing the implicit/explicit perception and assessment of individuals/communities' own or contextually available knowledge and know-how about potentially safe, secure, and protective tangible material resources (e.g., food and water; money; equipment).

- **Example quotations.** *“For me, it is wider and fresher clothes, mainly white, it is light clothes, wide ones”; “It has to do with the financial conditions of the person, my pension, look for example, my pension is never too much”; “The resource we always have is sunscreen protector, yes the use of sunscreen protector, I think it’s the most important”*
- **Exemplars.** *“fresh clothing; sunscreen; water bottles; umbrellas; hats; sunglasses; sprayers; mosquito nets; medicines; UV meters; irrigation systems; electric and non-electric fans; air conditioning and other climatization devices; having money, salary, or pensions; refreshments and other beverages; water; fruit; soup”*

2.1.2. Protective & Restorative Places

Coding units representing the implicit/explicit perception and assessment of individuals/communities' own or contextually available knowledge and know-how about potentially safe, secure, protective, and restorative places.

- **Example quotations.** *“I stay safe to the maximum, I stay at home every time I can, I stay at home until the extreme heat goes away”; “A garden more, with more trees, more shadows, and such things”; “We go to the beach, we go in the morning and then in the afternoon we make a picnic in the woods, and come back in the end of the day”*

- **Exemplars.** *“homes; pools; beaches; gardens; trees; stores; fountains; rivers; forests and natural parks; underground parking lots; dams; water wells; backyards with shade; countryside”*

2.1.3. Physical Skills

Coding units representing the implicit/explicit perception and assessment of individuals/communities’ own or contextually available knowledge and know-how about their own physical capabilities, to perform protective behaviours and/or endure physical stresses.

- **Example quotations.** *“The body gets increasingly habituated and the person also gains other routines to fight the intense heat”; “I had to adapt so that I could endure it, we have to adapt and make the best of it”; “I was born in Alentejo and lived there all my life, I know very well what extreme heat is, I grew with it, so I am physically prepared for it, and I like to stay in shape”*
- **Exemplars.** *“habituation; endurance; resistance; stamina; being in good physical shape; physical preparedness; autonomy to implement behaviours; physical resilience”*

2.1.4. Psychological Skills

Coding units representing the implicit/explicit perception and assessment of individuals/communities’ own or contextually available knowledge and know-how about their ability to think clearly, maintain focus, make plans, abstract from what is happening, and control and regulate emotions.

- **Example quotations.** *“I try not to think about what is happening, in the fact that it is very hot, I try to concentrate very hard and not let the heat interfere with me”; “I plan ahead what I am going to do on those days”; “I try to control what I’m feeling so that I can think better about what I can do in that situation, I think about what I did in the past and what worked”*
- **Exemplars.** *“cognitive shielding; cognitive restructuring; planning; cognitive abstraction; self-monitoring; self-regulation; self-soothing; numeracy; health literacy; memory”*

2.1.5. Behavioural Skills

Coding units representing the implicit/explicit perception and assessment of individuals/communities' own or contextually available knowledge and know-how about protective behaviours and strategies (e.g., approach and avoidance behaviours).

- **Example quotations.** *“In that case I would try to escape, I would probably try to leave or try by all means to find a way out of this situation, to escape the situation”; “I wave my hands to make some cold wind to my face”; “Well I move to the opposite side of the house from where the sun is coming, in the morning I stay in one side and in the afternoon I go to the other, if that does not work I lay myself on the floor, which is something very common here in Alentejo”*
- **Exemplars.** *“avoiding movement; avoid doing activities; searching for shadow; searching for fresher places; sleeping; freshening up; closing shades, windows, doors; doing relaxation exercises; avoiding alcohol; avoiding coffee and hot drinks; protecting the head; taking a bath; body moisturising; maintaining hydration; laying on the floor”*

2.2. Dispositions

Coding units representing the implicit/explicit perception and assessment of individuals/communities' own protection motivation traits (e.g., optimism), response tendencies (e.g., calmness), cognitions (e.g., ecological concern), and motives (e.g., affiliative), that facilitate protective responses.

2.2.1. Traits & Response Tendencies

Coding units representing the implicit/explicit perception and assessment of individuals/communities' own protection motivation traits and response tendencies associated with personality characteristics (e.g., optimism; calmness; patience; flexibility).

- **Example quotations.** *“I have to have patience and stay at home, I need to stay calm, and have patience, I need to be understanding”; “Well we have to be a little positive, do what we are told to do and wait patiently until better days come”; “We need to be understanding, it's very hot so have a little patience, instead of doing one thing we do another”*

- **Exemplars.** *“patience; serenity; calmness; acceptance; tolerance; resilience; pro-activity; responsibility; optimism; self-esteem; confidence; flexibility”*

2.2.2. Cognitions & Motives

Coding units representing the implicit/explicit perception and assessment of individuals/communities’ own protection motivation cognitions and motives (e.g., life goals).

- **Example quotations.** *“We need to have a positive attitude towards the heat, which is very important because if we have a negative attitude it seems that we will attract bad energy and it will not go well”; “First, I think that people need to recycle garbage and change big habits, like for example having more care with things, recycle the garbage, take more care of the streets, I recycle, that is, I try to take care of the environment”; “I want to live, I want to keep doing my life, have my independence so I don’t end up in a nursing home, I want to see my grandchildren grow, play with them, that’s why I always take care and protect myself”*
- **Exemplars.** *“positive attitudes and beliefs; pro-ecological behavioural goals and attitudes; self-efficacy; outcome-efficacy; coping orientation; affiliative motives; life goals; protection motivation”*

2.3. External Support

Coding units representing the implicit/explicit perception and assessment of individuals/communities’ contextually available support (e.g., emotional; informational; instrumental; institutional; spiritual) provided by material or immaterial others.

2.3.1. Emotional Support

Coding units representing the implicit/explicit perception and assessment of individuals/communities’ contextually available emotional support (e.g., emotional aid).

- **Example quotations.** *“I have two sons, and then sometimes they visit me at night, and they are always telling, mother do not walk in the sun, mother protect yourself, protect yourself from the heat”; “I always check on my mother, at least to give her some*

comfort”; “*It’s good to be with others, we can help each other and do something together to distract ourselves of the heat*”

- **Exemplars.** “*comfort; reinforcing feelings of safety; comforting others; emotional aid; shouldering; support provided by close ones and relatives*”

2.3.2. Informational Support

Coding units representing the implicit/explicit perception and assessment of individuals/communities’ contextually available informational support (e.g., availability or access to recommendations).

- **Example quotations.** “*We can use the media, computer, internet, listening to the radio and see how the day will be and what to do*”; “*I always go see in the internet, I see the number of days, and then I regulate myself, I see the days when I can leave or not, from 40 forward I will not leave, at 38 it is already a little too much*”; “*What I do is to follow the advices they give to people to safeguard themselves from heat. We are often informed through televisions or the media or other things*”
- **Exemplars.** “*access to information; information seeking; information and communication technologies*”

2.3.3. Instrumental Support

Coding units representing the implicit/explicit perception and assessment of individuals/communities’ contextually available instrumental support (e.g., physical help provided by others, for example in performing tasks).

- **Example quotations.** “*The doctors recommend that I do not to spend too much time in the sun*”; “*On those days something that I need to do it is my husband that does it, I ask my husband for help*”; “*Let’s say that I needed to do some errand, I would try to send someone for me to do it so I would not need to go, so I would avoid, I would avoid*”
- **Exemplars.** “*behavioural aids; help in tasks; physical support; help or advice from physicians, doctors, nurses, police officers, civil protection agents, firefighters, pharmacists, etc.*”

2.3.4. Spiritual Support

Coding units representing the implicit/explicit perception and assessment of individuals/communities' contextually available spiritual support (e.g., faith in a higher power).

- **Example quotations.** *“We cannot prevent it, we cannot prevent it, we are as they say, we are powerless, only God can protect us, is it not”; “It is the freshness that God sends me”; “I have faith that the heat will go away”*
- **Exemplars.** *“divine protection; spiritual relief; faith in a higher power”*

2.3.5. Institutional Support

Coding units representing the implicit/explicit perception and assessment of individuals/communities' contextually available institutional support (e.g., help and support specifically provided by authorities and institutions).

- **Example quotations.** *“I come here to the association where I can be more sheltered from the heat, I can mingle with other people, and I can have an improvement in my quality of life, nothing prevents me from avoiding the heat and coming here to the association”; “The authorities themselves, they should distribute water in those situations, because sometimes there are people who may not even have it”; “It’s the advice of the National Health Service”*
- **Exemplars.** *“support from associations, institutions, and recreative centres; support from authorities”*

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Chapter III

Appraisals and Verbalizations of Heat Wave Demands and Available Coping Resources: Effects of Emotion, Availability, and Links to Intention

Chapter based on:

Domingos, S., Bruine de Bruin, W., Gaspar, R., & Marôco, J. (2022). *Appraisals and verbalizations of heat wave demands and available coping resources: effects of emotion, availability, and links to intention*. [Manuscript in preparation].

Abstract

Enabling peoples' adaptation to heat waves is becoming increasingly vital. Promoting protective actions may involve addressing perceived situational demands and available resources, as well as emotions that may undermine intentions, as shown in previous studies. Here we tested the effect of emotion prompts on appraisals and verbal descriptions of demands and resources, and their effects on intentions to implement protective actions. We randomly assigned 156 Portuguese residents to instructions to think about an extreme hot weather event without an emotion prompt, with a positive emotion prompt, or with a negative emotion prompt, and assessed their appraisals and verbal descriptions of demands and resources, and their intentions to implement protective actions against heat waves. As compared to no-prompt and negative prompt, the positive emotion prompt led to lower intentions to protect against heat waves which was mediated by mentioning fewer demands. In our Portuguese sample, we replicated UK-based findings that positive emotions about hot weather may undermine intentions to protect against heat waves, perhaps due to lowering cognitive availability of demands. However, while the UK participants response pattern suggested positive views of heat waves, in contrast, our PT participants response pattern suggested negative views.

Keywords

Emotion; Demands & Resources Appraisals; Intentions; Risk Communication; Heat Waves

Introduction

Climate change is expected to increase the frequency, intensity, and duration of heat waves (Clayton et al., 2015; Intergovernmental Panel on Climate Change [IPCC], 2014; World Economic Forum [WEF], 2017). These events often result in surges of morbidity and mortality, which in turn pressures the already strained health care systems (Carey et al., 2017; Johnson et al., 2005; Knowlton et al., 2009; Kovats et al., 2004; Semenza et al., 1999). In countries such as the United States and Australia it is estimated that heat waves have been responsible for more deaths than any other natural hazard in the last 30 years (e.g., National Oceanic and Atmospheric Administration [NOAA], 2020; Scalley et al., 2015). Similarly, in Europe, it has been estimated that the 2003 European heat wave was directly responsible for approximately 35,000 excess deaths throughout the continent (Robine et al., 2008). Since then, health reports and research across Europe keep showing a trend of heat-related illness, emergency hospital admissions, and mortality associated to heat waves (e.g., Direção-Geral da Saúde [DGS], 2013, 2021; Oray et al., 2018; Pascal et al., 2018; Public Health England [PHE], 2018, 2019; Smith et al., 2016; van Loenhout et al., 2018; Williams et al., 2019; World Health Organization [WHO], 2015). For example, a report from the Portuguese Directorate-General for Health regarding the effects of the 2013 heat wave in the country, estimated an increase of approximately 8% in emergency hospital admissions, and 1684 excess deaths during that extreme hot weather event (DGS, 2013). More recently similar observations have been made in other countries. For example, in the United Kingdom it was estimated that the 2016 heat wave led to an increase of approximately 5% in emergency hospital admissions, and 908 excess deaths for that period (PHE, 2018).

In fact, epidemiological research suggests that there is excess mortality risk from both heat wave immediate and lagged effects of daily temperatures (Gasparrini & Armstrong, 2011). This risk is even more pronounced among the elderly, a particularly vulnerable population group, with research showing that there is 2% to 5% increase in mortality for every 1°C increase on average daily temperature during hot temperature periods (Yu et al., 2012). Their vulnerability correlates, for example, with age-related deterioration in skin vasodilation, reductions in heat loss responses of sweating, impairments in whole-body ability to dissipate heat, and pre-existing health conditions, which occur independently of individuals level of acclimation or habituation to heat (Bose-O'Reilly et al., 2021; Kaltsatou et al., 2018). This reality, particularly coupled with a rapidly aging world population (World Health Organization [WHO], 2017), poses systemic risks (Renn, 2021) not only because it strains the economic and

healthcare systems, but also the social and community systems, with multidimensional impacts on human health and wellbeing (Clayton et al., 2015).

Although there is evidence that people can reduce their vulnerability to extreme hot weather events by experiencing them (e.g., physiological adaptation, acclimation, and habituation) and improving infrastructure (e.g., adaptive changes in infrastructure) there may be limits to both physiological adaptation and adaptive changes in infrastructure (Arbuthnott et al., 2016), making protective behaviours (e.g., adaptive changes in behaviour) a fundamental drive for building adaptation and resilience to heat waves. On a broader picture, this means that promoting adaptation and mitigating heat wave risks to health and wellbeing requires the promotion of protective behaviours not only among the elderly and other at-risk groups (e.g., children, people with comorbidities, people in risk of poverty, homeless) but also among the active adult population in general. Firstly, this is because the active adult population may also be affected both directly (e.g., risk to own health, heat stress and exhaustion, cognitive function impairment, loss of productivity) and indirectly (e.g., collapse of emergency response systems, social instability and conflict) by the effects of heat on health and wellbeing (Bose-O'Reilly et al., 2021; Kjellstrom et al., 2016; Laurent, 2021; Laurent et al., 2018; McGregor et al., 2007). Secondly, because the protective behaviours implemented by the active adult population serve as a direct (e.g., protecting oneself and others; reminding others about what to do) and indirect (e.g., alleviating strains on the healthcare system) protective factor. For example, if a person decides that heat protection behaviours should be implemented, this may protect not only himself but also those that may live with him, such as children or elderly, and remind others to protect. Because of this, our study includes young adults, active adults, and elderly participants.

The Role of Demands and Resources in Promoting Adaptation to Heat Waves

Promoting adaptation and mitigating heat wave risks to physical and psychological health and wellbeing, requires the promotion of protective behaviours. Achieving this goal requires better understanding of the processes that may motivate people to protect themselves from heat waves. The literature suggests that how people cope with potential stressors, such as heat waves, may be shaped by their appraisals of the demands (e.g., primary appraisal – danger; effort; uncertainty) posed by the situation, and of the resources (e.g., secondary appraisal – knowledge, abilities, and skills; individual dispositional characteristics; available external support) that may enable adaptive coping responses (Blascovich, 2007, 2008; Blascovich &

Mendes, 2000, 2010; Domingos et al., 2020, 2018; Folkman & Lazarus, 1980; Gaspar et al., 2015, 2021; Lazarus & Folkman, 1984; Tomaka et al., 1993, 1997).

According to Folkman and Lazarus (1980, p. 223), appraisal is defined as “the cognitive process through which an event is evaluated with respect to what is at stake (primary appraisal) and what coping resources and options are available (secondary appraisal)”. In turn, building on the definition by Folkman and Lazarus (1980, p. 223), coping can be defined as “the set of cognitions and behaviours aimed at reducing external and internal demands through the use of personal and social resources to solve a stressful problem”. Grounded on this, coping thus “describes how people mobilize, modulate, manage, and coordinate their behaviour, emotion, and attention (or fail to do so) under stress – how people detect and respond to actual stressors in their everyday lives” (Skinner & Zimmer-Gembeck, 2009, p. 6). With regard to demands, these can be defined as “conditions or added constraints posed by a given situation and involve the perception or assessment of personally relevant danger (e.g., to health), required effort (e.g., tiredness), and uncertainty (e.g., what and how to do) inherent to the situation” (Blascovich & Mendes, 2000, 2010; Domingos et al., 2020; Gaspar et al., 2021). In turn, resources can be defined as “available individual and social assets or strengths used by people to help them cope with the situation and its added constraints, and involve the perception or assessment of personally relevant knowledge, abilities, and skills (e.g., what and how to do), individual dispositions (e.g., optimism; patience; personal motivations), and external support (e.g., help from others) inherent to the situational response” (Blascovich & Mendes, 2000, 2010; Domingos et al., 2020; Gaspar et al., 2021).

Research has systematically demonstrated that coping behaviour is a process influenced by perceived situational constraints (demands) and available personal and social resources (e.g., Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2009, 2015; Zimmer-Gembeck & Skinner, 2016), and that the relation between demands and resources perceptions has impact on cognitive (e.g., arithmetic tasks, message processing, decision making), affective (e.g., emotional experience and expression), behavioural (e.g., motor action/coordination, protective behaviours), and social (e.g., interactions with others) task performance (e.g., Blascovich et al., 1993, 2003, 1999; Brimmell et al., 2018; Fazio et al., 1992; Fonseca et al., 2014; Garcia-Marques et al., 2015; Mendes et al., 2002; Moore et al., 2012; Norris et al., 2010; Tomaka et al., 1993, 1997).

Originally the outcome of the relation between demands and resources perceptions (i.e., appraisal) has been conceptualized as psychophysiological states (i.e., motivational states

linked to specific physiological, affective, cognitive, and behavioural components), defined as “challenge” or “threat” motivational states (Blascovich & Mendes, 2000, 2010). For example, appraising sufficient resources to cope with the demands (i.e., challenge) has been linked with approach motivation. Such motivation has been connected to more efficient cardiac responses (e.g., vasodilation and greater peripheral blood flow), eustress¹¹, positive emotions (e.g., optimism, pride, and self-esteem), active¹² and proactive¹³ coping, and open posture behaviours (e.g., leaning towards approach). Differently, appraising insufficient resources to cope with the demands (i.e., threat), has been linked with avoidance motivation. Such motivation has been connected to less efficient cardiac responses (e.g., vasoconstriction), distress¹⁴, negative emotions (e.g., shame and anxiety), passive¹⁵ coping, and closed posture behaviours (e.g., leaning toward avoidance; for a review see Blascovich & Mendes, 2010). This relation has typically been assessed through psychophysiological measures, and through self-reported primary and secondary appraisal measures (Blascovich & Mendes, 2000, 2010; Blascovich &

¹¹ According to the American Psychological Association ‘eustress’ is defined as “the positive stress response, involving optimal levels of stimulation – a type of stress that results from challenging but attainable and enjoyable or worthwhile tasks (e.g., participating in an athletic event, giving a speech). It has a beneficial effect by generating a sense of fulfillment or achievement and facilitating growth, development, mastery, and high levels of performance” (American Psychological Association [APA], 2022).

¹² According to the American Psychological Association ‘active coping’ is defined as “a stress-management strategy in which a person directly works to control a stressor through appropriately targeted behavior, embracing responsibility for resolving the situation using one’s available internal resources. This type of coping strategy may take various forms, such as changing established habits. Active coping generally is considered adaptive, having been associated with fewer mood disturbances, enhanced self-efficacy, and other favorable consequences. It is similar to the earlier conceptualization of problem-focused coping but distinguished by its focus upon one’s internal resources” (APA, 2022).

¹³ According to the American Psychological Association ‘proactive coping’ is defined as “a stress-management strategy that reflects efforts to build up resources that facilitate promotion toward challenging goals and personal growth. Proactive individuals are motivated to meet challenges, and they commit themselves to their own high standards. They see demands and opportunities in the distant future and initiate a constructive path of action toward meeting them. Stress is interpreted as eustress, that is – productive arousal and vital energy – and coping thus becomes goal management instead of risk management. Proactive coping does not arise from any negative appraisals, such as harm, loss, or threat” (APA, 2022).

¹⁴ According to the American Psychological Association ‘distress’ is defined as “the negative stress response, often involving negative affect and physiological reactivity – a type of stress that results from being overwhelmed by demands and losses. It has a detrimental effect by generating physical and psychological maladaptation and posing serious health risks for individuals” (APA, 2022).

¹⁵ According to the American Psychological Association ‘passive coping’ is defined as “a stress-management strategy in which a person absolves himself or herself of responsibility for managing a stressor and instead relinquishes control over its resolution to external resources, such as other people and environmental factors. Individuals who cope passively often withdraw from interpersonal relationships and instead engage in such activities as hoping, praying, or avoiding the stressor. This type of coping strategy generally is considered maladaptive, having been associated with increased depression, poorer psychological adjustment, and other adverse consequences. It is similar to the earlier conceptualization of emotion-focused coping but distinguished by its focus on external factors and abdication of personal responsibility” (APA, 2022).

Tomaka, 1996; Tomaka et al., 1993, 1997). In this regard, there have been studies showing convergent validity between both psychophysiological measures and self-reported primary to secondary appraisal measures (Blascovich & Mendes, 2010; Tomaka et al., 1993, 1997), and other self-reported measures such as Ferguson et al. (1999) Appraisal of Life Events scale (Feinberg & Aiello, 2010). More recently Domingos et al. (2020), proposed the DeCodeR framework, a theory-driven mixed-method approach for assessing indicators of demands and resources perceptions and appraisals from peoples' verbal and written descriptions and narratives concerning social emergencies and crisis situations, enabling such data to be collected through different qualitative techniques (e.g., semi-structured interviews; social media user generated content during crisis events).

Although perceiving sufficient resources to cope with the demands of certain tasks typically results in better task performance and approach motivation, research is not completely consistent, and exceptions have been found. For example, Fonseca et al. (2014) found that appraising greater resources than demands was associated with lower engagement and more superficial processing in information processing tasks, seemingly impairing ability to distinguishing between strong and weak arguments. Feinberg and Aiello (2010) found mixed findings where individuals that appraised greater demands than resources in arithmetic tasks sometimes seemingly outperformed participants that appraised greater resources than demands, especially when working alone. Additionally, Hunter (2001) found that participants who appraised greater demands than resources performed better in recalling information related to danger than participants who appraised greater resources than demands, suggesting that demands could be cognitively less available for the later. One hypothesis advanced for these exceptions is that appraising greater resources than demands may be associated with better performance on tasks that require the use of relatively automatic processes but may lead to poorer performances on tasks that require more controlled processes (Fonseca et al., 2014). Another hypothesis is that appraising much greater resources than demands can lead to a state characterized by 'feelings of safety', lower demands and risk perceptions, reduced stress responses (i.e., distress and eustress), and lower motivation for task performance, processing information, or protection (Blascovich & Mendes, 2000).

This evidence reinforces that the impacts of the relation between demands and resources on motivation and coping behaviour are situation dependent, and that other factors (e.g., individual and social) may come into play within specific contexts. As such, better understanding of demands and resources appraisal processes in the context of extreme hot

weather events, and their impacts on other psychological variables (e.g., intentions to protect against heat waves) may provide not only important evidence for promoting adaptation to heat waves, but also contribute to the literature in this regard.

The Role of Affect and Availability in Promoting Adaptation to Heat Waves

When evaluating hazards people typically rely on intuitive risk judgments known as “risk perceptions” (Slovic, 1987), which can be influenced by heuristics such as the affect heuristic (Finucane et al., 2000; Slovic et al., 2004; Zajonc, 1980) and the availability heuristic (Tversky & Kahneman, 1973, 1974). Heuristics can be defined as “mental shortcuts” for making judgments or decisions, particularly in complex situations or when resources are limited or constrained (Finucane et al., 2000; Slovic et al., 2004). In the case of affect heuristic people base their judgments or decisions on readily available affective impressions (e.g., relying on perceived emotional valence), elaborating with that, instead of retrieving from memory all the relevant examples and weighing the pros and cons (Finucane et al., 2000). In the case of availability heuristic, people base their judgments or decisions on the ease and frequency in which information comes to mind (e.g., leading to the belief that something happens more frequently than it actually does), elaborating with that, instead of retrieving from memory all the relevant examples and weighing the pros and cons (Tversky & Kahneman, 1973). Moreover, research has established important interconnections between availability and affect heuristics, as the information that comes to mind through ease of recall also comes tagged with affect (Lichtenstein et al., 1978; Slovic et al., 2007), and the activation of concepts in the brain (e.g., association trees between words, images, memories, ideas, smells), learning, and predicting future outcomes are also connected to emotion (Damasio, 1994; Kiefer & Pulvermüller, 2012; Kiefer et al., 2007; Pulvermüller & Schumann, 1994; Rolls, 1999; Vigliocco et al., 2009). Thus, positive or negative affect towards a situation, or even variations of these (i.e., both affective and situational), may activate and make readily available different information in one’s mind (Wilson-Mendenhall et al., 2011). This is particularly important considering the notion of Bounded Rationality, which posits that rationality is bounded not only by people’s “limited inner mental environment” (e.g., available cognitive resources, memories accessibility, activated concept trees/networks) and “physical capacities” (e.g., degree to which a person can manage the physical tasks of daily living), but also by their two-way interactions with the “outer physical and social environment” (Simon, 2000). In other words, rationality is also bounded by person-environment interactions that can be defined as the “relationship between a person’s

psychological and physical capacities and the demands placed on those capacities by the person's social and physical environment" (American Psychological Association [APA], 2022). The conceptual features resulting from this relation are associated with emotional systems and "stored in distinct sensory and motor brain areas depending on specific sensory and motor experiences during concept acquisition" (Kiefer & Pulvermüller, 2012, p. 805).

As such, emotions play an important role in the way people perceive and interact with the world around them, and more specifically in the way they perceive risks (Slovic et al., 2004, 2007). For example, research has systematically provided evidence that people's positive or negative emotional reaction to a risk guides the way they perceive, think, and judge that risk, associating positive emotions to lower risk perception and negative emotions to greater risk perception (Alhakami & Slovic, 1994; Ferrer & Klein, 2015; Fischhoff et al., 1978; Loewenstein et al., 2001; Paek & Hove, 2017; Slovic, 1987; Slovic et al., 2004, 2007, Slovic & Peters, 2006; Taylor et al., 2014b). Emotions have also been shown to play a role in intentions to protect against heat waves, with previous research suggesting that United Kingdom residents tend to have positive emotions about hot weather, which undermines their intentions to protect against heat waves (Bruine de Bruin et al., 2016; Lefevre et al., 2015; Taylor et al., 2014a, 2014b). For example, in Bruine de Bruin et al. (2016), participants residing in the United Kingdom, were randomly assigned to one of three interventions aimed at promoting heat protection behaviours, or to a control group. The intervention strategies aimed to build on the availability heuristic by 1) prompting participants to recall the highest maximum summer temperature, on the affect heuristic by 2) prompting participants to recall the most unpleasant summer temperature, or 3) a combination of both. Interestingly results showed that asking participants to recall high summer temperatures elicited thoughts of pleasantly hot summer weather, whereas asking participants to recall the most unpleasant summer temperatures elicited thoughts of unpleasantly cold summer weather. The third strategy which combined these two approaches succeeded in evoking thoughts of unpleasantly hot summer weather and on increasing participants' expressed intentions to protect against heat. This study not only provided evidence on the affective and cognitive processes subjacent to "threats that evoke positive affect", but also suggested that UK residents have positive views of heat waves, as they showed similar responses (thoughts of pleasantly hot summer weather) between no-prompt (control) and the prompt that inadvertently evoked positive emotion (highest maximum summer temperature).

Given that UK residents seem to think fondly about hot weather, as also suggested in the studies by Abrahamson et al. (2009) and Wolf et al. (2010), and that hot summer weather was seemingly associated with negative affect among residents of the southern areas of the United States and Europe (Keller et al., 2005), there may be cross-country variability in such perceptions. Thus, there is a need for additional studies to better understand the dynamics of affect and availability in promoting adaptation to heat waves, and the situation specific factors that may determine these, specifically in countries vulnerable to the impacts of heat waves due to climate change. This is because, when developing communications and interventions to promote adaptation, there may be a need to customize them to the communication context (i.e., to the culture and geographical location).

Current Study

Here, we examine whether promoting intentions to protect against heat waves may involve addressing emotions, as well as the perceived demands (danger, effort, uncertainty) posed by heat waves, and the perceived resources (knowledge & capability, individual dispositions, external support) that enable coping in such situations. The present study built both on the affect and availability heuristics to test the effect that emotion prompts may have: 1) on intentions to protect against heat waves (RQ1); 2) on appraisals of demands and resources (RQ2); and 3) on the number of verbal descriptions of demands and resources produced by the participants (RQ3). We also examine if the effect that emotion prompts may have on intentions to protect against heat waves is mediated by appraisals of demands and resources, and by the number of verbal descriptions of demands and resources produced by the participants (RQ4).

Additionally, we also aim to understand if the results from Bruine de Bruin et al. (2016), who showed that UK residents tend to have positive emotions about hot weather, which seems to undermine their intentions to protect against heat waves, would be replicable in countries more exposed to heat waves occurrence and their risks, such as Portugal, a country identified as vulnerable to the impacts of heat waves due to climate change (Naumann et al., 2020; Rodrigues et al., 2021; Schleussner et al., 2019; von der Leyen, 2019). Hence, following from the work by Bruine de Bruin et al. (2016), we implemented a one-factor between-participants design, by randomly assigning Portuguese participants to three different conditions, with the type of emotion prompt as the independent variable (i.e., no prompt/control; positive emotion prompt; negative emotion prompt). We examined the effects of these emotion prompts on

intentions to protect against heat waves (RQ1), appraisals of demands and resources (RQ2) and verbalizations (RQ3), as well as if demands and resources appraisals and verbalizations mediated the emotion prompts effects on intentions (RQ4).

Method

Sample

The study was completed by a total of 156 Portuguese residents. Participants had between 18 and 88 years old ($M = 41.51$; $SD = 25.42$), with 78.8% female, and 91.7% reporting at least high school or lower education level, 11.5% reporting living alone, 67.3% reporting doing regular physical activity, and 16.7% reporting doing activities that forced them to expose to extreme hot weather. The sample was recruited following non-random sampling procedures, namely through convenience and snowball sampling, resorting to informants in the community (e.g., parishes councils; elderly associations; universities) and other participants for reference to potential participants. In line with Bruine de Bruin et al. (2016) data was collected in October 2016, after the second hottest summer in the country since 1931 (Instituto Português do Mar e da Atmosfera [IPMA], 2016).

Procedure

Experimental manipulation. Participants were randomly assigned to one of three experimental conditions: 1) a control condition without an emotion prompt, in which participants were instructed to “think about a typical extreme hot weather event (e.g., heat wave)”; 2) a condition with a negative emotion prompt, in which participants were instructed to “think about a typical extreme hot weather event (e.g., heat wave) that you would find unpleasant”, and 3) a condition with a positive emotion prompt, in which participants were instructed to “think about a typical extreme hot weather event (e.g., heat wave) that you would find pleasant”.

Situational temperature estimates. After the initial task, participants were asked to “describe, the best as you can, the situation you thought about”. Participants were also instructed to estimate the temperature they believe would be observed in the extreme hot weather event they thought about, by asking them “what temperature (in Celsius) do you think occurs or is registered in the extreme hot weather event you thought about”. Participants verbal

responses of estimated temperature were recorded. For those who answered by giving a temperature interval estimate, the average value of that estimate was computed and considered as the response.

Descriptions and appraisals of demands and resources. Subsequently, participants were asked to “describe the demands, that is the difficulties and barriers, posed to you by the extreme hot weather event you thought about, if any”, providing a description of the demands that came to mind. After providing their descriptions of demands, participants were instructed to “rate the level of demands posed by the extreme hot weather event you thought about”, giving their responses on a visual scale ranging from 0 (extremely low) to 100 (extremely high). Next, participants were asked to “describe the resources you have available to deal with the demands posed by the extreme hot weather event you thought about, if any”, providing a description of the resources that came to mind. After providing their descriptions of resources, participants were instructed to “rate the level of resources that you have available to deal with the demands posed by the extreme hot weather event you thought about”, giving their responses on a visual scale ranging from 0 (extremely low) to 100 (extremely high). Both ratings were based on the primary and secondary appraisal measures proposed by Blascovich, Tomaka, and colleagues (e.g., see Blascovich & Tomaka, 1996; Tomaka et al., 1993, 1997).

Participants responses to the questions used for eliciting demands and resources descriptions respectively (“describe the demands, that is the difficulties and barriers, posed to you by the extreme hot weather event you thought about, if any” and “describe the resources you have available to deal with the demands posed by the extreme hot weather event you thought about, if any”) were recorded, transcribed, and coded by two independent judges into one of two categories of demands or resources, in line with the theory-driven mixed-method framework proposed by Domingos et al. (2020), reaching acceptable interrater agreement (Cohen’s $\kappa = .91$). This allowed assessing not only the total number and percentage of verbal reports excerpts coded in each category (i.e., the number of demands and resources participants thought about), but also the specific types (sub-categories) of demands and resources participants thought about (Table 1). Overall, participants produced more verbal descriptions of resources ($N = 1364$; 60.92%) than demands ($N = 875$; 39.08%). Verbal descriptions of demands made by the participants were mostly related with effort (58.97%) and danger (39.89%), with fewer mentions to uncertainty (1.14%). Verbal descriptions of resources were mostly related with knowledge and capability (95.16%), with fewer mentions to external support (3.01%) and individual dispositions (1.83%).

Table 1*Demands and Resources Coding Framework and Coding Unit Examples*

Coding Framework Categories & Sub-Categories	Mentions
Examples	n (%)
Demands	875 (39.08)
Danger (e.g., fainting, dying, contracting a disease) <i>“Sometimes the issue of fainting due to the heat, I can faint or even worse”</i>	349 (15.59)
Effort (e.g., tiredness, concentration difficulty, exhaustion) <i>“Maybe I get more tired, the tiredness, yes, the tiredness also, a little bit, a little bit more”</i>	516 (23.04)
Uncertainty (e.g., about the situation, future, what to do) <i>“I would need more resources than there are, but I am not sure what those resources could be”</i>	10 (0.45)
Resources	1364 (60.92)
Knowledge & Capability (e.g., strategies, safe places, equipment’s) <i>“I lay down on the floor, here people usually lay on the floor of the houses because it is fresher”</i>	1298 (57.97)
Individual Dispositions (e.g., motives, cognitions, traits & states) <i>“I have to be patient and stay at home, be calm, and have patience, well, be understanding”</i>	25 (1.12)
External Support (e.g., family, neighbours, institutions) <i>“I come here [to the association], they turn this on cold, because I do not have this in my house”</i>	41 (1.83)
Total Mentions	2239 (100)

Ratings of intentions to protect against heat waves. After verbally reporting and rating their perceptions of extreme hot weather demands and resources, participants were instructed to rate a set of protective behaviours, as follows: “in the future, if you experience a heat wave, what is your intention to engage in each of the following behaviours?”. This was followed by the presentation of 24 items, in randomized order, describing heat wave protection behaviours (see Appendix A, p. 125), where participants rated their intention to have each behaviour on a

visual scale ranging from 0 (not inclined at all) to 100 (totally inclined). These behaviours were based on the list of recommendations for protection against heat waves issued by the Portuguese Directorate-General for Health (DGS, 2015) and on the scales used by Bruine de Bruin et al. (2016). Items included intentions for both self-protection and social help behaviours (e.g., reminding others who are close to them of drinking more water). Internal consistency across the 24 items was good and sufficient to create an averaged score (Cronbach's $\alpha = .86$).

Situational pleasantness/unpleasantness estimates. Lastly, participants rated their perception of pleasantness/unpleasantness associated with the event they thought about, upon receiving the instruction “the extreme hot weather event you thought about was” and thus rating it on a visual response scale ranging from 0 (extremely unpleasant) to 100 (extremely pleasant).

Analysis Plan

As manipulation checks, to test if instructions were successful in eliciting both affect and availability, we conducted analyses of variance (ANOVAs) to examine the experimental manipulation effect on situational temperature estimates and situational pleasantness/unpleasantness estimates. In line with Bruine de Bruin et al. (2016), this was done to test if instructing participants to think about an extreme hot weather event with a positive emotion prompt led to lower estimates of extreme temperature (i.e., higher cognitive availability of lower estimates of extreme temperatures) and higher pleasantness estimates (i.e., higher positive affect) compared to those instructed to think about it with without an emotion prompt or with a negative emotion prompt. Next, we used ANOVAs to examine the effect of the experimental manipulation (i.e., no emotion prompt/control, positive emotion prompt, or negative emotion prompt) on intentions to protect against heat waves (RQ1), on appraisals of demands and resources (RQ2), and on verbalizations of demands and resources (RQ3). Lastly, using the Preacher & Hayes (2008) PROCESS macro for the SPSS software, we conducted linear regressions with bootstrapping mediation tests to evaluate if demands and resources appraisals and verbalizations mediated the effects of the experimental manipulation on intentions (RQ4). For this, the experimental conditions were coded into dummy variables. Verification of assumptions (e.g., normality and absence of multivariate outliers) to perform the statistical tests were conducted in line with Marôco (2014). Control for demographic variables (age, gender, education, living alone, doing regular physical activity, and forced exposure to extreme hot weather) was included in the analysis, but excluding them produced

similar conclusions. For significant ANOVAs, Tukey HSD post-hoc tests were used to evaluate group differences. Effect sizes were reported using the η^2_p statistic and interpreted following guidelines for behavioural and social sciences Marôco (2014). For all analyses, we set $\alpha = .05$ (two-sided).

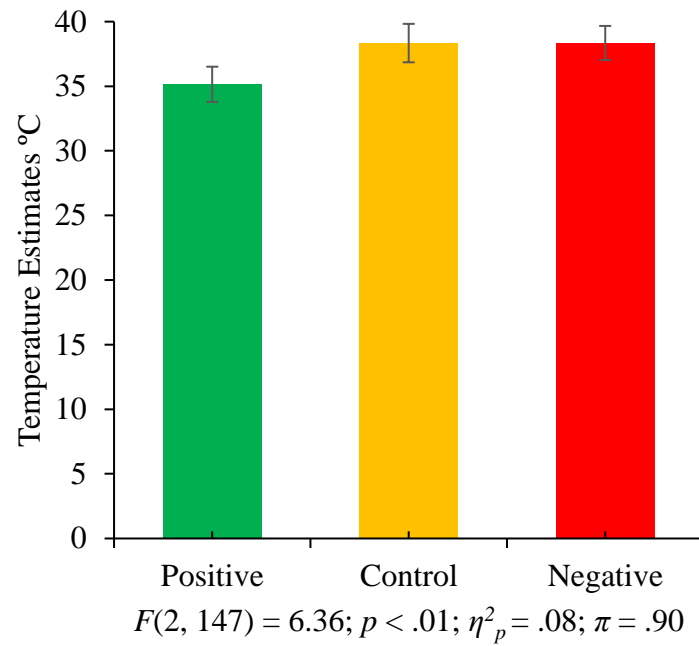
Manipulation Checks

As shown in Figure 1 and Figure 2, instructions to think about a typical extreme hot weather event without an emotion prompt (no-prompt/control), with a negative emotion prompt, or with a positive emotion prompt produced significant differences on temperature estimates in Celsius degrees ($F(2, 147) = 6.36; p < .01; \eta^2_p = .08; \pi = .90$) and pleasantness estimates ($F(2, 147) = 103.58; p < .001; \eta^2_p = .59; \pi = 1$).

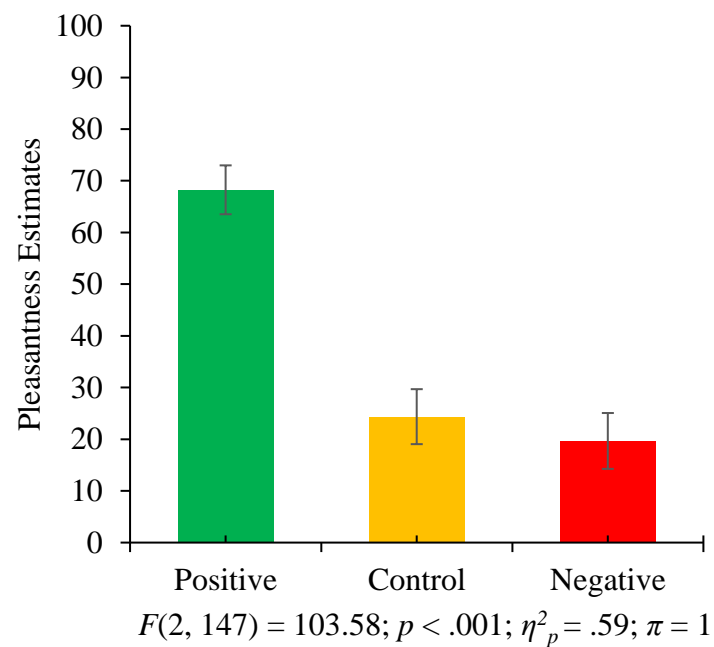
Temperature estimates were significantly lower in the positive prompt condition ($M = 35.15; SD = 4.86$), compared to the no-prompt ($M = 38.34; SD = 5.40; p < .01; 95\% CI]-5.52; -.87[$) and negative prompt ($M = 38.35; SD = 4.75; p < .01; 95\% CI]-5.54; -.86[$) conditions. No differences were found on average estimated temperature between no-prompt and negative conditions ($p = .999; 95\% CI]-2.32; 2.31[$). Moreover, average estimated temperatures across conditions, including the positive emotion prompt condition, were consistent with temperature ranges for extreme hot weather events during the summer in Portugal, evidencing that the estimates differed from normal average summer temperatures, considering the “Portuguese climate normal from 1971-2000 and the RCP 4.5 and RCP 8.5 projected scenarios for 2011-2040” (see <http://portaldoclima.pt/pt/>). Although a significant effect was found, the observed effect size near the lower bound of the medium effect size range suggests that other factors contribute to explain the variance of temperature estimates found in this study. Likewise, events were perceived as significantly more pleasant in the positive prompt condition ($M = 68.26; SD = 16.82$) compared to the no-prompt ($M = 24.37; SD = 19.30; p < .001; 95\% CI]35.28; 52.51[$) and negative prompt ($M = 19.66; SD = 19.40; p < .001; 95\% CI]39.94; 57.25[$) conditions. Again, no differences were found between no-prompt and negative conditions ($p = .399; 95\% CI]-3.87; 13.28[$). The observed effect size, near the lower bound of the very high effect size range suggests that the manipulation plays an important role in explaining the variance of pleasantness estimates found in this study.

Figure 1

Effect of Emotion Prompts on Estimated Temperatures (in Celsius)

**Figure 2**

Effect of Emotion Prompts on Pleasantness Estimates



Although these manipulations checks are generally in line with what was expected, interestingly, contrary to what was also expected the instructions did not produce significant differences between negative and no-prompt conditions.

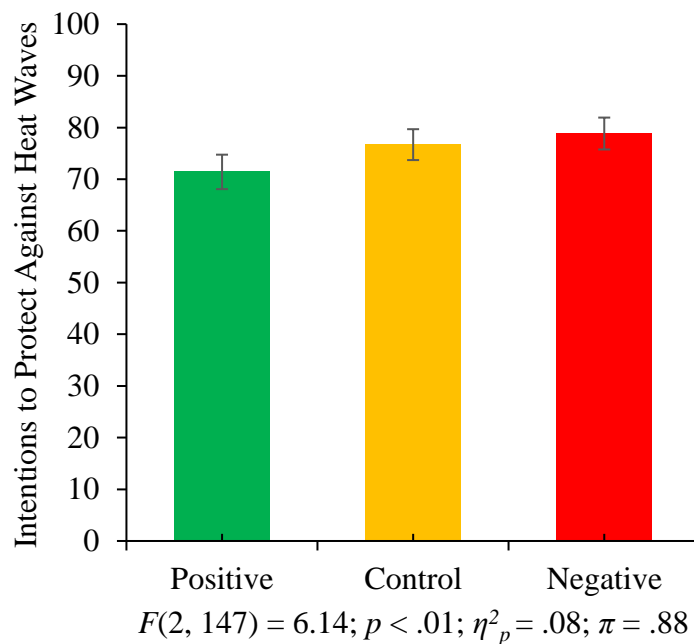
Results

Effect of Emotion Prompts on Intentions to Protect Against Heat Waves (RQ1)

Figure 3 shows a statistically significant effect of emotion prompts on intention to protect against heat waves ($F(2, 147) = 6.14; p < .01; \eta^2_p = .08; \pi = .88$). Participants in the positive prompt condition reported a lower level of intentions to protect against heat waves ($M = 71.42; SD = 11.85$) compared to the participants in the no-prompt ($M = 76.69; SD = 10.85; p < .05; 95\% \text{ CI } [-10.50; -.05]$) and negative prompt ($M = 78.84; SD = 11.08; p < .01; 95\% \text{ CI } [-12.67; -2.17]$) conditions. No differences were found between no-prompt and negative conditions ($p = .592; 95\% \text{ CI } [-7.35; 3.05]$). Although a significant effect was found, the effect size near the lower bound of the medium effect size range suggests that other factors may help explain the variance of intentions to protect against heat waves.

Figure 3

Effect of Emotion Prompts on Intentions to Protect Against Heat Waves



Effect of Emotion Prompts on Appraisals of Demands and Resources (RQ2)

Figure 4 and Figure 5 show a statistically significant effect of emotion prompts on both appraisals of demands ($F(2, 147) = 11.15; p < .001; \eta^2_p = .13; \pi = .99$) and resources ($F(2, 147) = 8.14; p < .001; \eta^2_p = .10; \pi = .96$). Observed effect sizes for both effects were within the medium effect size range.

Participants in the positive prompt condition appraised lower level of demands ($M = 57.20; SD = 16.08$) compared to the participants in the no-prompt ($M = 69.66; SD = 14.83; p < .001; 95\% \text{ CI } [-20.04; -4.89]$) and negative prompt ($M = 71.61; SD = 17.94; p < .001; 95\% \text{ CI } [-22.02; -6.79]$) conditions. No differences were found between no-prompt and negative conditions ($p = .814; 95\% \text{ CI } [-9.49; 5.59]$). Moreover, participants in the positive prompt condition also appraised higher level of resources ($M = 68.75; SD = 14.77$) compared to the participants in the no-prompt ($M = 56.62; SD = 17.35; p < .01; 95\% \text{ CI } [3.64; 20.63]$) and negative prompt ($M = 55.39; SD = 22.01; p < .01; 95\% \text{ CI } [4.83; 21.90]$) conditions. No differences were found between no-prompt and negative conditions ($p = .937; 95\% \text{ CI } [-7.23; 9.69]$).

Figure 4

Effect of Emotion Prompts on Appraisal of Demands

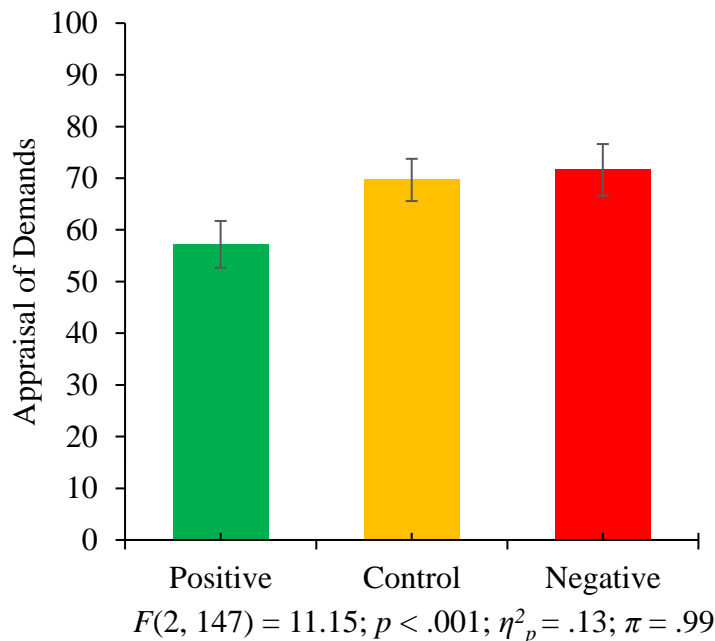


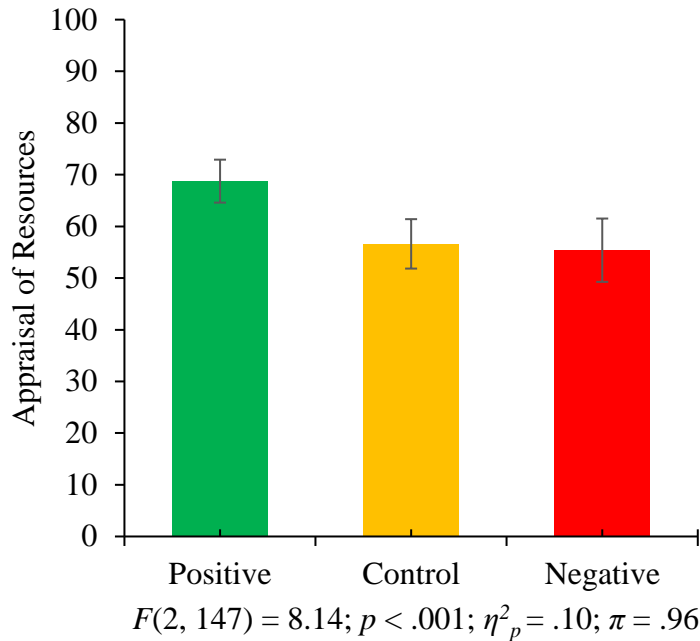
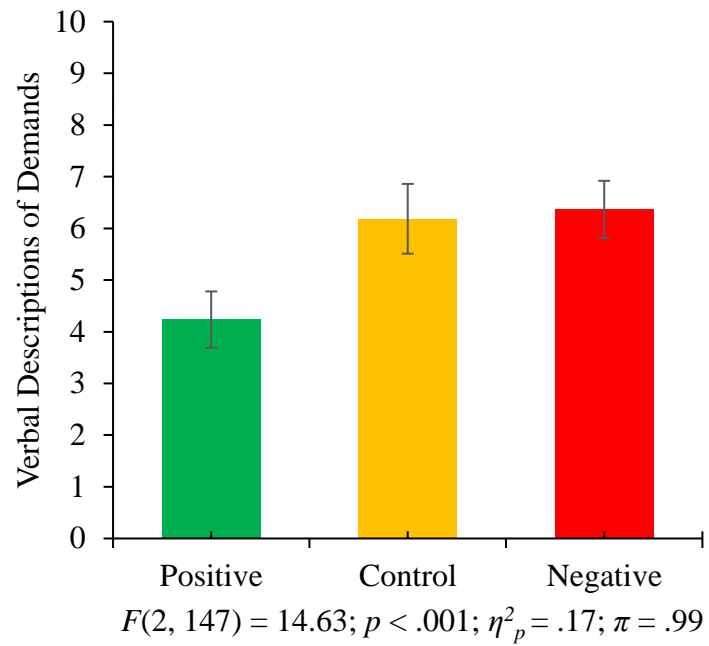
Figure 5*Effect of Emotion Prompts on Appraisal of Resources***Effect of Emotion Prompts on Verbal Descriptions of Demands and Resources (RQ3)**

Figure 6 shows a statistically significant effect of emotion prompts on verbal descriptions of demands made by the participants ($F(2, 147) = 14.63; p < .001; \eta^2_p = .17; \pi = .99$). As shown in Figure 7 the same was not observed for verbal descriptions of resources ($F(2, 147) = 1.13; p = .327; \eta^2_p = .02; \pi = .25$). Observed effect size of emotion prompts on verbal descriptions of demands was within the medium effect size range, whereas the effect size on verbal descriptions of resources was on the lower bound of the small effect size range.

