‘I’M A TEENAGER AND I FEEL LONELY’:

TOWARDS IDENTIFYING THE MULTIPLE FACETS AND TRAJECTORIES OF LONELINESS

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To Life,

for all the challenges it has posed to me, and which have made me grow.

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2260 _ Research Methods & Experimental Design

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GENERAL ABSTRACT

Loneliness is currently defined as a negative, painful, and distressful feeling that someone experiences when their relations and their social world is perceived as deficient (Peplau & Perlman, 1982). These feelings are especially salient during adolescence due to the changes and challenges that occur during this developmental period. Given the complex nature of this construct, in the present thesis, our focus was on three relevant aspects: (1) analyze factorial structure and the psychometric characteristics of a multidimensional loneliness measure that considers the different facets of loneliness, (2) examine the possibility of the cooccurrence of the different facets of loneliness, and (3) investigate the stability and changes of loneliness during adolescent years considering three consecutive school years.

Adopting the perspective that loneliness is multifaceted, our first aim was to analyze the factorial structure of a loneliness measure, which is RPLQ (Relational Provision Loneliness Questionnaire; Hayden-Thomson, 1989). This measure considers two facets of loneliness (social and emotional) and, simultaneously, the two more important social contexts where these feelings could occur (family and peers). Moreover, it was our intent, establish measurement invariance across sex and age, and establishing discriminant validity. Our results showed substantial support for the construct validity and reliability of the RPLQ. Measurement invariance was established across sex and age, and it was also assumed discriminant validity, provided by the contrast with positive and negative social functioning dimensions in peer group.

Studies considering simultaneously the different facets of loneliness and different social relations in which loneliness occurs are lacking. So, in second place, our focus was on the different facets of loneliness in the context of family and peers, and the cooccurrence of them in everyone. Adopting a person-centered approach, our aim was to identify distinct groups of adolescents with similar patterns of social and emotional loneliness within peers and family, and to examine if distinct profiles of loneliness were differently associated with positive and negative features of social adjustment to peer group. Our results revealed two clusters with more adaptative profiles (less-lonely and family-related loneliness) in which adolescents were perceived by peers as having more prosocial behaviors. Two other clusters displayed a more maladaptive profile (more-lonely and peer-related loneliness) in which youths were more likely to be perceived as socially withdrawn, excluded and victimized by peers. Sex differences was found with girls from more-lonely profile showing higher social loneliness related to peers, and social and emotional loneliness related to family context.

Finally, longitudinal studies are scarce, and all of them assume that the development process of loneliness was a continuum. So, in third place, our focus was on the stability and changes on loneliness profiles across adolescence. Our aim was to analyze the transitions and transition patterns among the loneliness profiles across the three consecutive school years. Our purpose was to examine the stability and changes in membership profile and examine if there were lasting effects. The association between loneliness and some of its strongest correlates completed our third aim. Our results showed that the less-lonely profile was the more stable, and the More-lonely has the lowest stability. Peer- and Family- related loneliness profiles were moderately stable over time. Even adolescents that showed a tendency to transition to other profiles, they tend to change into a profile with lower loneliness, except for Family-related loneliness profile. Our results also suggest there was a lasting effect of adolescent's loneliness with those who have a history of this feelings were more likely to be a lonely person later.

RESUMO GERAL

A solidão é normalmente definida como um sentimento negativo, doloroso e angustiante que é experimentado quando as relações sociais de alguém são percebidas como deficientes (Peplau & Perlman, 1982). É um sentimento especialmente saliente durante a adolescência devido às mudanças que ocorrem durante este período do desenvolvimento. A presente dissertação focou-se em três aspetos: (1) analisar a estrutura fatorial e as características psicométricas de uma medida de solidão multidimensional, (2) examinar a possibilidade de coocorrência das diferentes facetas da solidão, e (3) investigar a estabilidade e as mudanças da solidão durante a adolescência considerando três momentos consecutivos de avaliação.

Adotando uma perspetiva multifacetada da solidão, o nosso primeiro objetivo foi analisar a estrutura fatorial de uma medida de solidão, que é o RPLQ (Relational Provision Loneliness Questionnaire; Hayden-Thomson, 1989). Esta medida considera duas facetas da solidão (social e emocional) e, simultaneamente, dois contextos sociais importantes onde estes sentimentos podem ocorrer (família e pares). Além disso, foi nossa intenção estabelecer a invariância da medida entre sexo e idade, e estabelecer validade discriminante. Os nossos resultados mostraram a validade do construto e a fiabilidade do RPLQ. A invariância da medida foi estabelecida entre sexo e idade, e também foi assumida validade discriminante, fornecida pelo contraste com dimensões positivas e negativas do funcionamento social no grupo de pares.

O nosso segundo objetivo foi identificar grupos distintos de adolescentes com padrões semelhantes de solidão social e emocional nos pares e na família, e analisar se diferentes perfis de solidão estão associados a diferentes características de ajustamento social ao grupo de pares. Os nossos resultados revelaram dois clusters mais adaptativos (sem solidão e solidão no contexto da família) nos quais os adolescentes foram percebidos pelos pares como tendo comportamentos mais pró-sociais. Outros dois clusters exibiram perfis mais desadaptados (com solidão e solidão no contexto dos pares), nos quais os jovens eram percebidos como socialmente retraídos, excluídos e com maior possibilidade de serem vitimizados pelos pares. Diferenças entre os sexos foram encontradas com as meninas do perfil mais solitário, a apresentar maior solidão social na relação com os pares e maior solidão social e emocional no contexto familiar.