Participants in the positive prompt condition evoked and produced fewer verbal descriptions of demands ($M = 4.24; SD = 1.95$) compared to the participants in the no-prompt ($M = 6.19; SD = 2.45; p < .001; 95\% \text{ CI }]-2.95; -.96[$) and negative prompt ($M = 6.37; SD = 2.01; p < .001; 95\% \text{ CI }]-3.13; -1.13[$) conditions. No statistical significant differences were found between no-prompt and negative conditions ($p = .907; 95\% \text{ CI }]-1.17; .82[$). Differently, the number of verbal descriptions of resources evoked and produced did not differ significantly between participants in the positive prompt condition ($M = 8.20; SD = 2.81$) compared to the participants in the no-prompt ($M = 8.98; SD = 3.31; p = .414; 95\% \text{ CI }]-2.25; .68[$) and negative prompt ($M = 9.04; SD = 3.30; p = .366; 95\% \text{ CI }]-2.31; .63[$) conditions, as well as between participants in the no-prompt and negative conditions ($p = .995; 95\% \text{ CI }]-1.51; 1.40[$).

Figure 6

Effect of Emotion Prompts on the Average Number of Verbal Descriptions of Demands

**Figure 7**

Effect of Emotion Prompts on the Average Number of Verbal Descriptions of Resources

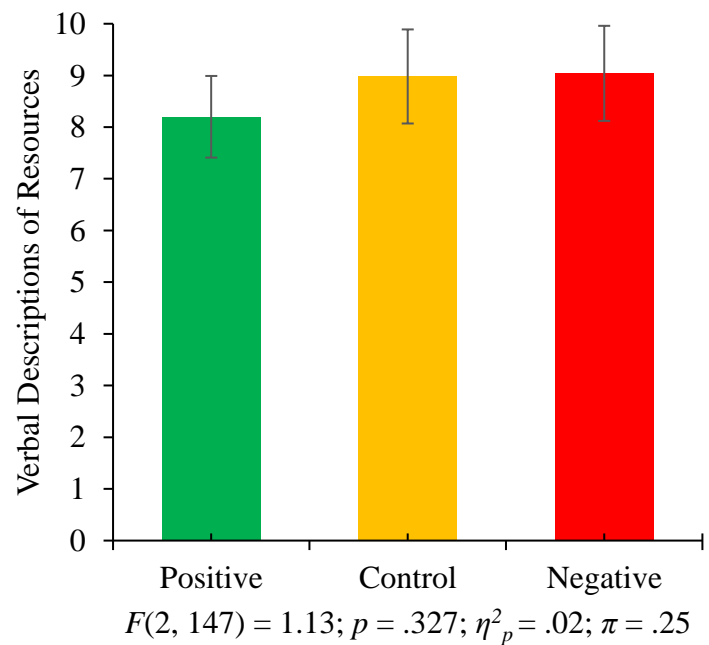
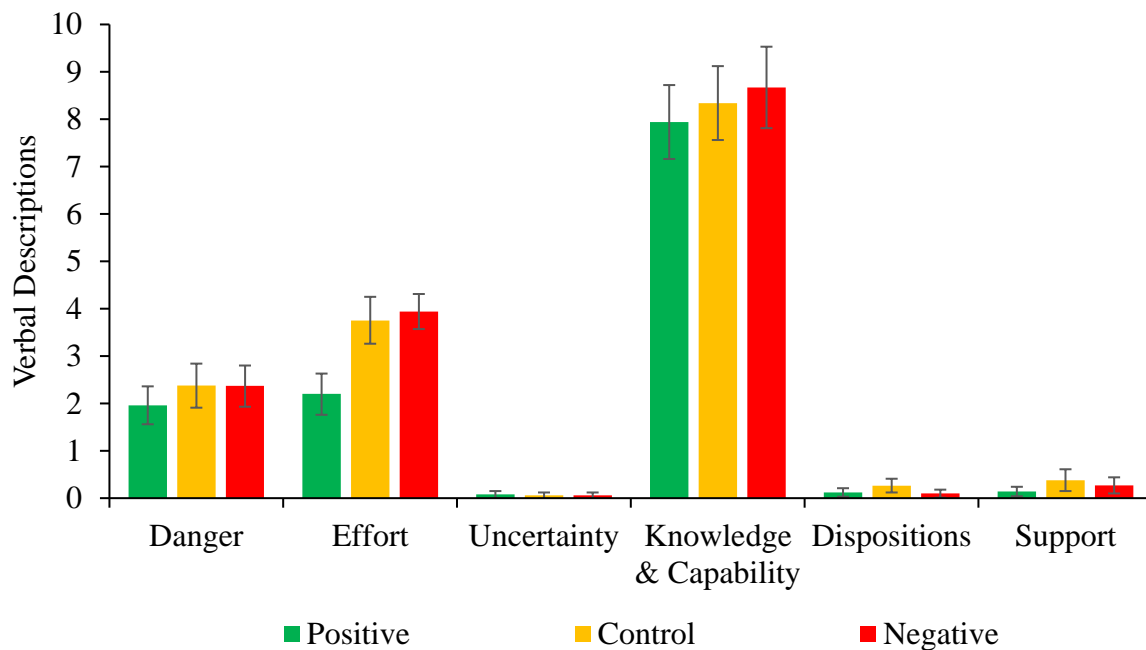


Figure 8 shows the average number of verbal descriptions of demands and resources, in their respective sub-categories, made by participants in each experimental condition. Statistically significant differences were only found for the number of verbal descriptions of effort, with an observed effect size on the medium effect size range ($F(2, 147) = 17.65$; $p < .001$; $\eta^2_p = .19$; $\pi = 1$). This suggests that the differences observed on verbal descriptions of demands were mainly driven by participants in the positive prompt condition evoking and producing fewer verbal descriptions of effort ($M = 2.20$; $SD = 1.55$) compared to the participants in the no-prompt ($M = 3.75$; $SD = 1.80$; $p < .001$; 95% CI $[-2.29, -.83]$) and negative prompt ($M = 3.94$; $SD = 1.34$; $p < .001$; 95% CI $[-2.48, -1.01]$) conditions. Again, no differences were found between no-prompt and negative conditions ($p = .814$; 95% CI $[-.91, .09]$).

Figure 8

Average Number of Verbal Descriptions of Demands and Resources, in their Sub-Categories



Mediating Role of Demands and Resources Appraisals and Verbalizations on the Effect of Emotion Prompts on Intentions to Protect Against Heat Waves (RQ4)

Table 2 shows regression models predicting reported intentions to protect against heat waves. The significant negative effect of the positive prompt condition (vs. each of the other two conditions) on reported intentions to protect against heat waves held when including demographic variables, with older participants reporting significantly greater intentions to

protect against heat waves (Model 2; $\beta = .133$; $p < .01$; 95% CI [.05; .21]), and with a marginal effect of gender, with female participants reporting higher intentions (Model 2; $\beta = 4.57$; $p < .10$; 95% CI [-.02; 9.17]). The effects of the positive emotion prompt condition (vs. each of the other conditions) were no longer significant after considering temperature and pleasantness estimates, appraisals of demands and resources, and verbalizations of demands and resources (Model 3). Yet, the effect of age on intention remained significant (Model 3; $\beta = .11$; $p < .01$; 95% CI [.03; .19]), with a marginal effect of gender (Model 3; $\beta = 4.07$; $p < .10$; 95% CI [-.55; 8.69]). Verbalizations of demands also emerged as a significant predictor of intentions to protect against heat waves (Model 3; $\beta = 1.02$; $p < .05$; 95% CI [.142; 1.89]).

Table 2

Regression Analyses^a Predicting Intentions to Protect Against Heat Waves

	Model 1	Model 2	Model 3 ^b
Positive vs Control	-5.27*	-4.88*	-.08
Positive vs Negative	-7.42**	-7.68**	-2.12
Control vs Negative	-2.15	-2.79	-2.19
Temperature Estimates	–	–	.05
Pleasantness Estimates	–	–	-.07
Appraisals of Demands	–	–	.06
Appraisals of Resources	–	–	.07
Verbalizations of Demands	–	–	1.02*
Verbalizations of Resources	–	–	-.01
Age	–	.13**	.11**
Female	–	4.57 [†]	4.07 [†]
Education at least high school	–	2.63	3.81
Living alone	–	-3.78	-3.36
Regular physical activity	–	.95	.71
Forced exposure	–	.89	1.56
R^2	.07	.15	.22
F -test of model change	$F(2, 153)$ = 5.91**	$F(8, 147)$ = 3.23**	$F(14, 141)$ = 2.80**

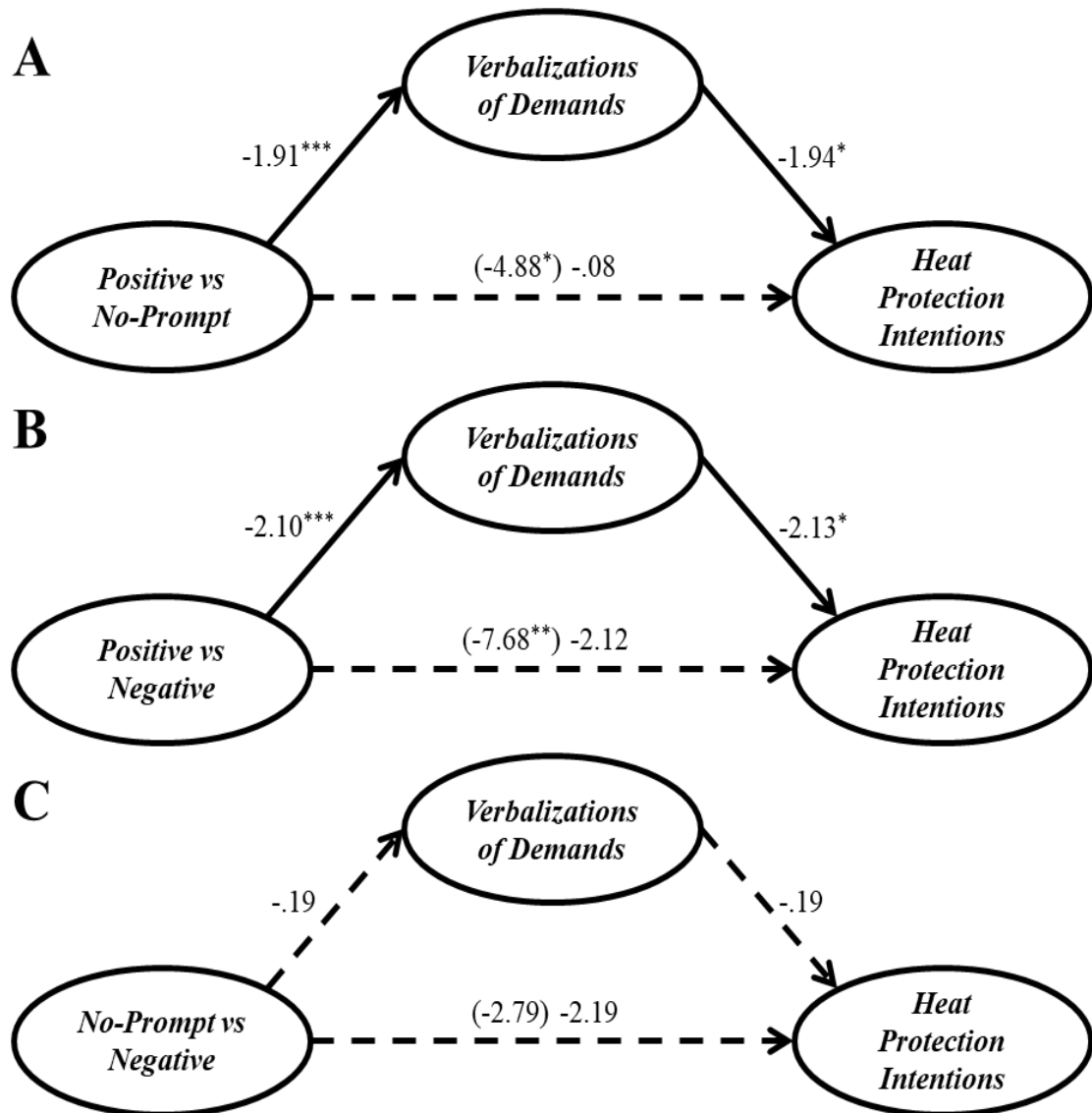
Note. ^a Unstandardized β . ^b Stepwise linear regression confirmed results of Model 3, with only Age and Verbalizations of Demands emerging as significant predictors of intentions to protect against heat waves. [†] $p < .10$; * $p < .05$; ** $p < .01$

Next, and considering the effects of emotion prompts on verbal descriptions of demands (RQ3), and their role as predictors of intention, we conducted mediation tests to examine whether the negative effect of the positive emotion prompt condition on intentions to protect against heat waves was due to participants in such condition (vs. each of the other two conditions) evoking and producing fewer verbalizations of demands. Figure 9 demonstrates support for such mediation effect, showing that the participants in the positive prompt condition reported lower intentions to protect against heat waves, compared to participants in both no-prompt and negative emotion prompt conditions, due to participants in such condition evoking and producing fewer verbalizations of demands. This effect was not observed between no-prompt and negative prompt conditions. In other words, asking participants to “think about a typical extreme hot weather event (e.g., heat wave)” with a positive emotion prompt (vs. each of the other two conditions) apparently undermined these participants intentions to protect against heat waves due to lowering the cognitive availability of demands to them (i.e., evoking and producing fewer verbalizations of demands). To simplify, only the significant mediation is shown in Figure 9. All regression coefficients can be seen in Appendix B (p. 127).

Because age was also found to be a significant predictor of intentions to protect against heat waves, we conducted a moderated mediation test to better understand the role of age. Thus, instead of controlling for age in the analysis as before, age was added as a moderator. The analysis showed a significant interaction effect of the positive emotion prompt condition mediated by verbalizations of demands with age ($\beta = -.19$; $p < .05$; 95% CI $[-.36; -.01]$), reducing the effect of age on intentions to protect against heat waves (Figure 10). This interaction effect was not found for the no-prompt condition ($\beta = -.03$; $p = .69$; 95% CI $[-.20; .13]$), although it was marginally significant for the negative emotion prompt condition ($\beta = .15$; $p = .07$; 95% CI $[-.01; .32]$).

Figure 9

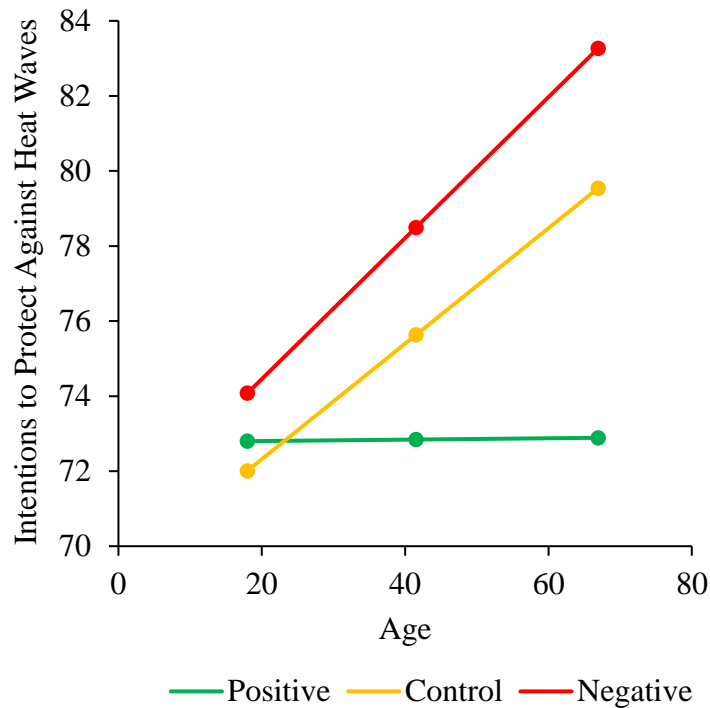
Mediation Tests Showing that the Effect of the Positive Emotion Prompt on Intentions to Protect Against Heat Waves is Mediated by Verbalizations of Demands



Note. All mediation analysis included sociodemographic variables as covariates (Age, Gender, Education, Living Alone, Regular Physical Activity, and Forced Exposure), as well as Temperature Estimates, Pleasantness Estimates, Appraisals of Demands, Appraisals of Resources, Verbalizations of Demands, and Verbalizations of Resources as potential mediators. To simplify, only the significant mediation is shown in the figures. All regression coefficients can be seen in Appendix B (p. 127). Solid lines reflect significant paths. * $p < .05$; ** $p < .01$; *** $p < .001$.

Figure 10

Intentions to Protect Against Heat Waves Accounting for the Interaction Effect of the Positive Emotion Prompt Condition Mediated by Verbalizations of Demands with Age

**Discussion**

Considering the effects of heat waves on health and wellbeing (Carey et al., 2017; DGS, 2021; Johnson et al., 2005; Knowlton et al., 2009; Kovats et al., 2004; Semenza et al., 1999), and with the expected increase in frequency, intensity, and duration of such events (Clayton et al., 2015; IPCC, 2014; WEF, 2017) promoting peoples' heat protection behaviours is becoming increasingly important. Aiming to contribute in this regard, we tested the effects that emotion prompts have on appraisals and verbal descriptions of demands and resources, and their effects on intentions to implement heat protection behaviours.

In line with previous research conducted in the United Kingdom (Bruine de Bruin et al., 2016; Lefevre et al., 2015) we found, in our Portuguese sample, that positive thoughts about extreme hot weather hindered intentions to protect against heat waves. Moreover, this effect was statistically explained by participants in such condition evoking and producing fewer verbalizations of extreme hot weather demands, suggesting that positive thoughts about extreme hot weather reduced cognitive availability of such demands. This in turn led to reduced intentions to protect against heat waves, including reducing the effect of age on such intentions

when compared to the no emotion prompt control condition. This finding is in line with behavioural decision research suggesting that the perceived need for protection against risks may be judged through affect and availability heuristics (Finucane et al., 2000; Slovic et al., 2004, 2007; Tversky & Kahneman, 1973, 1974).

Yet, it should be noted that the causal sequence observed in this study (i.e., mediation) between positive emotion prompt, verbalizations of demands, and intentions to protect against heat waves is connected to the experimental procedure. It first asked participants to think about an extreme hot weather event with a positive, negative, or no emotion prompt (control), and then asked participants to think specifically about demands posed by such event and the available resources to cope with them. In other words, the procedure first primed affect to then study its effects on availability and intention. As such, the results presented in this study apply mainly to situations where people elaborate about their initial thoughts (i.e., where additional thought is promoted before judgments of perceived need for risk protection) rather than situations where this does not happen (e.g., where additional thought is not promoted before judgments of perceived need for risk protection). This could, contrary to Bruine de Bruin et al. (2016) findings, help explain the lack of mediation effect of temperature estimates and pleasantness estimates found in this study. This distinct finding between both studies is important, suggesting that the undermining effect of positive emotion prompts on intentions to protect against heat waves may happen not only under conditions that facilitate intuitive/spontaneous processing of information and associated judgments and decision making, but also under conditions that facilitate analytic/deliberative processing (e.g., where subsequent thoughts may be influenced by the initial affective valence). One hypothesis, in line with Simon (2000) notion of Bounded Rationality, Damásio (1994) Somatic Marker hypothesis, and the work of Kiefer and Pulvermüller (2012) on conceptual representations in the mind and brain, is that emotion prompts may help set a specific bounded “inner mental environment”, indexed by emotion, where the thought processes run.

Curiously, and contrary to what was expected, appraisals of demands and resources as well as verbalizations of resources, were not found to be significant predictors of intention. In fact, research has systematically demonstrated that situational constraints (demands) and available personal and social resources are connected to motivational states that guide coping behaviour (Blascovich, 2007, 2008; Blascovich & Mendes, 2000, 2010; Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2009, 2015; Zimmer-Gembeck & Skinner, 2016). Yet, differences from previous research may help explain the observed results. First, the thought

induction procedure, that may have mitigated the expected effects of demands and resources appraisals on intentions to protect against heat waves (i.e., asking participant to think about demands and resources before appraising them). This is because engaging in issue-relevant thinking increases “elaboration likelihood”, promoting central processing (i.e., careful consideration) rather than peripheral processing (i.e., simple inferences based on emotional and contextual cues) of information (Petty & Cacioppo, 1986). Second, contrary to previous research with demands and resources, the current study focused on their potential effects on intentions (i.e., likelihood to act) rather than motivational states (i.e., psychophysiological goal-setting drives) and/or coping behaviours (i.e., actual behaviours). Third, participants reported their intention based on thought simulated situations (e.g., where they did not need to implement those responses), potentially reducing the importance of resources in such simulation, compared to active performance situations typically targeted by previous research (e.g., where demands were experienced, and responses had to be implemented). Lastly, we chose to test the effects of both demands and resources on intentions, instead of using an aggregated measure of both (i.e., ratios of demands and resources or interaction between demands and resources) as commonly used in research, as the goal was to better understand each type of appraisal’s role on intentions, rather than the appraisal of both. As such, here we focused not only on a different type of task and situation (i.e., simulated thought of heat waves) than the ones commonly studied by this line of research (e.g., task performance in laboratory or organizational settings), but most importantly we focused on the impacts that demands and resources have on the build-up of intentions rather than motivation and/or behaviour.

Based on these results, and in line with previous work developed by Schwarzer (2008), Lippke et al. (2010), and Schwarzer et al. (2011), as well as the systematic review on factors motivating climate change adaptation behaviour conducted by van Valkengoed and Steg (2019), we argue that promoting protective behaviours against heat waves, may also involve an intentional/pre-behavioural phase. In this phase, the cognitive availability of demands may have a more pre-eminent role in raising or hindering intentions. Also, instead of perceived personal and social resources availability, the perception of resources self-efficacy (i.e., the extent to which people believe they are capable of engaging in relevant adaptive actions) and the perception of resources outcome efficacy (i.e., the extent to which individuals believe that adaptive actions will be effective in protecting them from climate-related hazards) may have a more preponderant role when the target are intentions.

Another consistent result was that only the positive emotion prompt condition produced significant differences compared to the no emotion prompt condition (control), and no significant differences were found between the no emotion prompt and the negative emotion prompt conditions. Besides reporting lower level of intentions to protect against heat waves, participants in the positive emotion prompt condition appraised a lower level of demands, a higher level of resources, and produced fewer verbal descriptions of demands, suggesting they may have thought about less threatening extreme hot weather situations, when compared to participants in the no emotion prompt and the negative emotion prompt conditions (Blascovich & Mendes, 2000, 2010), with no significant differences observed between the latter two. Interestingly, although participants in the no emotion prompt and the negative emotion prompt conditions seemingly thought about more threatening extreme hot weather situations, by appraising more demands than resources, and producing more verbal descriptions of demands compared to participants in the positive emotion prompt condition, they also produced more verbalizations of resources than demands. This suggests that the available resources they thought about may not be enough to cope with heat waves, and therefore appraised as lower than demands. Moreover, although participants in the positive emotion prompt appraised a higher level of resources compared to participants in the no emotion prompt and negative prompt conditions, the number of verbal descriptions of resources they produced, did not differ significantly between experimental conditions. Taken together this suggests that the positive emotion prompt may also have led participants to overestimate available resources. Thus, even though positive affect about heat can have an adaptive function (e.g., restore self-confidence, which is an important resource for coping), it can also result in harm to self or others during active coping situations due to such overestimation of one's available resources (Folkman, 2008). Accordingly, unrealistic perceptions of demands and resources may have implications during active coping situations that may not be noticeable when intentions are formed (Zimmer-Gembeck & Skinner, 2016).

Replicating the findings of Bruine de Bruin et al. (2016), thinking about extreme hot weather events with a positive emotion prompt also produced lower situational temperature estimates, higher situational pleasantness estimates, and lower intentions to protect against heat waves when compared to thinking with a negative emotion prompt. Yet, in that study, with a sample of United Kingdom residents, participants also showed similar responses between no emotion prompt and positive emotion prompt conditions, suggesting positive rather than negative views of heat waves. Differently, in our sample of Portuguese residents, participants

showed similar responses between no emotion prompt and negative emotion prompt, suggesting negative rather than positive views of heat waves. These results are in line with findings using data from the European Social Survey that analysed the association between key socio-political and demographic factors and climate change perception across 22 European countries and Israel (Poortinga et al., 2019), where Portuguese respondents shown the highest levels of concern and perceived negative impacts arising from climate change.

Looking specifically at verbalizations of demands and resources, results also present important findings. Across experimental conditions, participants only differed significantly on the number of verbalization of demands related to effort associated with extreme hot weather, producing similar amount of verbalization of demands related to danger and uncertainty. This suggests that effort associated with extreme hot weather situations may have been less salient for participants in the positive emotion prompt condition, while the salience of danger and uncertainty was equal to all participants (e.g., same danger and uncertainty, but lower effort). Yet, the results do not account for the possibility of deeper qualitative differences on expressed demands related to danger and uncertainty between experimental conditions (e.g., danger to self vs. danger to others). This raises the need to better understand the qualitative types of demands expressed by the participants, and the existence of potential differences at that level.

Likewise, no significant differences were found in the number of verbalizations of resources sub-categories (i.e., knowledge & capability, dispositions, and external support) between experimental conditions, which also leaves open the question if there are or are not, deeper qualitative differences. Yet, and contrasting with the fewer verbalizations of demands related with uncertainty, results suggest that resources related to knowledge and capability (e.g., knowledge about protective behaviours) were the most salient, with comparatively fewer mentions to dispositions and external support. This is an important finding, suggesting that promotion of such resources availability and importance in adapting to future extreme hot weather situations may be in need, not just in Portuguese context but also in other countries that are seemingly exposed to extreme hot weather risks (Poortinga et al., 2019). In fact, recent research in the context of heat waves has shown dispositional resources, such as patience, as important contributors to behavioural intention and risk adverse behaviour (Haraguchi et al., 2021). Also, external support resources, such as “cooling centers”¹⁶ and support provided by

¹⁶ A cooling center (or “cooling shelter”) is a location, typically an air-conditioned or cooled building that has been designated as a site to provide respite and safety during extreme heat. This may be a government-owned building such as a library or school, an existing community center, religious center, recreation center, or a private business such as a coffee shop, shopping mall, or movie theatre (Widerynski et al., 2017).

others (e.g., family, friends, communities, social media, health professionals), play an important role in heat adaptation strategies (Bose-O'Reilly et al., 2021; Marinucci et al., 2014; Widerynski et al., 2017). For example, shared community places (e.g., places commonly used by a community or group of people) can be adapted to such function, while promoting social interaction, and meaningful pleasant activities that people can engage with during extreme hot weather events. This safeguards not only their physical but also their psychological health and wellbeing.

The prevalence of verbal descriptions of knowledge and capability, compared to other resources suggests additional implications. On the one hand, this may also help explain the missing expected effect of appraisals and verbalizations of resources on intentions to protect against heat waves observed in the study, as people may have knowledge and capability but lack the dispositions and the external support. On the other hand, it also provides evidence that, like United Kingdom residents, Portuguese residents can name heat protection behaviours (e.g., typically communicated on heat wave prevention campaigns), but it is possible that they have incomplete mental models about how to effectively implement those behaviours (Bruine de Bruin et al., 2016; Hass et al., 2021; Kalkstein & Sheridan, 2007; Morgan et al., 2002; Sheridan, 2007; Wolf et al., 2010).

Although findings were consistent and supported by existent literature, the current study is not without limitations. First, it has a smaller sample size than what is usual in this kind of research, but in compensation it included open ended questions to explore qualitative meanings and indicators of demands and resources perceptions, reaching theoretical, thematic, and data saturation (Saunders et al., 2018). Second the lower number of male participants in comparison to female participants, and the higher number of participants with at least high school level education rather than higher does not enable such group comparisons, although it provides tendency indicators for comparison and future research. Third, we relied on participants' self-reported intentions to protect against heat waves, rather than observations of actual protection behaviours, and as such conclusions about the effects of emotion prompts on behaviour should be made with parsimony. As such, while the combination of quantitative and qualitative data with other theoretical findings enables reliable predictive statements about the unobserved based on the observed, care should be taken when generalizing to other processes and situations, without forgetting the contextual specificities associated to the experimental manipulation used in this study. However, like in Bruine de Bruin et al. (2016), the overall pattern of results might apply to other hazards that evoke positive affect such as sunbathing (Bränström et al., 2001),

wood-burning fireplaces (Hine et al., 2007), and speeding (Rhodes & Pivik, 2011). Still, follow-up work should examine how these results replicate not only with larger samples and across different processes (e.g., not only intentional and motivational, but also experiential and behavioural) and situations, but also longitudinally, and across different geographies, cultures, and social groups, enabling better understandings about how to promote adaptation and protection to extreme hot weather events in the future.

Conclusion

Overall, the study findings provide practical evidence for risk communication and interventions aimed at promoting protection and adaptation against extreme hot weather events. In doing so, practitioners should be assertive and exert caution to avoid reminding the public about positive outcomes of hot weather, that may create concurrent goals (e.g., spending time in a protected place vs. going out and enjoying sun during a heat wave), influence the way they think and feel about such situations, and have negative impacts on intentions to protect against heat waves. Communication can thus focus on bridging identified gaps by highlighting the demands and severe impacts of extreme hot weather, including those that may be less familiar to the public, while providing resources that, besides providing knowledge, enable and facilitate the implementation of protective behaviours. This public empowerment strategy, that promotes consciousness (i.e., cognitive availability) about the negative impacts of extreme hot weather and gives the public the resources (e.g., specific knowledge, motivations, and support on how to protect oneself and others) and the means to implement adaptive measures, may be more effective than strategies that rely only on emotion-based appeals potentially leaving people uninformed about what to do and how to do it (Ruiter et al., 2001). Doing so can probably be combined with other theoretical approaches already used in other contexts to promote protective behaviours, such as the use of social norms (Schultz et al., 2007) or priming anticipated regret that may be felt after engaging in risky behaviours (Richard et al., 1996). Yet, it is important to test such strategies before widespread implementation, assuring that they are personally relevant to the target audiences, clear and understandable, tailored to their needs, cultural context, and language, and produce the intended effects of increased heat protection and lower distress (Bruine de Bruin & Bostrom, 2013; Bruine de Bruin et al., 2016; Fischhoff et al., 2011; Noar et al., 2007).

Appendix A

Intentions to Protect Against Heat Waves Scale

Intentions to Protect Against Heat Waves Scale

In the future, if you experience a heat wave, what is your intention to engage in each of the following behaviours...

- It.1 How inclined would you be to drink more water even without being thirsty?*
- It.2 How inclined would you be to avoid the sun during 11.00 a.m. and 5.00 p.m.?*
- It.3 How inclined would you be to stay 2 to 3 hours in a cooled place, with adequate temperature?*
- It.4 How inclined would you be to look for cooled shelters, with adequate temperature?*
- It.5 How inclined would you be to avoid drinking alcoholic and/or sugary beverages?*
- It.6 How inclined would you be to wear loose, light, and fresh clothing?*
- It.7 How inclined would you be to prevent heat from entering your home by closing shutters during the day?*
- It.8 How inclined would you be to cool down your home by opening the windows at night?*
- It.9 How inclined would you be to use air conditioning to cool down your home?*
- It.10 How inclined would you be to use a fan to cool yourself down?*
- It.11 How inclined would you be to use wet towels to cool yourself down?*
- It.12 How inclined would you be to spray your body with water to cool yourself down?*
- It.13 How inclined would you be to take a shower with adequate temperature to cool yourself down?*
- It.14 How inclined would you be to consult and read the warnings about extreme hot weather issued by the authorities?*
- It.15 How inclined would you be to find out if people living close to you (for example, your neighbours) are feeling well?*
- It.16 How inclined would you be to find out if those living with you are feeling well?*

- It.17 How inclined would you be to ask a family member or a friend for help if you were feeling unwell due to the heat?*
- It.18 How inclined would you be to ask a neighbour for help if you were feeling unwell due to the heat?*
- It.19 How inclined would you be to contact the helplines provided by the health authorities (for example, Health 24) if you were feeling unwell due to the heat?*
- It.20 How inclined would you be to go to the hospital emergency department if you were feeling unwell due to the heat?*
- It.21 How inclined would you be to go to the health centre if you were feeling unwell due to the heat?*
- It.22 How inclined would you be to offer or remind those who live with you to drink water?*
- It.23 How inclined would you be to check if those who live with you are in a cooled place, with adequate temperature?*
- It.24 How inclined would you be to check if those living close to you (for example, your neighbours) are in a cool place, with adequate temperature?*

Note. The Portuguese version can be made available upon request to the authors. Scale items are direct translations from the original scale in Portuguese and are not adapted or validated for English language. Before use in English or other language, the scale should be adapted to the specific recommendations in use in the country, and if possible validated. All items were based on the recommendations for protection against heat waves issued by the Portuguese Directorate-General for Health (DGS, 2015) and the work developed by Bruine de Bruin et al. (2016) and tailored to the Portuguese context (e.g., recommendations to keep out of the sun 11.00 a.m. and 5.00 p.m. in Portugal, instead of 11.00 a.m. and 3.00 p.m. in the United Kingdom). Item presentation was randomized, and participants rated each item on a visual scale ranging from 0 (not inclined at all) to 100 (totally inclined). Internal consistency across the 24 items was good and sufficient to create an averaged score (Chronbach's $\alpha = .86$).

Appendix B

Detailed Regression Coefficients of the Mediation Tests in Figure 9 (p. 117)

A: $\beta_{IntPvc} = -.08$; $p = .98$; 95% CI]-6.24; 6.08[| $\beta_{TempPvc} = -3.31$; $p < .001$; 95% CI]-5.24; -1.39[| $\beta_{PleasantPvc} = 43.72$; $p < .001$; 95% CI]36.42; 51.02[| $\beta_{DemappPvc} = -12.60$; $p < .001$; 95% CI]-18.95; -6.25[| $\beta_{ResappPvc} = 11.56$; $p < .01$; 95% CI]4.53; 18.60[| $\beta_{DemverbPvc} = -1.91$; $p < .001$; 95% CI]-2.74; -1.08[| $\beta_{ResverbPvc} = -.83$; $p = .18$; 95% CI]-2.05; .38[| $\beta_{IntTemp} = .05$; $p = .78$; 95% CI]-.31; .42[| $\beta_{IntPleasant} = -.07$; $p = .18$; 95% CI]-.16; .03[| $\beta_{IntDemapp} = .06$; $p = .27$; 95% CI]-.05; .17[| $\beta_{IntResapp} = .07$; $p = .20$; 95% CI]-.03; .16[| $\beta_{IntDemverb} = 1.02$; $p < .05$; 95% CI].14; 1.89[| $\beta_{IntResverb} = -.01$; $p = .97$; 95% CI]-.60; .57[| $\beta_{IntTemp*Pvc} = -.17$; $p = .78$; 95% CI]-1.65; 1.06[| $\beta_{IntPleasant*Pvc} = -2.84$; $p = .16$; 95% CI]-7.71; 1.41[| $\beta_{IntDemapp*Pvc} = -.77$; $p = .33$; 95% CI]-2.14; .47[| $\beta_{IntResapp*Pvc} = .75$; $p = .20$; 95% CI]-.34; 2.27[| $\beta_{IntDemverb*Pvc} = -1.94$; $p < .05$; 95% CI]-4.47; -.23[| $\beta_{IntResverb*Pvc} = .01$; $p = .97$; 95% CI]-.74; .59[

B: $\beta_{IntPvn} = -2.12$; $p = .53$; 95% CI]-8.68; 4.45[| $\beta_{TempPvn} = -3.08$; $p < .01$; 95% CI]-5.04; -1.13[| $\beta_{PleasantPvn} = 48.97$; $p < .001$; 95% CI]41.56; 56.38[| $\beta_{DemappPvn} = -14.75$; $p < .001$; 95% CI]-21.20; -8.30[| $\beta_{ResappPvn} = 12.38$; $p < .001$; 95% CI]5.24; 19.53[| $\beta_{DemverbPvn} = -2.10$; $p < .001$; 95% CI]-2.94; -1.26[| $\beta_{ResverbPvn} = -1.00$; $p = .11$; 95% CI]-2.24; .24[| $\beta_{IntTemp} = .05$; $p = .78$; 95% CI]-.31; .42[| $\beta_{IntPleasant} = -.07$; $p = .18$; 95% CI]-.16; .03[| $\beta_{IntDemapp} = .06$; $p = .27$; 95% CI]-.05; .17[| $\beta_{IntResapp} = .07$; $p = .20$; 95% CI]-.03; .16[| $\beta_{IntDemverb} = 1.02$; $p < .05$; 95% CI].14; 1.89[| $\beta_{IntResverb} = -.01$; $p = .97$; 95% CI]-.60; .57[| $\beta_{IntTemp*Pvn} = -.16$; $p = .78$; 95% CI]-1.42; 1.07[| $\beta_{IntPleasant*Pvn} = -3.18$; $p = .19$; 95% CI]-8.26; 1.61[| $\beta_{IntDemapp*Pvn} = -.90$; $p = .33$; 95% CI]-2.70; .49[| $\beta_{IntResapp*Pvn} = .81$; $p = .20$; 95% CI]-.42; 2.34[| $\beta_{IntDemverb*Pvn} = -2.13$; $p < .05$; 95% CI]-4.65; -.22[| $\beta_{IntResverb*Pvn} = .01$; $p = .97$; 95% CI]-.79; .62[

C: $\beta_{IntCvn} = -2.19$; $p = .31$; 95% CI]-6.46; 2.07[| $\beta_{TempCvn} = -.23$; $p = .81$; 95% CI]-1.71; 2.18[| $\beta_{PleasantCvn} = 5.28$; $p = .16$; 95% CI]-2.12; 12.61[| $\beta_{DemappCvn} = -2.16$; $p = .51$; 95% CI]-8.56; 4.26[| $\beta_{ResappCvn} = .82$; $p = .82$; 95% CI]-6.28; 7.92[| $\beta_{DemverbCvn} = -.19$; $p = .65$; 95% CI]-1.03; .65[| $\beta_{ResverbCvn} = -.17$; $p = .79$; 95% CI]-1.40; 1.06[| $\beta_{IntTemp} = .05$; $p = .78$; 95% CI]-.31; .42[| $\beta_{IntPleasant} = -.07$; $p = .18$; 95% CI]-.16; .03[| $\beta_{IntDemapp} = .06$; $p = .27$; 95% CI]-.05; .17[| $\beta_{IntResapp} = .07$; $p = .20$; 95% CI]-.03; .16[| $\beta_{IntDemverb} = 1.02$; $p < .05$; 95% CI].14; 1.89[| $\beta_{IntResverb} = -.01$; $p = .97$; 95% CI]-.60; .57[| $\beta_{IntTemp*Cvn} = -.01$; $p = .86$; 95% CI]-.34; .54[| $\beta_{IntPleasant*Cvn} = -.34$; $p = .32$; 95% CI]-1.22; .35[| $\beta_{IntDemapp*Cvn} = -.13$; $p = .58$; 95% CI]-.94; .30[| $\beta_{IntResapp*Cvn} = .05$; $p = .82$; 95% CI]-.70; .76[| $\beta_{IntDemverb*Cvn} = -.19$; $p = .68$; 95% CI]-1.30; .78[| $\beta_{IntResverb*Cvn} = .002$; $p = .97$; 95% CI]-.37; .40[

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Chapter IV

Exploratory Analysis of Predictors of Heat Wave Demands and Resources Perceptions and Heat Protection Intentions

Chapter based on:

Domingos, S., Gaspar, R., Marôco, J., & Bruine de Bruin, W. (2022). *“It’s hot today, should I protect myself?” An exploratory analysis of predictors of heat wave demands and resources perceptions and heat protection intentions*. [Manuscript in preparation].

Abstract

Heat waves pose serious threats to health and wellbeing, emphasising the importance of individuals' heat protection behaviours. Such behaviours may be shaped by perceived demands (e.g., danger; uncertainty) and resources to cope with these (e.g., dispositions; external support) during heat waves, and by intentions to perform the behaviours. To better predict and change such behaviours, we explored predictors of 1) heat wave demands and resources perceptions, and 2) self-reported heat protection intentions, and proposed 3) a model to test predictors of demands and resources perceptions and their combined effects on self-reported heat protection intentions, following theoretical and empirical evidence. To better understand the underlying processes, this was done during a heat wave, rather than retrospectively as in most of the literature. Data were collected during a heat wave that affected Portugal in August 2018. A total of 304 Portuguese residents (age 16-89 years; $M = 36.98$; $SD = 16.06$) reported heat wave demands and resources perceptions, and self-reported heat protection intentions. Demands and resources perceptions were predicted by different categories of factors (i.e., experiential and analytic): 1) temperature interference in daily life and heat wave risk perception (i.e., experiential) increased demands perceptions; 2) need for cognition, hearing heat protection recommendations, and positive affect about heat (i.e., analytic) increased resources perceptions. Both categories of factors, including heat wave demands and resources perceptions, increased self-reported heat protection intentions, except for positive affect about heat. The proposed theory and evidence-driven model was supported and provided contextualization for such findings. Risk communications promoting heat wave risk and demands (e.g., danger) awareness without raising awareness of available resources to cope with these (i.e., feeling of threat), or raising awareness of the latter without the former (i.e., feeling of safety) may hinder heat protection intentions. This suggests that interventions aimed at motivating towards heat protection behaviours should raise awareness of both heat wave demands and resources perceptions.

Keywords

Heat Waves; Heat Wave Risk Perception; Demands Perceptions; Resources Perceptions; Heat Protection Intentions

Introduction

Heat waves pose serious threats to health and wellbeing (Carey et al., 2017; Charlson et al., 2021; Direção-Geral da Saúde [DGS], 2021; Hajat et al., 2010; Johnson et al., 2005; Knowlton et al., 2009; Kovats et al., 2004; Oray et al., 2018; Semenza et al., 1999), producing both short and long term negative effects (Agüero, 2014; Anderson & Bell, 2011; Bouchama & Knochel, 2002; Gasparrini & Armstrong, 2011; Glazer, 2005; Kovats & Hajat, 2008; Laurent, 2021; Laurent et al., 2018; Ma et al., 2015; McGregor et al., 2007; Suh et al., 2021). Because heat waves are expected to become increasingly frequent, intense, and long lasting due to climate change (Intergovernmental Panel on Climate Change [IPCC], 2014; World Economic Forum [WEF], 2017), promoting heat protection behaviours will, therefore, become increasingly important for preventing the negative effects of heat waves on health and wellbeing (Clayton et al., 2015; Hajat et al., 2014; Howe et al., 2019; Lefevre et al., 2015).

With regard to protection behaviour, intentions are an important antecedent of these (Domingos et al., 2022; Lippke et al., 2010; Schwarzer, 2008; Schwarzer et al., 2011; van Valkengoed & Steg, 2019), and should be targeted in order to motivate people to protect themselves. For this, identifying predictors of protection intentions provides for a better understanding of the underlying motivational states that promote or hinder different behavioural responses during a certain situation (Schwarzer, 2008; Schwarzer et al., 2011). For example, Schwarzer et al. (2011) Health Action Process Approach suggests that intentions are predicted by factors such as, for example, risk perception and perceived resources (e.g., social support), and that these factors influence psychological (e.g., planning) and behavioural responses (e.g., actions). These and other factors should be identified to provide a better understanding about the underlying motivational states that guide such responses (Schwarzer, 2008; Schwarzer et al., 2011). Potential predictors of behavioural intentions still understudied in the context of heat wave protection intentions and behaviours are perceived demands (e.g., danger; effort; uncertainty) and resources (e.g., knowledge, abilities, and skills; dispositions; external support), as well as their relationship with risk perception and other situational variables (e.g., temperature feeling; interference in daily life).

The concept of demands and resources perceptions, and its effects on motivational states, intentions, coping behaviours, and stress responses, has been the target of extensive empirical research by distinct theoretical approaches, that share similar roots (e.g., Dienstbier, 1989; Folkman, 1984; Lazarus & Folkman, 1984) but focus on different settings (e.g., experimental; risk management; educational; organizational). Examples of these include the

Biopsychosocial Model of Challenge and Threat (Blascovich, 2007, 2008; Blascovich & Mendes, 2000, 2010; Blascovich & Tomaka, 1996; Fonseca et al., 2014), the Norm Deviation Approach (Gaspar et al., 2015), the Crisis Layers and Thresholds Model (Gaspar et al., 2021), the Families of Coping classification (Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2009, 2015; Zimmer-Gembeck & Skinner, 2016), the Job Demands-Control-Social Support (Karasek, 1979; Theorell & Karasek, 1996), the Job Demands-Resources Model (Demerouti et al., 2001), the Appraisal Model of Fear Appeals (Putwain & Symes, 2014, 2016; Putwain et al., 2017), and the model explaining the Processes of Adaptation to and Coping with Climate Change (Reser & Swim, 2011; Swim et al., 2009), among others. Moreover, the study of demands and resources perceptions has strong connections with approaches that focus on decision making, risk perception, and the effects of cognitive, affective, and perceptive factors in such processes (Finucane et al., 2000; Kahneman, 2011; Slovic, 1987; Slovic et al., 2004, 2007; Slovic & Peters, 2006; Tversky & Kahneman, 1973, 1974; Zajonc, 1980). This is because demands and resources perceptions can also influence such psychological and behavioural processes (Blascovich & Mendes, 2000, 2010; Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2015).

Theoretical approaches focused on demands and resources perceptions (e.g., Biopsychosocial Model of Challenge and Threat – Blascovich & Mendes, 2000; Job Demands-Resources Model – Demerouti et al., 2001) posit that peoples' psychological and behavioural responses during motivated performance situations (e.g., ranging from situations where one's performance or productivity is evaluated, to situations in which action is needed for continued wellbeing) are shaped by the appraisal of the demands (e.g., primary appraisal – danger; effort; uncertainty) that they perceive in such situations and the resources (e.g., secondary appraisal – knowledge, abilities, and skills; dispositions; external support) they perceive to have available to cope with such demands (Blascovich & Mendes, 2000, 2010; Demerouti et al., 2001; Gaspar et al., 2015; Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2015; Theorell & Karasek, 1996). For example, during a heat wave people may perceive greater danger of dehydration and/or greater effort in performing tasks and use resources they perceive to have available at that moment to cope with those demands, such as drinking a glass of water and/or asking for help to finish their tasks (Domingos et al., 2022, 2020).

This interconnection between demands and resources perceptions is influenced by how people think and feel, and by sociodemographic and situational/contextual factors (Blascovich & Mendes, 2000, 2010), usually resulting in motivational states of threat (i.e., typically when

perceived demands are much higher than perceived resources), challenge (i.e., typically when perceived demands and resources are at similar levels), or safety (i.e., typically when perceived resources are much higher than perceived demands). In turn, these motivational states are characterized by specific feelings (e.g., optimism vs. dread), that intentionally predispose the appraiser towards certain psychological coping and behavioural tendencies such as for example approach versus avoidance (Blascovich & Mendes, 2000, 2010; Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2015).

Assessing Demands and Resources Perceptions

Demands perceptions are defined as the perception of the danger, effort, and uncertainty associated with a specific risk (Blascovich & Mendes, 2000, 2010; Domingos et al., 2020). Resources perceptions refer to people's perception of whether they have the knowledge, abilities, and skills, the dispositions, and the external support to cope with the demands that are associated with a specific risk (Blascovich & Mendes, 2000, 2010; Domingos et al., 2020).

These perceptions constitute the core mechanism leading to intentions and coping behaviour (Blascovich & Mendes, 2000, 2010; Demerouti et al., 2001; Karasek, 1979; Theorell & Karasek, 1996), which has been operationalized and assessed as a function of psychophysiological patterns of cardiovascular responses (for a review see Blascovich & Mendes, 2010; Theorell & Karasek, 1996), but also, as a function of different self-reported measures of demands and resources (e.g., Blascovich & Tomaka, 1996; Demerouti et al., 2001; Feinberg & Aiello, 2010; Ferguson et al., 1999; Gonzalez-Mulé et al., 2021; Jenny et al., 2019; Tomaka et al., 1993, 1997). For example, early studies grounded on the Biopsychosocial Model of Challenge and Threat conducted by Blascovich, Tomaka and colleagues (e.g., Blascovich & Tomaka, 1996; Tomaka et al., 1993, 1997), employed a self-reported measure of demands and resources that simply asked participants "How stressful do you expect the upcoming task to be?" (demands – primary appraisal), and "How able are you to cope with this task?" (resources – secondary appraisal). Yet, other operationalizations of self-reported measures of demands and resources are found in the literature. Theoretical approaches in the field of work, stress, and health with roots close to the Biopsychosocial Model of Challenge and Threat such as the Job Demands-Control-Social Support (Karasek, 1979; Theorell & Karasek, 1996) and the Job Demands-Resources Model (Demerouti et al., 2001), frequently employ self-reported measures of demands and resources based on scales of perceived job demands (e.g., time pressure; work

interruption; uncertainty at work) and perceived job resources (e.g., job flexibility; peer support; planning capability).

Findings arising from these different studies show that perceiving much greater demands than resources typically correlated with psychophysiological patterns of “threat” (e.g., greater total peripheral vascular resistance), greater distress, poorer mental and physical health, lower productivity, greater anxiety, negative affective experiences, sleep disorders, and passive rather than active and proactive coping strategies. Perceiving sufficient resources to cope with perceived demands typically correlated with physiological patterns of “challenge” (e.g., lower total peripheral vascular resistance), greater eustress, better mental and physical health, higher productivity, lower anxiety, positive affective experiences, and active and proactive rather than passive coping strategies. Perceiving much greater resources than demands typically correlated with psychophysiological patterns of “safety” (e.g., lower total peripheral vascular resistance), absence of stress (i.e., distress and eustress), better mental and physical health, productivity, lower anxiety, positive affective experiences, but also lower motivation for protection. Interestingly, some studies also produced mixed findings (e.g., Bakker et al., 2005; Feinberg & Aiello, 2010; Fonseca et al., 2014; Gonzalez-Mulé & Cockburn, 2017; Hunter, 2001; Schaufeli & Taris, 2014). This could be related with how perceived demands and resources were operationalized, and the specific context in which the research was conducted, meaning that perceived demands and resources and its effects are also context dependent (Blascovich & Mendes, 2000; Theorell & Karasek, 1996).

In the context of heat waves, Domingos et al. (2022, 2020) proposed the DeCodeR Framework, a theory-driven mixed-method approach designed for evoking and coding verbal and written expressions about extreme hot weather events into categories of demands (danger; effort; uncertainty) and resources (knowledge, abilities, and skills; dispositions; external support) perceptions, with the goal of enabling follow-up surveys to examine prevalence of such perceptions in larger populations (Bruine de Bruin & Bostrom, 2013; Morgan et al., 2002). This allowed the creation of context-focused scales to assess heat wave demands and available coping resources perceptions, which were used in the current study.

Factors Influencing Heat Protection Intentions and Behaviours

In the context of heat waves several situational variables have been shown to influence heat protection intentions and behaviours (Bruine de Bruin et al., 2016; Hajat et al., 2010; Hass

et al., 2021; Lefevre et al., 2015). Among those, are temperature feeling (i.e., the subjective evaluation of how hot or cold the temperature is), temperature interference in daily life (i.e., the subjective evaluation of how much the temperature is hindering daily activities for the self and others), heat wave risk perception (i.e., the subjective evaluation of the risk posed by the heat wave situation for self and others), and risk communication related factors (i.e., reports of having heard heat protection recommendations issued by authorities). For example, magnitude of recalled temperature (e.g., another form of operationalizing temperature feeling) was found to be a significant predictor of heat protection intentions, with higher recalled temperatures increasing intentions (Bruine de Bruin et al., 2016). Yet, it also suggested that other factors, such as experienced effects of high temperatures (e.g., temperature interference in daily life) or heat wave risk perception, could help explain that relation. The later link between heat wave risk perception and response to heat warnings is well documented (for a review see Hass et al., 2021), suggesting that temperature interference in daily life, in conjunction with awareness of heat protection recommendations, may play an important role in such response (Hass & Ellis, 2019). For example, Lefevre et al. (2015) found that participants who reported having heard heat protection recommendations also reported more heat protection behaviours and greater intentions to implement them in future heat waves. Yet, they also suggested that the effect of having heard heat protection recommendations on intentions to implement heat protection behaviours in the future could be better explained by other factors.

Cognition and affect represent another important category of factors that shape protection intentions and behaviours (Blacovich & Mendes, 2000, 2010; Bodemer & Gaissmaier, 2015; Bruine de Bruin & Bostrom, 2013; Finucane et al., 2000; LeDoux, 1996; Loewenstein et al., 2001; Slovic et al., 2004; Zajonc, 1980). For example, the perception of potentially risky situations is shaped not only by what people already know and how they think about it, but also by their feelings about it (Bruine de Bruin & Bostrom, 2013; Finucane et al., 2000; Slovic et al., 2004, 2007; Slovic & Peters, 2006; Tversky & Kahneman, 1973, 1974).

On the cognitive domain, individual differences in the tendency to engage in and enjoy cognitively effortful activities – i.e., need for cognition – has been target of extensive research (Petty et al., 2009). Findings suggest that as need for cognition increases, people are more likely to think about a wide variety of things (i.e., generate more thoughts), which can then generate additional perceived resources but also exacerbate perceived demands (Cacioppo & Petty, 1982; Petty et al., 2009). Yet, studies mostly supported that need for cognition can lead to greater understanding of health-related phenomena, promoting protection intentions and

behaviours (Bakker, 1999; Bruine de Bruin et al., 2015; Hittner, 2004; Ruiter et al., 2004; Williams-Piehotka et al., 2003). For example, high threat appeals about breast cancer favourably influenced relevant attitudes and behaviours, but only for women high in need for cognition, possibly due to it enabling greater promotion of resources for tackling the demands of such situation (Ruiter et al., 2004). In the context of heat waves, Domingos et al. (2022) found that participants who produced fewer verbalizations of demands reported lower heat protection intentions, although an effect was not found for verbalizations of resources as participants did not differ on those. Yet, their study did not control for participants' need for cognition, being still unclear if and how need for cognition relates with heat wave demands and resources perceptions, and heat protection intentions.

On the affective domain, research suggests that negative emotion typically increases risk perceptions, protection intentions, and behaviours, whereas positive emotion typically decreases them (Bränström et al., 2001; Bruine de Bruin et al., 2016; Domingos et al., 2022; Finucane et al., 2000; Hine et al., 2007; Lefevre et al., 2015; Loewenstein et al., 2001; Rhodes & Pivik, 2011; Slovic et al., 2004, 2007; Slovic & Peters, 2006; Taylor et al., 2014). In the context of heat waves, positive affect about heat was associated with lower temperature estimates, higher pleasantness, lower demands appraisals, higher resources appraisals, and lower heat protection intentions (Bränström et al., 2001; Bruine de Bruin et al., 2016; Domingos et al., 2022; Lefevre et al., 2015). Yet, to our knowledge, no study explored the effects of positive affect about heat on self-reported heat protection intentions, while considering the role that heat wave risk perception together with demands and resources perceptions may have on that relation.

Sociodemographic and personal characteristics are also fundamental in shaping protection intentions and behaviours (Bodemer & Gaissmaier, 2015; Hass et al., 2021; Kaspersen et al., 2003). Although factors such as age (higher), gender (female), and health condition (having health problems) have been consistently associated with higher heat protection intentions and behaviours, the role of factors such as education level, living condition (alone vs. with others), physical activity, and employment status are less clear (Beckmann & Hiete, 2020; Bruine de Bruin et al., 2016, 2015; Domingos et al., 2022; Esplin et al., 2019; Hass & Ellis, 2019; Lefevre et al., 2015; Vu et al., 2019; Wolf et al., 2010).

Current Study

The reviewed literature, mainly conducted in experimental and in work and organizational contexts, shows that there is a broad understanding about the effects that demands and resources perceptions have on health, stress, task performance, and productivity. It also shows that, in the context of climate change in general, and heat waves in particular, a less studied topic in this literature (Swim et al., 2009), there are several factors that have been shown to predict heat protection intentions and behaviours. This was particularly the case for heat wave risk perception, temperature feeling, temperature interference in daily life, reports of having heard heat protection recommendations, and positive affect about heat. Yet, it is less clear what factors predict demands and resources perceptions in the context of heat waves, and how these relate with heat protection intentions, and other factors involved in the process of promoting or hindering such intentions (e.g., risk perception). This understanding is important, as research, conducted in other contexts (e.g., experimental task performance – Blascovich & Mendes, 2000; organizational burnout – Demerouti et al., 2001), shows that demands and resources perceptions have an important influence on how people cope with potentially stressful situations (Skinner & Zimmer-Gembeck, 2015). Knowing the factors that promote demands and resources, and the combined effects that these factors have on heat protection intentions may provide additional evidence and better contextualization for promoting human heat protection, adaptation, and resilience to heat waves, an important goal considering the effects of climate change and the emergence of a climatic crisis (Clayton et al., 2015; Hajat et al., 2014; Howe et al., 2019; IPCC, 2014; Lefevre et al., 2015; Swim et al., 2009; WEF, 2017).

In that regard, the August 2018 heat wave in Portugal (Instituto Português do Mar e da Atmosfera [IPMA], 2018), the focus of the current study, provided a unique opportunity to assess self-reported: 1) indicators of individual and social perceptions of heat wave demands and available coping resources; 2) heat protection intentions during the heat wave; 3) heat wave risk perception; 4) temperature feeling; 5) temperature interference in daily life; 6) reports of having heard heat protection recommendations; 7) variables in affective (i.e., positive affect about heat) and cognitive dimensions (i.e., need for cognition); and 8) personal (i.e., living alone, employment status, doing physical activity, having a health condition that could condition exposure to heat) and sociodemographic characteristics (i.e., age, gender, and highest level of education completed).

With this, we aimed to gain a better understanding about factors that enable predicting heat wave demands and available coping resources perceptions, the effects that these may have

on heat protection intentions during a heat wave, and the relations with other variables involved in the process of promoting heat protection intentions. Building on theoretical approaches focused on explaining the promotion of demands and resources perceptions, their synergies, and their impacts on intention and coping behaviour (e.g., Blascovich & Mendes, 2000; Demerouti et al., 2001; Skinner & Zimmer-Gembeck, 2015), as well as current research in the context of heat waves (e.g., Bruine de Bruin et al., 2016; Lefevre et al., 2015) we explored pathways for promoting heat protection intentions focusing on two research questions: RQ1) which are the predictors of heat wave demands and resources perceptions? this considers factors commonly studied in the literature, such as heat wave risk perception, temperature feeling, temperature interference in daily life, reports of having heard heat protection recommendations, need for cognition, and positive affect about heat; and RQ2) which are the predictors of heat protection intentions? this includes demands and resources perceptions, and other factors commonly studied in the literature, such as heat wave risk perception, temperature feeling, temperature interference in daily life, reports of having heard heat protection recommendations, need for cognition, and positive affect about heat. In doing so we also proposed a theory-driven and evidence-based path analysis model to better contextualize and understand the relations between factors, by answering the question: RQ3) which are the effects of demands and resources perceptions on heat protection intentions, in combination with the effects of other factors commonly studied in the literature, such as heat wave risk perception, temperature feeling, temperature interference in daily life, reports of having heard heat protection recommendations, need for cognition, and positive affect about heat.

Method

Sample

The study was completed by 304 Portuguese residents. The sample was recruited through parish councils, elderly associations, and universities, as well as referrals by the participants. Data were collected between 2 and 7 August 2018 during a heat wave that included, to that date, the hottest day registered in Portugal since the beginning of the XXI century, taking place during the second hottest month in Portugal since 2003, with maximum average temperatures above 40°C and minimum average temperatures above 20°C (IPMA, 2018). Participants were between 16 and 89 years old ($M = 36.98$; $SD = 16.06$), with 73.4% ($n = 223$) female, 77.3% ($n = 235$) reporting at least level 3 professional/vocational or higher

education level, 13.5% ($n = 41$) reporting living alone, 49.3% ($n = 150$) reporting doing regular physical activity, 8.6% ($n = 26$) reporting having a health condition that could condition exposure to hot weather, and 65.1% ($n = 198$) reporting being employed.

Procedure and Measures

Participants received an email invitation to an online survey about “natural events and climate change”. They were part of a larger longitudinal study aimed at understanding seasonal and geographical variations of extreme hot weather demands and available resources perceptions. Therefore, our participants only received the following instruction: “The aim of this study is to investigate how people cope with climate change and natural hazards, such as extreme temperature, throughout the different seasons of the year”. No additional information regarding the survey was provided. Questions relevant to our analyses are described below.

Heat wave demands and resources perceptions. Heat wave demands and resources perceptions were measured using two separate scales constructed from previous work with the DeCodeR Framework, a theory-driven mixed-method approach designed for demands and resources perceptions data collection and coding (Domingos et al., 2022, 2020). The demands perceptions scale was comprised by thirteen items representing danger, effort, and uncertainty, and the resources perceptions scale was comprised by eighteen items representing knowledge, abilities, & skills, individual dispositions, and external support (see Appendix A, p. 167). Both used a response scale anchored from 1 (strongly disagree) to 5 (strongly agree). The demands perceptions scale was first presented to the participants with the instruction “The following statements represent possible demands posed by heat waves, please rate how much you agree or disagree with each one” followed by the thirteen items presented in randomized order. Next, the resources perceptions scale was presented with the instruction “The following statements represent possible resources to cope with the demands posed by heat waves, please rate how much you agree or disagree with each one” followed by the eighteen items presented in randomized order. Reliability across the thirteen demands perceptions items (Cronbach’s $\alpha = .86$) and the eighteen resources perceptions items (Cronbach’s $\alpha = .79$) was good/acceptable and sufficient to warrant computing each participant’s mean rating for each scale.

Heat protection intentions during the heat wave. Self-reported intentions for implementing heat protection behaviours during the heat wave were measured using a revised version of the intentions to protect against heat waves scale proposed by Domingos et al. (2022).

All items were based on the list of recommendations for protection against heat waves issued by the Portuguese Directorate-General for Health (DGS, 2015) and on the scales used by Bruine de Bruin et al. (2016). The scale was comprised by twenty-five items, using a response scale anchored from 1 (not inclined at all) to 5 (totally inclined). Participants were instructed to “Read the following statements and rate how inclined you are to engage in each of the behaviours during the heat wave”. Items considered by the participants were presented in randomized order and can be seen in Appendix B (p. 170). Reliability was very good and sufficient to warrant computing each participant’s mean rating of heat protection intention during the heat wave (Cronbach’s $\alpha = .91$).

Heat wave risk perception. Heat wave risk perception was operationalized as a composite measure of the perceived risk of heat waves to one-self and others. As such, this measure included individual and social components of such perception and was comprised by three items using a response scale anchored from 1 (extremely low) to 5 (extremely high). Participants were asked “How do you rate the level of risk that the heat wave have or may have” and considered the following items: 1) “For you”; 2) “For your family”; 3) “For the Portuguese population”. Reliability was good and sufficient to warrant computing each participant’s mean rating of heat wave risk perception (Cronbach’s $\alpha = .81$).

Temperature Interference in daily life. Temperature interference in daily life was operationalized as a measure of the perception of high temperatures interference in regular daily life or routine. This measure included individual and social components of such perception and was comprised by three items using a response scale anchored from 1 (nothing at all) to 5 (extremely). Participants were instructed “How much did the temperatures felt in the last five days interfered with” and considered the following items: 1) “Your daily life or routine”; 2) “The daily life or routine of your family”; 3) “The daily life or routine of the Portuguese population”. Reliability was good and sufficient to warrant computing each participant’s mean rating of perceived temperature interference in daily life (Cronbach’s $\alpha = .85$).

Temperature feeling. Temperature feeling was operationalized as a measure of how hot or cold participants perceived the temperature to be during the five days prior to participating in the study, considering the season (summer). This was measured with a single item using a response scale anchored at 1 (a lot colder than average for the season) to 5 (a lot hotter than average for the season). Participants were asked “Considering the current season, how do you classify the temperature you felt in the last five days”.

Positive affect about heat. Using a translated version¹⁷ of the scale proposed by Lefevre et al. (2015), participants rated their positive affect about hot weather on six items, using a response scale anchored from 1 (strongly disagree) to 5 (strongly agree). Participants were instructed to “Read the following statements and rate how much you agree or disagree with each one, considering the meaning that hot weather has for you”. They considered the following items, presented in randomized order: 1) “I love hot weather”; 2) “I want to get tanned”; 3) “I spend time in the sun when I can”; 4) “I am concerned about skin cancer” (reverse coded); 5) “A positive impact of climate change is that summers will get hotter”; and 6) “I go on holiday to seek out warm or hot weather”. Initial reliability analysis across the six items was low to warrant the computation of each participant’s mean rating (Cronbach’s $\alpha = .67$). This was due to two items: 4) “I am concerned about skin cancer” (reverse coded); and 5) “A positive impact of climate change is that summers will get hotter”. Following the removal of those two items¹⁸ reliability was good and sufficient to warrant computing each participant’s mean rating, as reflecting overall positive affect about heat (Cronbach’s $\alpha = .81$).

Need for cognition. Need for cognition (NFC) was measured using the short version proposed by Epstein et al. (1996) included in the Rational-Experiential Inventory short scale (REI-10), which was translated to Portuguese¹⁹. This scale is comprised of five items, using a response scale anchored from 1 (completely false) to 5 (completely true). Participants were instructed to “Read the following statements and rate how much you agree or disagree with each one”. They considered the following items, presented in randomized order: 1) “I don’t like to have to do a lot of thinking” (reverse coded); 2) “I try to avoid situations that require thinking in depth about something” (reverse coded); 3) “I prefer to do something that challenges my

¹⁷ The original version in English (Lefevre et al., 2015) was translated to Portuguese and reverse translated to English by two independent translators fluent in both English and Portuguese and screened by a third independent translator fluent in both languages. The final version in Portuguese was then reviewed by the researchers, and pre-tested on a sample of Portuguese participants before being included in the study. The Portuguese version can be made available upon request to the authors.

¹⁸ Items 4 and 5 low internal consistency can be related with confounds due to cross-cultural differences between Portuguese and United Kingdom residents, for whom the scale was originally developed and applied. For example, item 4 highlights the conflict between enjoying sun exposure (e.g., getting tanned) and the risk of skin cancer, something very present in Portuguese culture (Duarte et al., 2017), whereas item 5 conflicts with the fact that Portuguese tend to see climate change and extreme hot weather as something predominantly negative, while also showing the highest levels of concern when compared to other European countries (Bruine de Bruin et al., 2016; Domingos et al., 2022; Poortinga et al., 2019).

¹⁹ The original version in English (Epstein et al., 1996) was translated to Portuguese and reverse translated to English by two independent translators fluent in both English and Portuguese, and then screened by a third independent translator fluent in both languages. The final version of the scale, in Portuguese, was then reviewed by the researchers, and pre-tested on a sample of Portuguese participants before being included in the study. The Portuguese version can be made available upon request to the authors.

thinking abilities rather than something that requires little thought”; 4) “I prefer complex to simple problems”; and 5) “Thinking hard and for a long time about something gives me little satisfaction” (reverse coded). Reliability across the five NFC items (Cronbach’s $\alpha = .80$) was good and sufficient to warrant computing each participant’s mean rating, as reflecting a measure of overall need for cognition.

Reports of having heard heat protection recommendations. In line with Lefevre et al. (2015), participants reported whether they had heard specific public recommendations about how to protect themselves from heat in the five days prior to their participation in the study. Possible answers were “yes” and “no”.

Sociodemographic and personal characteristics. Participants reported their age, gender, highest level of education completed, whether they lived alone or with others, whether they did regular physical activity or not, if they had any health condition (in their opinion) that could prevent or make inadvisable the exposure to hot weather, and their employment status (i.e., employed/unemployed). Comprehensive descriptive statistics for all variables can be seen in Appendix C (p. 172).

Analysis Plan

Through a correlational research design based on a cross-sectional survey implemented through a structured questionnaire, predictors of heat wave demands and resources perceptions (RQ1) and self-reported heat protection intentions (RQ2) were assessed using multiple linear regressions in IBM SPSS 20. Additionally, we conducted a path analysis to enable a theory-driven and evidence-based visualization of the processes and associations between predictors of heat wave demands and resources perceptions, and predictors of heat protection intentions (RQ3). Differently from multiple linear regression, path analysis allows considering theory-driven “chains” of influence between variables, including direct, indirect, and total effects as well as correlations between factors included in the model (Streiner, 2005), which may result in slight differences between both methods. As such this model enables not only the identification of direct predictors of demands perceptions, resources perceptions, and heat protection intentions, but also indirect predictors, highlighting the complex relations between the factors considered in the study. Considering the high reliability of all constructs we used path analysis to overcome the limitation of sample size and model complexity (Marôco, 2021). This model was drawn following theoretical and empirical evidence using IBM SPSS AMOS

20 and tested using *Bootstrap* resampling with reposition ($n_B = 10000$). The Maximum Likelihood (*ML*) parameter estimation method was chosen. Final adjustment was done after analysing the theoretical support for inclusion in the model of modification indices greater than 11 ($p < .001$), as suggested by Marôco (2021)²⁰. Quality of adjustment was assessed using X^2/df (values ≤ 2 indicative of acceptable model's fit), *RMSEA* (values $\leq .05$ and $p \geq .05$ indicative of good model's fit), *CFI* (values $\geq .9$ indicative of good model's fit), *GFI* (values $\geq .9$ indicative of good model's fit), *PCFI* (values $\geq .6$ indicative of good adjustment), and *PGFI* (values $\geq .6$ indicative of good adjustment). Verification of assumptions for all the used statistical procedures were conducted following the recommendations from Marôco (2014, 2021) and Tabachnick and Fidell (2007). For all analyses, we set $\alpha = .05$ (two-sided).

Results

Factors Predicting Heat Wave Demands and Resources Perceptions

Results in Table 1 show regressions predicting demands perceptions and resources perceptions. Heat wave risk perception ($\beta = .44$; $p < .001$; 95% CI [.28; .45]) and temperature interference in daily life ($\beta = .27$; $p < .001$; 95% CI [.11; .27]) were found to be significant positive predictors of demands perceptions. Need for cognition ($\beta = .26$; $p < .001$; 95% CI [.08; .21]), positive affect about heat ($\beta = .18$; $p < .01$; 95% CI [.03; .13]), reports of having heard heat protection recommendations ($\beta = .15$; $p < .01$; 95% CI [.04; .24]), and temperature interference in daily life ($\beta = .16$; $p < .05$; 95% CI [.01; .13]), were found to be significant positive predictors of resources perceptions.

Factors Predicting Heat Protection Intentions

Results in Table 2 show that resources perceptions was the strongest significant positive predictor of heat protection intentions ($\beta = .46$; $p < .001$; 95% CI [.56; .84]), followed by demands perceptions ($\beta = .19$; $p < .01$; 95% CI [.08; .29]), heat wave risk perception ($\beta = .19$; $p < .01$; 95% CI [.07; .25]), temperature interference in daily life ($\beta = .15$; $p < .01$; 95% CI [.03; .18]), and being female ($\beta = .11$; $p < .05$; 95% CI [.03; .27]). Positive affect about heat was

²⁰ All paths were drawn following theoretical and empirical evidence. Modification indices that statistically improved the model and the quality of adjustment but had no theoretical support were not included.

found to be a significant negative predictor of heat protection intentions ($\beta = -.14$; $p < .01$; 95% CI $[-.15; -.03]$).

Table 1

Regression Analyses (Standardized β) of Factors Predicting Heat Wave Demands and Resources Perceptions

	Demands Perceptions		Resources Perceptions	
	β	95% CI	β	95% CI
Age	.04	]-.002; .01[	-.08	]-.01; .001[
Female	.001	]-.13; .13[	-.02	]-.11; .08[
Education Level	.05	]-.03; .10[	.02	]-.04; .06[
Living Alone	-.01	]-.18; .15[	.07	]-.04; .21[
Health Condition	-.01	]-.22; .18[	.08	]-.04; .26[
Physical Activity	.06	]-.04; .18[	.06	]-.04; .13[
Employed	-.003	]-.12; .12[	.03	]-.07; .11[
Positive Affect about Heat	-.07	]-.11; .02[	.18**	]0.03; .13[
Need for Cognition	-.09 [†]]-.17; .01[	.26***	]0.08; .21[
Heard Recommendations	-.01	]-.14; .13[	.15**	]0.04; .24[
Temperature Feeling	-.02	]-.10; .07[	-.10	]-.12; .01[
Temperature Interference	.27***	]0.11; .27[	.16*	]0.01; .13[
Heat Wave Risk Perception	.44***	]0.28; .45[	-.06	]-.10; .03[
Model R^2		.39		.18
Model F		$F(13, 290) = 14.417***$		$F(13, 290) = 4.734***$

Note. Standardized regression coefficients. [†] $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Table 2

Regression Analyses (Standardized β) of Factors Predicting Heat Protection Intentions

	Heat Protection Intentions	
	β	95% CI
Age	.07	]-.001; .01[
Female	.11*	] .03; .27[
Education Level	-.08 [†]]-.11; .01[
Living Alone	.01	]-.13; .18[
Health Condition	.06	]-.07; .30[
Physical Activity	-.02	]-.13; .08[
Employed	-.02	]-.13; .09[
Positive Affect about Heat	-.14**	]-.15; -.03[
Need for Cognition	.04	]-.05; .11[
Heard Recommendations	.04	]-.06; .19[
Temperature Feeling	-.03	]-.11; .05[
Temperature Interference	.15**	] .03; .18[
Heat Wave Risk Perception	.19**	] .07; .25[
Demands Perceptions	.19**	] .08; .29[
Resources Perceptions	.46***	] .56; .84[
Model R^2	.47	
Model F	$F(15, 288) = 17.081***$	

Note. Standardized regression coefficients. [†] $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

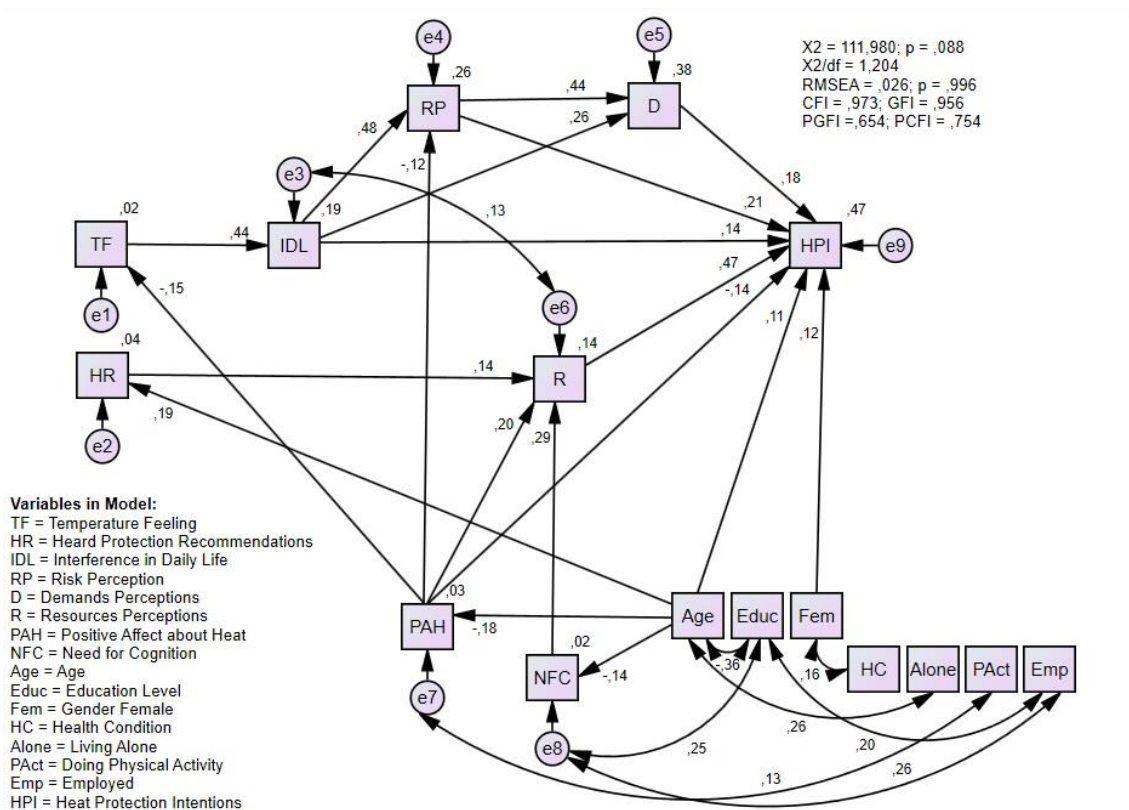
Predictors of Demands and Resources and Effects on Heat Protection Intentions

Figure 1 shows the proposed theory-driven and evidence-based path analysis model, focused on factors predicting heat wave demands and resources perceptions and on their combined effects on heat protection intentions. The model was significant and explained 38% of the variation of demands perceptions ($R^2 = .38$; $p < .001$; 95% CI [.28; .46]), 14% of the variation of resources perceptions ($R^2 = .14$; $p < .01$; 95% CI [.07; .22]), and 47% of the variation of heat protection intentions ($R^2 = .47$; $p < .001$; 95% CI [.37; .54]), presenting good

indicators for the model's predictive power. These values were similar to those obtained using multiple linear regressions. Besides the identification of indirect predictors of heat protection intentions such as temperature feeling and reports of having heard recommendations, and a marginally significant total effect of positive affect about heat, two main differences were observed. The path analysis model also identified age as a significant positive predictor of heat protection intentions ($\beta = .11$; $p < .05$; 95% CI [.03; .20]), while not supporting a significant positive direct effect of temperature interference in daily life on resources perceptions ($\beta = .09$; $p = .07$; 95% CI [-.01; .19]). Instead it identified a significant positive correlation between both variables ($r = .13$; $p < .05$; 95% CI [.02; .24]). Details on direct, indirect, and total effects as well as correlations can be seen on Appendix D (p. 174).

Figure 1

Path Analysis Model Illustrating Predictors of Heat Wave Demands and Resources Perceptions and their Combined Effects on Heat Protection Intentions



Note. Numbers on the top right of variable boxes represent Squared Multiple Correlations. Numbers near the arrows of regression lines represent Standardized Regression Weights (i.e., direct effects). Numbers on the middle of correlation lines represent Correlations. All paths significant for $p < .05$

Discussion

To better predict and promote heat protection intentions and behaviours, we explored predictors of 1) heat wave demands and resources perceptions, and 2) self-reported heat protection intentions, and proposed 3) a model to test predictors of demands and resources perceptions and their combined effects on self-reported heat protection intentions, following theoretical and empirical evidence. Heat wave demands and resources perceptions were predicted by different categories of factors (i.e., experiential and analytic). Temperature interference in daily life and heat wave risk perception (i.e., experiential) increased heat wave demands perceptions. Need for cognition, hearing heat protection recommendations, and positive affect about heat (i.e., analytic) increased heat wave resources perceptions. Both categories of factors, including heat wave demands and resources perceptions, increased self-reported heat protection intentions, except for positive affect about heat. The proposed path analysis model was supported, providing a better contextualization for such findings, as it highlighted factors contributing to heat wave demands and resources perceptions, and their combined effects on self-reported heat protection intentions. The path analysis model further suggested that as age increased self-reported heat protection intentions also increased, and that there was a positive association between interference in daily life and heat wave resources perceptions rather than a direct effect. Moreover, it also provided contextualization for the effects of positive affect about heat on self-reported heat protection intentions, showing that the total effect of positive affect about heat on self-reported heat protection intentions was only marginally significant, perhaps due to decreasing risk perception and temperature feeling, while increasing resources perceptions.

On the one hand, results suggest that the promotion of demands and resources perceptions may depend, to some degree, on different qualitative categories of predictors. That is, demands perceptions seem to be better predicted by factors promoting “awareness or generation of added constraints” (i.e., norm deviation; Gaspar et al., 2015, 2021, 2022) whereas resources perceptions seem to be better predicted by factors promoting “awareness or generation of assets, strengths, and alternatives” (e.g., Petty et al., 2009). For example, temperature feeling, temperature interference in daily life, and risk perception mostly contributed, directly or indirectly, for promoting heat wave demands perceptions, whereas need for cognition and reporting having heard heat protection recommendations mostly contributed directly for promoting heat wave coping resources perceptions.

On the other hand, results suggest that self-reported heat protection intentions were positively predicted by both categories of predictors (i.e., awareness/generation of constraints and assets), supporting that promoting feelings of threat (i.e., demands over resources) or feelings of safety (i.e., resources over demands) may hinder heat protection intentions. In other words, it suggests that lower perceptions of heat wave demands and resources, or significant differences between both (i.e., one being much higher than the other), can reduce the probability or the level of cognitive interaction between both perceptions, which is in line, for example, with elaboration likelihood theory (Petty & Cacioppo, 1986). One direct practical implication is that promoting heat protection intentions needs to rely not only on promoting factors connected to the awareness of risk or demands, as it is often done (Hass et al., 2021), but also on promoting factors connected to the availability of protective resources. In other words, risk communications promoting heat wave risk and demands (e.g., danger) awareness without raising awareness of available resources to cope with these (i.e., feeling of threat), or raising awareness of the latter without the former (i.e., feeling of safety) may hinder heat protection intentions. This suggests that interventions aimed at motivating towards heat protection behaviours, should raise awareness of both heat wave demands and resources perceptions.

Results were also supported by previous research enabling further integration and understanding. For example, building on the Health Action Process Approach (Schwarzer, 2008; Schwarzer et al., 2011), heat wave risk perception and resources perceptions were found to be important predictors of self-reported heat protection intentions. As in the study by Bruine de Bruin et al. (2016), temperature feeling increased self-reported heat protection intentions, although in our study we found that this effect was better explained by its direct effects on temperature interference in daily life, and indirect effects on heat wave risk perceptions and demands perceptions. Similarly, in line with the study by Lefevre et al. (2015) we found that reporting having heard heat protection recommendations increased self-reported heat protection intentions, although here we found that this effect was better explained by its direct effects on available resources perceptions. We also found that, besides correlating with heat wave resources perceptions, temperature interference in daily life also directly increased self-reported heat protection intentions, heat wave demands perceptions, and heat wave risk perception, which is in line with findings from Hass and Ellis (2019). This translated into further indirect effects on self-reported heat protection intentions, highlighting the role that experiencing negative effects of extreme hot weather may have on these. Results also supported an association between temperature interference in daily life and resources perceptions, instead of

between demands and resources perceptions, suggesting that the link between heat wave demands perceptions and corresponding coping resources perceptions may not be fully accommodated in participants minds (e.g., linking demands with the most effective resources) and still depend on the experience of negative effects. From a practical standpoint, building positive associations between perceived demands and resources may automate the interaction between both, facilitating protective response.

Effects of positive affect about heat and need for cognition were also mostly in line with previous research and theoretical predictions. On the one hand, as suggested by prior studies in the context of heat waves (e.g., see Bruine de Bruin et al., 2016; Domingos et al., 2022; Lefevre et al., 2015) we found that positive affect about heat reduced temperature feeling, risk perception, and self-reported heat protection intentions. Yet, here we also found that positive affect about heat increased resources perceptions, or at least the feeling of having resources, apparently nullifying the total effect of positive affect about heat on self-reported heat protection intentions (i.e., marginally significant total effect), thus providing an interesting contextualization of this affective process. On the other hand, we found that need for cognition increased resources perceptions but had no direct effect on other variables. The observed absence of effect can be related with the study context, that took place during a heat wave, with a probability for heat wave risk and demands perceptions being already more available in participants minds. As such, participants higher in need for cognition seemed to be able to mobilize greater resources perceptions to counter such demands, which is in line, for example, with findings from Ruiter et al. (2004). This also suggests an interesting combination of “experiential and analytic systems” as proposed by some (Denes-Raj & Epstein, 1994; Epstein et al., 1992, 1996; Sanna & Chang, 2006), with experiential systems (e.g., experience of temperature interference in daily life) mobilizing demands perceptions while and analytic systems (e.g., need for cognition) mobilizing coping resources perceptions.

Sociodemographic and personal and characteristics also contributed for a better contextualization of self-reported heat protection intentions and other variables in the model. As in previous research, we found that as age increased self-reported heat protection intentions increased and positive affect about heat and need for cognition decreased, and that female participants reported higher heat protection intentions (Bruine de Bruin et al., 2016, 2015; Domingos et al., 2022; Lefevre et al., 2015). Another finding with ties to previous research (Bruine de Bruin et al., 2016; Domingos et al., 2022; Lefevre et al., 2015) was that although we did not find any direct effect of education level on any other variables in the model, we found

a negative correlation with age, which can be associated with lower education levels among the older population in Portugal (Veloso & Rocha, 2016), as well as a positive correlation with need for cognition, all in line with findings from Bruine de Bruin et al. (2015). We also found a positive correlation between being a female participant and reporting a health condition that could prevent or make inadvisable exposure to hot weather, which is in line with studies suggesting that women have more attention to their health, more awareness of symptoms, and greater concern (Barsky et al., 2001; de Nooijer et al., 2003; Hass et al., 2021; Jones & Johnson, 2012). This possibly leads to a greater tendency for reporting a health condition that could prevent or make inadvisable the exposure to hot weather²¹, and greater self-reported heat protection intentions. Living alone was found to be positively correlated with age, an expectable result considering Portuguese sociodemographic indicators showing a growing tendency for elderly to live alone or exclusively in the company of other elders (Instituto Nacional de Estatística [INE], 2012, 2021; Oliveira et al., 2017), although no other association with variables in the model were found. A positive correlation between doing physical activity and positive affect about heat was also found. This provides an interesting insight to how it relates with heat protection intentions, such as lowering the motivation for delaying physical activities to a cooler time of day (e.g., Wolf et al., 2010). Finally, we found positive correlations between being employed and education level, as well as need for cognition, which is in line with sociodemographic tendencies in Portugal showing associations between being employed, education level, and performance in cognitive assessments (Oliveira et al., 2017) and research that links need for cognition to work settings (Mensmann & Frese, 2018), where those higher in need for cognition have higher probabilities to maintain their jobs.

Limitations relate with the sample, that was recruited following non-random sampling procedures and as such, it is not representative of the Portuguese population. The data was collected through a correlational research design, and the variables measured were self-reported rather than observations or other objective measurements (e.g., self-reported heat protection behavioural intentions rather than observation or measurement of the actual behaviour). Moreover, there is the possibility of alternative explanatory models in path analysis, further limiting generalization and causal inferences. To minimize such limitations, all analysis were supported by theoretical and empirical evidence in the context of heat waves, and bootstrap

²¹ Most participants did not report a health condition, and those who did reported relatively mild health conditions (see Appendix C, p. 172).

procedures were implemented in path analysis, with the model presenting good indicators of quality of adjustment and predictive power (Marôco, 2021).

With these limitations in mind, care should be taken when generalizing findings to other populations. However, rather than generalization, this exploratory study aimed at a broader understanding of the underlying processes involved in the promotion of demands and resources perceptions and protection intentions, supported by theoretical and empirical evidence. We suggest that these processes can constitute universal building blocks applied in different situations and contexts. Future studies can expand this idea by including factors such as social norms, perceived self-efficacy, outcome efficacy, and other perceptual, personal, social, environmental, and structural drivers of demands perceptions, resources perceptions, and intentions (e.g., see Hass et al., 2021; Schwarzer, 2008; Schwarzer et al., 2011; van Valkengoed & Steg, 2019). Specifically, and given its importance as shown in our results, the processes behind the promotion of resources perceptions may benefit from further studies, as this study contributed more to identifying predictors of demands perceptions rather than resources. The model should also be expanded beyond intentions, including for example, actual behaviours or psychological coping strategies (e.g., see Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2009, 2015; Zimmer-Gembeck & Skinner, 2016). Nevertheless, the present study allows providing an integrative and holistic framework capable of describing dynamic and complex psychological and behavioural phenomena inherent to demands and resources perceptions, while also enabling practical evidence-based applications, across contexts and ecological systems (e.g., Bronfenbrenner & Morris, 2007), for risk communication and behaviour change interventions.

Appendix A

Heat Wave Demands and Resources Perceptions Scales

Scales of heat wave demands and resources perceptions, with items in their respective subcategories, and instructions

Demands Scale

The following statements represent possible demands posed by heat waves, please rate how much you agree or disagree with each one. During a heat wave...

- | | |
|----------------------|---|
| <i>Danger</i> | <p><i>It1. There is greater danger to my physical and bodily health (more headaches, colds, etc.)</i></p> <p><i>It2. There is greater danger to my mental health (more stress, anxiety, discomfort, etc.)</i></p> <p><i>It3. There is greater danger to my life (more likely to faint, lose consciousness, dying, etc.)</i></p> <p><i>It4. There is greater danger to my social life (more likely to be isolated, away from others, miss on social events, etc.)</i></p> <p><i>It5. There is greater danger for people typically seen as more “vulnerable” (children, elderly, etc.)</i></p> <p><i>It6. There is greater danger to the environment (pets, plants, wildlife, etc.)</i></p> |
| <i>Effort</i> | <p><i>It7. I have greater physiologic effort (more sweating, accelerated heartbeat, alterations in blood pressure, etc.)</i></p> <p><i>It8. I have greater physical effort (more tiredness, fatigue, apathy, weakness, etc.)</i></p> <p><i>It9. I have greater mental effort (more difficulty in thinking, concentrating, making decisions, etc.)</i></p> <p><i>It10. I have greater emotional effort (more discomfort, irritability, difficulty in maintaining good mood, etc.)</i></p> <p><i>It11. I have a greater financial effort (more expenses with air conditioning equipment, fans, and other climatization devices, electricity bills, etc.)</i></p> |
-

Uncertainty

-
- It12. I have greater doubts about what can happen to me (consequences, harms, risks, etc.)*
- It13. I have greater doubts about what to do to protect myself (available resources, protective behaviors, etc.)*
-

Resources scale

The following statements represent possible resources to cope with the demands posed by heat waves, please rate how much you agree or disagree with each one. During a heat wave...

Knowledge, Abilities, & Skills

- It1. I have equipment's that can help me deal with the heat (air conditioning, fans, chillers, etc.)*
- It2. I have clothing that can help me cope with the heat (fresh and transpirable clothes, hats, etc.)*
- It3. I have objects that can help me cope with the heat (hand fans, water sprayers, etc.)*
- It4. I have information and communication technologies that can help me cope with the heat (social networks, smart apps, etc.)*
- It5. I have financial resources that can help me cope with the heat (readily available money, savings, etc.)*
- It6. I have access to places that can help me cope with the heat (places with shades, cooled places, climatized places, etc.)*
- It7. I have physical capabilities that can help me cope with the heat (stamina, vitality, physical health, etc.)*
- It8. I have mental capabilities that can help me cope with the heat (ability to plan ahead, devise strategies, etc.)*
- It9. I have emotional capabilities that can help me cope with the heat (ability to control my emotions, to recognize and control what I'm feeling, etc.)*
- It10. I have avoidance behaviors that can help me cope with the heat (escape the heat, avoid going outside, etc.)*
- It11. I have approach behaviors that can help me cope with the heat (looking for protective places, hydrate myself, etc.)*
-

<i>Dispositions</i>	<p><i>It12. I have personality tendencies that can help me cope with the heat (being calm, patient, understanding, interested, etc.)</i></p> <p><i>It13. I have thinking and action tendencies that can help me cope with the heat (being proactive, preventive, thoughtful, etc.)</i></p>
<hr/>	
<i>External Support</i>	<p><i>It14. I have family and friends who can support and help me cope with the heat (relatives, neighbors, etc.)</i></p> <p><i>It15. I have professionals who can give me recommendations and help me cope with the heat (health professionals, firefighters, etc.)</i></p> <p><i>It16. I have available information that can help me cope with the heat (informative pamphlets, web pages, etc.)</i></p> <p><i>It17. I have a belief that my faith in God, or in other spiritual beliefs, can help me cope with the heat</i></p> <p><i>It18. I have institutions that can help me cope with the heat, if necessary (associations, community institutions, health authorities, etc.)</i></p>

Note. The Portuguese version can be made available upon request to the authors. The English version presented above is a simple translation from the Portuguese version used in the study. Before use in English or other language, the scales should be adapted and adjusted to the specific cultural background of the country, and if possible validated. Each scale was presented separately (demands first), and item presentation of each scale was randomized. Both scales used a response scale anchored from 1 (strongly disagree) to 5 (strongly agree). Reliability across the 13 demands perceptions items (Cronbach's $\alpha = .86$) and the 18 resources perceptions items (Cronbach's $\alpha = .79$) as good/acceptable and sufficient to create an averaged score.

Appendix B

Heat Protection Intentions Scale

Heat protection intentions scale (during the heat wave)

Read the following statements and rate how inclined you are to engage in each of the behaviours during the heat wave. During the heat wave how inclined would you be to ...

- It1. Drink more water even without being thirsty?*
- It2. Avoid the sun during 11.00 a.m. and 5.00 p.m.?*
- It3. Stay 2 to 3 hours in a cooled place, with adequate temperature?*
- It4. Search for cooled shelters, with adequate temperature?*
- It5. Avoid drinking alcoholic beverages?*
- It6. Avoid drinking sugary beverages?*
- It7. Wear loose, light, and fresh clothing?*
- It8. Prevent heat from entering your home by closing shutters and windows during the day?*
- It9. Cool down your home by opening the windows at night?*
- It10. Use air conditioning to cool down your home?*
- It11. Use fans to cool down your home?*
- It12. Use wet towels to cool yourself down?*
- It13. Spray your body with water to cool yourself down?*
- It14. Take a shower with adequate temperature to cool yourself down?*
- It15. Consult and read the warnings about extreme hot weather issued by the authorities?*
- It16. Find out if those living with you or that are dear to you (for example your family) are feeling well?*
- It17. Find out if people living close to you (for example, your neighbours) are feeling well?*
- It18. Ask a family member or a friend for help if you are feeling unwell due to the heat?*
- It19. Ask a neighbour for help if you are feeling unwell due to the heat?*
- It20. Contact the helplines provided by the health authorities (for example, Health 24) if you are feeling unwell due to the heat?*

- It21. Go to the hospital emergency department or health centre if you are feeling unwell due to the heat?*
- It22. Offer or remind those living with you or that are dear to you (for example your family) to drink water?*
- It23. Offer or remind people living close to you (for example, your neighbours) to drink water?*
- It24. Check if those living with you or that are dear to you (for example, your family) are in a cooled place, with adequate temperature?*
- It25. Check if people living close to you (for example, your neighbours) are in a cooled place, with adequate temperature?*

Note. The Portuguese version can be made available upon request to the authors. The English version presented above is a simple translation from the Portuguese version used in the study. Before use in English or other language, the scale should be adapted to the specific recommendations in use in the country, and if possible validated. All items were based on the recommendations for protection against heat waves issued by the Portuguese Directorate-General for Health (DGS, 2015) and the work developed by Bruine de Bruin et al. (2016) and tailored to the Portuguese context (e.g., recommendations to keep out of the sun 11.00 a.m. and 5.00 p.m. in Portugal, instead of 11.00 a.m. and 3.00 p.m. in the United Kingdom). Item presentation was randomized, and participants rated each item using a response scale anchored from 1 (not inclined at all) to 5 (totally inclined). Internal consistency across the 25 items was very good and sufficient to create an averaged score (Chronbach's $\alpha = .91$).

Appendix C

Descriptive Statistics for all Variables Collected in the Study

Descriptive Statistics

Variable	<i>M; SD or % (n)</i>
Age	<i>M</i> = 36.98; <i>SD</i> = 16.06
16-25	27.6% (84)
26-60	61.5% (187)
61-75	8.2% (25)
≥ 76	2.6% (8)
Gender	
Male	26.6% (81)
Female	73.4% (223)
Education Level	<i>M</i> = 4.45; <i>SD</i> = .96
None (L1)	0% (0)
Primary Education (L2)	5.3% (16)
Secondary Education (L3)	17.4% (53)
Professional/Vocational Education (L4)	4.6% (14)
Higher Education (L5)	72.7% (221)
Living Alone	
Yes	13.5% (41)
No	86.5% (263)
Doing Physical Activity	
Yes	49.3% (150)
No	50.7% (154)
Health Condition	
No	91.4% (278)
Yes	8.6% (26)
Blood Pressure Condition (e.g., high/low)	3.6% (11)
Skin Condition (e.g., moles; allergy)	2.6% (8)
Respiratory Condition (e.g., asthma)	0.7% (2)
Headache Condition	0.7% (2)
Other Conditions (e.g., rheumatic; cancer)	1% (3)

Employment Status	
Employed	65.1% (198)
Unemployed/Retired	34.9% (106)
Positive Affect about Heat	$M = 3.11; SD = .88$
Need for cognition	$M = 3.66; SD = .68$
Demands Perceptions	$M = 3.47; SD = .60$
Resources Perceptions	$M = 3.68; SD = .39$
Heat Protection Intentions	$M = 3.59; SD = .59$
Temperature Feeling	$M = 4.38; SD = .72$
a lot colder than average for the season	0% (0)
colder than average for the season	1.3% (4)
average for the season	9.9% (30)
hotter than average for the season	38.8% (118)
a lot hotter than average for the season	50% (152)
Temperature Interference in Daily Life	$M = 3.26; SD = .84$
For self	$M = 3.06; SD = 1.07$
For family	$M = 3.07; SD = .97$
For Portuguese population	$M = 3.64; SD = .81$
Heat Wave Risk Perception	$M = 3.47; SD = .71$
For self	$M = 3.16; SD = .96$
For family	$M = 3.35; SD = .85$
For Portuguese population	$M = 3.88; SD = .65$
Heard Heat Protection Recommendations	
Yes	78.9% (240)
No	21.1% (64)

Appendix D

Path Analysis Direct, Indirect, and Total Effects, and Correlations Between Variables

Path analysis model: direct, indirect, and total effects, and correlations between variables

	Estimate	95% CI
Direct Effects		
IDL ← TF	.44***	].35; .53[
RP ← IDL	.48***	].39; .57[
D ← IDL	.26***	].16; .36[
HPI ← IDL	.14*	].02; .25[
D ← RP	.44***	].34; .53[
HPI ← RP	.21***	].10; .32[
HPI ← D	.18**	].07; .28[
R ← HR	.14**	].05; .24[
HPI ← R	.47***	].39; .54[
TF ← PAH	-.15*	]-.26; -.03[
RP ← PAH	-.12*	]-.21; -.01[
R ← PAH	.20**	].09; .31[
HPI ← PAH	-.14**	]-.23; -.05[
R ← NFC	.29***	].18; .39[
NFC ← Age	-.14*	]-.25; -.03[
PAH ← Age	-.18***	]-.28; -.08[
HR ← Age	.19***	].11; .27[
HPI ← Age	.11*	].03; .20[
HPI ← Fem	.12**	].04; .20[
Indirect Effects		
RP ← – TF	.21***	].15; .28[
D ← – TF	.21***	].15; .28[
HPI ← – TF	.14***	].09; .20[
D ← – IDL	.21***	].16; .27[
HPI ← – IDL	.19***	].13; .25[
HPI ← – RP	.08**	].03; .14[
HPI ← – HR	.07**	].02; .12[

IDL <-- PAH	-.06*	[-.12; -.01[
RP <-- PAH	-.03*	[-.06; -.01[
D <-- PAH	-.08**	[-.14; -.03[
HPI <-- PAH	.04	[-.02; .11[
HPI <-- NFC	.14***	].08; .19[
TF <-- Age	.03**	].01; .06[
IDL <-- Age	.01**	].003; .03[
RP <-- Age	.03**	].01; .06[
D <-- Age	.02**	].004; .03[
R <-- Age	-.05*	[-.10; -.002[
HPI <-- Age	.01	[-.02; .05[
Total Effects		
IDL <--- TF	.44***	].35; .53[
RP <--- TF	.21***	].15; .28[
D <--- TF	.21***	].15; .28[
HPI <--- TF	.14***	].09; .20[
RP <--- IDL	.48***	].39; .57[
D <--- IDL	.47***	].38; .56[
HPI <--- IDL	.32***	].21; .42[
D <--- RP	.44***	].34; .53[
HPI <--- RP	.29***	].19; .38[
HPI <--- D	.18**	].07; .28[
R <--- HR	.14**	].05; .24[
HPI <--- HR	.07**	].02; .12[
HPI <--- R	.47***	].39; .54[
TF <--- PAH	-.15*	[-.26; -.03[
IDL <--- PAH	-.06*	[-.12; -.01[
RP <--- PAH	-.15**	[-.25; -.04[
D <--- PAH	-.08**	[-.14; -.03[
R <--- PAH	.20**	].09; .31[
HPI <--- PAH	-.10 [†]	[-.21; .01[
R <--- NFC	.29***	].18; .39[
HPI <--- NFC	.14***	].08; .19[

PAH <— Age	-.18***	[-.28; -.08[
TF <— Age	.03**	].01; .06[
IDL <— Age	.01**	].003; .03[
HR <— Age	.19***	].11; .27[
NFC <— Age	-.14*	[-.25; -.03[
RP <— Age	.03**	].01; .06[
D <— Age	.02**	].004; .03[
R <— Age	-.05*	[-.10; -.002[
HPI <— Age	.13**	].04; .21[
HPI <— Fem	.12**	].04; .20[
Correlations		
IDL <-> R	.13*	].02; .24[
Age <-> Alone	.26***	].14; .39[
Fem <-> HC	.16***	].08; .21[
Educ <-> NFC	.25***	].16; .34[
Educ <-> Age	-.36***	[-.47; -.24[
Pact <-> PAH	.13*	].02; .24[
Emp <-> Educ	.20**	].09; .30[
Emp <-> NFC	.26***	].14; .37[

Note. Standardized coefficients.

TF = Temperature Feeling

HR = Heard Protection Recommendations

IDL = Temperature Interference in Daily Life

RP = Heat Wave Risk Perception

D = Heat Wave Demands Perceptions

R = Heat Wave Resources Perceptions

PAH = Positive Affect about Heat

NFC = Need for Cognition

Age = Age

Educ = Education Level

Fem = Gender Female

HC = Health Condition

Alone = Living Alone

PAct = Doing Physical Activity

Emp = Employed

HPI = Heat Protection Intentions

<— Direct Effects of X on Y

<- - Indirect Effects of X on Y

<— Total Effects of X on Y

<-> Correlation between X and Y

† $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

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Chapter V

Seasonal Variations and Predictors of Heat Wave Feelings of Threat across Different Heat Wave Geographical Susceptibility Locations of Portugal

Chapter based on:

Domingos, S., Gaspar, R., Marôco, J., & Bruine de Bruin, W. (2022). *Feeling the heat: seasonal variations and predictors of heat wave feelings of threat across different heat wave geographical susceptibility locations of Portugal*. [Manuscript in preparation].

Abstract

Vulnerability to heat waves and their negative effects on health varies not only due to individual factors (e.g., age) but also due to situational physical factors such as time, and geography. Here we explored seasonal variations and predictors of heat wave feelings of threat across different heat wave geographical susceptibility locations in Portugal. A total of 238 Portuguese residents responded to a web-based longitudinal survey: 1) before the summer; 2) during a heat wave in the summer; 3) during the summer; and 4) after the summer. Geographical location was used as an indicator for heat wave occurrence susceptibility (low; moderate; high). Together with other measures, heat wave demands and resources perceptions were assessed to compute an indicator of heat wave feelings of threat. During the heat wave, feelings of threat were higher among participants in high susceptibility locations, with demands outweighing resources perceptions, suggesting greater distress and coping difficulty. Although participants recovered after the heat wave, regression analysis suggested that older participants and female participants living in moderate-high susceptibility locations may have had greater difficulty in recovering. Heat wave risk perception and positive affect about heat were identified as the most consistent predictors of heat wave feelings of threat, with risk perception increasing and positive affect decreasing such feelings. Participants with (individual and geographical) vulnerability profiles, who have had greater difficulty in coping and recovering from heat waves, could benefit from resource building/enhancing interventions. In a climatic crisis context, with the aggravation of climate change effects, monitoring psychological responses to heat waves (e.g., threat) may enable anticipated action to build resilience before, rather than after, the effects become damaging to physical and psychological health.

Keywords

Feelings of Threat; Heat Waves; Geographical Susceptibility; Adaptation and Resilience

Introduction

Excessive exposure to extreme hot weather events can bring significant complications to individuals, affecting their health and wellbeing (Agüero, 2014; Charlson et al., 2021; Kovats & Hajat, 2008; Ma et al., 2015; World Health Organization [WHO], 2015). These negative effects can range from minor symptoms such as headache, nausea, sweating, weakness, impaired cognition, experience of negative emotions, and loss of productivity to severe physical and mental complications such as heat exhaustion, heat stroke, dehydration, anxiety, depression, and even death (Clayton et al., 2021; Gasparrini & Armstrong, 2011; Hajat et al., 2010, 2014; Laurent, 2021; Liu et al., 2021; Luber & McGeehin, 2008; McGregor et al., 2007; Oray et al., 2018; Thompson et al., 2018). Yet, the negative effects of extreme heat on health and wellbeing vary across time, individuals, communities, populations, and geographical locations (Esplin et al., 2019; Hass et al., 2021; Howe et al., 2019; Koppe et al., 2004; Mayrhuber et al., 2018). This variation may be due not only to individual factors such as sociodemographic characteristics (e.g., age; gender; education level) but also to situational factors such as geographical (e.g., intensity and frequency of exposure), and acclimation and adaptation processes (e.g., physiological adaptation; familiarization; habituation). Moreover, this variation can also result from the presence or absence of individual and social resources, and other factors such as healthy lifestyles (e.g., healthy eating habits; regular physical activity), health condition (e.g., absence of comorbidities), social support networks (e.g., living with others; being integrated in the community), adequate living conditions (e.g., thermal insulation), available protective equipment (e.g., air conditioning units), economic safety (e.g., having employment), and existence of local interventions and support facilities (e.g., public health interventions; community cooling centres), that can contribute for that variation (Arbuthnott et al., 2016; Bakhsh et al., 2018; Bose-O'Reilly et al., 2021; Hancock & Vasmatazidis, 2003; Hass & Ellis, 2019; Hass et al., 2021; Marinucci et al., 2014; Mayrhuber et al., 2018; Rodrigues et al., 2020; Widerynski et al., 2017). For example, when compared to individuals living in geographical locations less susceptible to the occurrence of heat waves, individuals in more susceptible locations may be more acclimated and familiarized to those events. This is because their experience may have enabled them to build not only procedural knowledge and material resources, but also physical, psychological, and social resources to help counter the effects of extreme heat (Arbuthnott et al., 2016; Esplin et al., 2019; Stocker et al., 2013; Valois et al., 2017). However, more frequent and intense exposure to extreme heat, coupled with other factors such as age or belonging to a risk group, can also deplete individuals

physical, psychological, and social resources (Hajat et al., 2014; Hancock & Vasmatazidis, 2003; Kovats & Hajat, 2008). This can be further aggravated when the geographical locations more susceptible to the occurrence of heat waves also correspond to more isolated and low-income areas, with older or more vulnerable populations, and greater inequalities in the access to physical and psychological healthcare, as it is the case in Portugal (Di Meglio et al., 2018; Mauritti et al., 2019; Moreira, 2011; Ordem dos Psicólogos Portugueses [OPP], 2020; Rego et al., 2013; Rodrigues, 2019; Rodrigues et al., 2020, 2021; Silva, 2012). In that regard, how heat waves and hot weather impact individuals living in different heat wave geographical susceptibility locations, and their psychological responses to such events over time (e.g., threat and stress) is still understudied in research.

Demands and Resources Perceptions as an Indicator of Threat and Stress

Psychological responses of threat and stress, as well as subjacent adaptation and coping behaviours can be understood as a function of individuals subjective evaluation of: 1) demands (i.e., perceived demands – danger; effort; uncertainty) posed by heat waves and other extreme hot weather events; and 2) personal and social resources (i.e., perceived resources – knowledge and capabilities; dispositions; external support) available to cope with such demands (Blascovich, 2007; Blascovich & Mendes, 2000, 2010; Domingos et al., 2022a, 2020, 2022b; Fredrickson, 2004; Gaspar et al., 2015, 2022; Gonzalez-Mulé & Cockburn, 2017; Gonzalez-Mulé et al., 2021; Jenny et al., 2019; Li et al., 2013; Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2015). Particularly, the ratio (D/R) between demands (D) and resources (R) perceptions have been systematically associated to specific psychological, physiological, and behavioural outcomes (for a review see Blascovich & Mendes, 2000, 2010; Tomaka et al., 1993, 1997). Higher values of this ratio (i.e., when perceived demands are significantly higher than resources; $D/R > 1$) have been associated to higher distress, worry, exhaustion, avoidance rather than approach behaviours (e.g., withdrawal; freeze), and more pernicious cardiovascular response patterns (e.g., greater total peripheral resistance). Lower values of this ratio (i.e., when perceived demands are significantly lower than resources; $D/R < 1$) have been associated to lower stress (i.e., distress and eustress), worry, exhaustion, less pernicious cardiovascular response patterns, but also lower motivation for protection (e.g., unawareness; underestimation). Balanced values of this ratio (i.e., when perceived demands and resources are not significantly different; $D/R \approx 1$) have been associated to higher eustress, protective response, and approach rather than avoidance behaviours (e.g., prevention; planning) while

maintaining less pernicious cardiovascular response patterns, making this an “optimal motivational state”, when feelings of threat (D/R) are high enough to promote protective action, without inducing damaging levels of stress or withdrawal/freeze behaviours (i.e., challenge). Moreover, there is evidence that this type of operationalization (i.e., D/R) represents a type of canonical cortical operation²² that provides explanation and context for the neural mechanisms behind the formation of these feelings, that is, for example, the feelings and the creation of meaning resulting from the comparison between two perceptions (Aqil et al., 2021; Carandini & Heeger, 2012; Louie et al., 2013).

Feelings of threat (D/R) can be influenced by multiple individual and sociodemographic factors and are typically context dependant (Blascovich & Mendes, 2000; Theorell & Karasek, 1996), being unclear if or how they vary in the context of heat waves, as well as across different seasons and heat wave geographical susceptibility locations. This understanding can be particularly important, as it may provide an evidence-based indicator about how different populations, in different geographical locations and at different times of the year, are feeling about heat waves (i.e., indicator of threat posed by heat waves), and how they are coping with and recovering from heat waves and hot weather (i.e., indicator of stress associated with heat waves and hot weather). Because feelings of threat (D/R) are operationalized from demands (D) and resources (R) perceptions, it has the advantage of also providing decision makers with additional information about prevalence of such perceptions, which have been shown to increase heat protection intentions (Domingos et al., 2022b). Additionally, better knowledge about predictors of feelings of threat (D/R) can provide decision makers with evidence for targeted interventions to promote protective action without inducing damaging levels of stress. Due to their predictive role, feelings of threat (D/R) can be further used as an indicator of change in such interventions (Blascovich & Mendes, 2010).

In the context of heat waves, research suggests that factors such as heat wave risk perception, positive affect about heat, need for cognition, temperature feeling, temperature interference in daily life, and awareness of heat protection recommendations may play an important role in shaping feelings of threat, although their role is still unclear (Beckmann & Hiete, 2020; Bruine de Bruin et al., 2016; Domingos et al., 2022b; Hajat et al., 2010; Hass et al., 2021; Lefevre et al., 2015). The current study aims to contribute to this by providing a better understanding of such role.

²² Canonical cortical operations are mathematical operations applied by the brain in a wide variety of contexts and capable of explaining and unifying seemingly unrelated neural and perceptual phenomena (Aqil et al., 2021).

Current Study

We conducted a web-based survey with a longitudinal research design to explore feelings of threat (D/R), as an indicator of how participants living in different geographical locations of Portugal, varying in heat wave occurrence susceptibility (heat wave geographical susceptibility), felt about heat waves. This was assessed across different seasons of the year (i.e., indicator of threat posed by heat waves), reflecting an overall longitudinal indicator of how participants coped with and recovered from heat waves and hot weather (i.e., indicator of stress associated with heat waves and hot weather).

For that we focused on three research questions: RQ1) Are there seasonal variations in heat wave feelings of threat (D/R) within the groups of participants living in the different heat wave geographical susceptibility locations of Portugal?; RQ2) Are there seasonal variations in heat wave feelings of threat (D/R) between the groups of participants living in the different heat wave geographical susceptibility locations of Portugal?; and RQ3) What factors predicted heat wave feelings of threat (D/R) across different seasons and different heat wave geographical susceptibility locations of Portugal?.

Method

Sample

The web-based longitudinal survey was completed by a sample of 238 Portuguese residents that participated in all four waves: 1) in the spring before the summer; 2) during a heat wave in the summer; 3) during the summer; and 4) in the autumn after the summer. The sample was recruited following non-random sampling procedures, namely through convenience and snowball sampling, resorting to informants in the community (e.g., parishes councils; elderly associations; universities) and other participants for reference to potential participants. Participants were between 17 and 89 years old ($M = 39.13$; $SD = 17.14$), with 70.2% ($n = 167$) female, 68.9% ($n = 164$) reporting at least level 3 professional/vocational or higher education level, 15.1% ($n = 36$) reporting living alone, 52.9% ($n = 126$) reporting doing regular physical activity, 62.6% reporting being employed ($n = 149$), and 0.4% ($n = 1$) reporting having a health condition that could condition exposure to hot weather (asthma)²³.

²³ Considering this participant heat wave geographical susceptibility group (high susceptibility), it was observed that, for this participant and across survey waves, feelings of threat (D/R) were below average, suggesting that, in this case, reporting a condition did not contribute for an overestimation of feelings of threat.

Procedure and Measures

Data was collected between June 2018 and November 2018. The first survey wave (SW1) took place in June 2018 during the last month of spring. The second survey wave (SW2) took place in August 2018, just after the beginning of the summer and during a heat wave with maximum average temperatures above 40°C and minimum average temperatures above 20°C (Instituto Português do Mar e da Atmosfera [IPMA], 2018a). The third survey wave (SW3) took place in September 2018 during the last month of summer, which was characterized as the hottest September since 1931 (IPMA, 2018b). The fourth wave (SW4) took place in November 2018 during the autumn, after the “summer like” temperatures that characterized the beginning of autumn 2018 in the country started decreasing²⁴ (IPMA, 2018b). In the first survey wave, participants received an email invitation to an online survey about climate change and natural hazards, with the following instruction “the aim of this study is to investigate how people cope with climate change and natural hazards, such as extreme temperature, throughout the different seasons of the year”. This also included information about follow-up survey waves, research contact procedures, and informed consent, including the right to withdraw from the study at any moment if they wished so. No additional information regarding the survey was provided. On subsequent survey waves participants received an email with the same background information and a request for continuing their participation. Periodic reminders were also sent to participants who had not yet gave their responses. Collected measures are described below.

Geographical susceptibility to the occurrence of heat waves (heat wave geographical susceptibility²⁵). This variable was assessed by asking participants the location where they lived (e.g., town, village, hamlet name), and consulting the geographical susceptibility level to the occurrence heat waves in that location, issued in the Portuguese National Civil Protection Commission Platform for Disaster Risk Reduction (Plataforma Nacional para a Redução do Risco de Catástrofes – PNRRC) “InfoRiscos”²⁶ web tool. Figure 1 shows the heat wave geographical susceptibility map for Portugal. Depending on participants living location, heat wave geographical susceptibility level was coded as low, moderate, high, or very high. Because

²⁴ The beginning of autumn 2018 in Portugal was characterized by very high values of air temperature, having been exceeded (or equaled) the values of the maximum temperature for the month of September (IPMA, 2018b).

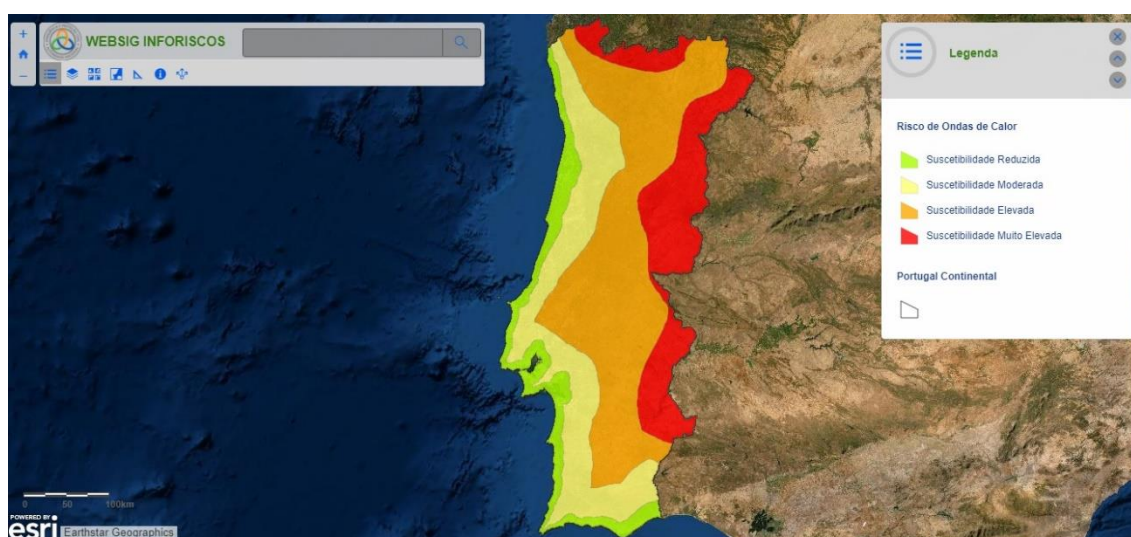
²⁵ Heat wave geographical susceptibility is defined as the annual probability of occurrence of heat waves in such locations, with the following classification: low susceptibility – probability $\leq 30\%$; moderate susceptibility – probability 31-50%; high susceptibility – probability 51-70%; very high susceptibility – probability $> 70\%$.

²⁶ The “InfoRiscos” web tool is part of the Portuguese National Platform for Disaster Risk Reduction (Plataforma Nacional para a Redução do Risco de Catástrofes – PNRRC) and managed by the Portuguese National Civil Protection Commission. This web tool can be accessed at <http://www.pnrrc.pt/index.php/geo/>

the four survey waves were completed by only 4 participants that reported living in very high heat wave geographical susceptibility locations, we decided to merge this sample with the sample of participants in the high susceptibility category²⁷. As such, the indicator of heat wave geographical susceptibility used in the analysis is comprised by three levels: 1) low susceptibility; 2) moderate susceptibility; 3) high susceptibility.

Figure 1

Portuguese National Civil Protection Commission Platform for Disaster Risk Reduction “InfoRiscos” Web Tool: with the heat wave geographical susceptibility layer and respective heat wave susceptibility levels for mainland Portugal



Note. Green = Low Susceptibility; Yellow = Moderate Susceptibility; Orange = High Susceptibility; Red = Very High Susceptibility. <http://www.pnrrc.pt/index.php/geo/>

Heat wave feelings of threat. This variable was computed by dividing the reported averaged value of demands perceptions by the reported averaged value of resources perceptions (D/R) in line with the threat appraisal operationalization proposed by Tomaka et al. (1993, 1997). Besides providing an indicator of the magnitude of heat wave feelings of threat, the computed measure also provides information to when perceived demands exceed perceived resources and vice-versa (i.e., when perceived demands are greater than perceived resources feelings of threat indicator will be greater than 1, and lower otherwise). To enable the computation of this indicator, heat wave demands and resources perceptions were assessed using two separate scales derived from the work developed by Domingos et al. (2022a, 2020,

²⁷ For these 4 participants and across survey waves feelings of threat (D/R) were below average, suggesting that the inclusion on the high susceptibility group did not contribute for an overestimation of feelings of threat.

2022b). The demands scale is comprised by thirteen items representing danger, effort, and uncertainty, and the resources scale is comprised by eighteen items representing knowledge, abilities, & skills, and also individual dispositions, and external support (Appendix A, p. 213). Both use a response scale anchored from 1 (strongly disagree) to 5 (strongly agree). On each survey wave, the demands scale was first presented to the participants with the instruction “The following statements represent possible demands posed by heat waves, please rate how much you agree or disagree with each one” followed by the thirteen items presented in randomized order. Next, for the resources scale, participants received the instruction: “The following statements represent possible resources to cope with the demands posed by heat waves, please rate how much you agree or disagree with each one”, which was followed by the eighteen items presented in randomized order. Reliability, observed for each survey wave, across the thirteen demands scale items (Cronbach’s α : SW1 = .88; SW2 = .89; SW3 = .89; SW4 = .89) and the eighteen resources scale items (Cronbach’s α : SW1 = .86; SW2 = .85; SW3 = .86; SW4 = .85) was good and sufficient to warrant computing each participant’s mean rating. This reflected participants overall perception of demands posed by heat waves, and of available resources to cope with these, that were used to compute the feelings of threat indicator (D/R).

Heat wave risk perception. This variable was operationalized as a composite measure of the perceived risk of heat waves to one-self and others. This measure was comprised by three items using a response scale anchored from 1 (extremely low) to 5 (extremely high). On each survey wave, participants were asked “How do you rate the level of risk that heat waves have or may have” considering the following items: 1) “For you”; 2) “For your family”; 3) “For the Portuguese population”. Reliability, observed for each survey wave was good and sufficient to warrant computing each participant’s mean rating of heat wave risk perception (Cronbach’s α : SW1 = .83; SW2 = .83; SW3 = .86; SW4 = .85).

Temperature feeling. This variable was operationalized as a measure of how hot or cold participants perceived the temperature to be during the five days prior to participating in each survey wave, considering the season. This was measured with a single item using a response scale anchored from 1 (a lot colder than average for the season) to 5 (a lot hotter than average for the season). In each survey wave, participants were asked: “Considering the current season, how do you classify the temperature you felt in the last five days”.

Temperature interference in daily life. This variable was operationalized as a measure of the perceived interference of high temperatures in regular daily life or routine. This measure included individual and social components and was comprised by three items using a response

scale anchored from 1 (nothing at all) to 5 (extremely). On each survey wave, participants were instructed “How much did the temperatures felt in the last five days interfered with” and considered the following items: 1) “Your daily life or routine”; 2) “The daily life or routine of your family”; 3) “The daily life or routine of the Portuguese population”. Reliability, observed for each survey wave, was good and sufficient to warrant computing each participant’s mean rating of perceived temperature interference in daily life (Cronbach’s α : SW1 = .86; SW2 = .88; SW3 = .88; SW4 = .89).

Positive affect about heat. This variable was assessed based on the translated version²⁸ of the scale proposed by Lefevre et al. (2015). Participants rated their positive affect about hot weather, on four items, using a response scale anchored from 1 (strongly disagree) to 5 (strongly agree). In each survey wave, participants were instructed to “Read the following statements and rate how much you agree or disagree with each one, considering the meaning that hot weather has for you”. They considered the following items, presented in randomized order: 1) “I love hot weather”; 2) “I want to get tanned”; 3) “I spend time in the sun when I can”; and 4) “I go on holiday to seek out warm or hot weather”. Reliability, observed for each survey wave, was good and sufficient to warrant computing each participant’s mean rating, as reflecting overall positive affect about heat (Cronbach’s α : SW1 = .80; SW2 = .81; SW3 = .83; SW4 = .82).

Need for cognition. This variable was measured using the short version proposed by Epstein et al. (1996) included in the Rational-Experiential Inventory short scale (REI-10), which was translated to Portuguese²⁹. This scale is comprised by five items, using a response scale anchored from 1 (completely false) to 5 (completely true). On each survey wave, participants were instructed to “Read the following statements and rate how much you agree or disagree with each one”. They considered the following items, presented in randomized order: 1) “I don’t like to have to do a lot of thinking” (reverse coded); 2) “I try to avoid situations that require thinking in depth about something” (reverse coded); 3) “I prefer to do something that

²⁸ The original version in English (Lefevre et al., 2015) was translated to Portuguese and reverse translated to English by two independent translators fluent in both English and Portuguese, and then screened by a third independent translator fluent in both languages. The final version of the scale, in Portuguese, was then reviewed by the researchers and pre-tested on sample of Portuguese participants before being included in the study. Two items from the original scale were previously excluded due to low internal consistency. The Portuguese version can be made available upon request to the authors.

²⁹ The original version in English (Epstein et al., 1996) was translated to Portuguese and reverse translated to English by two independent translators fluent in both English and Portuguese, and then screened by a third independent translator fluent in both languages. The final version of the scale, in Portuguese, was then reviewed by the researchers and pre-tested on sample of Portuguese participants before being included in the study. The Portuguese version can be made available upon request to the authors.

challenges my thinking abilities rather than something that requires little thought”; 4) “I prefer complex to simple problems”; and 5) “Thinking hard and for a long time about something gives me little satisfaction” (reverse coded). Reliability across the five items, observed for each survey wave, was good and sufficient to warrant computing each participant’s mean rating, as reflecting a measure of participants overall need for cognition (Cronbach’s α : SW1 = .82; SW2 = .82; SW3 = .85; SW4 = .87).

Reports of having heard heat protection recommendations. From the second survey wave onwards, and in line with Lefevre et al. (2015), this variable was assessed based on participants reports of whether they had heard specific public recommendations about how to protect themselves from heat in the five days prior to their participation in the study. Possible answers were “yes” and “no”.

Demographic variables. Participants reported their age, gender, highest level of education completed, whether they lived alone or with others, whether they did regular physical activity or not, if they had (in their opinion) any health condition that could prevent or make inadvisable the exposure to hot weather, and employment status. Comprehensive descriptive statistics can be seen in Appendix B (p. 216).

Analysis Plan

Seasonal variations in heat wave feelings of threat (D/R) within the groups of participants living in the different heat wave geographical susceptibility locations of Portugal were assessed using within-subjects ANOVAs (RQ1). Between-subjects ANOVAs were used to further assess seasonal variations in heat wave feelings of threat (D/R) between the groups of participants living in the different heat wave geographical susceptibility locations of Portugal (RQ2). Predictors of heat waves feelings of threat across different seasons and different heat wave geographical susceptibility locations of Portugal were assessed using multiple linear regressions (RQ3). All analysis were conducted in IBM SPSS 20 and the verification of assumptions (e.g., normality; absence of multivariate outliers) for the used statistical tests and bias corrections were performed in line with Marôco (2014) and Tabachnick and Fidell (2007). For all analyses, we set $\alpha = .05$ (two-sided).

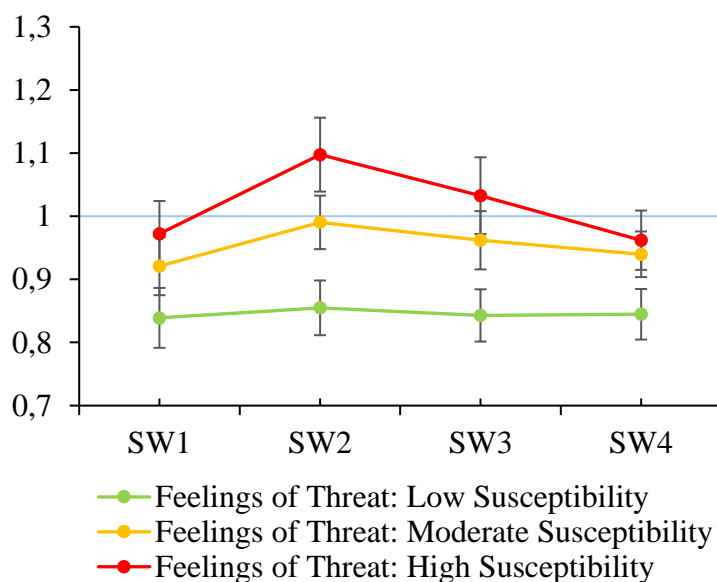
Results

Seasonal and Geographical Variations in Heat Wave Feelings of Threat (RQ1 & RQ2)

Figure 2 consolidates the results of seasonal variations in heat wave feelings of threat (D/R) within and between participants living in the different heat wave geographical susceptibility locations of Portugal, showing that: RQ1) seasonal variations in heat wave feelings of threat were only significant within participants living in high ($F(3, 246) = 12.271; p < .001; \eta^2_p = .130; \pi = .998$) and moderate ($F(3, 144) = 5.445; p < .01; \eta^2_p = .102; \pi = .904$) heat wave geographical susceptibility locations, and non-significant ($F(3, 315) = .431; p = .690; \eta^2_p = .004; \pi = .127$) within participants living in low heat wave geographical susceptibility locations; and that RQ2) in each survey wave were observed examples of significant differences in heat wave feelings of threat between participants living in the different heat wave geographical susceptibility locations ($F(8, 466) = 6.298; p < .001; \eta^2_p = .102; \pi = 1.000$). Details on means and standard deviations can be seen in Appendix B (p. 216; see specifically p. 220).

Figure 2

Seasonal Variations in Heat Wave Feelings of Threat Within and Between Participants Living in the Different Heat Wave Geographical Susceptibility Locations



Note. SW1 = First Survey Wave (Before the Summer); SW2 = Second Survey Wave (During a Heat Wave in the Summer); SW3 = Third Survey Wave (During the Summer); SW4 = Fourth Survey Wave (After the Summer). Scale ranging from 0.2 to 5. Versions of the figure separated by heat wave geographical susceptibility location can be seen respectively in Appendix C (p. 224; Figure C1, C2, C3). Details on differences between demands and resources perceptions highlighting when $D/R > 1$, $D/R < 1$, and $D/R \approx 1$ can be seen in Appendix D (p. 226).

Seasonal variations in heat wave feelings of threat within participants living in high heat wave geographical susceptibility locations. For participants living within high susceptibility locations, feelings of threat were significantly higher during a heat wave in the summer (SW2; $M = 1.10$; $SD = .27$) than before the summer (SW1; $M = .97$; $SD = .24$; $p < .001$; 95% CI [.06; .19]), during the summer (SW3; $M = 1.03$; $SD = .28$; $p < .01$; 95% CI [.02; .11]), and after the summer (SW4; $M = .96$; $SD = .22$; $p < .001$; 95% CI [.07; .21]). No other significant differences were observed between survey waves for these participants.

Seasonal variations in heat wave feelings of threat within participants living in moderate heat wave geographical susceptibility locations. For participants living within moderate susceptibility locations, feelings of threat were significantly higher during a heat wave in the summer (SW2; $M = .99$; $SD = .15$) than before the summer (SW1; $M = .92$; $SD = .16$; $p < .05$; 95% CI [.01; .13]) and after the summer (SW4; $M = .94$; $SD = .13$; $p < .05$; 95% CI [.01; .09]). No other significant differences were observed between survey waves for these participants.

First survey wave differences in heat wave feelings of threat between participants living in low, moderate, and high heat wave geographical susceptibility locations – before the summer. Feelings of threat were significantly higher among participants living in high susceptibility locations ($M = .97$; $SD = .24$) than among participants living in low susceptibility locations ($M = .84$; $SD = .25$; $p < .001$; 95% CI [.05; .21]). Differences between participants living in moderate susceptibility locations ($M = .92$; $SD = .16$) and participants living in low susceptibility locations ($M = .84$; $SD = .25$) were marginally significant ($p < .10$; 95% CI [-.01; .18]). Differences between participants living in high susceptibility locations ($M = .97$; $SD = .24$) and participants living in moderate susceptibility locations ($M = .92$; $SD = .16$) were non-significant ($p = .431$; 95% CI [-.05; .15]).

Second survey wave differences in heat wave feelings of threat between participants living in low, moderate, and high heat wave geographical susceptibility locations – during a heat wave in the summer. Feelings of threat were significantly higher among participants living in high susceptibility locations ($M = 1.10$; $SD = .27$) than among participants living in moderate ($M = .99$; $SD = .15$; $p < .05$; 95% CI [.01; .20]) and low susceptibility locations ($M = .86$; $SD = .23$; $p < .001$; 95% CI [.16; .32]). These were also significantly higher among participants living in moderate susceptibility locations ($M = .99$; $SD = .15$) than among participants living in low susceptibility locations ($M = .86$; $SD = .23$; $p < .01$; 95% CI [.04; .23]).

Third survey wave differences in heat wave feelings of threat between participants living in low, moderate, and high heat wave geographical susceptibility locations – during the summer. Feelings of threat were significantly higher among participants living in high susceptibility locations ($M = 1.03$; $SD = .28$) than among participants living in low susceptibility locations ($M = .84$; $SD = .22$; $p < .001$; 95% CI [.11; .27]). These were also significantly higher among participants living in moderate susceptibility locations ($M = .96$; $SD = .16$) than among participants living in low susceptibility locations ($M = .84$; $SD = .22$; $p < .01$; 95% CI [.03; .21]). Differences between participants living high susceptibility locations ($M = 1.03$; $SD = .28$) and participants living in moderate susceptibility locations ($M = .96$; $SD = .16$) were non-significant ($p = .206$; 95% CI [-.03; .17]).

Fourth survey wave differences in heat wave feelings of threat between participants living in low, moderate, and high heat wave geographical susceptibility locations – after the summer. Feelings of threat were significantly higher among participants living in high susceptibility locations ($M = .96$; $SD = .22$) than among participants living in low susceptibility locations ($M = .85$; $SD = .21$; $p < .001$; 95% CI [.05; .19]). These were also significantly higher among participants living in moderate susceptibility locations ($M = .94$; $SD = .13$) than among participants living in low susceptibility locations ($M = .85$; $SD = .21$; $p < .05$; 95% CI [.02; .18]). Differences between participants living high susceptibility locations ($M = .96$; $SD = .22$) and participants living in moderate susceptibility locations ($M = .94$; $SD = .13$) were non-significant ($p = .805$; 95% CI [-.06; .11]).

Seasonal and Geographical Predictors of Heat Wave Feelings of Threat (RQ3)

Regarding RQ3, in the overall and across survey waves and heat wave geographical susceptibility locations, heat wave risk perception was identified as the most consistent positive predictor, increasing heat wave feelings of threat. Positive affect about heat was identified as the most consistent negative predictor, decreasing heat wave feelings of threat. Yet, situations were identified across heat wave geographical susceptibility locations where only one or none of the two was found to be significant predictor. Temperature interference in daily life was found to be a positive predictor, increasing heat wave feelings of threat during a heat wave (SW2) in high and low heat wave geographical susceptibility locations, and during the summer (SW3) in high heat wave geographical susceptibility locations. Need for cognition was found to be a negative predictor, decreasing heat wave feelings of threat during a heat wave (SW2) in

high heat wave geographical susceptibility locations. Being employed was also found to be a negative predictor, decreasing heat wave feelings of threat before the summer (SW1) in high heat wave geographical susceptibility locations, as well as during a heat wave (SW2) and during the summer (SW3) in low heat wave geographical susceptibility locations. Factors such as age and being female were found to be positive predictors, increasing heat wave feelings of threat after a heat wave (SW3 & SW4), particularly in high (age; being female) and moderate (being female) heat wave geographical susceptibility locations. As such, the analysis identified two classes of predictors: 1) predictors that increased heat wave feelings of threat, such as heat wave risk perception, temperature interference in daily life, being female, and age; and 2) predictors that decreased heat wave feelings of threat, such as positive affect about heat, need for cognition, and employment status. Detailed results of regression analyses can be seen in Appendix E (p. 227).

Significant predictors of heat wave feelings of threat before the summer (SW1) in the different heat wave geographical susceptibility locations. In low susceptibility locations, heat wave risk perception increased ($\beta = .41$; $p < .001$; 95% CI [.07; .18]), and positive affect about heat decreased ($\beta = -.29$; $p < .01$; 95% CI [-.13; -.03]) feelings of threat. In moderate susceptibility locations, positive affect about heat decreased ($\beta = -.45$; $p < .01$; 95% CI [-.20; -.03]) feelings of threat. In high susceptibility locations, positive affect about heat ($\beta = -.30$; $p < .01$; 95% CI [-.14; -.02]) and being employed ($\beta = -.28$; $p < .05$; 95% CI [-.26; -.01]) decreased feelings of threat, whereas heat wave risk perception increased them ($\beta = .27$; $p < .01$; 95% CI [.02; .16]).

Significant predictors of heat wave feelings of threat during a heat wave in the summer (SW2) in the different heat wave geographical susceptibility locations. In low susceptibility locations, positive affect about heat ($\beta = -.29$; $p < .01$; 95% CI [-.11; -.03]) and being employed ($\beta = -.17$; $p < .05$; 95% CI [-.16; .000]) decreased feelings of threat. Heat wave risk perception ($\beta = .28$; $p < .01$; 95% CI [.02; .14]) and temperature interference in daily life ($\beta = .28$; $p < .01$; 95% CI [.02; .12]) increased feelings of threat. In moderate susceptibility locations, heat wave risk perception increased ($\beta = .45$; $p < .01$; 95% CI [.03; .17]) and positive affect about heat decreased ($\beta = -.35$; $p < .05$; 95% CI [-.12; -.01]) feelings of threat. In high susceptibility locations, need for cognition ($\beta = -.29$; $p < .01$; 95% CI [-.18; -.03]) and positive affect about heat ($\beta = -.22$; $p < .05$; 95% CI [-.12; -.01]) decreased feelings of threat, whereas temperature interference in daily life increased them ($\beta = .23$; $p < .05$; 95% CI [.01; .14]).

Significant predictors of heat wave feelings of threat during the summer (SW3) in the different heat wave geographical susceptibility locations. In low susceptibility locations, positive affect about heat ($\beta = -.18; p < .05; 95\% \text{ CI }]-.08; -.001[$), and being employed ($\beta = -.17; p < .05; 95\% \text{ CI }]-.16; -.001[$) decreased feelings of threat, whereas heat wave risk perception increased them ($\beta = .50; p < .001; 95\% \text{ CI }].07; .19[$). In moderate susceptibility locations, positive affect about heat decreased ($\beta = -.40; p < .05; 95\% \text{ CI }]-.15; -.02[$) and being female increased ($\beta = .44; p < .05; 95\% \text{ CI }].04; .27[$) feelings of threat. In high susceptibility locations, temperature interference in daily life ($\beta = .48; p < .001; 95\% \text{ CI }].08; .25[$), age ($\beta = .43; p < .05; 95\% \text{ CI }].001; .01[$), and being female ($\beta = .32; p < .01; 95\% \text{ CI }].07; .34[$) increased feelings of threat.

Significant predictors of heat wave feelings of threat after the summer (SW4) in the different heat wave geographical susceptibility locations. In low susceptibility locations, heat wave risk perception increased ($\beta = .39; p < .001; 95\% \text{ CI }].05; .16[$) and positive affect about heat decreased ($\beta = -.28; p < .01; 95\% \text{ CI }]-.10; -.02[$) feelings of threat. In moderate susceptibility locations, heat wave risk perception increased feelings of threat ($\beta = .49; p < .01; 95\% \text{ CI }].03; .16[$). In high susceptibility locations, heat wave risk perception ($\beta = .27; p < .05; 95\% \text{ CI }].02; .16[$) and being female ($\beta = .25; p < .05; 95\% \text{ CI }].01; .24[$) increased feelings of threat.

Discussion

Extreme hot weather events such as heat waves have serious impacts on health and wellbeing. Yet, how heat waves and hot weather impact individuals living in different heat wave geographical susceptibility locations of Portugal, as well as their psychological responses (e.g., threat and stress) to such events over time is still unclear (Esplin et al., 2019). Here we explored seasonal variations (before the summer; during a heat wave in the summer; during the summer; after the summer) and predictors of heat wave feelings of threat (indicator computed from perceived demands and resources) across different heat wave geographical susceptibility locations in Portugal. We found evidence of seasonal and geographical variations in heat wave feelings of threat, suggesting that the heat wave was more threatening for participants in high heat wave geographical susceptibility locations, compared to participants in other locations. Moreover, we identified heat wave risk perception as the most consistent positive predictor of heat wave feelings of threat, and positive affect about heat as the most consistent negative

predictor. This suggests that positive affect about heat may work as a protective resource in some situations, that is, by reducing feelings of threat and distress when these are high and other resources may be lacking. However, it may also reduce feelings of threat in situations where these probably would need to be promoted for motivating protective behaviour, that is, when the potentially risky situation is appraised as safe rather than challenging.

During the heat wave we found that heat wave feelings of threat were higher among participants in high heat wave geographical susceptibility locations, when compared to participants in moderate and low susceptibility locations. Heat wave feelings of threat were also higher among participants in moderate heat wave geographical susceptibility locations, when compared to participants in low susceptibility locations. Yet, differently from participants in moderate heat wave geographical susceptibility locations where perceived demands and available coping resources did not differ significantly ($D/R \approx 1$), participants in high susceptibility locations perceived significantly more demands than available coping resources ($D/R > 1$). This suggests that participants in high heat wave geographical susceptibility locations may have experienced not only greater threat but also greater distress and difficulty in coping with the heat wave. Differently, participants in moderate heat wave geographical susceptibility locations may have experienced a situation where heat wave perceived demands were concerning, but resources were perceived as enough to enable coping without inducing damaging levels of stress or withdrawal/freeze behaviours (Blascovich, 2007; Blascovich & Mendes, 2000, 2010; Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2015; Tomaka et al., 1993, 1997).

Before and after the heat wave we found no significant differences in heat wave feelings of threat between participants in high and moderate heat wave geographical susceptibility locations, with such feelings progressively decreasing in both locations after the heat wave. Although the trend suggests that participants recovered after the heat wave (i.e., $D/R \approx 1$ or $D/R < 1$), analysis of predictors of heat wave feelings of threat suggested that older participants and female participants living in moderate-high susceptibility locations may had greater difficulty in recovering. Yet it should be noted that this result does not mean that women are more vulnerable or perceive greater risk than men, but instead that their feelings of threat may be dependent on socio-cultural aspects (e.g., power relations; perceived personal control; gender roles and stereotypes) that promote such awareness (Alsharawy et al., 2021; Hitchcock, 2001; Olofsson & Rashid, 2011). For example, according to Hass et al. (2021), women typically express high heat risk perception as they often take on a larger caretaking role, which can

potentially increase their levels of threat and distress after heat waves, when taking care of affected family members.

Interestingly we found that heat wave feelings of threat did not vary significantly, over time, among participants in low heat wave geographical susceptibility locations. For these participants perceived heat wave demands were always significantly lower than perceived resources ($D/R < 1$). Moreover, the indicator of heat wave feelings of threat (D/R) tended to be significantly lower for participants in low heat wave geographical susceptibility locations, when compared to participants in high and moderate heat wave geographical susceptibility locations, except before the heat wave, when it did not differ significantly from participants in moderate heat wave geographical susceptibility locations. On the one hand, this suggests that at the time, and considering potential differences in the magnitude of the heat wave in low heat wave geographical susceptibility locations, participants perceived enough resources to cope with the perceived demands posed by the heat wave. This was also supported by predictor analysis, that identified being employed, a factor typically associated to heat protection and adaptive response (Hass et al., 2021), as contributing to lower heat wave feelings of threat among these participants during and right after the heat wave. On the other hand, considering that low feelings of threat (i.e., when resources significantly outweigh demands) are also associated to lower motivation for protection (Blascovich, 2007; Blascovich & Mendes, 2000, 2010) it is possible that participants living in these geographical locations were maybe still lacking awareness of the demands and the risk posed by heat waves. For example, as suggested by Hass et al. (2021, p. 5), “when a person believes they are acclimatized to heat or believe they already know what measures to take, they are less likely to take protective measures”. The latter can be exacerbated by positive affect about heat as suggested by the predictor analysis and research showing that positive affect about heat tends to reduce heat protection intentions and behaviours (Bruine de Bruin et al., 2016; Domingos et al., 2022a; Lefevre et al., 2015). In fact, it was more consistent in lowering heat wave feelings of threat than predictors typically associated with the mobilization of resources and generation of alternatives for protection (e.g. ideas on how to protect themselves), such as need for cognition and employment status (Bakker, 1999; Bruine de Bruin et al., 2015; Hass et al., 2021; Hittner, 2004; Ruiters et al., 2004; Williams-Piehota et al., 2003), representing a potential affective bias with implications for health and wellbeing (i.e., “a threat that evokes positive affect”; Bruine de Bruin et al., 2016), but also a protective factor when resources are lacking (Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2015; Swim et al., 2009).

Although studies suggest that greater heat wave risk perception can increase heat protection intentions and behaviours (Ban et al., 2019; Bruine de Bruin et al., 2016; Esplin et al., 2019; Hajat et al., 2010; Hass et al., 2021; Kalkstein & Sheridan, 2007; Lefevre et al., 2015; Sheridan, 2007), these findings, in accordance with Esplin et al. (2019), also highlight that increasing heat wave risk perception without providing resources, can have a detrimental effect as it may result in greater threat, distress, and further depletion of physical and psychological resources (Clayton et al., 2021; Swim et al., 2009). Furthermore, research suggests that following communication of heat warnings, coping resources are not always immediately available (Esplin et al., 2019), the effectiveness of various heat protection measures is often unknown, and protective behaviours are still misunderstood (Hass et al., 2021; Kalkstein & Sheridan, 2007; Sheridan, 2007). Considering this context, results further indicate that people living in high heat wave geographical susceptibility locations of Portugal, and potentially vulnerable groups (e.g., elderly; females) living in both high and medium susceptibility locations, could greatly benefit from resource building interventions to help them cope with and recover from the demands posed by these extreme hot weather events.

Results also suggest that closer monitoring of people's awareness of demands and availability of resources (e.g., ability) to cope with these events across different heat wave geographical susceptibility locations is needed and can be useful for policy planning. Such monitoring may enable, for example, timely delivery of resource building interventions, that is, before rather than after the effects of extreme heat become damaging to health and wellbeing (Kim et al., 2014). This capability may be particularly important considering the vulnerability of Portugal to climate change (Naumann et al., 2020; Rocha et al., 2020; Rodrigues et al., 2021; Schleussner et al., 2019) and the fact that extreme hot weather events are expected to become more intense, frequent, and long lasting (Clayton et al., 2015; Hajat et al., 2014; Howe et al., 2019; Intergovernmental Panel on Climate Change [IPCC], 2014; Lefevre et al., 2015; World Economic Forum [WEF], 2017). The institutional capability to monitor, identify emerging threats, and implement measures before such threats escalate gains further importance considering that some of the locations most susceptible to heat waves in Portugal also correspond to locations characterized by an older and more vulnerable population, with lower formal education levels, lower income, poorer housing conditions, and greater inequalities in the access to physical and psychological healthcare, that is, with less resources (Di Meglio et al., 2018; Mauritti et al., 2019; Moreira, 2011; OPP, 2020; Rego et al., 2013; Rodrigues, 2019; Rodrigues et al., 2020, 2021; Silva, 2012). In that regard, the survey-based methodology used

in this study provides a practical example of an evidence-based and theory-driven, easy to implement, and relatively low-cost way for assessing indicators of psychological responses of threat and stress associated with heat waves and hot weather, with the potential to be adapted and applied in the assessment of other “real world risky situations”. Because feelings of threat (D/R) are operationalized from demands (D) and resources (R) perceptions it has the advantage, if needed, of also providing decision makers with additional information about prevalence of such perceptions (Domingos et al., 2022b).

Although providing preliminary evidence that monitoring heat wave demands and resources perceptions over time enables better understanding about peoples’ psychological responses of threat and stress associated with such extreme weather events, the current study presents some limitations. The sample was collected following non-random sampling procedures and is not representative of the Portuguese population, nor of the populations living in the different heat wave geographical susceptibility locations. As such, results are indicative, and generalizations should be parsimonious. Yet, the sample captures the heterogeneity of some sociodemographic characteristics of those populations, and robust statistical procedures were used to reduce the potential impact of sample limitations. Moreover, when collecting the sample, procedures were implemented for limiting biasing effects of convenience samples, namely through the diversification of the geographical locations where the sample was recruited. As such, the sample was comprised by participants from multiple locations within the same heat wave geographical susceptibility level (i.e., living in different geographical locations with the same level of heat wave occurrence susceptibility), from the north to south, and from littoral to inland.

Despite its limitations, the current study provides a much-needed exploratory longitudinal analysis, which its absence was previously recognized as a limitation in the field of human responses to extreme hot weather events (see Hass et al., 2021). Future studies can explore more comprehensive samples, consider additional predictors, and include behavioural and physiological indicators of threat and stress. Such studies can also include measures of magnitude of heat waves in different heat wave geographical susceptibility locations (e.g., daily or average temperature during the heat wave), and individual acclimation to heat (e.g., habituation). In line with Hass et al. (2021) the current longitudinal study also highlights the importance of greater integration between research and intervention to provide citizens with the individual and social resources they still need to cope with, adapt, and build resilience to the demands posed by extreme hot weather events and other emerging risks in a context of climate

crisis. For example, it provides practical evidence indicative that people living in high heat wave geographical susceptibility locations of Portugal may still be needing protective resources, while highlighting the need to monitor threat and stress responses in moderate and low geographical susceptibility locations. By doing this, resources can be provided before rather than after these individuals start experiencing damaging levels of distress due to heat waves.

Appendix A

Heat Wave Demands and Resources Perceptions Scales

Scales of heat wave demands and resources perceptions, with items in their respective subcategories, and instructions

Demands Scale

The following statements represent possible demands posed by heat waves, please rate how much you agree or disagree with each one. During a heat wave...

- | | |
|----------------------|---|
| <i>Danger</i> | <p><i>It1. There is greater danger to my physical and bodily health (more headaches, colds, etc.)</i></p> <p><i>It2. There is greater danger to my mental health (more stress, anxiety, discomfort, etc.)</i></p> <p><i>It3. There is greater danger to my life (more likely to faint, lose consciousness, dying, etc.)</i></p> <p><i>It4. There is greater danger to my social life (more likely to be isolated, away from others, miss on social events, etc.)</i></p> <p><i>It5. There is greater danger for people typically seen as more “vulnerable” (children, elderly, etc.)</i></p> <p><i>It6. There is greater danger to the environment (pets, plants, wildlife, etc.)</i></p> |
| <i>Effort</i> | <p><i>It7. I have greater physiologic effort (more sweating, accelerated heartbeat, alterations in blood pressure, etc.)</i></p> <p><i>It8. I have greater physical effort (more tiredness, fatigue, apathy, weakness, etc.)</i></p> <p><i>It9. I have greater mental effort (more difficulty in thinking, concentrating, making decisions, etc.)</i></p> <p><i>It10. I have greater emotional effort (more discomfort, irritability, difficulty in maintaining good mood, etc.)</i></p> <p><i>It11. I have a greater financial effort (more expenses with air conditioning equipment, fans, and other climatization devices, electricity bills, etc.)</i></p> |
-

Uncertainty

-
- It12. I have greater doubts about what can happen to me (consequences, harms, risks, etc.)*
- It13. I have greater doubts about what to do to protect myself (available resources, protective behaviors, etc.)*
-

Resources scale

The following statements represent possible resources to cope with the demands posed by heat waves, please rate how much you agree or disagree with each one. During a heat wave...

Knowledge, Abilities, & Skills

- It1. I have equipment's that can help me deal with the heat (air conditioning, fans, chillers, etc.)*
- It2. I have clothing that can help me cope with the heat (fresh and transpirable clothes, hats, etc.)*
- It3. I have objects that can help me cope with the heat (hand fans, water sprayers, etc.)*
- It4. I have information and communication technologies that can help me cope with the heat (social networks, smart apps, etc.)*
- It5. I have financial resources that can help me cope with the heat (readily available money, savings, etc.)*
- It6. I have access to places that can help me cope with the heat (places with shades, cooled places, climatized places, etc.)*
- It7. I have physical capabilities that can help me cope with the heat (stamina, vitality, physical health, etc.)*
- It8. I have mental capabilities that can help me cope with the heat (ability to plan ahead, devise strategies, etc.)*
- It9. I have emotional capabilities that can help me cope with the heat (ability to control my emotions, to recognize and control what I'm feeling, etc.)*
- It10. I have avoidance behaviors that can help me cope with the heat (escape the heat, avoid going outside, etc.)*
- It11. I have approach behaviors that can help me cope with the heat (looking for protective places, hydrate myself, etc.)*
-

<i>Dispositions</i>	<p><i>It12. I have personality tendencies that can help me cope with the heat (being calm, patient, understanding, interested, etc.)</i></p> <p><i>It13. I have thinking and action tendencies that can help me cope with the heat (being proactive, preventive, thoughtful, etc.)</i></p>
<hr/>	
<i>External Support</i>	<p><i>It14. I have family and friends who can support and help me cope with the heat (relatives, neighbors, etc.)</i></p> <p><i>It15. I have professionals who can give me recommendations and help me cope with the heat (health professionals, firefighters, etc.)</i></p> <p><i>It16. I have available information that can help me cope with the heat (informative pamphlets, web pages, etc.)</i></p> <p><i>It17. I have a belief that my faith in God, or in other spiritual beliefs, can help me cope with the heat</i></p> <p><i>It18. I have institutions that can help me cope with the heat, if necessary (associations, community institutions, health authorities, etc.)</i></p>

Note. The Portuguese version can be made available upon request to the authors. The English version presented above is a simple translation from the Portuguese version used in the study. Before use in English or other language, the scales should be adapted and adjusted to the specific cultural background of the country, and if possible validated. Each scale was presented separately (demands first), and item presentation of each scale was randomized. Both scales used a response scale anchored from 1 (strongly disagree) to 5 (strongly agree).

Appendix B

Descriptive Statistics for all Variables Collected in the Study

Descriptive statistics

Variable	<i>M; SD; n or % (n)</i>
Heat Wave Geographical Susceptibility	
Low Susceptibility	44.5% (106)
Moderate Susceptibility	20.6% (49)
High Susceptibility	33.2% (79)
Very High Susceptibility (merged with High)	1.7% (4)
Age Global	<i>M = 39.13; SD = 17.14; n = 238</i>
16-25	24.8% (59)
26-60	58.8% (140)
61-75	13.9% (33)
+76	2.5% (6)
Age Low Susceptibility	<i>M = 34.29; SD = 12.65; n = 106</i>
16-25	28.3% (30)
26-60	66.0% (70)
61-75	5.7% (6)
+76	0.0% (0)
Age Moderate Susceptibility	<i>M = 38.29; SD = 17.47; n = 49</i>
16-25	32.7% (16)
26-60	51.0% (25)
61-75	14.3% (7)
+76	2.0% (1)
Age High Susceptibility	<i>M = 45.86; SD = 19.72; n = 83</i>
16-25	15.7% (13)
26-60	54.2% (45)
61-75	24.1% (20)
+76	6.0% (5)
Gender Global	
Male	29.8% (71)
Female	70.2% (167)

Gender Low Susceptibility

Male 34.0% (36)

Female 66.0% (70)

Gender Moderate Susceptibility

Male 28.6% (14)

Female 71.4% (35)

Gender High Susceptibility

Male 25.3% (21)

Female 74.7% (62)

Education Level Global $M = 4.25; SD = 1.10; n = 238$

None (L1) 0% (0)

Primary Education (L2) 10.1% (24)

Secondary Education (L3) 21.0% (50)

Professional/Vocational Education (L4) 2.9% (7)

Higher Education (L5) 66.0% (157)

Education Level Low Susceptibility $M = 4.66; SD = .80; n = 106$

None (L1) 0% (0)

Primary Education (L2) 2.8% (3)

Secondary Education (L3) 12.3% (13)

Professional/Vocational Education (L4) .9% (1)

Higher Education (L5) 84.0% (89)

Education Level Moderate Susceptibility $M = 4.22; SD = 1.05; n = 49$

None (L1) 0% (0)

Primary Education (L2) 6.1% (3)

Secondary Education (L3) 26.5% (13)

Professional/Vocational Education (L4) 6.1% (3)

Higher Education (L5) 61.2% (30)

Education Level High Susceptibility $M = 3.73; SD = 1.25; n = 83$

None (L1) 0% (0)

Primary Education (L2) 21.7% (18)

Secondary Education (L3) 28.9% (24)

Professional/Vocational Education (L4) 3.6% (3)

Higher Education (L5) 45.8% (38)

Living Alone Global

Yes	15.1% (36)
No	84.9% (202)

Living Alone Low Susceptibility

Yes	19.8% (21)
No	80.2% (85)

Living Alone Moderate Susceptibility

Yes	8.2% (4)
No	91.8% (45)

Living Alone High Susceptibility

Yes	13.3% (11)
No	86.7% (72)

Physical Activity Global

Yes	52.9% (126)
No	47.1% (112)

Physical Activity Low Susceptibility

Yes	59.4% (63)
No	40.6% (43)

Physical Activity Moderate Susceptibility

Yes	44.9% (22)
No	55.1% (27)

Doing Physical Activity High Susceptibility

Yes	49.4% (41)
No	50.6% (42)

Health Condition Global

Yes (Asthma; High Susceptibility)	0.4% (1)
No	99.6% (237)

Employ Status Global

Employed	62.6% (149)
Unemployed/Retired	37.4% (89)

Employ Status Low Susceptibility

Employed	69.8% (74)
Unemployed/Retired	30.2% (32)

Employ Status Moderate Susceptibility

Employed	55.1% (27)
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Unemployed/Retired	44.9% (22)
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Employ Status High Susceptibility

Employed	57.8% (48)
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Unemployed/Retired	42.2% (35)
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Heard Heat Protection Recommendations

Survey Wave 2 Global

Yes	81.5% (194)
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No	18.5% (44)
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Survey Wave 3 Global

Yes	78.2% (186)
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No	21.8% (52)
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Survey Wave 4 Global

Yes	83.2% (198)
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No	16.8% (40)
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Survey Wave 2 Low Susceptibility

Yes	77.4% (82)
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No	22.6% (24)
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Survey Wave 2 Moderate Susceptibility

Yes	81.6% (40)
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No	18.4% (9)
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Survey Wave 2 High Susceptibility

Yes	86.7% (72)
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No	13.3% (11)
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Survey Wave 3 Low Susceptibility

Yes	73.6% (78)
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No	26.4% (28)
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Survey Wave 3 Moderate Susceptibility

Yes	75.5% (37)
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No	24.5% (12)
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Survey Wave 3 High Susceptibility

Yes 85.5% (71)

No 14.5% (12)

Survey Wave 4 Low Susceptibility

Yes 78.3% (83)

No 21.7% (23)

Survey Wave 4 Moderate Susceptibility

Yes 87.8% (43)

No 12.2% (6)

Survey Wave 4 High Susceptibility

Yes 86.7% (72)

No 13.3% (11)

Heat Wave Feelings of Threat (D/R)Survey Wave 1 Global $M = .90; SD = .24; n = 238$ Survey Wave 2 Global $M = .96; SD = .25; n = 238$ Survey Wave 3 Global $M = .93; SD = .25; n = 238$ Survey Wave 4 Global $M = .91; SD = .20; n = 238$ Survey Wave 1 Low Susceptibility $M = .84; SD = .25; n = 106$ Survey Wave 1 Moderate Susceptibility $M = .92; SD = .16; n = 49$ Survey Wave 1 High Susceptibility $M = .97; SD = .24; n = 83$ Survey Wave 2 Low Susceptibility $M = .86; SD = .23; n = 106$ Survey Wave 2 Moderate Susceptibility $M = .99; SD = .15; n = 49$ Survey Wave 2 High Susceptibility $M = 1.10; SD = .27; n = 83$ Survey Wave 3 Low Susceptibility $M = .84; SD = .22; n = 106$ Survey Wave 3 Moderate Susceptibility $M = .96; SD = .16; n = 49$ Survey Wave 3 High Susceptibility $M = 1.03; SD = .28; n = 83$ Survey Wave 4 Low Susceptibility $M = .85; SD = .21; n = 106$ Survey Wave 4 Moderate Susceptibility $M = .94; SD = .13; n = 49$ Survey Wave 4 High Susceptibility $M = .96; SD = .22; n = 83$ **Heat Wave Risk Perception**Survey Wave 1 Global $M = 3.30; SD = .74; n = 238$ Survey Wave 2 Global $M = 3.45; SD = .75; n = 238$ Survey Wave 3 Global $M = 3.31; SD = .78; n = 238$

Survey Wave 4 Global	$M = 3.30; SD = .73; n = 238$
Survey Wave 1 Low Susceptibility	$M = 3.20; SD = .79; n = 106$
Survey Wave 1 Moderate Susceptibility	$M = 3.19; SD = .60; n = 49$
Survey Wave 1 High Susceptibility	$M = 3.49; SD = .71; n = 83$
Survey Wave 2 Low Susceptibility	$M = 3.24; SD = .79; n = 106$
Survey Wave 2 Moderate Susceptibility	$M = 3.41; SD = .64; n = 49$
Survey Wave 2 High Susceptibility	$M = 3.74; SD = .66; n = 83$
Survey Wave 3 Low Susceptibility	$M = 3.16; SD = .66; n = 106$
Survey Wave 3 Moderate Susceptibility	$M = 3.22; SD = .66; n = 49$
Survey Wave 3 High Susceptibility	$M = 3.56; SD = .74; n = 83$
Survey Wave 4 Low Susceptibility	$M = 3.20; SD = .79; n = 106$
Survey Wave 4 Moderate Susceptibility	$M = 3.25; SD = .67; n = 49$
Survey Wave 4 High Susceptibility	$M = 3.45; SD = .65; n = 83$
Temperature Feeling	
Survey Wave 1 Global	$M = 1.81; SD = .80; n = 238$
Survey Wave 2 Global	$M = 4.36; SD = .75; n = 238$
Survey Wave 3 Global	$M = 3.56; SD = .80; n = 238$
Survey Wave 4 Global	$M = 3.22; SD = 1.03; n = 238$
Survey Wave 1 Low Susceptibility	$M = 1.88; SD = .87; n = 106$
Survey Wave 1 Moderate Susceptibility	$M = 1.65; SD = .60; n = 49$
Survey Wave 1 High Susceptibility	$M = 1.81; SD = .80; n = 83$
Survey Wave 2 Low Susceptibility	$M = 4.29; SD = .68; n = 106$
Survey Wave 2 Moderate Susceptibility	$M = 4.18; SD = .93; n = 49$
Survey Wave 2 High Susceptibility	$M = 4.55; SD = .70; n = 83$
Survey Wave 3 Low Susceptibility	$M = 3.50; SD = .78; n = 106$
Survey Wave 3 Moderate Susceptibility	$M = 3.67; SD = .88; n = 49$
Survey Wave 3 High Susceptibility	$M = 3.57; SD = .77; n = 83$
Survey Wave 4 Low Susceptibility	$M = 3.43; SD = .93; n = 106$
Survey Wave 4 Moderate Susceptibility	$M = 3.29; SD = .87; n = 49$
Survey Wave 4 High Susceptibility	$M = 2.93; SD = 1.18; n = 83$
Temperature Interference in Daily Life	
Survey Wave 1 Global	$M = 2.44; SD = .83; n = 238$
Survey Wave 2 Global	$M = 3.21; SD = .90; n = 238$

Survey Wave 3 Global	$M = 2.38; SD = .80; n = 238$
Survey Wave 4 Global	$M = 2.25; SD = .82; n = 238$
Survey Wave 1 Low Susceptibility	$M = 2.40; SD = .85; n = 106$
Survey Wave 1 Moderate Susceptibility	$M = 2.42; SD = .70; n = 49$
Survey Wave 1 High Susceptibility	$M = 2.50; SD = .88; n = 83$
Survey Wave 2 Low Susceptibility	$M = 3.07; SD = .91; n = 106$
Survey Wave 2 Moderate Susceptibility	$M = 3.14; SD = .90; n = 49$
Survey Wave 2 High Susceptibility	$M = 3.43; SD = .85; n = 83$
Survey Wave 3 Low Susceptibility	$M = 2.37; SD = .84; n = 106$
Survey Wave 3 Moderate Susceptibility	$M = 2.39; SD = .66; n = 49$
Survey Wave 3 High Susceptibility	$M = 2.39; SD = .83; n = 83$
Survey Wave 4 Low Susceptibility	$M = 2.23; SD = .87; n = 106$
Survey Wave 4 Moderate Susceptibility	$M = 2.23; SD = .75; n = 49$
Survey Wave 4 High Susceptibility	$M = 2.28; SD = .81; n = 83$

Positive Affect about Heat

Survey Wave 1 Global	$M = 3.27; SD = .87; n = 238$
Survey Wave 2 Global	$M = 2.99; SD = .91; n = 238$
Survey Wave 3 Global	$M = 3.08; SD = .93; n = 238$
Survey Wave 4 Global	$M = 3.20; SD = .89; n = 238$
Survey Wave 1 Low Susceptibility	$M = 3.43; SD = .93; n = 106$
Survey Wave 1 Moderate Susceptibility	$M = 3.26; SD = .64; n = 49$
Survey Wave 1 High Susceptibility	$M = 3.07; SD = .89; n = 83$
Survey Wave 2 Low Susceptibility	$M = 3.14; SD = .96; n = 106$
Survey Wave 2 Moderate Susceptibility	$M = 3.02; SD = .78; n = 49$
Survey Wave 2 High Susceptibility	$M = 2.80; SD = .90; n = 83$
Survey Wave 3 Low Susceptibility	$M = 3.21; SD = 1.02; n = 106$
Survey Wave 3 Moderate Susceptibility	$M = 3.06; SD = .75; n = 49$
Survey Wave 3 High Susceptibility	$M = 2.93; SD = .89; n = 83$
Survey Wave 4 Low Susceptibility	$M = 3.28; SD = .99; n = 106$
Survey Wave 4 Moderate Susceptibility	$M = 3.16; SD = .75; n = 49$
Survey Wave 4 High Susceptibility	$M = 3.11; SD = .83; n = 83$

Need for Cognition

Survey Wave 1 Global	$M = 3.65; SD = .74; n = 238$
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Survey Wave 2 Global	$M = 3.58; SD = .73; n = 238$
Survey Wave 3 Global	$M = 3.58; SD = .72; n = 238$
Survey Wave 4 Global	$M = 3.59; SD = .78; n = 238$
Survey Wave 1 Low Susceptibility	$M = 3.80; SD = .74; n = 106$
Survey Wave 1 Moderate Susceptibility	$M = 3.59; SD = .66; n = 49$
Survey Wave 1 High Susceptibility	$M = 3.49; SD = .75; n = 83$
Survey Wave 2 Low Susceptibility	$M = 3.77; SD = .67; n = 106$
Survey Wave 2 Moderate Susceptibility	$M = 3.43; SD = .73; n = 49$
Survey Wave 2 High Susceptibility	$M = 3.43; SD = .76; n = 83$
Survey Wave 3 Low Susceptibility	$M = 3.82; SD = .68; n = 106$
Survey Wave 3 Moderate Susceptibility	$M = 3.41; SD = .72; n = 49$
Survey Wave 3 High Susceptibility	$M = 3.38; SD = .70; n = 83$
Survey Wave 4 Low Susceptibility	$M = 3.79; SD = .71; n = 106$
Survey Wave 4 Moderate Susceptibility	$M = 3.43; SD = .78; n = 49$
Survey Wave 4 High Susceptibility	$M = 3.44; SD = .80; n = 83$

Appendix C

Seasonal Variations in Heat Wave Feelings of Threat Within Participants Living in the Different Heat Wave Geographical Susceptibility Location

Figure C1

Seasonal Variations in Heat Wave Feelings of Threat Within Participants Living in High Heat Wave Geographical Susceptibility Locations

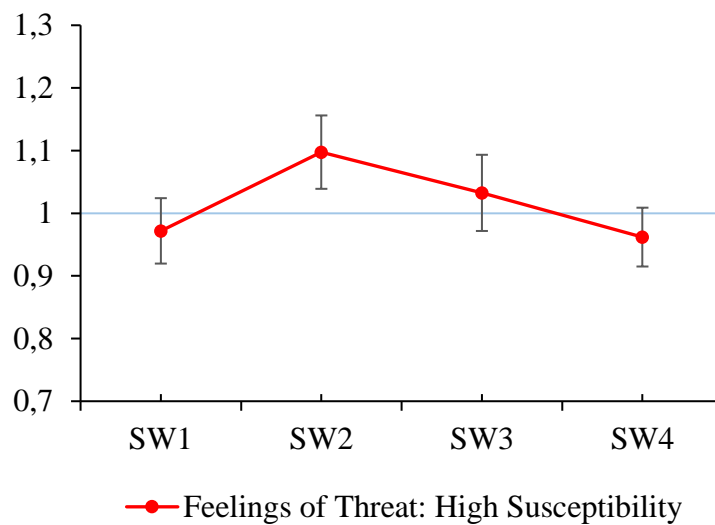


Figure C2

Seasonal Variations in Heat Wave Feelings of Threat Within Participants Living in Moderate Heat Wave Geographical Susceptibility Locations

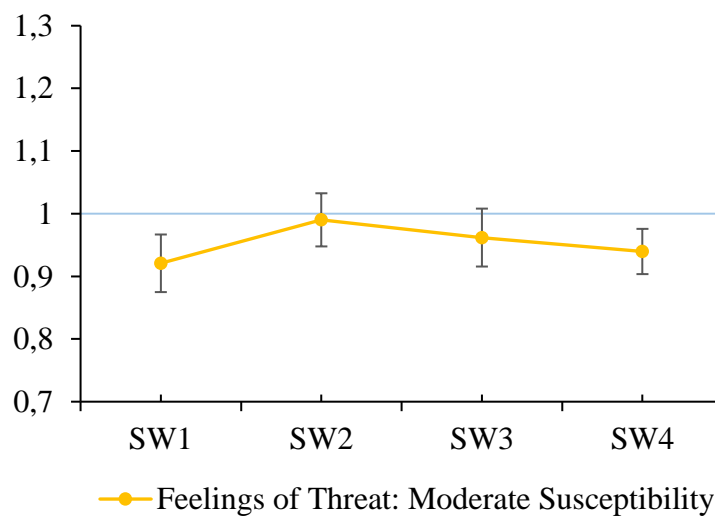
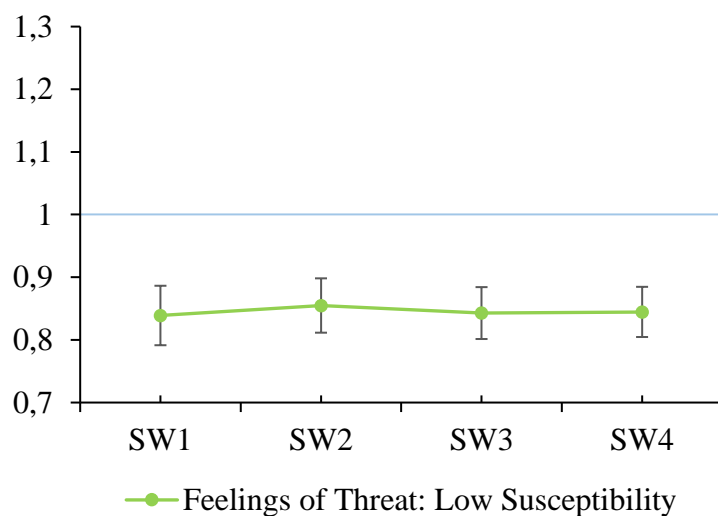


Figure C3

Seasonal Variations in Heat Wave Feelings of Threat Within Participants Living in Low Heat Wave Geographical Susceptibility Locations



Note. For all figures: SW1 = First Survey Wave (Before the Summer); SW2 = Second Survey Wave (During a Heat Wave in the Summer); SW3 = Third Survey Wave (During the Summer); SW4 = Fourth Survey Wave (After the Summer). Scale ranging from 0.2 to 5. Details on differences between demands and resources perceptions highlighting when $D/R > 1$, $D/R < 1$, and $D/R \approx 1$ can be seen in Appendix D (p. 226).

Appendix D

Differences Between Demands and Resources Perceptions in the Different Heat Wave Geographical Susceptibility Locations across Survey Waves

Paired sample t-tests for differences between demands and resources perceptions in the different heat wave geographical susceptibility locations across survey waves, showing when demands perceptions are statistically higher, lower, or equal to resources perceptions

	Paired Differences			
	Mean(SD)	95% CI	t(df)	p
Low Susceptibility				
SW1: Demands – Resources	-.66(.90)	]-.83; -.48[	t(105) = -7.52	.000
SW2: Demands – Resources	-.59(.83)	]-.75; -.43[	t(105) = -7.37	.000
SW3: Demands – Resources	-.64(.83)	]-.80; -.48[	t(105) = -7.98	.000
SW4: Demands – Resources	-.63(.77)	]-.78; -.48[	t(105) = -8.44	.000
Moderate Susceptibility				
SW1: Demands – Resources	-.32(.56)	]-.48; -.16[	t(48) = -4.04	.000
SW2: Demands – Resources	-.06(.53)	]-.21; .10[	t(48) = -.73	.469
SW3: Demands – Resources	-.17(.57)	]-.33; -.01[	t(48) = -2.08	.043
SW4: Demands – Resources	-.23(.45)	]-.36; -.10[	t(48) = -3.51	.001
High Susceptibility				
SW1: Demands – Resources	-.18(.83)	]-.36; .001[	t(82) = -1.98	.052
SW2: Demands – Resources	.24(.85)	].05; .42[	t(82) = -2.56	.012
SW3: Demands – Resources	.01(.83)	]-.17; .19[	t(82) = .13	.894
SW4: Demands – Resources	-.20(.74)	]-.36; -.04[	t(82) = -2.46	.016

Note. SW1 = First Survey Wave (Before the Summer); SW2 = Second Survey Wave (During a Heat Wave in the Summer); SW3 = Third Survey Wave (During the Summer); SW4 = Fourth Survey Wave (After the Summer). When perceived demands are significantly higher than resources then $D/R > 1$; When perceived demands are significantly lower than resources then $D/R < 1$; When perceived demands and resources are not significantly different then $D/R \approx 1$.

Appendix E

Regression Analyses (Standardized β) Showing Factors Predicting Heat Wave Feelings of Threat across Heat Wave Geographical Susceptibility Locations and Survey Waves

	Low Susceptibility	Moderate Susceptibility	High Susceptibility
	β 95% CI	β 95% CI	β 95% CI
Predictors First Survey Wave Before the Summer			
Age	.08]-.002; .01[	-.11]-.004; .002[	-.08]-.01; .003[
Female	-.01]-.10; .09[	.29 [†]]-.006; .21[	.10]-.06; .17[
Education Level	.04]-.05; .07[	.13]-.02; .07[	-.16]-.09; .03[
Living Alone	-.03]-.12; .09[	-.13]-.25; .10[	.02]-.13; .16[
Physical Activity	-.12]-.14; .03[	-.01]-.10; .10[	-.11]-.15; .05[
Being Employed	-.14 [†]]-.17; .01[	-.11]-.12; .06[	-.28*]-.26; -.01[
Heard Recommendations	–	–	–
Positive Affect about Heat	-.29**]-.13; -.03[	-.45**]-.20; -.03[	-.30**]-.14; -.02[
Need for Cognition	-.09]-.09; .04[	.13]-.04; .10[	-.19]-.13; .01[
Heat Wave Risk Perception	.41***].07; .18[	.08]-.06; .10[	.27**].02; .16[
Temperature Interference	.13]-.02; .09[	.19]-.03; .11[	.09]-.04; .09[
Temperature Feeling	-.04]-.07; .05[	.26]-.02; .16[	.03]-.05; .07[
R^2	.37	.41	.37
Model F	$F(11, 94) =$ 5.012***	$F(11, 37) =$ 2.373*	$F(11, 71) =$ 3.716***

	Low Susceptibility	Moderate Susceptibility	High Susceptibility
	β 95% CI	β 95% CI	β 95% CI
Predictors Second Survey Wave Heat Wave in the Summer			
Age	.01 [-.003; .003[	-.16 [-.004; .001[	.22 [-.001; .01[
Female	-.05 [-.11; .06[	.19 [-.04; .16[	.09 [-.07; .17[
Education Level	.16 [†] [-.004; .10[	.08 [-.03; .05[	.002 [-.06; .06[
Living Alone	-.01 [-.10; .09[	.10 [-.10; .21[	-.01 [-.15; .14[
Physical Activity	.04 [-.06; .09[	.16 [-.04; .14[	-.02 [-.11; .09[
Being Employed	-.17* [-.16; .000[	-.07 [-.10; .06[	-.08 [-.17; .08[
Heard Recommendations	-.07 [-.13; .05[	.06 [-.09; .14[	-.08 [-.12; .08[
Positive Affect about Heat	-.29** [-.11; -.03[	-.35* [-.12; -.01[	-.22* [-.12; -.01[
Need for Cognition	-.12 [-.10; .02[	-.22 [-.10; .01[	-.29** [-.18; -.03[
Heat Wave Risk Perception	.28** [.02; .14[	.45** [.03; .17[	.20 [†] [-.001; .16[
Temperature Interference	.28** [.02; .12[	.14 [-.03; .08[	.23* [.01; .14[
Temperature Feeling	-.05 [-.07; .04[	.03 [-.05; .05[	.03 [-.07; .09[
R^2	.41	.45	.48
Model F	$F(12, 93) =$ 5.419***	$F(12, 36) =$ 2.424*	$F(12, 70) =$ 5.416***

	Low Susceptibility	Moderate Susceptibility	High Susceptibility
	β 95% CI	β 95% CI	β 95% CI
Predictors Third Survey Wave During the Summer			
Age	.07 [-.002; .004[	-.07 [-.004; .002[	.43*].001; .01[
Female	-.08 [-.11; .04[	.44*].04; .27[	.32**].07; .34[
Education Level	.09 [-.02; .07[	.13 [-.02; .07[	.01 [-.07; .07[
Living Alone	-.04 [-.11; .07[	.14 [-.10; .26[	-.07 [-.23; .11[
Physical Activity	-.05 [-.09; .05[	-.13 [-.14; .06[	.01 [-.11; .12[
Being Employed	-.17* [-.16; -.001[	.04 [-.08; .10[	-.09 [-.19; .09[
Heard Recommendations	-.02 [-.09; .07[	.06 [-.09; .14[	.07 [-.10; .21[
Positive Affect about Heat	-.18* [-.08; -.001[	-.40* [-.15; -.02[	-.08 [-.09; .04[
Need for Cognition	.04 [-.05; .07[	.19 [-.02; .11[	-.05 [-.11; .07[
Heat Wave Risk Perception	.50***].07; .19[	.29 [†]].000; .14[	.13 [-.03; .13[
Temperature Interference	.11 [-.03; .09[	.18 [-.03; .12[	.48***].08; .25[
Temperature Feeling	.004 [-.05; .05[	-.12 [-.08; .04[	-.06 [-.10; .06[
R^2	.43	.43	.36
Model F	$F(12, 93) =$ 5.731***	$F(12, 36) =$ 2.220*	$F(12, 70) =$ 3.323**

	Low Susceptibility	Moderate Susceptibility	High Susceptibility
	β 95% CI	β 95% CI	β 95% CI
Predictors Fourth Survey Wave After the Summer			
Age	.04 [-.002; .004[	-.03 [-.003; .002[	-.27 [-.01; .001[
Female	.02 [-.08; .10[	.25 [-.02; .16[	.25*].01; .24[
Education Level	.09 [-.03; .07[	-.05 [-.04; .03[	-.25 [-.10; .01[
Living Alone	.002 [-.10; .10[	-.07 [-.16; .10[	.08 [-.09; .19[
Physical Activity	-.04 [-.09; .06[	.15 [-.04; .11[	-.13 [-.15; .04[
Being Employed	-.17 [†] [-.16; .01[	-.06 [-.09; .05[	-.12 [-.17; .06[
Heard Recommendations	-.12 [-.15; .03[	-.13 [-.17; .08[	.16 [-.04; .24[
Positive Affect about Heat	-.28** [-.10; -.02[	-.20 [-.09; .02[	-.08 [-.08; .04[
Need for Cognition	-.01 [-.06; .05[	.12 [-.03; .07[	-.03 [-.07; .06[
Heat Wave Risk Perception	.39***].05; .16[	.49**].03; .16[	.27*].02; .16[
Temperature Interference	.02 [-.05; .06[	-.04 [-.06; .05[	-.12 [-.09; .03[
Temperature Feeling	.01 [-.04; .04[	-.24 [-.08; .01[	-.06 [-.06; .03[
R^2	.29	.42	.27
Model F	$F(12, 93) =$ 3.218**	$F(12, 36) =$ 2.135*	$F(12, 70) =$ 2.185*

Note. Standardized regression coefficients. [†] $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

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Chapter VI
General Discussion

Summary

Extreme hot weather events such as heat waves have been an increasingly growing concern for health agencies and authorities over the last years, mainly due to its severe impacts on human health and wellbeing. In a scenario of climate change, heat waves are expected to become more frequent, intense, and long lasting, with greater probability for public health crisis to emerge as result of changing environmental factors. As such, better understanding about how people perceive these events is needed to promote protection intentions and behaviours and facilitate current and future institutional responses.

In this Doctoral Thesis we aimed to explore and better understand demands and resources perceptions in the context of heat waves, the effects that cognitive, affective, and sociodemographic factors (e.g., positive affect about heat; heat wave risk perception; temperature interference in daily life) have on such perceptions, and their combined impacts on heat protection intentions, particularly among the Portuguese population.

This work included the: 1) development of a theory-driven mixed-method framework to collect and code expressions of demands and resources perceptions in the context of heat waves, enabling the identification of common heat wave demands and available coping resources perceptions, as well as potential misconceptions, in the Portuguese context, while serving as the basis for the creation of demands and resources scales used in follow-up studies; 2) identification of the effects that emotional prompts (i.e., thinking about extreme hot weather events without an emotion prompt, with a negative emotion prompt, or with a positive emotion prompt) have on temperature estimates and perception of pleasantness associated with extreme hot weather events, on heat wave protection intentions, on extreme hot weather events demands and resources appraisals, and on the number of verbal descriptions of demands and resources perceptions produced by the participants, enabling to determine if the results obtained with United Kingdom residents would replicate in a Portuguese sample, thus allowing for a cross-cultural comparison between Portuguese and United Kingdom residents; 3) identification of cognitive, affective, and sociodemographic predictors (e.g., positive affect about heat; heat wave risk perception; temperature interference in daily life) of heat wave demands and resources perceptions, and their combined effects on heat protection intentions during a heat wave in Portugal, allowing the proposal of a broader theory-driven and evidence-based path analysis model, further illustrating the interconnections between factors; and 4) identification of seasonal variations in heat wave demands and resources perceptions (i.e., in the spring before the summer, during a heat wave in the summer, during the summer, and in the autumn after the

summer), across different heat wave geographical susceptibility locations of Portugal (i.e., low, moderate, high), as an indicator of heat wave feelings of threat and stress, as well as predictors of such seasonal and geographical variation.

Overall, this work enabled better understanding about demands and available coping resources perceptions, as indicators of threat and stress, associated with extreme hot weather events such as heat waves, over time and across different geographical locations of Portugal. Moreover, it provided a first step at creating and implementing an integrated approach for monitoring demands and resources perceptions at the individual and social levels, and across different contexts, with relevant impacts for theory and practice, so that future events can be appraised more as a challenge.

Identification of Heat Wave Demands and Resources Perceptions, and Misconceptions

Because perceptions of demands and resources are context dependent (Blascovich & Mendes, 2000; Theorell & Karasek, 1996) the first step was to develop a theory-driven framework to collect and code expressions of demands and resources perceptions in the context of extreme hot weather events: the DeCodeR framework. On the one hand, this work enabled the identification of common extreme hot weather demands and available coping resources perceptions, in disagreement or in agreement with experts and health authorities' views. On the other hand, it also enabled assessing common terminology, knowledge, emotional expressions, needs, goals, motivations, relevant beliefs about the topic, and what could still be missing from participants minds in that regard (Bostrom et al., 1994; Bruine de Bruin & Bostrom, 2013; Morgan et al., 2002). The identification of such factors is particularly important for crisis and risk communication as research suggests that peoples' interpretation of information and interaction with potentially risky situations is shaped, for example, by their existing perceptions, emotions, feelings, motivations, beliefs, knowledge, and ways of thinking and processing information (Bostrom et al., 1994; Breakwell, 2010; Bruine de Bruin & Bostrom, 2013; Domingos et al., 2018; Finucane et al., 2000; Kahneman, 2011; Kasperson et al., 1988; Kempton, 1986; Loewenstein et al., 2001; Meyer et al., 1985; Morgan et al., 2002; Slovic et al., 2004, 2007; Slovic & Peters, 2006; Tversky & Kahneman, 1973, 1974; Zajonc, 1980). Moreover, this understanding also enables tailoring communication materials and interventions, for example, to specific audiences' language, needs, goals, and expectations (e.g., Bostrom et al., 1994; Bruine de Bruin & Bostrom, 2013; Morgan et al., 2002).

Even though the development of this data collection and coding framework was centred around the recall of extreme hot weather events in a laboratory setting, through semi-structured interviews, and not around the actual experience of the event itself (e.g., during a heat wave), research suggests that there is a clear link between thinking about and experiencing a situation. This can evoke the memory of past experiences of uncomfortably hot weather, temperature interference in daily life, its consequences for health and wellbeing, and even heat protection recommendations and actions implemented in past extreme hot weather events, which has been shown to promote higher heat protection intentions and reported heat protection behaviours (Abrahamson et al., 2009; Akompab et al., 2013; Ban et al., 2019; Bruine de Bruin et al., 2016; Esplin et al., 2019; Hass & Ellis, 2019; Hass et al., 2021; Howe et al., 2019; Khare et al., 2015; Lefevre et al., 2015; Palutikof et al., 2004; Wolf et al., 2010a, 2010b). As such, this work enabled the identification of second-order and third-order categories of extreme hot weather demands and coping resources perceptions (higher-order), together with exemplars (e.g., key words associated to mentions made by participants), and quotations of participants expressions (see Chapter II, Appendix C, p. 75).

Regarding demands perceptions, the work showed evidence that, beyond perceiving demands associated with danger to their general physical health (e.g., broader consequences to health), and to their physical integrity and existence in particular (i.e., more severe consequences), participants also perceived demands associated with psychological danger (e.g., distress and anxiety), social danger (e.g., conflict with others and social withdrawal or isolation), ecological danger (e.g., fear of impacts on fauna and flora, and occurrence of forest fires and droughts), and danger to vulnerable people (e.g., identification and worry about potential vulnerable individuals or groups of individuals). Participants also perceived demands related with efforts they had associated with extreme hot weather events, making mentions to: physiological and metabolic symptoms and ‘nuisances’ (e.g., annoyance with sweating and accelerated heartbeat); effort in doing everyday activities (e.g., tiredness and fatigue) and/or implementing heat protection behaviours or strategies (e.g., feeling bad when using air conditioning units or fans, feeling bad when drinking water, difficulty in preventing the household to warmup and in cooling it down); psychological effort (e.g., impaired cognition and mood swings); and the financial effort needed to be able to properly cope with extreme hot weather (e.g., costs with energy, with the acquisition of equipment such as air conditioning units, and with adaptations in the household to make it more energy efficient). Although less common when compared to perceived danger and effort, participants also perceived demands

associated with uncertainty, particularly about what could happen during extreme hot weather events and what to do to ensure adequate protection. As suggested in the literature (e.g., Bruine de Bruin & Bostrom, 2013; Bruine de Bruin et al., 2015; Festinger, 1957; Hass et al., 2021; Kalkstein & Sheridan, 2007; Kause et al., 2021; Peters et al., 2006; Sheridan, 2007) this uncertainty can result from lack of information and knowledge about the effects of extreme hot weather and about what to do, which can be related, for example with: perception of conflicting information (e.g., between authorities, experts, and other sources of information, and not knowing who to trust or where to get reliable information); perception of information as too complex or hard to understand (e.g., particularly numerical information such as percentages and probabilities, and even textual information with scientific jargon or terminology harder to understand for those with lower levels of formal education); and avoidance or low motivation to process information that goes against one's goals (e.g., of enjoying hot weather) or that is too painful to process (e.g., loss frames – probability of dying). Particularly concerning information painful to process, or communication framed as loss frames, research suggests that it can be preferable, when possible, to communicate using gain frames (Kause et al., 2021). For example, instead of communicating “if you do not follow the recommendation there is a high probability that you will die or have other negative consequences” it may be preferable to communicate “if you follow the recommendation there is a high probability that you will survive or have other positive benefits”, while aligning such communication with peoples' motivations and goals (e.g., doing what you like the most for years to come).

Regarding heat protection resources perceptions, the work showed evidence that participants mainly perceived resources associated with knowledge, abilities, and skills, namely by describing: tangible resources (e.g., food and water, money, equipment's such as fans and air conditioning units, other material goods such as clothes, and frequent mentions to sunscreen and even ultraviolet radiation meters); protective and restorative places (e.g., households, pools, beaches, dams, forests and natural parks, and even having a backyard with shade or owning a water well); physical skills (e.g., the belief of being accustomed and habituated to extreme hot weather events, having the stamina to endure it, and having the physical skills and autonomy to implement protective behaviours); psychological skills (e.g., the ability to recognize and control one's emotions, or the ability to plan ahead and around the effects of extreme hot weather); and behavioural skills (e.g., knowledge about specific behaviours and strategies to face extreme hot weather such as staying hydrated, looking for a climatized space to stay, and other behavioural strategies). Less common were perceived resources associated with dispositions, with

references being made to traits and response tendencies (e.g., patience, flexibility, acceptance, optimism) and cognitions and motives (e.g., positive attitudes and views leaning towards protection, and protection-oriented goals such as staying healthy or maintaining autonomy). Perceived heat protection resources associated with external support were also less common, although a broad set of categories were identified, including: emotional support (e.g., emotional aid, shouldering, and affective support provided by close ones and relatives); informational support (e.g., access to and availability of information); instrumental support (e.g., physical help and aid provided by others, for example in performing tasks); spiritual support (e.g., belief in divine protection and intervention, or belief that a higher power can help endure the demands posed by extreme hot weather events); and institutional support (e.g., help and support specifically provided by authorities and institutions). This suggested that although perceived heat protection resources covered the most commonly communicated recommendations issued by the health authority in Portugal (e.g., Direção-Geral da Saúde [DGS], 2015, 2021), perceptions regarding dispositions and availability of external support were less common, indicating that these resource perceptions may still be missing from peoples' mental models³⁰ about heat protection, or even, particularly in the case of external support, be missing in the 'real world'. This is an important finding, with practical implications, as evidence in the literature and from our studies, suggests that psychological and behavioural responses depend not only on the perception of demands, but also on the perception of resources (Blascovich & Mendes, 2000, 2010; Demerouti et al., 2001; Gaspar et al., 2015; Reser & Swim, 2011; Skinner et al., 2003; Swim et al., 2009, 2011b; Theorell & Karasek, 1996). This implies that: 1) missing resources (and demands) in one's mental model about extreme hot weather events may restrict the umbrella of possible responses; and 2) people may recognize the risk and the demands posed by extreme hot weather events such as heat waves, perceive having knowledge, abilities, and skills to cope with such demands, but still lack the external support or the dispositions and motivations to implement protective action. In fact, the role of dispositions is frequently underestimated or misunderstood, both by the public and by health authorities, when the topic is protection from extreme weather events, but as shown in the psychological and behavioural literature it plays a very important role (Clayton et al., 2014, 2021; Swim et al., 2009, 2011b; Wong-Parodi & Feygina, 2018). For example, personal dispositions contribute not only to increased preparation, proactivity, and engagement in protective behaviours, but also to more effective emotional control, lower distress, better capacity to cope with a 'hard time', better

³⁰ Mental Models can be defined as "people's decision-relevant beliefs regarding a risk" (Bruine de Bruin & Bostrom, 2013, p. 14062; Morgan et al., 2002, p. 21).

recovery after extreme or traumatic events, and better mental health (Clayton et al., 2014, 2021; Swim et al., 2009; Wong-Parodi & Feygina, 2018). Recommendations in that regard highlight the importance of communicating and fostering hope and optimism, promoting self-efficacy and feelings of accomplishment, cultivating emotional self-regulation, and connecting communication to sources of personal meaning (Clayton et al., 2021).

Taken together these findings also suggest that, if external support resources do not exist in the ‘real world’, it may be important to create them (e.g., spaces that allow cooling the body temperature; community support associations; recreative centres; public spaces such as parks with proper shades and cooling infrastructures). If they do exist, it may be important to implement interventions and communication strategies to promote knowledge and awareness about such resources, enable accessibility and usability, and promote protection-oriented dispositions and motivations, not only towards the use of external support resources but also towards the implementation of other heat protection behaviours. More importantly, accessibility and usability together with motivation and other psychological and social factors should always be considered when designing and implementing ‘real world’ applications and infrastructures, that is, if we really want people to use and enjoy such applications and infrastructures (Bettencourt, 2020; Lin & Brown, 2021; Thompson, 2013; Uzzell, 1991; Uzzell & Lewand, 1990).

The work also enabled the identification of potential misconceptions not only about extreme hot weather events impacts on health and wellbeing (i.e., demands), but also about heat protection responses (i.e., resources). For example, some of the physiological and metabolic symptoms that participants typically described and contextualized as a nuisance (e.g., annoyance with sweating and accelerated heartbeat), can be indicative of more insidious and dangerous health consequences, both physical and psychological (Hajat et al., 2010). In the case of extreme hot weather impacts on health, feeling or having awareness of symptoms related to heat exposure and heat stress on the organism, even mild ones, is generally already an indicator of danger to health, although evidence suggests that this is not always perceived that way, particularly among the elderly or more vulnerable populations (Hajat et al., 2010; Hass & Ellis, 2019; Kovats & Hajat, 2008; Kovats et al., 2004). This also relates with the perception mentioned by participants, of being accustomed to extreme hot weather, as research as shown that people tend to frequently overestimate their ability to cope with extreme hot weather events (Abrahamson et al., 2009; Bruine de Bruin et al., 2016; Hass & Ellis, 2019; Howe et al., 2019; Wolf et al., 2010b). Recommendations in that regard suggest the need to promote awareness

about the symptoms of heat exhaustion and heatstroke, not only physical but also psychological, with clear links to what people should do when they experience the first symptoms, even mild ones, and promoting proactive behaviours such as the habit of fluid intake during periods of hot weather, even in the absence of thirst (Hajat et al., 2010).

Another common misconception or confound identified, was the association established between heat exposure and sunlight or ultraviolet radiation exposure, as participants often mentioned the need to avoid the sun or to use sunscreen protector. In fact, although applying sunscreen and avoiding exposure to direct sunlight, particularly in peak heat hours, are important protection recommendations for maintaining proper health and wellbeing, it may not be enough to prevent the impacts of extreme hot weather on health and wellbeing, as sun protection does not necessarily mean heat protection. As noted in the literature review developed by Taylor et al. (2014, p. 6), “such misunderstandings may lead to the implementation of inappropriate risk protection efforts, such as applying sunscreen to prevent sunburn but not drinking enough water to prevent dehydration”. This observed association may be due to heat protection recommendations campaigns that frequently communicate heat protection recommendations together with sunlight and ultraviolet exposure protection recommendations (e.g., DGS, 2015, 2021; Hajat et al., 2010; World Health Organization [WHO], 2015). Although the association is understandable from a practical standpoint, future work should assess if or how such associations undermine proper heat protection, so that proper action can be taken. A similar potential misconception was identified in the category restorative and protective places, as participants often mentioned activities such as going to the beach, to a pool, or to the countryside as a heat protection resource. However, outdoor places can also be particularly risky during extreme hot weather events, particularly when people do not go prepared or are ‘caught off-guard’ (e.g., going in peak heat hours; not taking enough water), and some of these places can even be overcrowded, with the potential to amplify distress and interpersonal conflict (Clayton et al., 2014, 2021; Swim et al., 2009; WHO, 2015). Although access to the restorative potential of outdoor environments can also have benefits for health and wellbeing (Clayton et al., 2014, 2021; Hartig & Catalano, 2013; Pasanen et al., 2014), this finding raises the importance of promoting awareness that extreme hot weather events should be perceived differently from regular hot weather or enjoyable summer days, that their outcomes can be uncertain, and that this should be taken into consideration when planning activities during extreme hot weather events. This promotion should also provide people with other alternatives and solutions (e.g., going to a museum or arts exhibit), and build motivation

for the adoption of such alternatives and solutions during extreme hot weather events. Additionally, participants often mentioned their houses as one of their best or most important protective resources, yet they also mentioned the difficulty in preventing the households to warmup and to cool them down. This can be indicative that people may still lack tangible resources (e.g., equipment such as air conditioning units, or proper thermal insulation in their households), and knowledge on how keep the households fresh during extreme hot weather events. This finding is particularly relevant as fatalities attributable to heat waves often happen at home before people have the chance to seek emergency help (Deng et al., 2018; Fouillet et al., 2006; Ji et al., 2022; Vellei et al., 2017). Lastly, this also relates with mentions made by the participants about feeling bad when using air conditioning units or fans, and about feeling bad when drinking water. This suggests that people may still be lacking knowledge about strategies on how to properly use air conditioning units or fans, and about diversified strategies on how to facilitate fluid intake and hydration, a finding in line with what was previously suggested by Hajat et al. (2010).

Taken together these findings have practical value and implications for future heat wave risk communication and interventions, highlighting the demands and resources perceptions, the misconceptions, and the terminology that participants used to talk about extreme hot weather events such as heat waves. This suggests possibilities for tailoring risk communication and intervention strategies aimed at reinforcing existing adaptive beliefs, demystifying misconceptions, and providing resources that people may still be needing to be more motivated for heat protection, and to actually implement heat protection intentions into behaviours. The ability to tailor risk interventions and communications is fundamental to promote effective protection, as research suggests that people tend to distrust and even disregard information that they perceive to interfere negatively with their identity, goals, and beliefs, or that they do not relate with or understand (Ecker et al., 2022). Likewise, research also suggests that the way people appropriate themselves of expert knowledge and terminology does not always map into their intended original meaning, being instead interpreted, adapted, and assimilated in line with their feelings and beliefs to serve their goals and informational needs (Bruine de Bruin & Bostrom, 2013; Morgan et al., 2002). That is, people extract meaning from the information based on what they know and how they feel about it, and because what they know and how they feel about it does not always map into what experts know and feel, it may originate distrust, misconceptions, and misinformation (Bruine de Bruin & Bostrom, 2013). In that regard, distrust, misconceptions, and misinformation can be further amplified by psychological

processes such as heuristics and biases (e.g., confirmation bias where people select information that confirms their points of views and neglects information that contradicts them), and cognitive dissonance, where to avoid that psychological state of discomfort people may, for example, decrease the importance of information inconsistent with their beliefs and increase the importance of consistent information (Festinger, 1957; Finucane et al., 2000; Kahneman, 2011; Slovic et al., 2004, 2007; Tversky & Kahneman, 1973, 1974). Moreover, it should be noted that misconceptions and misinformation can not only lead to poor judgements and ineffective decision-making processes, potentially undermining protection intentions and behaviours, but also have a lingering influence on people's reasoning even after properly corrected, an effect known as the continued influence effect (Ecker et al., 2022). As such, knowing more about different ways on how people think about, feel, and express themselves about heat wave demands and coping resources, as well as the related knowledge, misconceptions, goals, and motivations they have, may enable experts and authorities to better tailor communication and communication materials. This should avoid politicization and sensationalism, focusing on peoples' informational needs, using terminology and analogies that people relate with and that are closer to the characteristics of the concepts being communicated (Bruine de Bruin & Bostrom, 2013; Bruine de Bruin et al., 2021; Morgan et al., 2002). Overall, it should provide people with the resources they still need to better understand the situation, make informed decisions, and implement protective measures.

Effects of Emotion Prompts on Heat Wave Demands and Resources Perceptions

Grounded on the studies conducted by Bruine de Bruin et al. (2016) and Lefevre et al. (2015), with United Kingdom residents, the goal was to better understand, in our Portuguese sample, the effects that thinking about extreme hot weather events without an emotion prompt, with a negative emotion prompt, or with a positive emotion prompt have on: 1) temperature estimates and perception of pleasantness associated with extreme hot weather events; 2) heat protection intentions; 3) extreme hot weather events demands and coping resources appraisals; and 4) the number of verbal descriptions of extreme hot weather demands and resources perceptions produced by the participants. In that regard, we found that positive emotions about hot weather undermined heat protection intentions. Besides undermining heat protection intentions, we also found that positive emotions about hot weather: 1) reduced temperature estimates, extreme hot weather demands appraisals, and the number of verbal descriptions of demands perceptions; 2) increased the perception of pleasantness associated with extreme hot

weather events, and extreme hot weather coping resources appraisals; and 3) had no apparent effect on the number of verbal descriptions of resources perceptions.

Interestingly, the effect of positive emotions about extreme hot weather on heat protection intentions was statistically explained (i.e., mediated) by participants in such condition evoking or recalling and producing fewer verbal descriptions of extreme hot weather demands perceptions. This suggests that positive thoughts and feelings about extreme hot weather reduced the cognitive availability of extreme hot weather demands perceptions (descriptions), which in turn led to reduced heat protection intentions. This finding is in line with behavioural decision research suggesting that the perceived need for protection against risks may be judged through both affect and availability (Finucane et al., 2000; Kahneman, 2011; Slovic et al., 2004, 2007; Slovic & Peters, 2006; Tversky & Kahneman, 1973, 1974).

Moreover, besides replicating findings from Bruine de Bruin et al. (2016) and Lefevre et al. (2015) that positive emotions about hot weather may undermine heat protection intentions, adding that this may occur due to positive emotions about hot weather lowering cognitive availability of extreme hot weather demands perceptions, we also found indicators for cross-cultural and geographical differences in the way people perceive extreme hot weather events. In this case, while Bruine de Bruin et al. (2016) United Kingdom participants showed similar responses between no emotion prompt and positive emotion prompt conditions, suggesting positive rather than negative views of heat waves, differently, in our study, Portuguese participants showed similar responses between no emotion prompt and negative emotion prompt, suggesting negative rather than positive views of heat waves. These results are in line with findings using data from the European Social Survey that analysed the association between key socio-political and demographic factors and climate change perception across 22 European countries and Israel (Poortinga et al., 2019), which showed that Portuguese participants reported the highest levels of concern about negative impacts of climate change, such as heat waves. In that regard, our results provide additional evidence and contextualization for geographical and cultural differences in how extreme hot weather events are perceived (Hass et al., 2021; Koppe et al., 2004; Mayrhuber et al., 2018).

Another difference from the studies conducted with United Kingdom residents was that the perception of pleasantness associated to extreme hot weather events and temperature estimates were not found to mediate the effect of emotion prompts on heat protection intentions. Again, this can be due to geographical and cultural differences between both countries, but it can also be due to differences in the procedure. That is, in our study with Portuguese residents

the procedure first task primed affect and then a second task promoted thoughtful elaboration about extreme hot weather demands and coping resources before asking participants to rate their heat protection intentions. Differently in Bruine de Bruin et al. (2016) the first task primed affect and the second task asked participants to report the magnitude of the temperature they had in mind and the pleasantness of the recalled temperature before rating their heat protection intentions. On the one hand, this may indicate that the results presented in this study may apply mainly to situations where people elaborate about their initial thoughts (i.e., where additional thought or elaboration is promoted before judgments of perceived need for risk protection) rather than situations where this does not happen (e.g., where no additional thought or elaboration is promoted before judgments of perceived need for risk protection). On the other hand, and considering findings from both studies, this may also indicate that the undermining effect of positive emotion prompts on heat protection intentions may happen not only under more automatic conditions, but also under more thoughtful conditions. One hypothesis, in line with Simon (1964, 1990, 2000) notion of Bounded Rationality, Damásio (1994) Somatic Marker hypothesis, and the work of Kiefer and Pulvermüller (2012) about conceptual representations in the mind and brain, is that emotion prompts may help set a specific bounded ‘inner mental environment’, indexed by emotion and feelings, where the thought processes run. Moreover, emotional stimulus about an event, negative or positive, serves as a selective retrieval cue for material stored in memory that is congruent with that emotional stimulus, and the material that is associatively linked to the current emotional status is more likely to be recalled and used in information processing and decision making (Bower, 1983; Bower & Forgas, 2000; Forgas, 2008). For example, if the emotional stimulus is positive, people have a tendency to remember positive information about that event first, whereas if the emotional stimulus is negative, people have a tendency to remember negative information instead.

Results from this study provided yet more evidence for the crucial role that affect has on how people perceive and interact with the world around them (Bruine de Bruin & Bostrom, 2013; Domingos et al., 2018; Finucane et al., 2000; Forgas, 2008; Kahneman, 2011; Loewenstein et al., 2001; Morgan et al., 2002; Slovic, 1987; Slovic et al., 2004, 2007; Slovic & Peters, 2006; Tversky & Kahneman, 1973, 1974; Zajonc, 1980), while also providing practical implications for risk communication in the context of “extreme natural environmental hazards capable of evoking positive affect” (Bruine de Bruin et al., 2016). For example, when the goal is to promote heat protection intentions, proper risk communication should avoid unintentionally reminding the audience about positive outcomes of hot weather or about

pleasant but risky behaviours during extreme hot weather events, as the undermining effect seemingly occurs both in automatic and thoughtful information processing contexts. Cross-cultural differences also highlight that care should be taken when devising heat protection communications for different populations/audiences or adapting communication materials imported from other contexts or cultures. For example, because different audiences may have different goals and informational needs, the same arguments may be interpreted differently across audiences (e.g., an audience with positive rather than negative views of extreme hot weather versus an audience with negative rather than positive views of extreme hot weather may have different interpretations about heat protection recommendations). As noted by Bruine de Bruin and Bostrom (2013, p. 14063), this stresses the importance of knowing the target audience and testing “communications for adequacy and understanding (with members of intended audience) as well as for accuracy (with domain experts)”. This is an important step so that risk communications can effectively facilitate the audience’s ability to process and understand the information being communicated and use it to make informed decisions (Bruine de Bruin & Bostrom, 2013). In fact, Clayton et al. (2021, p. 59) further highlighted that government, health authorities, and other institutions involved in promoting adaptation and resilience to extreme weather events “should deepen relationships with the breadth of community constituencies and consider testing their warning and communication systems regularly; this effort should include ensuring that warnings are translated into community spoken languages and are accessible to the Deaf community and to those with vision loss, or other disabilities”.

Predictors of Heat Wave Demands and Resources Perceptions

While previously we have focused on understanding demands and resources perceptions associated with extreme hot weather events, by asking participants to think about such events, here we assessed such perceptions within the context of a heat wave that occurred in Portugal between 2 and 7 August 2018 (Instituto Português do Mar e da Atmosfera [IPMA], 2018). Based on the previous work, we developed heat wave demands and resources perceptions scales, and aimed to better understand factors (e.g., cognitive, affective, sociodemographic) that predict heat wave demands and resources perceptions, as well as their combined effects on heat protection intentions during the heat wave. For that we used variables previously studied in the heat waves literature, that have been shown to have effects on heat protection intentions, such as temperature feeling, temperature interference in daily life, heat wave risk perception, reports

of having heard heat protection recommendations, and positive affect about heat (Bruine de Bruin et al., 2016; Hass et al., 2021; Lefevre et al., 2015), together with other factors such as need for cognition and sociodemographic variables (e.g., age, gender). Supported by reviewed literature, mainly on heat waves, we also proposed a theory-driven and evidence-based path analysis model illustrating the effects of such factors on heat wave demands and resources perceptions, and their combined effects on heat protection intentions, during the heat wave.

We found that heat wave risk perception and temperature interference in daily life were significant positive predictors of heat wave demands perceptions, whereas need for cognition, positive affect about heat, and reports of having heard heat protection recommendations were significant positive predictors of heat wave resources perceptions. The combination of statistical analysis methods (i.e., multiple linear regression and path analysis) also suggested a significant positive association between temperature interference in daily life and heat wave resources perceptions, rather than a direct effect. Additionally, we identified temperature interference in daily life, heat wave risk perception, heat wave demands perceptions, heat wave resources perceptions, age, and gender (being female) as significant positive predictors of heat protection intentions. In line with previous work, positive affect about heat was identified as a significant negative predictor of heat protection intentions, although when considering the combined effects of positive affect about heat on other variables that were found to predict heat protection intentions, that effect was seemingly nullified (i.e., marginally significant total effect). Moreover, we identified significant positive indirect and total effects of variables such as temperature feeling and reports of having heard heat protection recommendations on heat protection intentions, which suggests that although they may not have had direct effects on heat protection intentions, they still may play an important role, particularly due to effects they had on other factors.

These results suggest that increasing or decreasing heat wave demands and resources perceptions may require addressing different qualitative categories of predictors. That is, while heat wave demands perceptions seem to be better predicted by factors more connected to heat wave risk perception (Hass et al., 2021), potentially representing a growing ‘awareness or generation of added constraints’ (i.e., norm deviation³¹; Gaspar et al., 2015, 2021a, 2022a), heat wave resources perceptions seem to be better predicted by factors more connected to ‘awareness or generation of assets and strengths’ such as having heard heat protection recommendations or

³¹ Norm Deviation can be defined as the perception or detection that a new situation has emerged and starts to deviate from what it is considered to be ‘normal’ or ‘status quo’ (Gaspar et al., 2015).

need for cognition, which has been shown to facilitate generation of alternatives (Bakker, 1999; Bruine de Bruin et al., 2016; Bruine de Bruin et al., 2015; Cacioppo & Petty, 1982; Hittner, 2004; Lefevre et al., 2015; Petty et al., 2009; Ruiter et al., 2004; Williams-Piehota et al., 2003). Moreover, this pattern also suggests an interaction between ‘experiential and analytic systems’ (Cacioppo & Petty, 1982; Denes-Raj & Epstein, 1994; Epstein et al., 1992, 1996; Petty et al., 2009; Sanna & Chang, 2006) in the context of heat wave perceptions, with experiential systems (e.g., experience of temperature interference in daily life) mobilizing demands perceptions, and analytic systems (e.g., need for cognition) mobilizing coping resources perceptions.

Interestingly, heat wave resources perceptions were identified as the strongest single predictor of heat protection intentions during the heat wave, providing additional evidence that increasing protection intentions requires not only promoting the perception of risk and demands (Barnett & Vasileiou, 2014; Breakwell, 2010; Ferrer & Klein, 2015; Joffe, 2003; Kalkstein & Sheridan, 2007; Renner et al., 2015; Schweizer et al., 2021; Sheeran et al., 2014; van der Pligt, 1996), but also the availability and perception of resources (Blascovich, 2007; Bonanno, 2004; Haggerty et al., 1994; Luthar, 2003; Masten, 2001; Reser & Swim, 2011; Rutter, 1987; Schoon, 2006; Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2009, 2015; Swim et al., 2009; Taylor et al., 2000; Zimmer-Gembeck & Skinner, 2016). However, this finding represents a key difference compared to the emotion prompts study, that was not conducted during a heat wave, and where heat wave resources perceptions were not found to predict heat protection intentions. That difference between studies could have been related with the distance between thinking about an event and experiencing the event itself, and with cognitive limitations individuals may have when making retrospective appraisals and future estimations (Hass et al., 2021; Mattarella-Micke & Beilock, 2012; Skinner et al., 2003). On the one hand, within our research context/population, when thinking about extreme hot weather events (without a positive emotion prompt) the negative emotions associated to such events may be more salient/available increasing the probability that demands are perceived (e.g., recall of information about negative constraints or experience of negative consequences). However, because the possibility or the need to implement protective actions in that moment is not actually present, it may reduce the probability of perceiving resources, particularly if they are not cognitively associated with such negative emotions or perceived demands (Bower, 1983; Bower & Forgas, 2000; Forgas, 2008). On the other hand, when experiencing extreme hot weather events, the negative emotions associated to such events may also be more salient/available which increases the probability that demands are perceived. Yet, because there

may be an actual need to implement protective actions in the moment, it may also increase the probability of perceiving resources, thus highlighting the role of resources perceptions during active coping/performance situations (Blascovich & Mendes, 2000; Skinner et al., 2003) and pro-active coping (Skinner et al., 2003; Swim et al., 2009). Taken together, this further suggests that the link between heat wave demands and coping resources may still be missing from peoples' mental models about heat protection. Hence, to facilitate heat protection intentions before heat waves, it may be important to promote awareness of demands while remembering the protective resources. Differently, to facilitate heat protection intentions during heat waves, it may be important to promote awareness of protective resources while remembering the demands. Thus, although the communication focus/framing can differ, the link between demands and resources perceptions should always be promoted. This further highlights that promoting feelings of threat (i.e., when demands perceptions outweigh resources perceptions – $D > R$), or feelings of safety (i.e., when resources perceptions outweigh demands perceptions – $D < R$) may not have an effect as strong on heat protection intentions as compared to the effect from promoting feelings of challenge (i.e., when there is a balance and interaction between demands and resources perceptions – $D \approx R$). This is in line with findings in other research contexts (Blascovich & Mendes, 2000, 2010; Demerouti et al., 2001; Gonzalez-Mulé & Cockburn, 2017; Lesener et al., 2019; Putwain et al., 2017; Skinner et al., 2003; Swim et al., 2009). Moreover, promoting awareness of heat wave demands and resources perceptions and the links between both (i.e., challenge), not only during heat waves but also preventively before heat waves, and through this, promoting heat protection intentions, gains further relevance. This is because existing research also shows a tendency for more negative health consequences and more deaths during the first heat wave of the warm season, even if that event is less severe than following heat waves (Anderson & Bell, 2009, 2011; Esplin et al., 2019; Liss et al., 2017).

Another interesting result was related with the effects of positive affect about heat. On the one hand, as suggested by our emotion prompts study, and by other research in the context of heat waves (e.g., Bruine de Bruin et al., 2016; Lefevre et al., 2015), we found that positive affect about heat directly reduced temperature feeling, heat wave risk perception, and heat protection intentions. However, it did not have a direct effect on heat wave demands perceptions, although it had a significant negative indirect effect on it. This suggests that the effects of positive affect about heat on heat wave demands perceptions may be better explained by its effects on the awareness of risk. On the other hand, we also found that positive affect about heat increased perceived resources, or at least the feeling of having resources.

Considering all the direct and indirect effects, this seemingly nullified the total effect of positive affect about heat on heat protection intentions (i.e., not increasing nor decreasing overall heat protection intentions), although showing a tendency (marginally significant) for reducing heat protection intentions. Taken together these results seem to highlight both the biasing potential of positive affect but also its protective potential for health and wellbeing (Bruine de Bruin et al., 2016; Clayton et al., 2021; Lefevre et al., 2015; Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2015; Swim et al., 2009; Zimmer-Gembeck & Skinner, 2016).

Affect has been shown to be an important influence on how people perceive and interact with the world around them (Bruine de Bruin & Bostrom, 2013; Domingos et al., 2018; Finucane et al., 2000; Forgas, 2008; Kahneman, 2011; Loewenstein et al., 2001; Morgan et al., 2002; Slovic, 1987; Slovic et al., 2004, 2007; Slovic & Peters, 2006; Tversky & Kahneman, 1973, 1974; Zajonc, 1980). In that regard, these results provide an interesting additional contribute for contextualizing the different effects and relations between positive affect and other factors, suggesting that more research is needed to better understand and contextualize its effects and relations in broader and more holistic ‘real world’ contexts, as ‘variables exist not only in the vacuum’. This is because, as previously stated, positive affect can have an undermining potential on heat protection intentions, but at the same time also works as a protective resource for health and wellbeing (Bruine de Bruin et al., 2016; Clayton et al., 2021; Lefevre et al., 2015; Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2015; Swim et al., 2009; Zimmer-Gembeck & Skinner, 2016). Future studies can contribute for a better clarification of these relations and help disentangle the different effects of affect (e.g., biasing factor versus protective factor), with the goal of better understanding how to harness the benefits of positive affect for health and wellbeing, while limiting potential negative bias effects. In that regard, and in line with previous recommendations, one possibility for limiting the potential negative bias effects of positive affect for health and wellbeing in heat wave risk communications, can be avoiding unintentionally reminding the audience about positive outcomes of hot weather or about pleasant but risky behaviours during extreme hot weather events. Yet, to harness the benefits of positive affect, these communications should instead provide other sources of affective and emotional resources and incentives, centred around a variety of safe alternatives (e.g., enjoyable and personally meaningful activities that can take place in climatized spaces).

Taken together, from a practical standpoint, these results also suggest that heat wave risk communications should strive to reinforce the link between heat wave risk, demands, and

resources perceptions in peoples' minds, by promoting the interaction between 'experiential and analytic systems' (e.g., stronger connection between what is being experienced and what can be done). This can be done by communicating heat wave risks and demands in association with protective resources before heat waves occur, and protective resources in association with heat wave risks and demands during heat waves (e.g., ensuring demands and resources are matched together). Moreover, actual availability and accessibility of such resources when they are most needed, should also be provided.

Seasonal and Geographical Variations in Heat Wave Demands and Resources Perceptions

In our previous studies, the focus was exploring heat wave demands and resources perceptions, their relations with other factors (e.g., heat wave risk perception, positive affect about heat, and need for cognition), and their combined effects on heat protection intentions. Differently from those, here we focused on the relation between heat wave demands and resources perceptions as an indicator of heat wave feelings of threat and stress (i.e., distress) across different seasons of the year (i.e., in the spring before the summer, during a heat wave in the summer, during the summer, and in the autumn after the summer) and different heat wave geographical susceptibility locations of Portugal (i.e., low, moderate, and high geographical susceptibility to the occurrence of heat waves). Hence, we sought to describe seasonal variations in heat wave demands and resources perceptions as an indicator of feelings of threat and stress, across different heat wave geographical susceptibility locations of Portugal, and predictors of such variation. For that we operationalized feelings of threat as the ratio (D/R) between demands (D) and resources (R) perceptions, which simplifies longitudinal data analysis and visualization (i.e., relying on the information provided by one aggregated indicator instead of two separate indicators), while enabling assessing when demands perceptions were higher, lower, or equal to resources perceptions, which has been systematically associated by research to specific psychological, physiological, and behavioural outcomes (for a review see Blascovich & Mendes, 2000, 2010; Tomaka et al., 1993, 1997), particularly states of threat, challenge, and safety (see Chapter I, p. 16-17).

Across seasons (i.e., survey waves), we found that heat wave feelings of threat (D/R) only varied within the group of participants living in high heat wave geographical susceptibility locations, and within the group of participants living in moderate heat wave geographical susceptibility locations. These remained relatively stable over time within the group of

participants living in low heat wave geographical susceptibility locations, that always perceived significantly lower heat wave demands than heat wave coping resources (i.e., greater safety). In that regard, results suggested a significant increase in the ratio between demands and resources perceptions during the heat wave for participants living in high and moderate heat wave geographical susceptibility locations. Yet, for participants living in moderate heat wave geographical susceptibility locations, heat wave demands perceptions did not differ significantly from heat wave coping resources perceptions during the heat wave. Differently, participants living in high heat wave geographical susceptibility locations perceived significantly higher heat wave demands than coping resources. This suggests that, comparatively to participants living in moderate heat wave geographical susceptibility locations, participants in high geographical susceptibility locations appraised the situation more as a threat (i.e., characterized by distress) than as a challenge (i.e., characterized by eustress). We also found that prior to the heat wave, participants living in high heat wave geographical susceptibility locations were possibly already appraising heat waves as a challenge, as demands perceptions did not differ significantly from heat wave coping resources. Differently, in moderate and low heat wave geographical susceptibility locations, demands perceptions were significantly lower than heat wave coping resources perceptions, suggesting greater safety. After the heat wave, results suggest that participants living in high heat wave geographical susceptibility locations were able to reduce heat wave feelings of threat and distress (i.e., from threat towards challenge), and that a similar trend (i.e., from challenge towards safety), was also followed by participants living in moderate heat wave geographical susceptibility locations. Yet, predictor analysis suggested that this reduction or recovery may have been more demanding particularly among older participants living in high heat wave geographical susceptibility locations, and female participants living in both high and moderate heat wave geographical susceptibility locations. This result is in line with findings from the previous study that took place during a heat wave, where older participants and female participants also reported higher heat protection intentions during the heat wave. However, here the effect was observed on feelings of threat, and after rather than during the heat wave, suggesting that although reporting higher heat protection intentions during heat waves these groups of people may still be more affected by the lagged effects of extreme hot weather after heat waves than others (Gasparrini & Armstrong, 2011). These results are in line with findings that suggest that vulnerable groups (e.g., elderly; children; people with comorbidities; people in risk of poverty or homeless; people with substance-use disorders) tend to have greater difficulty in coping with extreme hot weather events, and that females tend to be more responsive than males to extreme

temperatures, which may increase their risk perception, worry and distress when compared to other groups of people (Agüero, 2014; Charlson et al., 2021; Gasparri & Armstrong, 2011; Hajat et al., 2014; Hass et al., 2021; Kaltsatou et al., 2018; Kovats & Hajat, 2008; Laurent, 2021; Laurent et al., 2018; Liu et al., 2021; Ma et al., 2015; Wang et al., 2020; Yu et al., 2012). Yet it should be noted that this does not mean that women are more vulnerable or perceive greater risk than men, but instead that their risk perception and feelings of threat may be dependent on socio-cultural aspects (e.g., power relations; perceived personal control; gender roles and stereotypes) that promote such awareness (Alsharawy et al., 2021; Hitchcock, 2001; Olofsson & Rashid, 2011).

In line with findings from our previous studies, these results further support that although greater heat wave risk and demands perceptions can contribute to higher heat protection intentions and behaviours (Ban et al., 2019; Bruine de Bruin et al., 2016; Esplin et al., 2019; Hajat et al., 2010; Hass et al., 2021; Kalkstein & Sheridan, 2007; Lefevre et al., 2015; Sheridan, 2007; Swim et al., 2009) increasing heat wave risk and demands perceptions without also providing or increasing heat wave coping resources perceptions, can result in greater threat, distress, further depletion of physical and psychological resources, and possibly even in the occurrence of more withdrawal or freeze behaviours, and negative mental health outcomes such as anxiety, depression, and suicide (Blascovich & Mendes, 2000, 2010; Clayton et al., 2014, 2021; Demerouti et al., 2001; Esplin et al., 2019; Gonzalez-Mulé & Cockburn, 2017; Hickman et al., 2021; Lesener et al., 2019; Liu et al., 2021; Skinner et al., 2003; Swim et al., 2009; Theorell & Karasek, 1996; Thompson et al., 2018). This notion is particularly important and has strong practical implications, given that research in the context of heat waves also suggests that following communication of heat warnings, the needed coping resources are not always immediately available (Esplin et al., 2019), the effectiveness of various heat protection measures is often unknown, and protective behaviours are still misunderstood (Hass et al., 2021; Kalkstein & Sheridan, 2007; Sheridan, 2007), which is in line with findings reported across our studies. Furthermore, it reinforces recommendations arising from our previous studies that heat wave risk interventions and communications should strive to reinforce the link between heat wave risk, demands, and resources perceptions in peoples' minds, by promoting the interaction between 'experiential and analytic systems', and the match between demands and resources perceptions (e.g., linking each demand to the most effective and easy to implement resource, and to other resources that can be implemented). The goal is not only to promote prevention, proactivity, and protection-oriented dispositions, but also to enable people to readily detect

potentially threatening heat wave demands as they experience them, and intuitively (e.g., automatically) apply the 'best' coping resource they can, given the situation they are in. That is, motivating protective response without inducing damaging levels of threat and stress (Blascovich, 2007; Blascovich & Mendes, 2000, 2010; Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2015; Tomaka et al., 1993, 1997).

Lastly, we found that from the factors used in our previous research and that were included in this study, heat wave risk perception was the most consistent positive predictor of heat wave feelings of threat (D/R) across survey waves and heat wave geographical susceptibility locations, whereas positive affect about heat was the most consistent negative predictor. On the one hand, in line with our previous findings, this highlights the potentially biasing effect of positive affect on feelings of threat and stress, which may lead to underestimation of risk (Bruine de Bruin et al., 2016; Finucane et al., 2000; Slovic et al., 2004, 2007; Slovic & Peters, 2006), particularly in low heat wave geographical susceptibility locations. This biasing effect can be particularly significant on the context of heat waves, especially before the warm season (i.e., before a heat wave), when people may be longing for hot weather (Abrahamson et al., 2009; Bränström et al., 2001; Bruine de Bruin et al., 2016; Fuller & Bulkeley, 2013; Harley, 2003; Wolf et al., 2010b). As previously noted, this can have associations with the fact that the first heat wave of the warm season tends to be more impactful in peoples' health (Anderson & Bell, 2009, 2011; Esplin et al., 2019; Liss et al., 2017). For example, as result of this biasing effect people may not immediately remember the demands posed by heat waves and the available coping resources, and may disregard heat protection advices and proper planning of their activities or protection needs (Anderson & Bell, 2009, 2011; Esplin et al., 2019; Liss et al., 2017; Sheridan, 2007). On the other hand, as stated before, positive affect and positive emotions also serve as coping resources (Clayton et al., 2014, 2021; Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2015; Swim et al., 2009; Zimmer-Gembeck & Skinner, 2016), suggesting they may also help to achieve psychological balance when situations are more threatening (e.g., emotional regulation), and particularly when other heat protection resources are not available. Nevertheless, this disentanglement of affect as bias or coping resource needs to be better addressed in future research (i.e., better disentanglement and distinction between when and how positive affect has potential negative bias effects and when and how it works as a protective resource with benefits for health and wellbeing). This should also consider other explanatory factors, particularly those potentially pertaining to coping resources mobilization, such as perceived efficacy of resources and perceived self-

efficacy for example (Reser & Swim, 2011; Schwarzer, 2008; Schwarzer et al., 2011; Swim et al., 2009).

From a practical standpoint, and considering the vulnerability of Portugal to climate change (Naumann et al., 2020; Rocha et al., 2020; Rodrigues et al., 2021; Schleussner et al., 2019), and the fact that extreme hot weather events are expected to become more frequent, intense, and long lasting (Clayton et al., 2015; Hajat et al., 2014; Howe et al., 2019; Intergovernmental Panel on Climate Change [IPCC], 2014, 2022; Lefevre et al., 2015; World Economic Forum [WEF], 2017; WHO, 2015), results also suggests that closer monitoring of peoples' awareness of demands and availability of resources (e.g., ability) to cope with these events across different heat wave geographical susceptibility locations is needed. This can enable resource building interventions that can be timely delivered, that is, before rather than after the effects of extreme heat become damaging to health and wellbeing (Kim et al., 2014). This pre-emptive institutional response capability gains importance considering that some of the locations most susceptible to heat waves in Portugal also correspond to locations characterized by an older and more vulnerable population, with lower formal education levels, lower income, poorer housing conditions, and greater inequalities in the access to physical, psychological and mental healthcare, that is, with less resources (Di Meglio et al., 2018; Mauritti et al., 2019; Moreira, 2011; Ordem dos Psicólogos Portugueses [OPP], 2020a; Rego et al., 2013; Rodrigues, 2019; Rodrigues et al., 2020, 2021; Silva, 2012). Given the reality of the Portuguese context, and in line with the findings presented by Clayton et al. (2021) and Thompson et al. (2018), the findings from our studies further support not only the need for strengthening mental and psychological healthcare services across the country, making these services more accessible and affordable, but also the need for integrating and addressing mental health issues when creating national and local heat wave prevention plans. Moreover, as evidence evolves, there should be an integration of psychological indicators (i.e., mental health related) of threat (e.g., distress), morbidity (e.g., anxiety combined with depression), and mortality (e.g., suicide) associated with temperature thresholds into hot weather risk prevention public health plans, risk matrix calculations, and warning systems (Thompson et al., 2018).

Limitations and Future Research

Through Chapters II to V, we highlighted specific limitations associated with the studies and analysis conducted, discussed what was done to mitigate such limitations, and suggested

future research to overcome them. Here we summarize the main limitations across the reported work, highlighting that generalization of findings should be made with parsimony. We discuss in greater detail future research possibilities to promote better understanding about the role that demands and resources perceptions may have in promoting adaptation and resilience, and facilitating protective intentions and behaviours. This should consider not only heat waves but also other natural and man-made hazards (e.g., extreme cold weather; epidemics and pandemics; mass shootings; terrorist attacks; domestic violence).

The initial work was not conducted during heat waves, and thus relied on asking participants to remember and thinking about extreme hot weather events, that is, thinking about the experience of the event instead of experiencing it in the moment, which may have limited its 'ecological validity'. This is particularly relevant given that there are memory and cognitive limitations (e.g., recall bias) on how individuals make retrospective appraisals and future estimations of their associated coping responses (Hass et al., 2021; Mattarella-Micke & Beilock, 2012; Skinner et al., 2003), which may have been related, for example, with the lack of significant effect of heat wave resources perceptions and appraisals on heat protection intentions observed in the initial work. Yet, despite such limitations, research also suggests that there is a clear link between thinking about and experiencing a situation (i.e., cognitive simulation), as it can evoke the memory of past experiences and the emotional attributes associated with such memories (Abrahamson et al., 2009; Akompab et al., 2013; Ban et al., 2019; Bruine de Bruin et al., 2016; Esplin et al., 2019; Hass & Ellis, 2019; Hass et al., 2021; Howe et al., 2019; Khare et al., 2015; Lefevre et al., 2015; Palutikof et al., 2004; Wolf et al., 2010a, 2010b). Additionally, in the initial work, the goal was to gather evidence about how the Portuguese population perceived heat wave demands and resources, representing a first step at creating a theory-driven and evidence-based coding framework that enables extracting qualitative and quantitative meaning (i.e., psychological) about such perceptions from verbal and written expressions: the DeCodeR framework. This work also set the context for the creation of demands and resources perceptions scales that could be used to assess such perceptions in larger samples of the population (Bruine de Bruin & Bostrom, 2013). As such, with the initial work, we were more focused on identifying examples of heat wave demands and resources perceptions, rather than studying its prevalence in the population or making generalizations. Moreover, sample size was large enough to enable reaching theoretical saturation, that is, the point where no new content was emerging from the interviews (Bazeley, 2013; Bruine de Bruin & Bostrom, 2013; Guest et al., 2006; Krippendorff, 2004; Morgan et al.,

2002). To ensure greater heterogeneity and diversity of qualitative content we recruited participants in different geographical locations of Portugal and across different age groups.

The development of the DeCodeR framework was also done, since the beginning, with the goal of potentially enabling timely adaptation of the coding procedures and processes to other natural and man-made hazards (e.g., extreme cold weather; epidemics and pandemics; mass shootings; terrorist attacks; domestic violence), laying the foundations for the framework that was used, for example, during the COVID-19 pandemic to monitor COVID-19 demands and resources perceptions as an indicator of systemic risk appraisal, threat, and distress over the pandemic course in Portugal (e.g., Arriaga et al., 2020, 2021; Domingos et al., 2022; Gaspar et al., 2021b, 2022a, 2022b; OPP 2020b). As a first step at creating a theory-driven and evidence-based coding framework that enables extracting qualitative and quantitative meaning about demands and resources perceptions from peoples' discourse and that can potentially be adapted to different situations and contexts with relative ease, there is also an ongoing and ever evolving discussion and improvement of categories and subcategories definitions, contents, and relations. In that regard, the development of the DeCodeR framework is still an open ongoing process, and future studies can provide better theoretical and empirical clarification about less clear aspects and interconnections between categories (e.g., better distinction between psychological skills and dispositions).

To provide better ecological and convergent validity, future studies can also use this framework to explore how indicators of demands and resources perceptions obtained from qualitative data relate with indicators of such perceptions obtained through psychophysiological measures and other indicators (e.g., Blascovich & Mendes, 2010). For example, in a different context than heat waves (i.e., COVID-19 pandemic), we found that the ratio between COVID-19 demands and resources perceptions, which were coded from publicly available comments made by social media users/commenters in response to COVID-19 publications on Facebook released by the Directorate-General for Health and the seven main national media outlets using the DeCodeR framework, had positive strong to moderate correlations with relevant epidemiological indicators, namely: 1) the cumulative number of SARS-CoV-2 confirmed daily infections; 2) the total daily number of new COVID-19 deaths; and 3) the cumulative daily number of COVID-19 hospitalizations in Intensive Care Units (Domingos et al., 2022; Gaspar et al., 2022b). Likewise, in the future it could be useful to compare heat wave demands and resources perceptions with heat wave epidemiological indicators, including indicators related to mental health, to better understand if and how these relate.

It is our contention that the proposed framework allows bridging the gap between research and practice, providing a flexible and adaptive theory-driven data collection and coding procedure that provides not only evidence-based information about demands and resources perceptions, but also about indicators that enable better contextualization of such perceptions and associated emotional and behavioural responses. This framework can also be used in combination with other data collection procedures (e.g., surveys), or to inform the creation of such procedures, enabling, for example, contextualization and integration between different layers of evidence for supporting policymakers and health authorities' decision making processes, communications, and interventions (Arriaga et al., 2020, 2021; Breakwell & Barnett, 2003; Breakwell et al., 2001; Domingos et al., 2022; Gaspar et al., 2021b, 2022a, 2022b, 2021c, 2020a, 2020b, 2020c; OPP, 2020b).

Answering to some of the limitations on the initial work, the follow-up was conducted not only during extreme hot weather events (i.e., heat waves), but also before and after the events. To assess heat wave demands and resources perceptions in larger samples of the population, and over time, and building on the knowledge gained from the initial work, we developed and proposed two new scales, one for heat wave demands perceptions and other for available heat wave coping resources perceptions. As such, the doctoral work also represented a first step in the development of these psychometric instruments. Although these scales present good indicators of reliability, work well as an overall measure of heat wave demands and resources perceptions, and can give indicators about the prevalence of specific demands and resources perceptions in the population, further adjustments and clarifications of subcategories will be needed to provide proper validation for the Portuguese population, which is a priority for future studies. For example, we found not only high correlations between items in different subcategories of demands or resources respectively (e.g., between danger and effort, or between knowledge, abilities, and skills and external support), but also between items from the different higher-order categories of demands and resources (e.g., between danger and external support). From a theoretical standpoint there is a clear relation between demands and resources perceptions that can help justify such associations (Blascovich & Mendes, 2000), but this can also suggest the possibility of different theoretical configurations of categories/dimensions of heat wave demands and resources perceptions, that can better describe the data, and that should be considered and clarified in a future validation study. In that regard, the heat protection intentions scale, being developed based on the operationalization proposed by Lefevre et al. (2015) and Bruine de Bruin et al. (2016), could also benefit from conceptual improvements,

such as for example, distinction between individual and social approach versus avoidance heat protection intentions and behaviours, as to better identify predictors, motivators, and impacts (physical and psychological) of different heat wave protection mechanisms (Swim et al., 2009).

Additionally, there were limitations associated with sampling procedures and the samples collected during the work developed that are worth discussing. In that regard, samples on all studies were recruited following non-random sampling procedures and as such are not representative of the Portuguese population, nor of the populations residing in different geographical susceptibility locations. In our samples, we also had a tendency for having lower number of male participants in comparison to female participants, a tendency that we were unable to correct or adjust across studies. To minimize such limitations, all analysis were supported by theoretical and empirical evidence arising from literature produced in the context of heat waves, climate change, and natural environmental hazards. Robust statistical procedures were used, including the observance of assumptions for their application, and appropriate bias corrections when applicable. Moreover, to limit biasing effects of convenience samples there was also an effort to recruit ‘natural, diversified, and heterogeneous’ samples, that is, including a variety of participants ranging from younger adults to older adults, and recruiting participants across most of the different geographical locations of Portugal (e.g., North, Centre, South, Littoral, Interior, and autonomous regions of Madeira and Azores) and in different settings (e.g., through parish councils, universities, companies and business organizations, cultural and recreative associations, senior associations). Still, it should be noted that variables measured across studies were self-reported, rather than observations or other objective measurements (e.g., self-reported heat protection intentions rather than observation of the actual behaviour), and that data were correlational, thus limiting causal inferences.

With these limitations in mind, caution should be taken when generalizing findings to other populations, although more than generalization, this doctoral work aimed at a more general understanding about heat wave demands and resources perceptions in the Portuguese context, their predictors and effects on heat protection intentions, and the potential of monitoring such perceptions as indicators of psychological responses of threat and stress in the context of heat waves. This resulted in improving the knowledge about the factors influencing demands and resources perceptions, and the knowledge about their combined effects on protection intentions. Additionally, it enabled developing a theory-driven framework for monitoring demands and resources perceptions, as indicators of psychological responses of

threat and stress, in association with extreme events and crisis situations, providing preliminary evidence for its executability, applicability, and utility.

Overall, and regardless of limitations, the developed work, supported by extensive theoretical and empirical evidence, provides much-needed exploratory quantitative, qualitative, and longitudinal analysis, which are still lacking in the field of human responses to extreme hot weather events (see Hass et al., 2021). In that regard, the developed work provides a new, differentiated, and unique approach. Whether in the context of heat waves, or other natural or man-made hazards (e.g., extreme cold weather; epidemics and pandemics; mass shootings; terrorist attacks; domestic violence), future research can explore if and how the results here presented replicate. This research can be conducted not only with larger samples, but also over time and across different situations, geographies, cultures, and social groups, while considering additional factors that can play an important role in shaping demands and resources perceptions, protection intentions, and protection behaviours, as well as considering the relations between factors as part of a broader 'ecological setting'. As pointed by Hass et al. (2021) this could be accomplished by inquiring large sample sizes across a diverse range of individual, social, and geographical contexts, using emerging and powerful statistical methods to separate apart the complex associations, interactions, and effects between factors. This should be paired with robust research designs that can enable establishing causal linkages, such as longitudinal assessments, quasi-experimental designs, and even community randomized controlled trials. Additional factors considered in such studies can include psychological, physiological, social, and environmental drivers of risk, demands, and resources perceptions, emotional responses, protection intentions and behaviours, and adaptation, mitigation, and resilience processes. Example of such factors include social norms, psychological distance, trust, perceived response efficacy, perceived self-efficacy, perceived vulnerability, resilience, and acclimation, and objective measures of vulnerability, resilience, acclimation, and temperature (e.g., Clayton et al., 2015, 2014, 2021; Hass et al., 2021; Reser & Swim, 2011; Schwarzer, 2008; Schwarzer et al., 2011; Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2009, 2015; Swim et al., 2009, 2011a, 2011b; van Valkengoed & Steg, 2019; Zimmer-Gembeck & Skinner, 2016). Such studies can also explore not only the impacts that demands and resources perceptions may have on protection intentions but also on concurrent intentions and behaviours (e.g., understanding what promotes or hinders intentions and behaviours opposite to protection intentions and behaviours in different risk or crisis contexts), categories of intentions and behaviours (e.g., approach versus avoidance intentions and behaviours), and have a greater focus on actual

behavioural responses happening during risk and crisis situations (i.e., rather than intentions). Future research can also rely not only on data obtained from self-reported measures and/or psychophysiological indicators, but also on data obtained from other sources. Examples include data obtained from: news and media outlets (e.g., textual data from journals, magazines, and social media posts); digital images and videos (e.g., posted in journals, magazines, and social media); and information and communication technologies (e.g., wearable sensors, smart clothes, and applications that can provide contextual information such as audio, movement, temperature, detailed positioning, metadata, and other indicators that can be used to extrapolate not only behavioural responses but even psychological responses). This can include the development of frameworks for coding physical and psychological indicators of demands and resources from images, videos, smart sensors, and other technology-based formats, and may even include data obtained from computerized simulations of high-risk and infrequent scenarios with modelled psychological indicators (see van der Wal et al., 2021a, 2021b). This could provide evidence to better understand the demands that people actually experience when facing environmental hazards in the real world, including less frequent hazards, and the resources that they actually use or fail to use to protect themselves or cope with such hazards. Future studies in the context of heat waves, or other natural or man-made hazards (e.g., extreme cold weather; epidemics and pandemics; mass shootings; terrorist attacks; domestic violence), can also consider analysing differences in specific risk, demands, and resources perceptions between different groups of experts and professionals involved in risk and catastrophe prevention (e.g., Fonseca, 2017). These studies can include differences between those groups of experts and professionals and the general population (e.g., lay people), to identify common points, and address possible gaps in knowledge and misconceptions that may undermine communication or cause entropy between them (Bruine de Bruin & Bostrom, 2013; Morgan et al., 2002). In that regard, linguistic and semantic analysis (e.g., Coenen et al., 2006) of the expressions and words used by the participants to describe heat wave demands and resources perceptions can also be conducted in the future. For example, these may be useful for the development of computer-based approaches for automatic identification and monitoring of indicators of such perceptions. Future work can also focus on the development and testing of intervention and communication materials based on findings that were reported in this doctoral work. For example, this testing could include assessing, through randomized controlled trials, how successful those interventions and communications are at bridging the gap between how experts and lay people think and feel about risks, at promoting accurate demands and resources perceptions, at increasing intentions, and at facilitating decision making and protection

behaviours across different sociocultural and geographical contexts. Lastly, future research can also promote better understanding about the impacts of perceiving significantly more heat wave demands than available coping resources on mental health outcomes (e.g., distress; anxiety; depression; suicide), as to enable better integration of psychological indicators into extreme hot weather risk prevention public health plans, risk matrix calculations, and warning systems (e.g., Thompson et al., 2018).

Practical Implications

More than ‘just’ promoting the scientific knowledge about heat wave demands and resources perceptions and their effects on heat protection intentions, the developed research aimed at identifying practical applications for such knowledge. Because people interpret reality and information in light of their own knowledge, beliefs, feelings, and perceptions (Bostrom et al., 1994; Breakwell, 2010; Bruine de Bruin & Bostrom, 2013; Domingos et al., 2018; Finucane et al., 2000; Forgas, 2008; Kahneman, 2011; Kaspersen et al., 1988; Loewenstein et al., 2001; Morgan et al., 2002; Slovic et al., 2004; Tversky & Kahneman, 1974; Zajonc, 1980) and because of the close association that the current research has with how people perceive and cope with extreme hot weather events (i.e., heat waves), as well as with their responses of threat and stress during such events, which has been shown to have impacts on their health and continued wellbeing (Clayton et al., 2021; Hickman et al., 2021; Swim et al., 2009), this work produced mostly practical recommendations for crisis and risk communication. In doing so it also provided evidence for policymakers and health organizations that can support their decision making processes when developing future heat wave prevention plans. Although some of these recommendations may overlap, for example, with other recommendations arising from research in the field of risk communication and decision making, the current research work reinforced their importance and practical utility, bringing them to the context of extreme hot weather events in Portugal. This contextualization enables, for example, support for designing crisis and risk communication and interventions tailored to address specific gaps in knowledge and misconceptions about heat waves demands and resources perceptions identified in the Portuguese context, using language, terminology, and analogies with which the Portuguese population can relate with, as to facilitate their understanding and informed decision making (e.g., Bostrom et al., 1994; Bruine de Bruin & Bostrom, 2013; Morgan et al., 2002).

One key evidence that we found in the context of heat waves in Portugal, and that relate with other findings in the literature, is that heat protection intentions depend not only on the perception of heat wave risks and demands but also on the perception of available resources to cope with the demands posed by heat waves. This further suggests that crisis and risk interventions and communications must strive to balance between both, because although the perception of risk and demands is a needed condition to motivate people for protection (Barnett & Vasileiou, 2014; Breakwell, 2010; Ferrer & Klein, 2015; Joffe, 2003; Kalkstein & Sheridan, 2007; Renner et al., 2015; Schweizer et al., 2021; Sheeran et al., 2014; van der Pligt, 1996), in bottom line people need resources to be able to implement such intentions into behaviours. For that it is also important that crisis and risk interventions and communications strive to reinforce the link, that is, the accessibility and interaction, between specific demands perceptions and specific resources perceptions in peoples' minds (e.g., when the perception of a demand comes to mind it comes accompanied with associated protective resources perceptions). That is, by consistently and systematically mapping specific demands perceptions to the specific resources perceptions that better alleviate such demands, and by establishing a clear connection between the perception of demands during the experience of potentially risky situations (e.g., symptoms) and the perception of the specific resources that can best alleviate such demands (i.e., interaction between experiential and analytic systems).

We also found evidence that, in the Portuguese context, people may still be missing external support and dispositional resources (e.g., motivation) for being able to take adequate protective action against heat waves. As shown in the literature (e.g., Clayton et al., 2014, 2021; Swim et al., 2009, 2011b; Wong-Parodi & Feygina, 2018), it is important that crisis and risk interventions and communications promote these types of resources, not only in the context of heat waves, but also in the context of other natural or man-made hazards. This requires addressing not only the availability, accessibility, and usability of external support resources, but also addressing the dispositions and motives that people must have to use such resources and engage in protective behaviours. In line with our previous recommendations this can be done by creating alternatives for protection and aligning those alternatives with the goals that different people, or groups of people may have, catering for different audiences, and reinforcing the link between demands and available coping resources. Moreover, our findings suggested that participants often viewed their houses as their best protective resource against heat waves. Yet, houses can be particularly vulnerable to extreme natural events, including heat waves, particularly when people lack the resources (e.g., knowledge and material) to properly maintain

or make their households more resilient to such events. In fact, fatalities attributable to heat waves often happen at home before people have the chance to seek emergency help (Deng et al., 2018; Fouillet et al., 2006; Ji et al., 2022; Vellei et al., 2017). Although providing these resources often connects with fiscal and economic incentives, our findings also suggested that people can sometimes still be lacking the knowledge to properly apply practical solutions, that is, although they know about the resources and can describe them, they may lack deeper knowledge on how to properly implement such resources (Hass et al., 2021; Kalkstein & Sheridan, 2007; Sheridan, 2007). For example, we found evidence that people could still be lacking knowledge about how to properly use equipment such as air conditioning units or fans, or on how to manage their fluid intake (e.g., water or other alternatives) in a more pleasant way. In that regard, instead of communicating what people already know (e.g., you should be in a climatized space during heat waves; you should drink more water during heat waves), future risk communication can focus on communicating what they still may be needing to know (e.g., how to properly climatize their houses; how to properly use a fan; how to make fluid intake more pleasant).

Our findings also provide evidence that may help experts and authorities to better tailor heat wave risk communications and communication materials, focusing on peoples' informational needs and preferred terminology, to facilitate their understanding, informed decision making, and implementation of protective measures (Bruine de Bruin & Bostrom, 2013; Bruine de Bruin et al., 2021; Morgan et al., 2002). This highlights the importance of simplifying crisis and risk communication materials and reducing psychological distance³² to natural environmental hazards. Here it is important to note that simplifying crisis and risk communication should not be understood as synonymous for paternalizing or infantilizing communication. Instead, it should be understood as designing communication materials in ways people can recognize and relate with, that is, tailored or adjusted to what people already know, to how they make decisions and think about the risk, to their preferred wording and communication formats, and to what they still need to know to make informed decisions (Bruine de Bruin & Bostrom, 2013; Morgan et al., 2002). This requires knowing how people

³² In this context psychological distance can be defined as an emotional and cognitive distancing, detachment, or disengagement from a problem, either because those problems are not present in the direct experience of reality, are hard to imagine or conceptualize, or even are too painful to think about, being promoted, for example, by the extent to which problems are perceived as affecting distant or remote geographical locations (e.g., between continents, countries, and districts), being distant into the future or the past, being unclear and uncertain, or affecting other persons and social groups instead of one-self (American Psychological Association [APA], 2022; Liberman et al., 2007; Spence et al., 2012; Taylor et al., 2014).

perceive the risk, the demands, and the resources associated to different hazards, the expressions they use to talk about such hazards, and the meaning that those words carry for them (i.e., as compared to expert meanings). This is necessary so that knowledge gaps and misconceptions can be properly identified and addressed, and relevant knowledge that already exists reinforced. Moreover, the inclusion of numbers, complex mathematical indicators, graphs, and other visualizations should be made only when it is sure that people have the resources to properly decode and understand such information (Kause et al., 2021). In the same way, crisis and risk communication should avoid politicization and sensationalism, and always take an ethical stance by ensuring that communication does not intentionally or unintentionally create or contribute to discrimination or stigmatization of individuals or groups of individuals (Schwabish & Feng, 2021). As suggested by Bruine de Bruin and Bostrom (2013, p. 14063) for that it is important to “iteratively test communications for adequacy and understanding (with members of intended audience) as well as for accuracy (with domain experts)”. Because people also tend to respond first to risks that are psychologically closer to them and that interfere with their immediate goals (Lieberman et al., 2007; Spence et al., 2012; Taylor et al., 2014), simplifying communication materials and making them more accessible and relevant to people, in ways they can relate with, increases the probability that they understand and use the information to think, elaborate, build knowledge around it, and make informed decisions with it, promoting productive public debate, and reducing the psychological distance to risk (Bruine de Bruin & Bostrom, 2013).

In the context of extreme events, crisis and risk interventions and communications often involve providing citizens with negative and sometimes even painful information (e.g., pleasant behaviours and tasks that should be avoided, potential material and economic losses, health complications, potential harm to family and friends, and even death) that may be hard to think about and process. This can further contribute to psychological distance and detachment from risk, leaving people uninformed or misinformed (APA, 2022; Kause et al., 2021; Lieberman et al., 2007; Spence et al., 2012; Taylor et al., 2014). In such situations, to avoid greater distress and promote motivation for protection, and as suggested by our findings (i.e., harnessing the benefits of positive affect), instead of framing communication as loss frames, communications can be framed as gain frames (Kause et al., 2021), by aligning positive outcomes of protection with people's own goals and objectives (e.g., the goal is not death but instead surviving). Moreover, instead of prohibiting pleasant but potentially risky behaviours (e.g., avoid going to the beach during a heat wave), promoting dissatisfaction and reminding people about pleasant

behaviours that should be avoided, potentially hindering protection motivation (i.e., bias effect of positive affect), communication can instead promote the variety of safe and pleasant alternatives. That is, provide a choice of resources for people to protect themselves (e.g., plan something with your family that involves being in climatized space during the heat wave, such as going to the mall, to the cinema, to a museum, to an arts exhibit, or to a recreative centre). As suggested in the literature, arts and other sociocultural activities are linked to reducing social isolation, and these activities have the advantage that can be provided within safe and climatized environments, promoting not only physical health but also mental health (Clayton et al., 2021). Nevertheless, to promote this kind of protection motivation on different individuals it is also important to provide different alternatives for ‘safe’ activities with which different people can relate with and enjoy. This is because different individuals may perceive different demands and resources, and have different goals, needs, and motivations to engage in such activities.

Knowing peoples’ perceptions, motivations, goals, needs, emotional responses, beliefs, knowledge, and preferred terminology, and having available previously tested communications materials gains further importance in the context of crisis communication. Due to its urgency, this type of communication often needs to be implemented quickly, in short term, and with less time for preparation (Gaspar et al., 2021a, 2021b). As such it is important to ensure that communication designers and communicators are prepared and already have an evidence-based perspective about how their audience can possibly respond to the arguments, terminology, and examples they may use in such communications. Approaches such as the one we propose in this Doctoral Thesis may enable building such body of evidence that can be iteratively tested to generate ‘communication templates’ adjusted to future scenarios.

In that regard, an important practical contribution of the work developed on this Doctoral Thesis was its adaptation and application to the COVID-19 pandemic context in Portugal (e.g., Arriaga et al., 2020, 2021; Domingos et al., 2022; Gaspar et al., 2021b, 2022a, 2022b, 2021c, 2020a, 2020b, 2020c; OPP, 2020b). This adaptation and application was framed by the scientific opportunity (and the civic duty) to collaborate with the Directorate-General for Health Division in Literacy, Health and Wellbeing, with the goal of facilitating the institutional understanding about how people were perceiving the pandemic crisis, enabling the identification of priority issues, and providing recommendations for COVID-19 risk and crisis communication. For that we adapted the DeCodeR framework to enable coding publicly available comments made by social media users/commenters in response to COVID-19 publications on Facebook (Domingos et al., 2021). These were publications released by the

Directorate-General for Health and the seven main national media outlets (Correio da Manhã; Expresso; Observador; Público; RTP Notícias; SIC Notícias; TVI24). The comments were coded into categories of perceived demands and coping resources co-occurring with the COVID-19 pandemic in the country. This work was integrated as part of a broader multimethod ‘social sensing’ approach, the ResiliScience approach (Domingos et al., 2022; Gaspar et al., 2022b, 2021c), and based on the idea that it is possible to reliably observe physical, psychological, and social phenomena at scale, as interpreted by the collective intelligence of individuals, groups, and communities within the social system, which can be achieved, for example, through the lens of social media users (Boyd & Crawford, 2012; Culotta, 2010; Galesic et al., 2021; Gaspar et al., 2021a, 2014; Wang et al., 2019). In line with our previous studies in the context of heat waves, and supported by extensive research in the context of threat, stress, risk perception, and coping (e.g., Barnett & Breakwell, 2003; Barnett & Vasileiou, 2014; Blascovich & Mendes, 2000, 2010; Breakwell, 2010; Gaspar et al., 2015, 2021a; Joffe, 2003; Joffe & Haarhoff, 2002; Renn, 2020; Schweizer et al., 2021; Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007, 2009, 2015; Slovic et al., 2004, 2007; Slovic & Peters, 2006; Swim et al., 2009; Tomaka et al., 1993, 1997; Zimmer-Gembeck & Skinner, 2016) we used the ratio (D/R) between demands (D) and resources (R) perceptions as what we defined as an indicator of ‘systemic risk appraisal’³³, threat, and stress (i.e., distress) deriving from a combination of multiple social and individual dimensions emerging as a direct or indirect consequence of the COVID-19 pandemic in Portugal. This indicator was found to have positive strong to moderate correlations with relevant epidemiological indicators, namely: 1) the cumulative number of SARS-CoV-2 confirmed daily infections; 2) the total daily number of new COVID-19 deaths; and 3) the cumulative daily number of COVID-19 hospitalizations in Intensive Care Units (Domingos et al., 2022; Gaspar et al., 2022b). Over two years, this work enabled: 1) continued monitoring of demands and resources perceptions associated with the COVID-19 pandemic in Portugal, as a longitudinal indicator of COVID-19 systemic risk appraisal, threat, and stress; and 2) the identification of expressions associated with COVID-19 demands and resources perceptions, as indicative of different COVID-19 crisis templates emerging over the course of the pandemic (i.e., different qualitative configurations of COVID-19 demands and resources perceptions over time). All in all, the work produced regular reports and recommendations for communication, informing health authorities and policymakers about such perceptions

³³ The perception and assessment (i.e., individual or public subjective evaluation/appraisal) concerning the probability of unexpected, unwanted, and negative consequences occurring at various dimensions (e.g., economy, health system, social relations) and levels of the social system (Domingos et al., 2022; Gaspar et al., 2022b).

evolution over time, and providing data for comparison with other methodologies implemented by the Directorate-General for Health and its partners (e.g., Instituto Nacional de Saúde Doutor Ricardo Jorge – INSA; Portuguese Behavioural Science Task Force in the context of COVID-19 pandemic), such as epidemiological data and public perception surveys.

As a last practical implication, the knowledge and data gathered about demands and resources perceptions over the course of this doctoral work, which included comments/expressions made by participants and the identification of exemplars (i.e., specific words associated with demands and resources perceptions used by participants), either in the context of heat waves or in the context of the COVID-19 pandemic, also has the potential for being used in the development of computer-based approaches. These can enable automated monitoring of indicators of demands and resources perceptions, threat and stress correlates, and other psychological and behavioural responses. The goal of such approaches is to provide up-to-date and accurate information to decision makers and health authorities about how people are responding to current or emerging risks and crisis, in nearly real time, potentiating institutional response to promote citizens physical and psychological health and wellbeing.

Final Remarks

The work reported in this Doctoral Thesis provided a better understanding about demands and available coping resources perceptions, as indicators of threat and stress associated with extreme hot weather events such as heat waves, over time and across different geographical locations of Portugal. This included not only identifying factors influencing heat wave demands and available coping resources perceptions, and their impacts on heat protection intentions, but also identifying associated qualitative content, providing evidence and better understanding about the beliefs, emotional responses, behaviours, arguments, and preferred terminology people may have about such events in the Portuguese context.

Conducted exclusively with Portuguese samples, this work enabled: 1) the development of a theory-driven and evidence based framework to collect and code expressions of demands and resources perceptions in contexts of extreme hot weather events (i.e., heat waves), which was also later adapted to epidemic/pandemic events (i.e., COVID-19); 2) the identification of cognitive, affective, and sociodemographic predictors of heat wave demands and resources perceptions, and heat protection intentions; 3) better understanding about the effects that such cognitive, affective, and sociodemographic factors, in particular positive affect about heat, have

on heat wave demands and resources perceptions, and their combined effects on heat protection intentions; and 4) the identification of seasonal variations in heat wave demands and resources perceptions, across different heat wave geographical susceptibility locations of Portugal, as an indicator of heat wave feelings threat and stress, including predictors of such variation. This work further enabled providing health authorities and policymakers in Portugal with indicators about how the Portuguese population perceived the demands and resources associated both with heat waves and COVID-19 related events, which included recommendations for risk and crisis communication (e.g., Arriaga et al., 2020, 2021; DGS, 2021; Domingos et al., 2022; Gaspar et al., 2021b, 2022a, 2022b, 2021c, 2020a, 2020b, 2020c; OPP, 2020b).

Considering the vulnerability of Portugal to climate change (Naumann et al., 2020; Rocha et al., 2020; Rodrigues et al., 2021; Schleussner et al., 2019), its inequities and inequalities in the access to physical, psychological, and mental healthcare (Di Meglio et al., 2018; Mauritti et al., 2019; Moreira, 2011; OPP, 2020a; Rego et al., 2013; Rodrigues, 2019; Rodrigues et al., 2020, 2021; Silva, 2012), the fact that extreme hot weather events are expected to become more frequent, intense, and long lasting (Clayton et al., 2015; Hajat et al., 2014; Howe et al., 2019; IPCC, 2014, 2022; Lefevre et al., 2015; WEF, 2017; WHO, 2015), and the probability of emergence of future physical and mental public health crisis as result of changing environmental factors (Clayton et al., 2014, 2021; IPCC, 2014, 2022; Swim et al., 2009; WHO, 2015), the current Doctoral Thesis provides an important contribute to better understand how to respond to future situations. Its results provide not only preliminary evidence for the importance of monitoring people's awareness of demands and available resources (e.g., ability) to cope with extreme hot weather and other natural or man-made hazards, but also preliminary evidence that such monitoring can be successfully implemented, with relatively low costs, and provide useful knowledge to assist and inform policy and decision making in a timely manner, that is, while that knowledge and information is still up-to-date and can make an impact in risk and crisis interventions and communications. Moreover, it had the advantage of providing not only a quantitative approach, but also a qualitative approach, adding meaning and context to the perceptions of heat wave demands and resources, and later of COVID-19.

Overall, and despite its focus on heat waves, this work provides a first step at creating and implementing an integrated approach for monitoring demands and resources perceptions at the individual and social levels, across different contexts and geographical locations, and for different types of events: disease outbreaks, extreme weather events amplified by climate change, and other applications. Besides providing recommendations for theory and practice, it

also prepared the way for the development of future computer-based approaches for automating such monitoring. The goal is to ensure that individual, collective, and institutional responses can happen more often, and before rather than after situations reach damaging levels of threat and stress for health and wellbeing, promoting protective action and building resilience. This can be accomplished by providing people with the resources they still need to adapt and cope with the demands, so that future extreme weather events, emerging risks, and crisis can be appraised more as a challenge.

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Study Materials in Portuguese Supporting Chapters II and III

Termo de Consentimento Informado

Caro(a) participante, o estudo para o qual solicitamos a sua participação realiza-se no âmbito de uma tese de doutoramento em Psicologia e centra-se no tema das “alterações globais e comportamento humano”, procurando perceber como as pessoas respondem e se adaptam perante eventos resultantes de alterações que ocorrem a nível global. O estudo será centrado num tipo de eventos específicos, que lhe apresentaremos de seguida.

Procedimento: Este estudo terá como base uma entrevista e algumas questões no formato de questionário e levará aproximadamente 30 minutos. Para tal, solicita-se que responda às perguntas e preencha as escalas de acordo com as instruções, procurando ser o mais sincero possível nas suas respostas. Não existem respostas certas ou erradas. Para motivos estritos de análise de dados, e com a sua autorização, a entrevista será gravada em áudio.

Riscos/Desconforto: Para a participação neste estudo, os riscos de desconforto dos participantes são mínimos. Eventualmente poderá sentir-se desconfortável com algumas afirmações que lhe irão ser apresentadas, no entanto, para além de ser algo que acontece muito raramente, não é essa a intenção do estudo.

Benefícios/Prejuízos: A participação neste estudo é voluntária, pelo que poderá interrompê-la a qualquer momento. A não participação não lhe trará qualquer prejuízo, e ainda contribuirá para o desenvolvimento deste estudo a nível científico.

Confidencialidade: Os dados recolhidos serão apenas utilizados para fins de investigação e não serão analisados individualmente, mas sim de forma coletiva. Além disso, não serão pedidos quaisquer dados que o identifiquem, pelo que é garantida a confidencialidade e o anonimato dos dados. Os resultados sumários deste estudo poderão ser-lhe enviados mais tarde, se assim o entender e o solicitar ao investigador.

Critérios de participação: Para poder participar terá de ter pelo menos 18 anos e a sua língua materna ser o português. Caso aceite participar, deverá dar o seu termo de aceitação selecionando a opção abaixo. Desde já muito obrigada pelo tempo dispensado e pela sua colaboração que será muito importante!

Sim, aceito participar neste estudo

Não, não aceito participar neste estudo

Introdução (antes de iniciar gravação)

Ao longo deste estudo vou fazer-lhe algumas perguntas. Por vezes vou pedir-lhe que dê a resposta a essas perguntas oralmente, por palavras suas. Noutras vezes vou pedir-lhe que dê a resposta apontando com o dedo numa escala o local onde se situa a sua resposta. Já lhe darei exemplos de como o fazer. É importante referir que não há respostas certas nem erradas. O importante é que as suas respostas descrevam o melhor possível aquilo que está a pensar ou a sentir no momento.

Vou mostrar-lhe um exemplo de cada tipo de perguntas para se tornar mais claro

Uma pergunta de resposta oral seria:

Pense por favor numa situação típica em que está a ver televisão. Pode descrever-me a situação em que pensou?

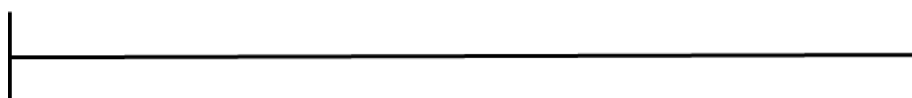
Uma pergunta de resposta apontando com o dedo numa escala seria:

Em que grau é que a situação típica em que pensou se desvia ou não se desvia daquilo que é o seu dia a dia habitual ou normal?

Para responder a esta questão basta colocar o dedo sobre esta linha, no sítio que mais represente a sua resposta. Se considera que a situação típica em que pensou é completamente igual ao seu dia a dia normal, coloque o dedo mais sobre a metade esquerda (fazer o gesto para mostrar ao participante). Se considera que a situação típica em que pensou é extremamente diferente do seu dia a dia normal coloque o dedo mais sobre a metade direita (fazer o gesto para mostrar ao participante). Quanto mais perto das pontas da linha colocar o dedo (fazer o gesto para mostrar ao participante), mais forte é o seu sentimento. Ou seja, quando mais perto do extremo esquerdo maior o seu sentimento de que a situação é completamente igual ao normal, e quanto mais perto do extremo direito maior o seu sentimento de que a situação é extremamente diferente do normal. Experimente você:

Completamente
igual ao normal

Extremamente
diferente do normal



Instrução Inicial

(pedir autorização ao participante antes de iniciar gravação)

Vou pedir-lhe para pensar numa situação e depois vou fazer-lhe algumas perguntas sobre o que pensou. Como lhe disse antes não há respostas certas nem erradas. O importante é que as suas respostas descrevam o melhor possível aquilo que está a pensar ou a sentir.

Instruções para Diferentes Tarefas de Evocação

Grupo Controlo

Pense por favor numa situação climatérica típica de calor extremo ou intenso (por exemplo onda de calor).

Grupo Experimental 1 (afeto negativo)

Pense por favor numa situação climatérica típica de calor extremo ou intenso (por exemplo onda de calor) que seja para si desagradável .

Grupo Experimental 2 (afeto positivo)

Pense por favor numa situação climatérica típica de calor extremo ou intenso (por exemplo onda de calor) que seja para si agradável.

Peço que pense naquilo que é comum neste tipo de situações, nas características típicas destas situações.

Questões para Exploração da Situação Evocada

1. Pode descrever-me, o melhor possível, a situação típica em que pensou? (Se o participante tiver dificuldade – Pode descrever-me, o melhor possível, aquilo em que pensou?)

1.1. (Caso o exemplo dado pelo participante não incluía comportamentos ou ações realizadas pelo próprio) Na situação que referiu, pode dizer-me qual ou quais seriam os seus comportamentos nessa situação típica (por exemplo, o que faria)?

1.2. Em relação à situação climatérica de calor extremo ou intenso em que pensou, qual diria que é a temperatura típica (em graus celsius), que ocorre ou é registada, nesse tipo de situação? (registar temperatura média ou intervalo de temperaturas, consoante o que a pessoa referir)

2. Comparando com o seu dia a dia habitual, a situação típica em que pensou é uma situação fora do normal?

2.1.A. (Se sim) Em que aspeto(s) é que a situação típica em que pensou é fora do habitual ou do normal daquilo que é o seu dia a dia?

(Caso não fique patente na resposta) Pode dar-me exemplos de indicadores que o levam a perceber/dizer que essa situação é fora do habitual ou normal daquilo que é o seu dia a dia?

(Se a resposta não permitir inferir a tendência afetiva explorar no final da resposta, tentando compreender se a situação se diferencia do habitual ou normal pela positiva ou pela negativa) Como vê esta diferença em relação àquilo que é o normal: como algo negativo, positivo, ou nem negativo nem positivo?

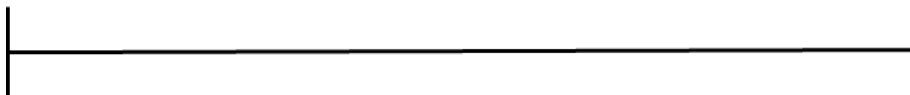
2.1.B. (Se não) Em que aspeto(s) é que a situação em que pensou é igual ao habitual ou normal no seu dia a dia?

(Se a resposta não permitir inferir a tendência afetiva explorar no final da resposta, tentando compreender se a situação se diferencia do habitual ou normal pela positiva ou pela negativa) Como vê esta diferença em relação àquilo que é o normal: como algo negativo, positivo, ou nem negativo nem positivo?

2.2. Em que grau ou em que medida é que a situação típica em que pensou se desvia ou não se desvia daquilo que é o seu dia a dia habitual ou normal?

Completamente
igual ao normal

Extremamente
diferente do normal

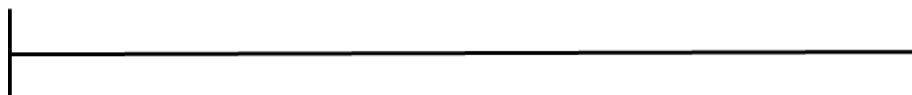


3. A situação típica em que pensou anteriormente, poderia interferir de alguma forma com a sua vida profissional, académica ou com alguma atividade que faça normalmente no seu dia a dia? (Se sim) Em que aspeto(s)?

3.1. Em que grau é que a situação típica em que pensou anteriormente, poderia interferir ou não interferir com a sua vida profissional, académica ou com alguma atividade que faça normalmente no seu dia a dia?

Não interferiu nada com a
minha vida profissional

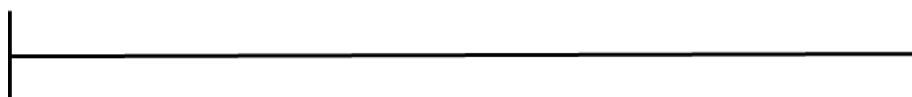
Interferiu extremamente com
a minha vida profissional



4. Em que medida é que a situação típica em que pensou é uma situação ameaçadora para si?

Nada ameaçadora

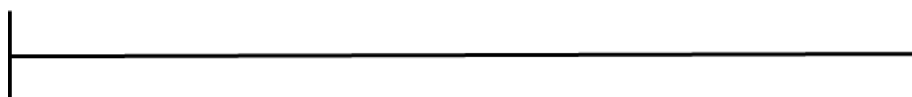
Extremamente ameaçadora



5. Nos últimos 6 meses, com que frequência ocorreram situações semelhantes àquela em que pensou?

Nada frequentes

Extremamente frequentes



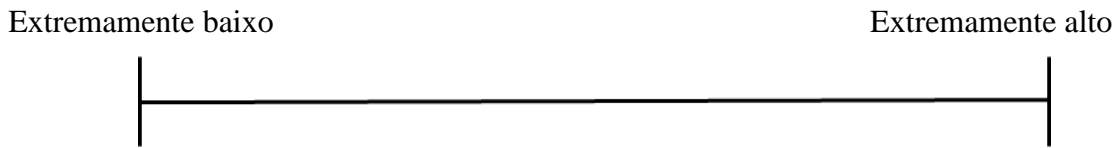
6. Considera que situações climatéricas de calor extremo ou intenso como aquela em que pensou são situações que lhe colocam exigências, ou seja, dificuldades e barreiras, que em circunstâncias normais não teria ou que teria menos?

6.1. (Se sim) Pode descrever qual ou quais considera serem as exigências, ou seja, as dificuldades e barreiras colocadas por situações climatéricas de calor extremo ou intenso como aquela em que pensou?

a) Qual(quais) dessas exigências se aplicam apenas aos outros?

b) Qual(quais) dessas exigências se aplicam a si?

6.2. Como classifica o nível de exigências que as situações climatéricas de calor extremo ou intenso, como aquela em que pensou, têm para si?



7. Tendo em conta o nível de exigências que as situações climatéricas de calor extremo ou intenso como aquela em que pensou têm para si, o que faz para lidar com essas exigências ou impedir que estas o afetem?

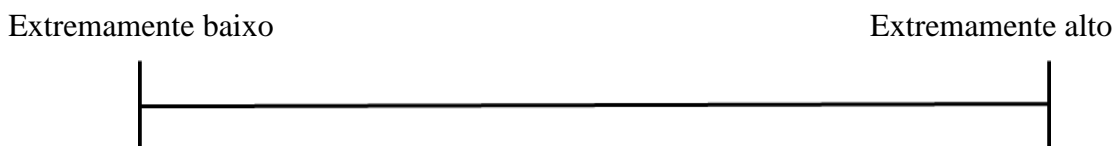
7.1. Pode descrever qual ou quais considera serem os recursos que as pessoas, em geral, podem usar para enfrentar as exigências colocadas pelas situações climatéricas de calor extremo ou intenso como aquela em que pensou (ou seja, quais os recursos que as pessoas podem usar para fazer frente a situações climatéricas de calor extremo ou intenso)?

7.2. Pode descrever qual ou quais considera serem os recursos que você pode usar para enfrentar as exigências colocadas pelas situações climatéricas de calor extremo ou intenso como aquela em que pensou (referir exigências referidas pelo participante anteriormente como exemplo. Se o participante tiver dificuldade – o que pode fazer para lidar com situações de calor extremo ou intenso como aquela em que pensou)?

a) Tem acesso a todos esses recursos?

b) Para além desses recursos, existem recursos aos quais você não tem acesso? Porquê?

7.3. Como classifica o nível de recursos que você tem à sua disposição ou a que você tem acesso para lidar com as exigências colocadas por situações climatéricas de calor extremo ou intenso como aquela em que pensou?



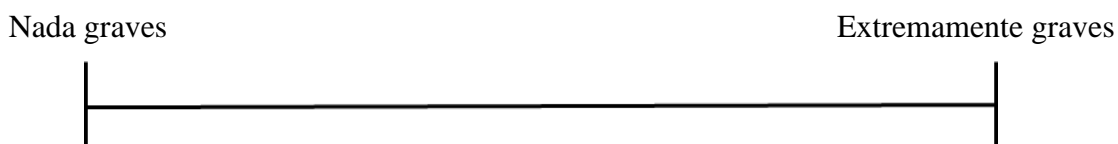
8. Tem alguma estratégia pessoal para lidar com as exigências colocadas por situações climatéricas de calor extremo ou intenso como aquela em que pensou? (Se sim) Qual(quais)?

9. Em que medida é que situações climatéricas de calor extremo ou intenso como aquela em que pensou representam um risco para si?



10. Quais as consequências que as situações climatéricas de calor extremo ou intenso como aquela em que pensou podem ter para si?

10.1. Como classifica o grau de gravidade ou severidade que essa(s) consequências podem ter para si?



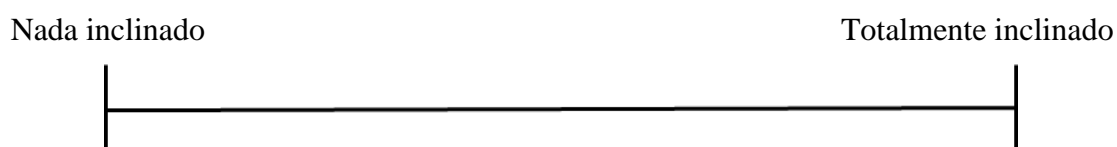
11. Com base em vários estudos meteorológicos efetuados ao longo dos anos, sabe-se que existe uma elevada probabilidade de no futuro você passar por uma situação climatérica de calor extremo ou intenso como aquela em que pensou. O que considera que poderá fazer para evitar os possíveis efeitos negativos dessa situação (por exemplo para a sua saúde)?

12. Se no futuro passar por uma situação climatérica de calor extremo ou intenso como aquela em que pensou, qual a sua intenção para ter cada um dos seguintes comportamentos:

12.1. Quão inclinado(a) estaria para beber mais água mesmo sem ter sede?



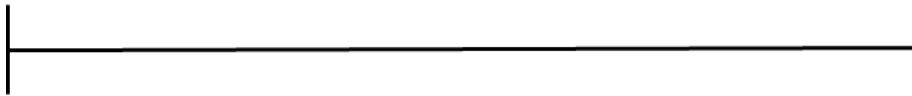
12.2. Quão inclinado(a) estaria para evitar a exposição ao sol durante as 11h e as 17h



12.3. Quão inclinado(a) estaria para ficar 2 a 3 horas num local fresco com temperatura adequada à situação, ou seja, nem muito quente nem muito fria?

Nada inclinado

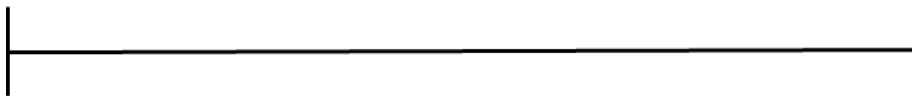
Totalmente inclinado



12.4. Quão inclinado(a) estaria para procurar locais de abrigo frescos com temperatura adequada à situação, ou seja, nem muito quente nem muito fria?

Nada inclinado

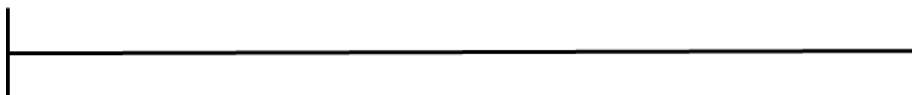
Totalmente inclinado



12.5. Quão inclinado(a) estaria para evitar beber bebidas alcoólicas e/ou açucaradas?

Nada inclinado

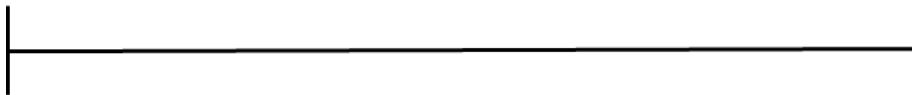
Totalmente inclinado



12.6. Quão inclinado(a) estaria para usar roupa larga, leve e fresca?

Nada inclinado

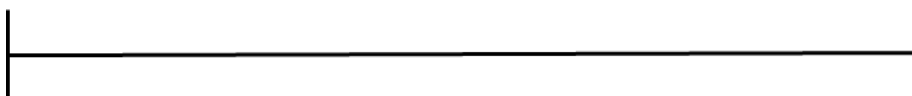
Totalmente inclinado



12.7. Quão inclinado(a) estaria para evitar que o calor entre dentro de sua casa, fechando persianas e janelas?

Nada inclinado

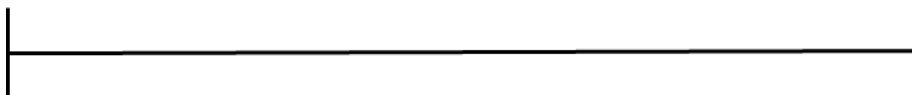
Totalmente inclinado



12.8. Quão inclinado(a) estaria para arrefecer a sua casa abrindo as janelas à noite?

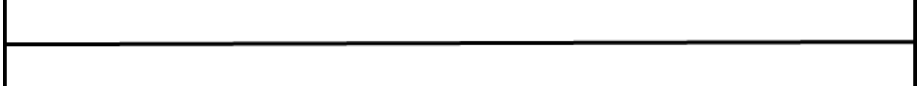
Nada inclinado

Totalmente inclinado



12.9. Quão inclinado(a) estaria para usar ar condicionado para arrefecer a casa?

Nada inclinado Totalmente inclinado



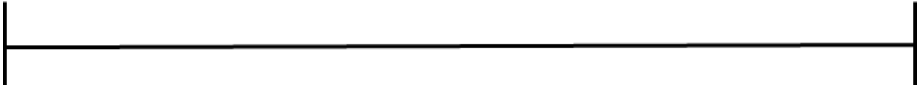
12.10. Quão inclinado(a) estaria para usar uma ventoinha para se refrescar?

Nada inclinado Totalmente inclinado



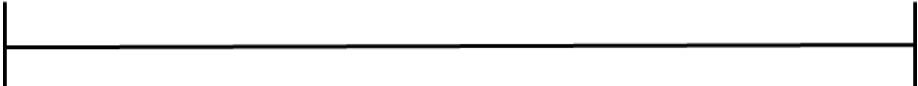
12.11. Quão inclinado(a) estaria para usar toalhas húmidas para se refrescar?

Nada inclinado Totalmente inclinado



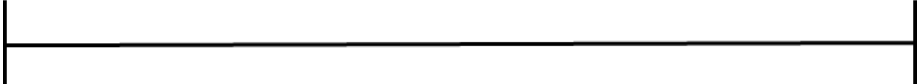
12.12. Quão inclinado(a) estaria para ir borrifando o corpo com água para se refrescar?

Nada inclinado Totalmente inclinado



12.13. Quão inclinado(a) estaria para tomar um banho fresco, ou seja, nem com água muito quente nem muito fria?

Nada inclinado Totalmente inclinado

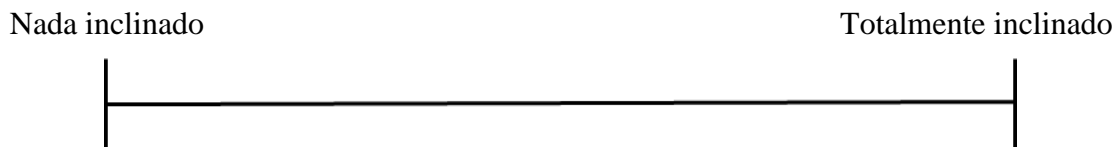


12.14. Quão inclinado(a) estaria para consultar e ler os avisos relativos ao calor extremo ou intenso comunicados pelas autoridades competentes?

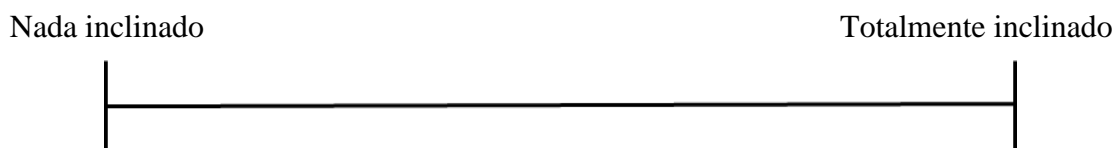
Nada inclinado Totalmente inclinado



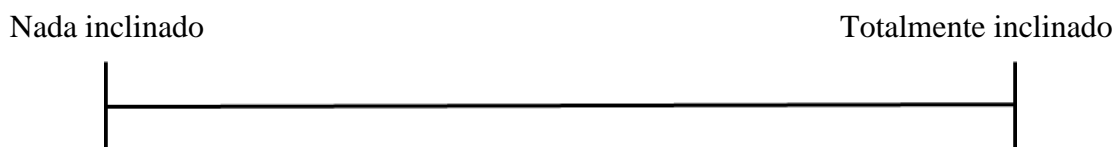
12.15. Quão inclinado(a) estaria para se informar se as pessoas que vivem perto de si (por exemplo, vizinhos) se estão a sentir bem?



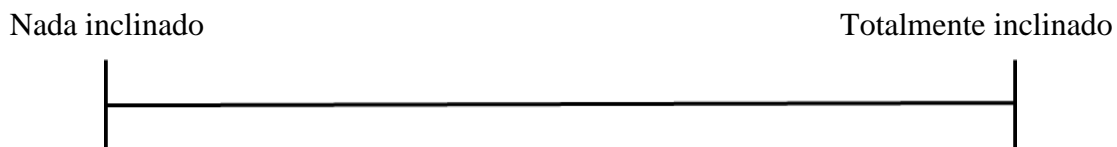
12.16. Quão inclinado(a) estaria para se informar se as pessoas que vivem consigo se estão a sentir bem?



12.17. Quão inclinado(a) estaria para pedir ajuda a um familiar ou amigo caso se sinta mal com o calor?



12.18. Quão inclinado(a) estaria para pedir ajuda a um vizinho caso se sinta mal com o calor?



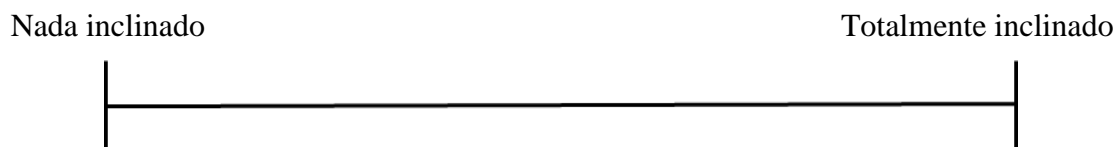
12.19. Quão inclinado(a) estaria para contactar as linhas de apoio disponibilizadas pelas autoridades de saúde (por exemplo a linha Saúde 24) caso se sinta mal com o calor?



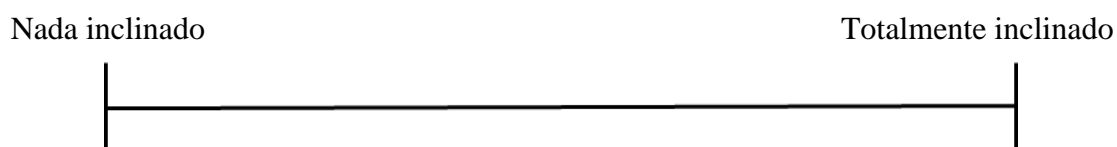
12.20. Quão inclinado(a) estaria para se deslocar à urgência do hospital caso se sinta mal com o calor?



12.21. Quão inclinado(a) estaria para se deslocar ao centro de saúde caso se sinta mal com o calor?



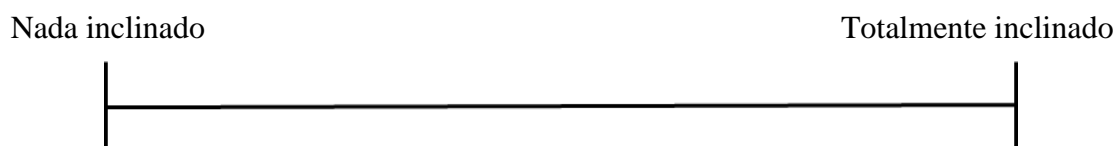
12.22. Quão inclinado(a) estaria para oferecer ou lembrar aqueles que vivem consigo de beber água?



12.23. Quão inclinado(a) estaria para verificar se aqueles que vivem consigo estão num local fresco com temperatura adequada à situação, ou seja, nem muito quente nem muito fria?



12.24. Quão inclinado(a) estaria para verificar se as pessoas que vivem perto de si (por exemplo, vizinhos) estão num local fresco com temperatura adequada à situação ou seja, nem muito quente nem muito fria?



13. Durante o ano de 2016 e até hoje, quantos dias houve de calor extremo ou intenso?

14. Após tudo aquilo que falámos, pode explicar, o que é para si uma situação climatérica de calor extremo ou intenso? (Se a resposta for vaga ou ambígua) Pode especificar melhor, com mais detalhe?

15. Acima de que valor de temperatura ou a partir de que graus celsius podemos dizer que estamos a passar por uma situação climatérica de calor extremo ou intenso?

15.1. Pode dar-me exemplos de indicadores que o levam a perceber/dizer que essa situação é fora do habitual ou normal daquilo que é o seu dia a dia. Por exemplo estando numa situação de calor, normal para a época, e ao longo dessa situação a temperatura começa a aumentar, se não tiver informação que é uma situação climatérica de calor extremo ou intenso nem informação sobre a temperatura, o que a leva a perceber a diferença?

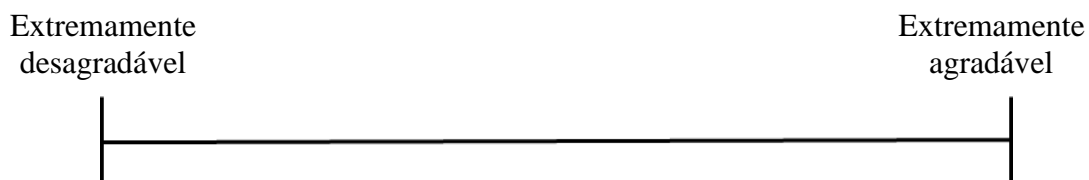
16. Na tarefa que lhe pedi no início deste estudo, para pensar numa situação climatérica típica de calor extremo ou intenso, na descrição que fez da situação...

1) Lembrou-se especificamente da última vez em que passou por uma situação climatérica de calor extremo ou intenso?

2) Lembrou-se especificamente de uma vez em que passou por uma situação climatérica de calor extremo ou intenso?

3) Fez uma descrição geral tendo em conta as características que as situações climatéricas de calor extremo ou intenso normalmente têm?

17. Na tarefa que lhe pedi no início deste estudo, para pensar numa situação climatérica típica de calor extremo ou intenso, a situação em que pensou é tipicamente uma situação



Questionário Sociodemográfico

18. Idade

19. Género (não perguntar; identificar)

M/F

20. Nível de Escolaridade

Nenhum, não sei ler nem escrever

Nenhum, mas sei ler e/ou escrever

Ensino Básico – 1º Ciclo (1º ao 4º ano ou antiga instrução primária)

Ensino Básico – 2º Ciclo (5º ao 6º ano ou antigo ciclo preparatório)

Ensino Básico – 3º Ciclo (7º ao 9º ano ou antigo 3º ao 5º ano do liceu)

Ensino Secundário (10º ao 12º ano ou antigo 6º ao 7º ano do liceu)

Ensino Pós-Secundário (Cursos de Especialização Tecnológica)

Ensino Superior – Bacharelato (inclui antigos cursos médios)

Ensino Superior (Licenciatura)

Ensino Superior (Mestrado)

Ensino Superior (Doutoramento)

Prefiro não responder

21. Localidade de residência (onde passa a maior parte da sua vida)

22. Há quanto tempo reside nesta localidade?

23. Habitualmente passa a maior parte do Verão nessa localidade?

Sim/Não

(se não) Se não passa a maior parte do Verão nessa localidade, em que localidade costuma passar o Verão?

24. Ao longo da sua vida residiu em mais alguma localidade?

Sim/Não

(se sim) Qual localidade? Durante aproximadamente quanto tempo?

25. Reside em Portugal há mais de 30 anos ou desde que nasceu?

Sim/Não

(se não) Em que país ou países residiu? Durante quanto tempo?

26. Estado Civil

Solteiro(a)

Viúvo(a)

Casado(a) ou união de facto

Divorciado(a)

27. Vive sozinho?

Sim/Não

28. Faz exercício físico?

Sim/Não

(se sim) Se sim, quantas horas por semana?

29. Tem alguma condição que o impeça de se expor ao calor ou de "apanhar" calor?

Sim/Não

(se sim) Se sim, qual?

30. Foi-lhe diagnosticado pelo médico ou algum especialista estar em risco crónico de desidratação?

31. Qual a sua condição perante o trabalho?

Nunca Trabalhei

Estudante

Trabalhador Estudante

Empregado

Desempregado

Reformado

32. A sua atividade profissional, académica ou outra atividade que ocupe grande parte do seu dia a dia, obriga-o a expor-se ao calor?

Sim/Não

(se sim) Quantas horas por dia está exposto(a) ao calor? Em que período do dia?

Entre as 7h e as 11h

Entre as 11h e as 15h

Entre as 15h e as 19h

Todo o dia

Study Materials in Portuguese Supporting Chapters IV and V

Consentimento Informado & Instrução Inicial

(Momento 1 – Antes do Verão)

Caro(a) participante, solicitamos a sua colaboração num estudo que pretende compreender o modo como as pessoas lidam com eventos naturais e alterações climáticas, como por exemplo a temperatura e o clima associados às várias estações do ano.

Calendarização do estudo: Este estudo vai decorrer entre junho e outubro de 2018, estando dividido em 4 momentos de resposta. O momento atual corresponde ao 1º momento. Em cada momento estimamos que a sua participação dure aproximadamente 30 minutos. Se aceitar participar, é bastante importante que participe em todos os 4 momentos para que o estudo atinja todos os objetivos pretendidos.

Relativamente aos 4 momentos prevemos a seguinte calendarização: 1º Momento: 4 de junho a 18 de junho – Primavera; 2º Momento: 23 de julho a 6 de agosto – Verão; 3º Momento: 7 de agosto a 14 de outubro – Verão; 4º Momento: 15 de outubro a 29 de outubro – Outono.

Recompensa pela participação: Tendo em conta a duração do estudo vamos sortear 20 vouchers de 50 euros, em cartão SONAE (utilizáveis por exemplo nas lojas Continente, Worten, Modalfa, Zippy, Sport Zone, Wells, etc.). Apenas os participantes que participem nos 4 momentos ficam habilitados a este sorteio. O sorteio vai decorrer no dia 12 de novembro de 2018. Caso seja contemplado com um dos vouchers será contactado nesse dia.

Cada pessoa apenas pode participar uma vez por momento, sendo que o programa informático usado neste estudo deteta múltiplas participações da mesma pessoa no mesmo momento, invalidando a participação.

Forma de contacto: Caso aceite participar necessitamos do seu endereço de email. Este não será usado para quaisquer outros fins que não o seu contacto no âmbito deste estudo e não será partilhado com terceiros. Sempre que o contactarmos no futuro iremos fazê-lo a partir do endereço samuel.domingos@sapo.pt ou rgaspar@fch.lisboa.ucp.pt, com o assunto “Estudo sobre eventos naturais e alterações climáticas”.

Código de Participação: De forma a permitir registar a sua participação nos 4 momentos, necessitamos de lhe atribuir um Código de Participação. Para criar este código, iremos pedir-lhe a segunda letra do seu primeiro nome, a segunda letra do seu último nome, e o seu ano de nascimento, como no exemplo seguinte: Teresa Santos 1947 – Código de Participação = EA1947.

Condições de participação: A participação neste estudo é voluntária, pelo que poderá interrompê-la a qualquer momento. Se decidir não participar, ou se interromper a sua participação em qualquer um dos momentos do estudo isso não lhe trará qualquer prejuízo.

Confidencialidade: Os dados recolhidos serão utilizados apenas para fins de investigação e apenas os membros da equipa de investigação (Samuel Domingos; Rui Gaspar de Carvalho; João Marôco) terão acesso aos mesmos. As respostas não serão analisadas individualmente, mas sim de forma coletiva, sendo garantida a confidencialidade e o anonimato. Se por algum motivo pretender eliminar os seus dados e respostas pode fazê-lo. Para tal basta enviar um email para samuel.domingos@sapo.pt a solicitá-lo.

Se aceita participar no estudo, nas condições expressas acima, dê o seu termo de aceitação selecionando a opção em baixo.

Sim, aceito participar neste estudo.

Não, não aceito participar neste estudo.

Questionário

1. Afeto Positivo face ao Calor (Lefevre et al., 2015)

Pedimos-lhe que leia as seguintes afirmações e indique em que medida concorda ou discorda com cada uma, tendo em conta aquilo que o calor significa para si.

It1. Adoro o tempo quente

It2. Quero ficar bronzeado(a)

It3. Passo tempo ao sol quando posso

It4. Preocupo-me com os cancros de pele

It5. Um impacto positivo das alterações climáticas é que os verões vão ficar mais quentes

It6. Quando vou de férias vou em busca de calor ou tempo quente

Opções de resposta para cada item: 1 “Discordo Totalmente”; 2 “Discordo”; 3 “Nem Discordo nem Concordo”; 4 “Concordo”; 5 “Concordo Totalmente”.

2. Thinking Styles – Rational-Experiential Inventory (REI) short version (Epstein, Pacini, Denes-Raj, & Heier, 1996)

Vamos apresentar-lhe um conjunto de afirmações que exprimem formas de pensar e sentir. Leia atentamente cada afirmação e indique em que medida concorda ou discorda com cada uma.

NC

It1. Não gosto de ter de pensar muito

It2. Tento evitar situações que requerem ter de pensar em profundidade sobre algo

It3. Prefiro fazer algo que desafie as minhas capacidades de pensamento em vez de fazer algo em que tenha de pensar pouco

It4. Prefiro problemas complexos a problemas simples

It5. Pensar muito e durante muito tempo é algo que me dá pouca satisfação

FI

It6. Confio nos meus sentimentos iniciais acerca das pessoas

It7. Creio poder confiar nos meus palpites

It8. As minhas primeiras impressões acerca dos outros estão quase sempre certas

It9. Quando se trata de confiar nas pessoas, geralmente posso confiar nos meus instintos

It10. Normalmente consigo sentir se uma pessoa está certa ou errada, mesmo que não consiga explicar como sei isso

Opções de resposta para cada item: 1 “Discordo Totalmente”; 2 “Discordo”; 3 “Nem Discordo nem Concordo”; 4 “Concordo”; 5 “Concordo Totalmente”.

3. Escala Afeto – PANAS-VRP (Galinha, Pereira, & Esteves, 2014)

Vamos apresentar-lhe um conjunto de palavras que descrevem diferentes sentimentos e emoções. Leia atentamente cada palavra e indique em que medida sentiu cada um destes sentimentos e emoções nas últimas duas semanas.

Nas últimas duas semanas senti-me...

Interessado(a)

Nervoso(a)

Entusiasmado(a)

Amedrontado(a)

Inspirado(a)

Ativo(a)

Assustado(a)

Culpado(a)

Determinado(a)

Atormentado(a)

Opções de resposta para cada item: 1 “Nada ou muito ligeiramente”; 2 “Um pouco”; 3 “Moderadamente”; 4 “Bastante”; 5 “Extremamente”.

4. Escala Exigências (Self)

Vamos apresentar-lhe um conjunto de afirmações que representam possíveis exigências colocadas por vagas de calor. Leia atentamente cada uma e indique em que medida concorda ou discorda com cada afirmação.

Quando ocorrem vagas de calor...

It1. Há maior perigo para a minha saúde física/corporal (mais dores de cabeça, constipações, etc.)

It2. Há maior perigo para a minha saúde mental (mais stress, ansiedade, nervosismo, etc.)

It3. Há maior perigo para a minha vida (maior probabilidade de desmaiar, perder os sentidos, morrer, etc.)

It4. Há maior perigo para a minha vida social (maior probabilidade de ficar isolado, afastado dos outros, perder eventos sociais, etc.)

It5. Há maior perigo para pessoas ditas mais “vulneráveis” (crianças, idosos, etc.)

It6. Há maior perigo para o meio ambiente (animais, plantas, etc.)

It7. Faço um maior esforço metabólico (mais transpiração, alterações na pressão arterial, etc.)

It8. Faço um maior esforço físico (mais a cansaço, lentidão, fraqueza, etc.)

It9. Faço um maior esforço mental (mais preocupações, dificuldade em pensar, etc.)

It10. Faço um maior esforço emocional (mais alterações de humor, desconforto, irritabilidade, etc.)

It11. Tenho um maior esforço financeiro (mais gastos com equipamentos de climatização, ventoinhas, energia elétrica no uso de equipamentos, etc.)

It12. Tenho mais dúvidas face ao que me pode acontecer (consequências, malefícios, perigos para mim, etc.)

It13. Tenho mais dúvidas face ao que fazer para me proteger desse calor (se tenho recursos suficientes, que comportamentos devo ter, etc.)

Opções de resposta para cada item: 1 “Discordo Totalmente”; 2 “Discordo”; 3 “Nem Discordo Nem Concordo”; 4 “Concordo”; 5 “Concordo Totalmente”.

5. D/R Appraisal – Primary Appraisal – Demands (based on Tomaka, Blascovich, Kelsey, Leitten, 1993)

Pense nas exigências (possível perigo, esforço, dúvidas) que poderão existir em situações de vaga de calor.

No geral, como classifica o nível de exigências que as situações de vaga de calor têm:

It1. Para si?

It2. Para as pessoas da sua família?

It3. Para a população Portuguesa em geral?

It4. Para a população Mundial em geral?

Opções de resposta para cada item: 1 “Extremamente Baixo”; 2 “Baixo”; 3 “Moderado”; 4 “Elevado”; 5 “Extremamente Elevado”.

6. Escala Recursos (Self)

Vamos apresentar-lhe um conjunto de afirmações que representam possíveis recursos para lidar com as exigências colocadas por vagas de calor. Leia atentamente cada uma e indique em que medida concorda ou discorda com cada afirmação.

Quando ocorrem vagas de calor...

It1. Tenho equipamentos que me podem ajudar a lidar com esse calor (ar condicionado, ventoinhas, etc.)

It2. Tenho vestuário que me pode ajudar a lidar com esse calor (roupas adequadas, chapéus, etc.)

It3. Tenho objetos que me podem ajudar a lidar com esse calor (leques, borrifadores, etc.)

It4. Tenho tecnologias de informação e comunicação que me podem ajudar a lidar com esse calor (redes sociais, aplicações de smartphone, etc.)

It5. Tenho recursos financeiros que me podem ajudar a lidar com esse calor (dinheiro disponível para uso imediato, poupanças, etc.)

It6. Tenho acesso a locais que me podem ajudar a lidar com esse calor (sombras, lugares frescos, etc.)

It7. Tenho capacidades físicas que me podem ajudar a lidar com esse calor (a minha resistência física, saúde física, etc.)

It8. Tenho capacidades mentais que me podem ajudar a lidar com esse calor (a minha capacidade de planeamento, de pensar em estratégias, etc.)

It9. Tenho capacidades emocionais que me podem ajudar a lidar com esse calor (a minha capacidade de saber controlar e lidar com as minhas emoções, de saber reconhecer o que estou a sentir, etc.)

It10. Tenho comportamentos de evitamento que me podem ajudar a lidar com esse calor (fugir do calor, evitar sair à rua, etc.)

It11. Tenho comportamentos de enfrentamento que me podem ajudar a lidar com esse calor (procurar locais que me protejam, hidratar o corpo, etc.)

It12. Tenho características da minha personalidade que me podem ajudar a lidar com esse calor (ser calmo, paciente, compreensivo, interessado, etc.)

It13. Tenho formas de pensar e agir que me podem ajudar a lidar com esse calor (ser proativo, preventivo, etc.)

It14. Tenho familiares e amigos que me podem dar suporte e ajudar a lidar com esse calor (parentes, vizinhos, etc.)

It15. Tenho acesso a profissionais que me podem dar recomendações e ajudar a lidar com esse calor (profissionais de saúde, bombeiros, etc.)

It16. Tenho disponível informação que me pode ajudar a lidar com esse calor (panfletos informativos, páginas da internet, etc.)

It17. Tenho a crença que Deus, outra força espiritual, ou a minha própria força de espírito me pode ajudar a lidar com esse calor

It18. Tenho instituições que me podem ajudar a lidar com esse calor se for necessário (associações, instituições, autoridades, etc.)

Opções de resposta para cada item: 1 “Discordo Totalmente”; 2 “Discordo”; 3 “Nem Discordo Nem Concordo”; 4 “Concordo”; 5 “Concordo Totalmente”.

7. D/R Appraisal – Secondary Appraisal – Resources (based on Tomaka, Blascovich, Kelsey, Leitten, 1993)

Pense nos recursos (equipamentos, objetos, conhecimentos, habilidades, capacidades, suporte externo, etc.) que poderão existir para lidar com situações de vaga de calor.

No geral, como classifica o nível de recursos que os seguintes têm para lidar com situações de vaga de calor:

It1. Você?

It2. As pessoas da sua família?

It3. A população Portuguesa em geral?

It4. A população Mundial em geral?

Opções de resposta para cada item: 1 “Extremamente Baixo”; 2 “Baixo”; 3 “Moderado”; 4 “Elevado”; 5 “Extremamente Elevado”.

8. Risco Percebido (Próprio, Família, Outros)

Seguidamente pedimos-lhe que pense no nível de risco que as situações de vaga de calor poderão ter para si, para a sua família, e para as outras pessoas em geral.

Como classifica o nível de risco que as situações de vaga de calor têm ou podem ter:

It1. Para si?

It2. Para as pessoas da sua família?

It3. Para a população Portuguesa em geral?

It4. Para a população Mundial em geral?

Opções de resposta para cada item: 1 “Extremamente Baixo”; 2 “Baixo”; 3 “Moderado”; 4 “Elevado”; 5 “Extremamente Elevado”.

9. Intenções

Vamos apresentar-lhe um conjunto de frases que representam possíveis comportamentos que pode ter durante situações de vaga de calor. Se no futuro passar por uma vaga de calor indique qual a sua intenção para ter cada um desses comportamentos.

Se no futuro passar por uma vaga de calor quão inclinado(a) estaria para...

It1. Beber mais água mesmo sem ter sede

It2. Evitar a exposição ao sol durante as 11h e as 17h

It3. Ficar 2 a 3 horas num local fresco com temperatura adequada à situação (nem muito quente nem muito fria)

It4. Procurar locais de abrigo frescos com temperatura adequada à situação (nem muito quente nem muito fria)

It5. Evitar beber bebidas alcoólicas

It6. Evitar beber bebidas açucaradas

It7. Usar roupa larga, leve e fresca

It8. Evitar que o calor entre dentro de casa fechando persianas e janelas durante o dia

It9. Arrefecer a casa abrindo as janelas à noite

It10. Usar ar condicionado para arrefecer a casa

- It11. Usar ventoinha(s) para arrefecer a casa
- It12. Colocar toalhas húmidas sobre o corpo para se refrescar
- It13. Borrifar o corpo com água para se refrescar
- It14. Tomar um banho refrescante
- It15. Consultar os avisos relativos ao calor extremo comunicados pelas autoridades
- It16. Se informar se as pessoas que vivem consigo ou que lhe são mais próximas (familiares) se estão a sentir bem
- It17. Se informar se as pessoas que vivem perto de si (vizinhos) se estão a sentir bem
- It18. Pedir ajuda a um familiar ou amigo caso se sinta mal com o calor
- It19. Pedir ajuda a um vizinho caso se sinta mal com o calor
- It20. Contactar as linhas de apoio disponibilizadas pelas autoridades de saúde (linha Saúde 24) para saber mais sobre os efeitos do calor na saúde
- It21. Se deslocar ao hospital ou centro de saúde caso se sinta mal com o calor
- It22. Oferecer ou lembrar aqueles que vivem consigo ou que lhe são mais próximos (familiares) de beber água
- It23. Oferecer ou lembrar aqueles que vivem perto de si (vizinhos) de beber água
- It24. Verificar se aqueles que vivem consigo ou que lhe são mais próximos (familiares) estão num local fresco com temperatura adequada à situação (nem muito quente nem muito fria)
- It25. Verificar se as pessoas que vivem perto de si (vizinhos) estão num local fresco com temperatura adequada à situação (nem muito quente nem muito fria)

Opções de resposta para cada item: 1 “Nada Inclinado”; 2 “Pouco Inclinado”; 3 “Inclinado”; 4 “Muito Inclinado”; 5 “Totalmente Inclinado”.

10. Normalidade

Seguidamente pedimos-lhe para pensar quão normal para a estação do ano em que estamos, tem sido a temperatura que se fez sentir nos últimos cinco dias.

10.1. Em que medida considera que a temperatura que se fez sentir nos últimos cinco dias foi normal para a estação do ano em que estamos?

Opções de resposta: 1 “Nada Normal”; 2 “Pouco Normal”; 3 “Moderadamente Normal”; 4 “Quase Normal”; 5 “Completamente Normal”.

10.2. Nos últimos cinco dias diria que esteve:

Opções de resposta: 1 “Muito mais frio/fresco que o normal para a estação do ano”; 2 “Um pouco mais frio/fresco que o normal para a estação do ano”; 3 “Nem mais frio/fresco ou quente/calor que o normal para a estação do ano”; 4 “Um pouco mais quente/calor que o normal para a estação do ano”; 5 “Muito mais quente/calor que o normal para a estação do ano”.

11. Interferência

Seguidamente pedimos-lhe para pensar em que medida considera que a temperatura que se fez sentir nos últimos cinco dias interferiu com a sua vida, com a vida da sua família, e com a vida das outras pessoas em geral.

Em que medida considera que a temperatura que se fez sentir nos últimos cinco dias interferiu com:

It1. A sua vida?

It2. A vida das pessoas da sua família?

It3. A vida da população Portuguesa em geral?

It4. A vida da população Mundial em geral?

Opções de resposta para cada item: 1 “Nada”; 2 “Pouco”; 3 “Moderadamente”; 4 “Muito”; 5 “Extremamente”.

12. Atitudes face às vagas de calor (Negatividade/Positividade; adaptado da Tese de Mestrado)

Quando pensa em vagas de calor, o que é que isso o(a) faz sentir?

	1	2	3	4	5	
Extremamente mal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente bem
Extremamente insatisfeito(a)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente satisfeito(a)
Extremamente desconfortável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente confortável
Extremamente negativo	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente positivo

13. BriefCope (Marôco, Campos, Bonafé, Vinagre, & Pais-Ribeiro, 2014)

Vamos apresentar-lhe um conjunto de afirmações que exprimem formas de lidar com o stress e com as preocupações. Leia atentamente cada afirmação e indique em que medida implementa ou não cada uma das seguintes ações para lidar com vagas de calor. Não responda com base no que lhe parece que deveria ser feito, mas sim com base no que faz ou não para lidar com as vagas de calor e com as suas consequências.

Quando ocorrem vagas de calor...

- It1. Concentro os meus esforços em alguma coisa que me permita enfrentar a situação
- It2. Tomo medidas para tentar melhorar a minha situação (desempenho)
- It3. Tento encontrar uma estratégia que me ajude no que tenho que fazer
- It4. Penso muito sobre a melhor forma de lidar com a situação
- It5. Peço conselhos e ajuda a outras pessoas para enfrentar melhor a situação
- It6. Peço conselhos e ajuda a pessoas que passaram pelo mesmo
- It7. Procuo apoio emocional de alguém (família, amigos)
- It8. Procuo o conforto e compreensão de alguém

- It9. Tento encontrar conforto na minha religião ou crença espiritual
- It10. Rezo ou medito
- It11. Tento analisar a situação de maneira diferente, de forma a torná-la mais positiva
- It12. Procuro algo positivo em tudo o que está acontecendo
- It13. Faço críticas a mim mesmo
- It14. Culpo-me pelo que está acontecendo
- It15. Tento aceitar as coisas tal como estão acontecendo
- It16. Tento aprender a viver com a situação
- It17. Fico aborrecido(a) e expesso os meus sentimentos (emoções)
- It18. Sinto e expesso os meus sentimentos de aborrecimento
- It19. Tenho dito para mim mesmo(a): “isto não é verdade”
- It20. Recuso-me a acreditar que isto esteja a acontecer comigo
- It21. Refugio-me noutras atividades para me abstrair da situação
- It22. Faço outras coisas para pensar menos na situação, tal como ir ao cinema, ver TV, ler, sonhar ou ir às compras
- It23. Desisto de me esforçar para obter o que quero
- It24. Simplesmente desisto de tentar atingir o meu objetivo
- It25. Refugio-me no álcool ou noutras drogas (comprimidos, etc.) para me sentir melhor
- It26. Uso álcool ou outras drogas (comprimidos, etc.) para me ajudar a ultrapassar os problemas
- It27. Enfrento a situação levando-a para a brincadeira
- It28. Enfrento a situação com sentido de humor

Opções de resposta para cada item: 0 “Nunca Fiz Isto”, 1 “Faço Isto Poucas Vezes”; 2 “Faço Isto Algumas Vezes”; 3 “Costumo Fazer Isto”; 4 “Faço Sempre Isto”.

Questionário Sociodemográfico

14. Idade

15. Sexo

M/F

16. Nível de Escolaridade

Nenhum (nunca fui à escola)

Ensino Básico (primária e/ou ciclo)

Ensino Secundário (10º ao 12º ano)

Ensino Pós-Secundário (Cursos de Especialização Tecnológica)

Ensino Superior (Bacharelato, Licenciatura, Mestrado, Doutoramento)

17. Localidade de Residência

18. Localidade onde passou as últimas duas semanas

19. Estado Civil

Solteiro(a)

Viúvo(a)

Casado(a) ou União de Facto

Divorciado(a)

20. Vive sozinho?

Sim/Não

21. Faz exercício físico?

Sim/Não

(se sim) Se sim, aproximadamente quantas horas por semana?

22. Tem alguma condição que o impeça de se expor ao calor ou de "apanhar" calor (não confundir exposição ao calor com exposição ao sol)?

Sim/Não

(se sim) Se sim, qual?

23. Qual a sua condição perante o trabalho?

Nunca Trabalhei

Estudante

Trabalhador Estudante

Trabalhador a Tempo Inteiro

Desempregado

Reformado

Mensagem Final

Muito obrigado pela sua participação, o seu contributo é bastante importante para nós! Esperamos que possa participar nos restantes momentos deste estudo, seria uma ajuda fundamental para o nosso trabalho e para a promoção da adaptação da população Portuguesa a cenários de alteração climática. Quando for a altura do próximo momento iremos enviar-lhe um email para o informar que o pode fazer. Muito obrigado!

Caso tenha familiares, amigos ou conhecidos que estejam interessados em participar, estes também o podem fazer. Para tal basta partilhar o seguinte link:

http://ispawjrc.qualtrics.com/jfe/form/SV_5ijkHUjh9e1WgWF

Se tiver familiares que não tenham ou não usem email com regularidade, estes também podem fazê-lo usando o seu email. Nessa situação usamos o Código de Participação para diferenciar entre participantes com o mesmo email.

Relembramos que apenas quem participe nos 4 momentos fica habilitado ao sorteio.

Mais uma vez muito obrigado pelo tempo que nos disponibilizou.

Instrução Inicial

(Momento 2 – Durante uma Onda de Calor no Verão)

Caro(a) participante, muito obrigado por ter aceitado participar no nosso estudo sobre eventos naturais e alterações climáticas, o seu contributo é bastante importante! Solicitamos agora a sua colaboração no 2º momento do estudo. Se possível, pedimos-lhe por favor que o preencha ainda hoje ou preferencialmente nos próximos 2 dias, assim que lhe for possível. Estimamos que a sua participação dure aproximadamente 30 minutos. Para os últimos 2 momentos de participação, prevemos a seguinte calendarização: 3º Momento: a ocorrer entre 17 de agosto e 14 de outubro – Verão; 4º Momento: a ocorrer entre 15 de outubro e 29 de outubro – Outono. Quando for altura desses momentos enviar-lhe-emos um email a informar. Relembramos que todos os participantes que participem nos 4 momentos do estudo ficam habilitados ao sorteio de 20 vouchers de 50 euros (máximo 1 voucher por pessoa), em cartão SONAE (utilizáveis por exemplo nas lojas Continente, Worten, Modalfa, Zippy, Sport Zone, Wells, etc.). O sorteio vai decorrer no dia 12 de novembro de 2018. Caso seja contemplado com um dos vouchers será contactado nesse dia. Caso tenha alguma questão por favor não hesite em contactar o investigador através do email samuel.domingos@sapo.pt. Muito obrigado!

Questionário

1. Afeto Positivo face ao Calor (Lefevre et al., 2015)

Pedimos-lhe que leia as seguintes afirmações e indique em que medida concorda ou discorda com cada uma, tendo em conta aquilo que o calor significa para si.

It1. Adoro o tempo quente

It2. Quero ficar bronzado(a)

It3. Passo tempo ao sol quando posso

It4. Preocupo-me com os cancros de pele

It5. Um impacto positivo das alterações climáticas é que os verões vão ficar mais quentes

It6. Quando vou de férias vou em busca de calor ou tempo quente

Opções de resposta para cada item: 1 “Discordo Totalmente”; 2 “Discordo”; 3 “Nem Discordo nem Concordo”; 4 “Concordo”; 5 “Concordo Totalmente”.

2. Thinking Styles – Rational-Experiential Inventory (REI) short version (Epstein, Pacini, Denes-Raj, & Heier, 1996)

Vamos apresentar-lhe um conjunto de afirmações que exprimem formas de pensar e sentir. Leia atentamente cada afirmação e indique em que medida concorda ou discorda com cada uma.

NC

It1. Não gosto de ter de pensar muito

It2. Tento evitar situações que requerem ter de pensar em profundidade sobre algo

It3. Prefiro fazer algo que desafie as minhas capacidades de pensamento em vez de fazer algo em que tenha de pensar pouco

It4. Prefiro problemas complexos a problemas simples

It5. Pensar muito e durante muito tempo é algo que me dá pouca satisfação

FI

It6. Confio nos meus sentimentos iniciais acerca das pessoas

It7. Creio poder confiar nos meus palpites

It8. As minhas primeiras impressões acerca dos outros estão quase sempre certas

It9. Quando se trata de confiar nas pessoas, geralmente posso confiar nos meus instintos

It10. Normalmente consigo sentir se uma pessoa está certa ou errada, mesmo que não consiga explicar como sei isso

Opções de resposta para cada item: 1 “Discordo Totalmente”; 2 “Discordo”; 3 “Nem Discordo nem Concordo”; 4 “Concordo”; 5 “Concordo Totalmente”.

3. Escala Afeto – PANAS-VRP (Galinha, Pereira, & Esteves, 2014)

Vamos apresentar-lhe um conjunto de palavras que descrevem diferentes sentimentos e emoções. Leia atentamente cada palavra e indique em que medida sentiu cada um destes sentimentos e emoções durante os primeiros cinco dias deste mês.

Durante os primeiros cinco dias deste mês senti-me...

Interessado(a)

Nervoso(a)

Entusiasmado(a)

Amedrontado(a)

Inspirado(a)

Ativo(a)

Assustado(a)

Culpado(a)

Determinado(a)

Atormentado(a)

Opções de resposta para cada item: 1 “Nada ou muito ligeiramente”; 2 “Um pouco”; 3 “Moderadamente”; 4 “Bastante”; 5 “Extremamente”.

4. Escala Exigências (Self)

Vamos apresentar-lhe um conjunto de afirmações que representam possíveis exigências colocadas por vagas de calor. Leia atentamente cada uma e indique em que medida concorda ou discorda com cada afirmação.

Quando ocorrem vagas de calor...

It1. Há maior perigo para a minha saúde física/corporal (mais dores de cabeça, constipações, etc.)

It2. Há maior perigo para a minha saúde mental (mais stress, ansiedade, nervosismo, etc.)

It3. Há maior perigo para a minha vida (maior probabilidade de desmaiar, perder os sentidos, morrer, etc.)

It4. Há maior perigo para a minha vida social (maior probabilidade de ficar isolado, afastado dos outros, perder eventos sociais, etc.)

It5. Há maior perigo para pessoas ditas mais “vulneráveis” (crianças, idosos, etc.)

It6. Há maior perigo para o meio ambiente (animais, plantas, etc.)

It7. Faço um maior esforço metabólico (mais transpiração, alterações na pressão arterial, etc.)

It8. Faço um maior esforço físico (mais a cansaço, lentidão, fraqueza, etc.)

It9. Faço um maior esforço mental (mais preocupações, dificuldade em pensar, etc.)

It10. Faço um maior esforço emocional (mais alterações de humor, desconforto, irritabilidade, etc.)

It11. Tenho um maior esforço financeiro (mais gastos com equipamentos de climatização, ventoinhas, energia elétrica no uso de equipamentos, etc.)

It12. Tenho mais dúvidas face ao que me pode acontecer (consequências, malefícios, perigos para mim, etc.)

It13. Tenho mais dúvidas face ao que fazer para me proteger desse calor (se tenho recursos suficientes, que comportamentos devo ter, etc.)

Opções de resposta para cada item: 1 “Discordo Totalmente”; 2 “Discordo”; 3 “Nem Discordo Nem Concordo”; 4 “Concordo”; 5 “Concordo Totalmente”.

5. D/R Appraisal – Primary Appraisal – Demands (based on Tomaka, Blascovich, Kelsey, Leitten, 1993)

Pense nas exigências (possível perigo, esforço, dúvidas) que poderão existir em situações de vaga de calor.

No geral, como classifica o nível de exigências que as situações de vaga de calor têm:

It1. Para si?

It2. Para as pessoas da sua família?

It3. Para a população Portuguesa em geral?

It4. Para a população Mundial em geral?

Opções de resposta para cada item: 1 “Extremamente Baixo”; 2 “Baixo”; 3 “Moderado”; 4 “Elevado”; 5 “Extremamente Elevado”.

6. Escala Recursos (Self)

Vamos apresentar-lhe um conjunto de afirmações que representam possíveis recursos para lidar com as exigências colocadas por vagas de calor. Leia atentamente cada uma e indique em que medida concorda ou discorda com cada afirmação.

Quando ocorrem vagas de calor...

It1. Tenho equipamentos que me podem ajudar a lidar com esse calor (ar condicionado, ventoinhas, etc.)

It2. Tenho vestuário que me pode ajudar a lidar com esse calor (roupas adequadas, chapéus, etc.)

It3. Tenho objetos que me podem ajudar a lidar com esse calor (leques, borrifadores, etc.)

It4. Tenho tecnologias de informação e comunicação que me podem ajudar a lidar com esse calor (redes sociais, aplicações de smartphone, etc.)

It5. Tenho recursos financeiros que me podem ajudar a lidar com esse calor (dinheiro disponível para uso imediato, poupanças, etc.)

It6. Tenho acesso a locais que me podem ajudar a lidar com esse calor (sombras, lugares frescos, etc.)

It7. Tenho capacidades físicas que me podem ajudar a lidar com esse calor (a minha resistência física, saúde física, etc.)

It8. Tenho capacidades mentais que me podem ajudar a lidar com esse calor (a minha capacidade de planeamento, de pensar em estratégias, etc.)

It9. Tenho capacidades emocionais que me podem ajudar a lidar com esse calor (a minha capacidade de saber controlar e lidar com as minhas emoções, de saber reconhecer o que estou a sentir, etc.)

It10. Tenho comportamentos de evitamento que me podem ajudar a lidar com esse calor (fugir do calor, evitar sair à rua, etc.)

It11. Tenho comportamentos de enfrentamento que me podem ajudar a lidar com esse calor (procurar locais que me protejam, hidratar o corpo, etc.)

It12. Tenho características da minha personalidade que me podem ajudar a lidar com esse calor (ser calmo, paciente, compreensivo, interessado, etc.)

It13. Tenho formas de pensar e agir que me podem ajudar a lidar com esse calor (ser proativo, preventivo, etc.)

It14. Tenho familiares e amigos que me podem dar suporte e ajudar a lidar com esse calor (parentes, vizinhos, etc.)

It15. Tenho acesso a profissionais que me podem dar recomendações e ajudar a lidar com esse calor (profissionais de saúde, bombeiros, etc.)

It16. Tenho disponível informação que me pode ajudar a lidar com esse calor (panfletos informativos, páginas da internet, etc.)

It17. Tenho a crença que Deus, outra força espiritual, ou a minha própria força de espírito me pode ajudar a lidar com esse calor

It18. Tenho instituições que me podem ajudar a lidar com esse calor se for necessário (associações, instituições, autoridades, etc.)

Opções de resposta para cada item: 1 “Discordo Totalmente”; 2 “Discordo”; 3 “Nem Discordo Nem Concordo”; 4 “Concordo”; 5 “Concordo Totalmente”.

7. D/R Appraisal – Secondary Appraisal – Resources (based on Tomaka, Blascovich, Kelsey, Leitten, 1993)

Pense nos recursos (equipamentos, objetos, conhecimentos, habilidades, capacidades, suporte externo, etc.) que poderão existir para lidar com situações de vaga de calor.

No geral, como classifica o nível de recursos que os seguintes têm para lidar com situações de vaga de calor:

It1. Você?

It2. As pessoas da sua família?

It3. A população Portuguesa em geral?

It4. A população Mundial em geral?

Opções de resposta para cada item: 1 “Extremamente Baixo”; 2 “Baixo”; 3 “Moderado”; 4 “Elevado”; 5 “Extremamente Elevado”.

8. Risco Percebido (Próprio, Família, Outros)

Seguidamente pedimos-lhe que pense no nível de risco que as situações de vaga de calor poderão ter para si, para a sua família, e para as outras pessoas em geral.

Como classifica o nível de risco que as situações de vaga de calor têm ou podem ter:

- It1. Para si?
- It2. Para as pessoas da sua família?
- It3. Para a população Portuguesa em geral?
- It4. Para a população Mundial em geral?

Opções de resposta para cada item: 1 “Extremamente Baixo”; 2 “Baixo”; 3 “Moderado”; 4 “Elevado”; 5 “Extremamente Elevado”.

9. Nas últimas duas semanas ouviu ou leu alguma notícia, informação, ou recomendação sobre os riscos associados ao calor e/ou sobre o que fazer para se proteger?

Sim/Não. Se Sim. Pode por favor descrever resumidamente aquilo que se lembra de ter ouvido/lido no espaço imediatamente abaixo?

10. Intenções

Vamos apresentar-lhe um conjunto de frases que representam possíveis comportamentos que pode ter durante situações de vaga de calor. Durante a de calor, indique qual a sua intenção para ter cada um desses comportamentos.

Durante a vaga de calor, quão inclinado(a) está para...

- It1. Beber mais água mesmo sem ter sede
- It2. Evitar a exposição ao sol durante as 11h e as 17h
- It3. Ficar 2 a 3 horas num local fresco com temperatura adequada à situação (nem muito quente nem muito fria)
- It4. Procurar locais de abrigo frescos com temperatura adequada à situação (nem muito quente nem muito fria)
- It5. Evitar beber bebidas alcoólicas

- It6. Evitar beber bebidas açucaradas
- It7. Usar roupa larga, leve e fresca
- It8. Evitar que o calor entre dentro de casa fechando persianas e janelas durante o dia
- It9. Arrefecer a casa abrindo as janelas à noite
- It10. Usar ar condicionado para arrefecer a casa
- It11. Usar ventoinha(s) para arrefecer a casa
- It12. Colocar toalhas húmidas sobre o corpo para se refrescar
- It13. Borrifar o corpo com água para se refrescar
- It14. Tomar um banho refrescante
- It15. Consultar os avisos relativos ao calor extremo comunicados pelas autoridades
- It16. Se informar se as pessoas que vivem consigo ou que lhe são mais próximas (familiares) se estão a sentir bem
- It17. Se informar se as pessoas que vivem perto de si (vizinhos) se estão a sentir bem
- It18. Pedir ajuda a um familiar ou amigo caso se sinta mal com o calor
- It19. Pedir ajuda a um vizinho caso se sinta mal com o calor
- It20. Contactar as linhas de apoio disponibilizadas pelo Estado (linha Saúde 24) para saber mais sobre os efeitos do calor na saúde
- It21. Deslocar-se ao hospital ou centro de saúde caso se sinta mal com o calor
- It22. Oferecer ou lembrar aqueles que vivem consigo ou que lhe são mais próximos (familiares) de beber água
- It23. Oferecer ou lembrar aqueles que vivem perto de si (vizinhos) de beber água
- It24. Verificar se aqueles que vivem consigo ou que lhe são mais próximos (familiares) estão num local fresco com temperatura adequada à situação (nem muito quente nem muito fria)
- It25. Verificar se as pessoas que vivem perto de si (vizinhos) estão num local fresco com temperatura adequada à situação (nem muito quente nem muito fria)

Opções de resposta para cada item: 1 “Nada Inclinado”; 2 “Pouco Inclinado”; 3 “Inclinado”; 4 “Muito Inclinado”; 5 “Totalmente Inclinado”.

11. Normalidade

Seguidamente pedimos-lhe para pensar quão normal para a estação do ano em que estamos, foi a temperatura que se fez sentir durante os primeiros cinco dias deste mês.

11.1. Em que medida considera que a temperatura que se fez sentir durante os primeiros cinco dias deste mês foi normal para a estação do ano em que estamos?

Opções de resposta: 1 “Nada Normal”; 2 “Pouco Normal”; 3 “Moderadamente Normal”; 4 “Quase Normal”; 5 “Completamente Normal”.

11.2. Durante os primeiros cinco dias deste mês dias diria que esteve:

Opções de resposta: 1 “Muito mais frio/fresco que o normal para a estação do ano”; 2 “Um pouco mais frio/fresco que o normal para a estação do ano”; 3 “Nem mais frio/fresco ou quente/calor que o normal para a estação do ano”; 4 “Um pouco mais quente/calor que o normal para a estação do ano”; 5 “Muito mais quente/calor que o normal para a estação do ano”.

12. Interferência

Seguidamente pedimos-lhe para pensar em que medida considera que a temperatura que se fez sentir durante os primeiros cinco dias deste mês interferiu com a sua vida, com a vida da sua família, e com a vida das outras pessoas em geral.

Em que medida considera que a temperatura que se fez sentir durante os primeiros cinco dias deste mês interferiu com:

It1. A sua vida?

It2. A vida das pessoas da sua família?

It3. A vida da população Portuguesa em geral?

It4. A vida da população Mundial em geral?

Opções de resposta para cada item: 1 “Nada”; 2 “Pouco”; 3 “Moderadamente”; 4 “Muito”; 5 “Extremamente”.

13. Atitudes face às vagas de calor (Negatividade/Positividade; adaptado da Tese de Mestrado)

Quando pensa em vagas de calor, o que é que isso o(a) faz sentir?

	1	2	3	4	5	
Extremamente mal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente bem
Extremamente insatisfeito(a)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente satisfeito(a)
Extremamente desconfortável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente confortável
Extremamente negativo	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente positivo

Questionário Sociodemográfico

14. Localidade de residência

15. Localidade onde se encontra neste momento

16. Localidade onde passou as últimas duas semanas

Mensagem Final

Muito obrigado pela sua participação, o seu contributo é bastante importante para nós!

Esperamos que possa participar nos últimos 2 momentos deste estudo. Tal seria uma ajuda fundamental para o nosso trabalho e para a promoção da adaptação da população Portuguesa a cenários de alteração climática. Quando for a altura do próximo momento iremos enviar-lhe um email para o informar que o pode fazer. Relembramos que apenas quem participe nos 4 momentos fica habilitado ao sorteio dos 20 vouchers SONAE de 50 euros.

Mais uma vez muito obrigado pelo tempo que nos disponibilizou.

Instrução Inicial

(Momento 3 – Durante o Verão)

Caro(a) participante, muito obrigado por participar no nosso estudo sobre eventos naturais e alterações climáticas, o seu contributo é bastante importante! Solicitamos agora a sua colaboração no 3º momento do estudo. Se possível, pedimos-lhe por favor que o preencha ainda hoje ou preferencialmente nos próximos 2 dias, assim que lhe for possível. Estimamos que a sua participação dure aproximadamente 30 minutos. Relembramos que todos os participantes que participem nos 4 momentos do estudo ficam habilitados ao sorteio de 20 vouchers de 50 euros (máximo 1 voucher por pessoa), em cartão SONAE (utilizáveis por exemplo nas lojas Continente, Worten, Modalfa, Zippy, Sport Zone, Wells, etc.). O sorteio vai decorrer no dia 12 de novembro de 2018. Caso seja contemplado com um dos vouchers será contactado nesse dia. Para o 4º momento prevemos que este se realize entre 15 de outubro e 29 de outubro. Quando for altura desse momento enviar-lhe-emos um email a informar. Caso tenha alguma questão por favor não hesite em contactar o investigador através do email samuel.domingos@sapo.pt. Muito obrigado!

Questionário

1. Afeto Positivo face ao Calor (Lefevre et al., 2015)

Pedimos-lhe que leia as seguintes afirmações e indique em que medida concorda ou discorda com cada uma, tendo em conta aquilo que o calor significa para si.

It1. Adoro o tempo quente

It2. Quero ficar bronzeado(a)

It3. Passo tempo ao sol quando posso

It4. Preocupo-me com os cancros de pele

It5. Um impacto positivo das alterações climáticas é que os verões vão ficar mais quentes

It6. Quando vou de férias vou em busca de calor ou tempo quente

Opções de resposta para cada item: 1 “Discordo Totalmente”; 2 “Discordo”; 3 “Nem Discordo nem Concordo”; 4 “Concordo”; 5 “Concordo Totalmente”.

2. Thinking Styles – Rational-Experiential Inventory (REI) short version (Epstein, Pacini, Denes-Raj, & Heier, 1996)

Vamos apresentar-lhe um conjunto de afirmações que exprimem formas de pensar e sentir. Leia atentamente cada afirmação e indique em que medida concorda ou discorda com cada uma.

NC

It1. Não gosto de ter de pensar muito

It2. Tento evitar situações que requerem ter de pensar em profundidade sobre algo

It3. Prefiro fazer algo que desafie as minhas capacidades de pensamento em vez de fazer algo em que tenha de pensar pouco

It4. Prefiro problemas complexos a problemas simples

It5. Pensar muito e durante muito tempo é algo que me dá pouca satisfação

FI

It6. Confio nos meus sentimentos iniciais acerca das pessoas

It7. Creio poder confiar nos meus palpites

It8. As minhas primeiras impressões acerca dos outros estão quase sempre certas

It9. Quando se trata de confiar nas pessoas, geralmente posso confiar nos meus instintos

It10. Normalmente consigo sentir se uma pessoa está certa ou errada, mesmo que não consiga explicar como sei isso

Opções de resposta para cada item: 1 “Discordo Totalmente”; 2 “Discordo”; 3 “Nem Discordo nem Concordo”; 4 “Concordo”; 5 “Concordo Totalmente”.

3. Escala Afeto – PANAS-VRP (Galinha, Pereira, & Esteves, 2014)

Vamos apresentar-lhe um conjunto de palavras que descrevem diferentes sentimentos e emoções. Leia atentamente cada palavra e indique em que medida sentiu cada um destes sentimentos e emoções nas últimas duas semanas.

Nas últimas duas semanas senti-me...

Interessado(a)

Nervoso(a)

Entusiasmado(a)

Amedrontado(a)

Inspirado(a)

Ativo(a)

Assustado(a)

Culpado(a)

Determinado(a)

Atormentado(a)

Opções de resposta para cada item: 1 “Nada ou muito ligeiramente”; 2 “Um pouco”; 3 “Moderadamente”; 4 “Bastante”; 5 “Extremamente”.

4. Escala Exigências (Self)

Vamos apresentar-lhe um conjunto de afirmações que representam possíveis exigências colocadas por vagas de calor. Leia atentamente cada uma e indique em que medida concorda ou discorda com cada afirmação.

Quando ocorrem vagas de calor...

It1. Há maior perigo para a minha saúde física/corporal (mais dores de cabeça, constipações, etc.)

It2. Há maior perigo para a minha saúde mental (mais stress, ansiedade, nervosismo, etc.)

It3. Há maior perigo para a minha vida (maior probabilidade de desmaiar, perder os sentidos, morrer, etc.)

It4. Há maior perigo para a minha vida social (maior probabilidade de ficar isolado, afastado dos outros, perder eventos sociais, etc.)

It5. Há maior perigo para pessoas ditas mais “vulneráveis” (crianças, idosos, etc.)

It6. Há maior perigo para o meio ambiente (animais, plantas, etc.)

It7. Faço um maior esforço metabólico (mais transpiração, alterações na pressão arterial, etc.)

It8. Faço um maior esforço físico (mais a cansaço, lentidão, fraqueza, etc.)

It9. Faço um maior esforço mental (mais preocupações, dificuldade em pensar, etc.)

It10. Faço um maior esforço emocional (mais alterações de humor, desconforto, irritabilidade, etc.)

It11. Tenho um maior esforço financeiro (mais gastos com equipamentos de climatização, ventoinhas, energia elétrica no uso de equipamentos, etc.)

It12. Tenho mais dúvidas face ao que me pode acontecer (consequências, malefícios, perigos para mim, etc.)

It13. Tenho mais dúvidas face ao que fazer para me proteger desse calor (se tenho recursos suficientes, que comportamentos devo ter, etc.)

Opções de resposta para cada item: 1 “Discordo Totalmente”; 2 “Discordo”; 3 “Nem Discordo Nem Concordo”; 4 “Concordo”; 5 “Concordo Totalmente”.

5. D/R Appraisal – Primary Appraisal – Demands (based on Tomaka, Blascovich, Kelsey, Leitten, 1993)

Pense nas exigências (possível perigo, esforço, dúvidas) que poderão existir em situações de vaga de calor.

No geral, como classifica o nível de exigências que as situações de vaga de calor têm:

It1. Para si?

It2. Para as pessoas da sua família?

It3. Para a população Portuguesa em geral?

It4. Para a população Mundial em geral?

Opções de resposta para cada item: 1 “Extremamente Baixo”; 2 “Baixo”; 3 “Moderado”; 4 “Elevado”; 5 “Extremamente Elevado”.

6. Escala Recursos (Self)

Vamos apresentar-lhe um conjunto de afirmações que representam possíveis recursos para lidar com as exigências colocadas por vagas de calor. Leia atentamente cada uma e indique em que medida concorda ou discorda com cada afirmação.

Quando ocorrem vagas de calor...

It1. Tenho equipamentos que me podem ajudar a lidar com esse calor (ar condicionado, ventoinhas, etc.)

It2. Tenho vestuário que me pode ajudar a lidar com esse calor (roupas adequadas, chapéus, etc.)

It3. Tenho objetos que me podem ajudar a lidar com esse calor (leques, borrifadores, etc.)

It4. Tenho tecnologias de informação e comunicação que me podem ajudar a lidar com esse calor (redes sociais, aplicações de smartphone, etc.)

It5. Tenho recursos financeiros que me podem ajudar a lidar com esse calor (dinheiro disponível para uso imediato, poupanças, etc.)

It6. Tenho acesso a locais que me podem ajudar a lidar com esse calor (sombras, lugares frescos, etc.)

It7. Tenho capacidades físicas que me podem ajudar a lidar com esse calor (a minha resistência física, saúde física, etc.)

It8. Tenho capacidades mentais que me podem ajudar a lidar com esse calor (a minha capacidade de planeamento, de pensar em estratégias, etc.)

It9. Tenho capacidades emocionais que me podem ajudar a lidar com esse calor (a minha capacidade de saber controlar e lidar com as minhas emoções, de saber reconhecer o que estou a sentir, etc.)

It10. Tenho comportamentos de evitamento que me podem ajudar a lidar com esse calor (fugir do calor, evitar sair à rua, etc.)

It11. Tenho comportamentos de enfrentamento que me podem ajudar a lidar com esse calor (procurar locais que me protejam, hidratar o corpo, etc.)

It12. Tenho características da minha personalidade que me podem ajudar a lidar com esse calor (ser calmo, paciente, compreensivo, interessado, etc.)

It13. Tenho formas de pensar e agir que me podem ajudar a lidar com esse calor (ser proativo, preventivo, etc.)

It14. Tenho familiares e amigos que me podem dar suporte e ajudar a lidar com esse calor (parentes, vizinhos, etc.)

It15. Tenho acesso a profissionais que me podem dar recomendações e ajudar a lidar com esse calor (profissionais de saúde, bombeiros, etc.)

It16. Tenho disponível informação que me pode ajudar a lidar com esse calor (panfletos informativos, páginas da internet, etc.)

It17. Tenho a crença que Deus, outra força espiritual, ou a minha própria força de espírito me pode ajudar a lidar com esse calor

It18. Tenho instituições que me podem ajudar a lidar com esse calor se for necessário (associações, instituições, autoridades, etc.);

Opções de resposta para cada item: 1 “Discordo Totalmente”; 2 “Discordo”; 3 “Nem Discordo Nem Concordo”; 4 “Concordo”; 5 “Concordo Totalmente”.

7. D/R Appraisal – Secondary Appraisal – Resources (based on Tomaka, Blascovich, Kelsey, Leitten, 1993)

Pense nos recursos (equipamentos, objetos, conhecimentos, habilidades, capacidades, suporte externo, etc.) que poderão existir para lidar com situações de vaga de calor.

No geral, como classifica o nível de recursos que os seguintes têm para lidar com situações de vaga de calor:

It1. Você?

It2. As pessoas da sua família?

It3. A população Portuguesa em geral?

It4. A população Mundial em geral?

Opções de resposta para cada item: 1 “Extremamente Baixo”; 2 “Baixo”; 3 “Moderado”; 4 “Elevado”; 5 “Extremamente Elevado”.

8. Risco Percebido (Próprio, Família, Outros)

Seguidamente pedimos-lhe que pense no nível de risco que as situações de vaga de calor poderão ter para si, para a sua família, e para as outras pessoas em geral.

Como classifica o nível de risco que as situações de vaga de calor têm ou podem ter:

- It1. Para si?
- It2. Para as pessoas da sua família?
- It3. Para a população Portuguesa em geral?
- It4. Para a população Mundial em geral?

Opções de resposta para cada item: 1 “Extremamente Baixo”; 2 “Baixo”; 3 “Moderado”; 4 “Elevado”; 5 “Extremamente Elevado”.

9. Durante este verão ouviu ou leu alguma notícia, informação, ou recomendação sobre os riscos associados ao calor e/ou sobre o que fazer para se proteger?

Sim/Não. Se Sim. Pode por favor descrever resumidamente aquilo que se lembra de ter ouvido/lido no espaço imediatamente abaixo?

10. Intenções

Vamos apresentar-lhe um conjunto de frases que representam possíveis comportamentos que pode ter durante situações de vaga de calor. Se no futuro passar por uma vaga de calor indique qual a sua intenção para ter cada um desses comportamentos.

Se no futuro passar por uma vaga de calor quão inclinado(a) estaria para...

- It1. Beber mais água mesmo sem ter sede
- It2. Evitar a exposição ao sol durante as 11h e as 17h
- It3. Ficar 2 a 3 horas num local fresco com temperatura adequada à situação (nem muito quente nem muito fria)
- It4. Procurar locais de abrigo frescos com temperatura adequada à situação (nem muito quente nem muito fria)
- It5. Evitar beber bebidas alcoólicas

- It6. Evitar beber bebidas açucaradas
- It7. Usar roupa larga, leve e fresca
- It8. Evitar que o calor entre dentro de casa fechando persianas e janelas durante o dia
- It9. Arrefecer a casa abrindo as janelas à noite
- It10. Usar ar condicionado para arrefecer a casa
- It11. Usar ventoinha(s) para arrefecer a casa
- It12. Colocar toalhas húmidas sobre o corpo para se refrescar
- It13. Borrifar o corpo com água para se refrescar
- It14. Tomar um banho refrescante
- It15. Consultar os avisos relativos ao calor extremo comunicados pelas autoridades
- It16. Se informar se as pessoas que vivem consigo ou que lhe são mais próximas (familiares) se estão a sentir bem
- It17. Se informar se as pessoas que vivem perto de si (vizinhos) se estão a sentir bem
- It18. Pedir ajuda a um familiar ou amigo caso se sinta mal com o calor
- It19. Pedir ajuda a um vizinho caso se sinta mal com o calor
- It20. Contactar as linhas de apoio disponibilizadas pelo Estado (linha Saúde 24) para saber mais sobre os efeitos do calor na saúde
- It21. Deslocar-se ao hospital ou centro de saúde caso se sinta mal com o calor
- It22. Oferecer ou lembrar aqueles que vivem consigo ou que lhe são mais próximos (familiares) de beber água
- It23. Oferecer ou lembrar aqueles que vivem perto de si (vizinhos) de beber água
- It24. Verificar se aqueles que vivem consigo ou que lhe são mais próximos (familiares) estão num local fresco com temperatura adequada à situação (nem muito quente nem muito fria)
- It25. Verificar se as pessoas que vivem perto de si (vizinhos) estão num local fresco com temperatura adequada à situação (nem muito quente nem muito fria)

Opções de resposta para cada item: 1 “Nada Inclinado”; 2 “Pouco Inclinado”; 3 “Inclinado”; 4 “Muito Inclinado”; 5 “Totalmente Inclinado”.

11. Normalidade

Seguidamente pedimos-lhe para pensar quão normal para a estação do ano em que estamos, tem sido a temperatura que se fez sentir nos últimos cinco dias.

11.1. Em que medida considera que a temperatura que se fez sentir nos últimos cinco dias foi normal para a estação do ano em que estamos?

Opções de resposta: 1 “Nada Normal”; 2 “Pouco Normal”; 3 “Moderadamente Normal”; 4 “Quase Normal”; 5 “Completamente Normal”.

11.2. Nos últimos cinco dias diria que esteve:

Opções de resposta: 1 “Muito mais frio/fresco que o normal para a estação do ano”; 2 “Um pouco mais frio/fresco que o normal para a estação do ano”; 3 “Nem mais frio/fresco ou quente/calor que o normal para a estação do ano”; 4 “Um pouco mais quente/calor que o normal para a estação do ano”; 5 “Muito mais quente/calor que o normal para a estação do ano”.

12. Interferência

Seguidamente pedimos-lhe para pensar em que medida considera que a temperatura que se fez sentir nos últimos cinco dias interferiu com a sua vida, com a vida da sua família, e com a vida das outras pessoas em geral.

Em que medida considera que a temperatura que se fez sentir nos últimos cinco dias interferiu com:

It1. A sua vida?

It2. A vida das pessoas da sua família?

It3. A vida da população Portuguesa em geral?

It4. A vida da população Mundial em geral?

Opções de resposta para cada item: 1 “Nada”; 2 “Pouco”; 3 “Moderadamente”; 4 “Muito”; 5 “Extremamente”.

13. Interferência da Temperatura e Recuperação da Onda de Calor

Considera que a temperatura que se fez sentir durante a vaga de calor que ocorreu durante a primeira semana de agosto interferiu com a sua vida?

Sim/Não

(Se Sim) Em que medida considera que conseguiu recuperar (no geral) dessa interferência?

Opções de resposta: 1 “Não recuperei nada”; 2 “Recuperei pouco”; 3 “Recuperei mais ou menos”; 4 “Recuperei muito”; 5 “Recuperei totalmente”

14. Atitudes face às vagas de calor (Negatividade/Positividade; adaptado da Tese de Mestrado)

Quando pensa em vagas de calor, o que é que isso o(a) faz sentir?

	1	2	3	4	5	
Extremamente mal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente bem
Extremamente insatisfeito(a)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente satisfeito(a)
Extremamente desconfortável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente confortável
Extremamente negativo	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente positivo

Questionário Sociodemográfico

15. Localidade de residência

16. Localidade onde se encontra neste momento

17. Localidade onde passou as últimas duas semanas

Mensagem Final

Muito obrigado pela sua participação, o seu contributo é bastante importante para nós!

Esperamos que possa participar no último momento deste estudo. Tal seria uma ajuda fundamental para o nosso trabalho e para a promoção da adaptação da população Portuguesa a cenários de alteração climática. Quando for a altura do próximo momento iremos enviar-lhe um email para o informar que o pode fazer. Relembramos que apenas quem participe nos 4 momentos fica habilitado ao sorteio dos 20 vouchers SONAE de 50 euros.

Mais uma vez muito obrigado pelo tempo que nos disponibilizou.

Instrução Inicial

(Momento 4 – Após o Verão)

Caro(a) participante, muito obrigado por participar no nosso estudo sobre eventos naturais e alterações climáticas, o seu contributo é bastante importante!

Solicitamos agora a sua colaboração no 4º momento do estudo. Este corresponde ao último momento de participação. Se possível, pedimos-lhe por favor que o preencha ainda hoje ou preferencialmente nos próximos 2 dias, assim que lhe for possível. Estimamos que a sua participação dure aproximadamente 30 minutos.

Relembramos que todos os participantes que participem nos 4 momentos do estudo ficam habilitados ao sorteio de 20 vouchers de 50 euros (máximo 1 voucher por pessoa), em cartão SONAE (utilizáveis por exemplo nas lojas Continente, Worten, Modalfa, Zippy, Sport Zone, Wells, etc.). O sorteio vai decorrer no dia 12 de novembro de 2018. Caso seja contemplado com um dos vouchers será contactado nesse dia. Caso tenha alguma questão por favor não hesite em contactar o investigador através do email samuel.domingos@sapo.pt. Muito obrigado!

Questionário

1. Afeto Positivo face ao Calor (Lefevre et al., 2015)

Pedimos-lhe que leia as seguintes afirmações e indique em que medida concorda ou discorda com cada uma, tendo em conta aquilo que o calor significa para si.

It1. Adoro o tempo quente

It2. Quero ficar bronzeado(a)

It3. Passo tempo ao sol quando posso

It4. Preocupo-me com os cancros de pele

It5. Um impacto positivo das alterações climáticas é que os verões vão ficar mais quentes

It6. Quando vou de férias vou em busca de calor ou tempo quente

Opções de resposta para cada item: 1 “Discordo Totalmente”; 2 “Discordo”; 3 “Nem Discordo nem Concordo”; 4 “Concordo”; 5 “Concordo Totalmente”.

2. Thinking Styles – Rational-Experiential Inventory (REI) short version (Epstein, Pacini, Denes-Raj, & Heier, 1996)

Vamos apresentar-lhe um conjunto de afirmações que exprimem formas de pensar e sentir. Leia atentamente cada afirmação e indique em que medida concorda ou discorda com cada uma.

NC

It1. Não gosto de ter de pensar muito

It2. Tento evitar situações que requerem ter de pensar em profundidade sobre algo

It3. Prefiro fazer algo que desafie as minhas capacidades de pensamento em vez de fazer algo em que tenha de pensar pouco

It4. Prefiro problemas complexos a problemas simples

It5. Pensar muito e durante muito tempo é algo que me dá pouca satisfação

FI

It6. Confio nos meus sentimentos iniciais acerca das pessoas

It7. Creio poder confiar nos meus palpites

It8. As minhas primeiras impressões acerca dos outros estão quase sempre certas

It9. Quando se trata de confiar nas pessoas, geralmente posso confiar nos meus instintos

It10. Normalmente consigo sentir se uma pessoa está certa ou errada, mesmo que não consiga explicar como sei isso

Opções de resposta para cada item: 1 “Discordo Totalmente”; 2 “Discordo”; 3 “Nem Discordo nem Concordo”; 4 “Concordo”; 5 “Concordo Totalmente”.

3. Escala Afeto – PANAS-VRP (Galinha, Pereira, & Esteves, 2014)

Vamos apresentar-lhe um conjunto de palavras que descrevem diferentes sentimentos e emoções. Leia atentamente cada palavra e indique em que medida sentiu cada um destes sentimentos e emoções nas últimas duas semanas.

Nas últimas duas semanas senti-me...

Interessado(a)

Nervoso(a)

Entusiasmado(a)

Amedrontado(a)

Inspirado(a)

Ativo(a)

Assustado(a)

Culpado(a)

Determinado(a)

Atormentado(a)

Opções de resposta para cada item: 1 “Nada ou muito ligeiramente”; 2 “Um pouco”; 3 “Moderadamente”; 4 “Bastante”; 5 “Extremamente”.

4. Escala Exigências (Self)

Vamos apresentar-lhe um conjunto de afirmações que representam possíveis exigências colocadas por vagas de calor. Leia atentamente cada uma e indique em que medida concorda ou discorda com cada afirmação.

Quando ocorrem vagas de calor...

It1. Há maior perigo para a minha saúde física/corporal (mais dores de cabeça, constipações, etc.)

It2. Há maior perigo para a minha saúde mental (mais stress, ansiedade, nervosismo, etc.)

It3. Há maior perigo para a minha vida (maior probabilidade de desmaiar, perder os sentidos, morrer, etc.)

It4. Há maior perigo para a minha vida social (maior probabilidade de ficar isolado, afastado dos outros, perder eventos sociais, etc.)

It5. Há maior perigo para pessoas ditas mais “vulneráveis” (crianças, idosos, etc.)

It6. Há maior perigo para o meio ambiente (animais, plantas, etc.)

It7. Faço um maior esforço metabólico (mais transpiração, alterações na pressão arterial, etc.)

It8. Faço um maior esforço físico (mais a cansaço, lentidão, fraqueza, etc.)

It9. Faço um maior esforço mental (mais preocupações, dificuldade em pensar, etc.)

It10. Faço um maior esforço emocional (mais alterações de humor, desconforto, irritabilidade, etc.)

It11. Tenho um maior esforço financeiro (mais gastos com equipamentos de climatização, ventoinhas, energia elétrica no uso de equipamentos, etc.)

It12. Tenho mais dúvidas face ao que me pode acontecer (consequências, malefícios, perigos para mim, etc.)

It13. Tenho mais dúvidas face ao que fazer para me proteger desse calor (se tenho recursos suficientes, que comportamentos devo ter, etc.)

Opções de resposta para cada item: 1 “Discordo Totalmente”; 2 “Discordo”; 3 “Nem Discordo Nem Concordo”; 4 “Concordo”; 5 “Concordo Totalmente”.

5. D/R Appraisal – Primary Appraisal – Demands (based on Tomaka, Blascovich, Kelsey, Leitten, 1993)

Pense nas exigências (possível perigo, esforço, dúvidas) que poderão existir em situações de vaga de calor.

No geral, como classifica o nível de exigências que as situações de vaga de calor têm:

It1. Para si?

It2. Para as pessoas da sua família?

It3. Para a população Portuguesa em geral?

It4. Para a população Mundial em geral?

Opções de resposta para cada item: 1 “Extremamente Baixo”; 2 “Baixo”; 3 “Moderado”; 4 “Elevado”; 5 “Extremamente Elevado”.

6. Escala Recursos (Self)

Vamos apresentar-lhe um conjunto de afirmações que representam possíveis recursos para lidar com as exigências colocadas por vagas de calor. Leia atentamente cada uma e indique em que medida concorda ou discorda com cada afirmação.

Quando ocorrem vagas de calor...

It1. Tenho equipamentos que me podem ajudar a lidar com esse calor (ar condicionado, ventoinhas, etc.)

It2. Tenho vestuário que me pode ajudar a lidar com esse calor (roupas adequadas, chapéus, etc.)

It3. Tenho objetos que me podem ajudar a lidar com esse calor (leques, borrifadores, etc.)

It4. Tenho tecnologias de informação e comunicação que me podem ajudar a lidar com esse calor (redes sociais, aplicações de smartphone, etc.)

It5. Tenho recursos financeiros que me podem ajudar a lidar com esse calor (dinheiro disponível para uso imediato, poupanças, etc.)

It6. Tenho acesso a locais que me podem ajudar a lidar com esse calor (sombrias, lugares frescos, etc.)

It7. Tenho capacidades físicas que me podem ajudar a lidar com esse calor (a minha resistência física, saúde física, etc.)

It8. Tenho capacidades mentais que me podem ajudar a lidar com esse calor (a minha capacidade de planeamento, de pensar em estratégias, etc.)

It9. Tenho capacidades emocionais que me podem ajudar a lidar com esse calor (a minha capacidade de saber controlar e lidar com as minhas emoções, de saber reconhecer o que estou a sentir, etc.)

It10. Tenho comportamentos de evitamento que me podem ajudar a lidar com esse calor (fugir do calor, evitar sair à rua, etc.)

It11. Tenho comportamentos de enfrentamento que me podem ajudar a lidar com esse calor (procurar locais que me protejam, hidratar o corpo, etc.)

It12. Tenho características da minha personalidade que me podem ajudar a lidar com esse calor (ser calmo, paciente, compreensivo, interessado, etc.)

It13. Tenho formas de pensar e agir que me podem ajudar a lidar com esse calor (ser proativo, preventivo, etc.)

It14. Tenho familiares e amigos que me podem dar suporte e ajudar a lidar com esse calor (parentes, vizinhos, etc.)

It15. Tenho acesso a profissionais que me podem dar recomendações e ajudar a lidar com esse calor (profissionais de saúde, bombeiros, etc.)

It16. Tenho disponível informação que me pode ajudar a lidar com esse calor (panfletos informativos, páginas da internet, etc.)

It17. Tenho a crença que Deus, outra força espiritual, ou a minha própria força de espírito me pode ajudar a lidar com esse calor

It18. Tenho instituições que me podem ajudar a lidar com esse calor se for necessário (associações, instituições, autoridades, etc.);

Opções de resposta para cada item: 1 “Discordo Totalmente”; 2 “Discordo”; 3 “Nem Discordo Nem Concordo”; 4 “Concordo”; 5 “Concordo Totalmente”.

7. D/R Appraisal – Secondary Appraisal – Resources (based on Tomaka, Blascovich, Kelsey, Leitten, 1993)

Pense nos recursos (equipamentos, objetos, conhecimentos, habilidades, capacidades, suporte externo, etc.) que poderão existir para lidar com situações de vaga de calor.

No geral, como classifica o nível de recursos que os seguintes têm para lidar com situações de vaga de calor:

It1. Você?

It2. As pessoas da sua família?

It3. A população Portuguesa em geral?

It4. A população Mundial em geral?

Opções de resposta para cada item: 1 “Extremamente Baixo”; 2 “Baixo”; 3 “Moderado”; 4 “Elevado”; 5 “Extremamente Elevado”.

8. Risco Percebido (Próprio, Família, Outros)

Seguidamente pedimos-lhe que pense no nível de risco que as situações de vaga de calor poderão ter para si, para a sua família, e para as outras pessoas em geral.

Como classifica o nível de risco que as situações de vaga de calor têm ou podem ter:

It1. Para si?

It2. Para as pessoas da sua família?

It3. Para a população Portuguesa em geral?

It4. Para a população Mundial em geral?

Opções de resposta para cada item: 1 “Extremamente Baixo”; 2 “Baixo”; 3 “Moderado”; 4 “Elevado”; 5 “Extremamente Elevado”.

9. Durante o último verão ouviu ou leu alguma notícia, informação, ou recomendação sobre os riscos associados ao calor e/ou sobre o que fazer para se proteger?

Sim/Não. Se Sim. Pode por favor descrever resumidamente aquilo que se lembra de ter ouvido/lido no espaço imediatamente abaixo?

10. Intenções

Vamos apresentar-lhe um conjunto de frases que representam possíveis comportamentos que pode ter durante situações de vaga de calor. Se no futuro passar por uma vaga de calor indique qual a sua intenção para ter cada um desses comportamentos.

Se no futuro passar por uma vaga de calor quão inclinado(a) estaria para...

It1. Beber mais água mesmo sem ter sede

It2. Evitar a exposição ao sol durante as 11h e as 17h

It3. Ficar 2 a 3 horas num local fresco com temperatura adequada à situação (nem muito quente nem muito fria)

It4. Procurar locais de abrigo frescos com temperatura adequada à situação (nem muito quente nem muito fria)

It5. Evitar beber bebidas alcoólicas

- It6. Evitar beber bebidas açucaradas
- It7. Usar roupa larga, leve e fresca
- It8. Evitar que o calor entre dentro de casa fechando persianas e janelas durante o dia
- It9. Arrefecer a casa abrindo as janelas à noite
- It10. Usar ar condicionado para arrefecer a casa
- It11. Usar ventoinha(s) para arrefecer a casa
- It12. Colocar toalhas húmidas sobre o corpo para se refrescar
- It13. Borrifar o corpo com água para se refrescar
- It14. Tomar um banho refrescante
- It15. Consultar os avisos relativos ao calor extremo comunicados pelas autoridades
- It16. Se informar se as pessoas que vivem consigo ou que lhe são mais próximas (familiares) se estão a sentir bem
- It17. Se informar se as pessoas que vivem perto de si (vizinhos) se estão a sentir bem
- It18. Pedir ajuda a um familiar ou amigo caso se sinta mal com o calor
- It19. Pedir ajuda a um vizinho caso se sinta mal com o calor
- It20. Contactar as linhas de apoio disponibilizadas pelo Estado (linha Saúde 24) para saber mais sobre os efeitos do calor na saúde
- It21. Deslocar-se ao hospital ou centro de saúde caso se sinta mal com o calor
- It22. Oferecer ou lembrar aqueles que vivem consigo ou que lhe são mais próximos (familiares) de beber água
- It23. Oferecer ou lembrar aqueles que vivem perto de si (vizinhos) de beber água
- It24. Verificar se aqueles que vivem consigo ou que lhe são mais próximos (familiares) estão num local fresco com temperatura adequada à situação (nem muito quente nem muito fria)
- It25. Verificar se as pessoas que vivem perto de si (vizinhos) estão num local fresco com temperatura adequada à situação (nem muito quente nem muito fria)

Opções de resposta para cada item: 1 “Nada Inclinado”; 2 “Pouco Inclinado”; 3 “Inclinado”; 4 “Muito Inclinado”; 5 “Totalmente Inclinado”.

11. Normalidade

Seguidamente pedimos-lhe para pensar quão normal para a estação do ano em que estamos, tem sido a temperatura que se fez sentir nos últimos cinco dias.

11.1. Em que medida considera que a temperatura que se fez sentir nos últimos cinco dias foi normal para a estação do ano em que estamos?

Opções de resposta: 1 “Nada Normal”; 2 “Pouco Normal”; 3 “Moderadamente Normal”; 4 “Quase Normal”; 5 “Completamente Normal”.

11.2. Nos últimos cinco dias diria que esteve:

Opções de resposta: 1 “Muito mais frio/fresco que o normal para a estação do ano”; 2 “Um pouco mais frio/fresco que o normal para a estação do ano”; 3 “Nem mais frio/fresco ou quente/calor que o normal para a estação do ano”; 4 “Um pouco mais quente/calor que o normal para a estação do ano”; 5 “Muito mais quente/calor que o normal para a estação do ano”.

12. Interferência

Seguidamente pedimos-lhe para pensar em que medida considera que a temperatura que se fez sentir nos últimos cinco dias interferiu com a sua vida, com a vida da sua família, e com a vida das outras pessoas em geral.

Em que medida considera que a temperatura que se fez sentir nos últimos cinco dias interferiu com:

It1. A sua vida?

It2. A vida das pessoas da sua família?

It3. A vida da população Portuguesa em geral?

It4. A vida da população Mundial em geral?

Opções de resposta para cada item: 1 “Nada”; 2 “Pouco”; 3 “Moderadamente”; 4 “Muito”; 5 “Extremamente”.

13. Interferência da Temperatura e Recuperação da Onda de Calor

Considera que a temperatura que se fez sentir durante a vaga de calor que ocorreu durante a primeira semana de agosto interferiu com a sua vida?

Sim/Não

(Se Sim) Em que medida considera que conseguiu recuperar (no geral) dessa interferência?

Opções de resposta: 1 “Não recuperei nada”; 2 “Recuperei pouco”; 3 “Recuperei mais ou menos”; 4 “Recuperei muito”; 5 “Recuperei totalmente”

14. Normalidade do Último Verão

Seguidamente pedimos-lhe para pensar quão normal considera que foi a temperatura que se fez sentir durante o último verão.

14.1. No geral, em que medida considera que a temperatura que se fez sentir no último verão foi normal para essa estação do ano?

Opções de resposta: 1 “Nada Normal”; 2 “Pouco Normal”; 3 “Moderadamente Normal”; 4 “Quase Normal”; 5 “Completamente Normal”

14.2. No geral, no último verão diria que esteve:

Opções de resposta: 1 “Muito mais frio/fresco que o normal para a estação do ano”; 2 “Um pouco mais frio/fresco que o normal para a estação do ano”; 3 “Nem mais frio/fresco ou quente/calor que o normal para a estação do ano”; 4 “Um pouco mais quente/calor que o normal para a estação do ano”; 5 “Muito mais quente/calor que o normal para a estação do ano”.

15. Interferência da Temperatura no Último Verão

Seguidamente pedimos-lhe para pensar em que medida considera que a temperatura que se fez sentir durante o último verão interferiu com a sua vida, com a vida da sua família, e com a vida das outras pessoas em geral.

No geral, em que medida considera que a temperatura que se fez sentir no último verão interferiu com:

It1. A sua vida?

It2. A vida das pessoas da sua família?

It3. A vida da população Portuguesa em geral?

It4. A vida da população Mundial em geral?

Opções de resposta para cada item: 1 “Nada”; 2 “Pouco”; 3 “Moderadamente”; 4 “Muito”; 5 “Extremamente”.

16. Atitudes face às vagas de calor (Negatividade/Positividade; adaptado da Tese de Mestrado)

Quando pensa em vagas de calor, o que é que isso o(a) faz sentir?

	1	2	3	4	5	
Extremamente mal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente bem
Extremamente insatisfeito(a)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente satisfeito(a)
Extremamente desconfortável	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente confortável
Extremamente negativo	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremamente positivo

Questionário Sociodemográfico

17. Localidade de residência

18. Localidade onde se encontra neste momento

19. Localidade onde passou as últimas duas semanas

Mensagem Final

Muito obrigado pela sua participação, o seu contributo é bastante importante para nós!

Por ter participado nos 4 momentos do estudo relembramos que está habilitado ao sorteio dos 20 vouchers SONAE de 50 euros (máximo 1 voucher por pessoa). O sorteio vai decorrer no dia 12 de novembro de 2018. Caso seja contemplado com um dos vouchers será contactado por email nesse dia.

Mais uma vez muito obrigado pela sua participação e pelo tempo que nos disponibilizou.