O nosso terceiro objetivo foi analisar a estabilidade e a mudança, através da transição entre os perfis de solidão, ao longo de três anos letivos consecutivos, verificando também se existem efeitos de precedência. A associação entre solidão e alguns de seus correlatos mais fortes completou o nosso terceiro objetivo. Os nossos resultados mostraram que o perfil menos solitário foi o mais estável, e o mais solitário apresentou menor estabilidade. Os perfis de solidão relacionados a pares e familiares foram moderadamente estáveis ao longo do tempo. No entanto, os adolescentes que mostraram tendência para mudar, tendem a transitar para um perfil com menor solidão, com a exceção do perfil de solidão na família. Os nossos resultados também sugerem que há um efeito de precedência, em que adolescente com um histórico de solidão têm maior probabilidade de se tornarem adultos solitários.

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Chapter I: General introduction

General introduction

Some considerations

Conceptualized as an emotional problem (e.g., Matthews et al., 2016) and categorized as an internalizing problem (e.g., Qualter et al., 2015), loneliness is an unpleasant and aversive feeling that may have a negative impact on an individual's social and emotional development, as well as on their general well-being, particularly during adolescence (e.g., Heinrich & Gullone, 2006). Adolescents, who are facing significant challenges and changes in their social worlds, are particularly vulnerable to experiencing loneliness. In this sense, it is critical to protect youths from adverse experiences and risk factors that may have an impact on their potential to develop, not only for their well-being during adolescence, but also for their psychological and physical health in adulthood.

Associated with increased risk for psychological and physical health disorders, even with mortality, loneliness is becoming increasingly recognized as a public health concern (Leigh-Hunt et al., 2017; Holt-Lunstad, 2017) that need to be addressed with effective interventions. Although transient feelings of loneliness may be normative, when these feelings become chronic and severe serious psychological and physical health problems can arise.

According to data by World Health Organization (WHO, 2021), up to 50% of all mental health conditions start before the age of 14 years and up to one in five adolescents experience a mental disorder each year. For example, suicide is one of the three leading causes of death among older adolescents. In turn, poor adolescents' mental health is associated with a range of high-risk behaviors, such as self-harm, tobacco, alcohol and substance use, risky sexual behaviors and exposure to violence, and the effects of which persist throughout the life-course and have serious implications.

Additionally, in the WHO European Region, depression and anxiety disorders fall into the top 5 causes of overall disease burden among children and adolescents (as measured by disability-adjusted life years). Suicide is the leading cause of death among 10–19-year-olds in low- and middle-income countries of the European Region, and the second-leading cause in high-income countries.

In Portugal, according to the Technical Report (Baarck & Kavacic, 2022) published by Join Research Center (JRC), of the European Commission (EC), loneliness issues are a subject

of preoccupation. About 21,9% of Portuguese people, in 2020, felt lonely more than half of the time in the two previous weeks preceding their interview. This result is even more worrying if it takes in consideration the evolution of this indicator, which rose 15.3% compared to 2016, making Portugal the sixth country in the European Union where feelings of loneliness increased the most.

The lock down imposed by the covid-19 pandemic is not unrelated to this phenomenon. However, this result is strange if other more recent studies, carried out by Health Behavior in School-aged Children (HBSC) in collaboration with WHO on adolescence in Portugal, are considered. These studies revealed that between 2018 and 2022, Portuguese adolescents' perception of unhappiness rose from 18.3% to 27.2%.

Definition

Although considering different theoretical approaches that lead to different definitions of loneliness, there were three features that were consensual across all definitions (Peplau & Perlman, 1982; Rotenberg, 1999): (1) loneliness results from perceived deficiencies in one's social life, (2) it is a subjective condition that can only be assessed from the individual's own perspective, and (3) it is a negative, painful, and distressing emotional experience.

How it has been referred previously, loneliness is currently defined as a negative, painful, and distressful feeling that someone experience when their relations and their social world is perceived as deficient (Peplau & Perlman, 1982), emerging when is perceived a discrepancy between their actual social and personal relationships and those they would like to have. The discrepancy on their relationships could be expressed in terms of the quality, quantity, or both (e.g., Qualter et al., 2015, Hyland et al., 2019). Providing a global indicator of dissatisfaction from the quality and/or quantity of social relationships (Houghton et al., 2014), loneliness reflects an internal, subjective, and emotional aspect of one's social lives.

Qualitative research on adolescents' perceptions of loneliness showed that youth themselves have defined loneliness as a negative and distressing emotional experience, associated with sadness, emptiness, apathy, and feeling unloved (e.g., Verity et al., 2021). Emerging from both quantitative and qualitative aspects in their relationships (Hemberg et al., 2022), these feelings could be related with inadequate satisfaction of basic interpersonal and social needs. Youth also described loneliness as a dark experience or a dark place, suggesting that they felt consumed by negative emotions when lonely (Verity et al., 2021).

In the present thesis, we relied on the most used definition that which is the definition by Peplau and Perlman (1982). This definition highlights not only the affective facet of loneliness (unpleasant emotion), but also the cognitive aspect of being lonely (feeling not connected and not understood by others), and clearly allows to distinguish loneliness from social isolation, aloneness, and solitude. Even though it is considered that a lack of social contact and support are important antecedents of these feelings, loneliness is a subjective experience, contrasting with the objective state of being socially isolated or being alone.

Although loneliness emerges more frequently among people with little social contact, it is possible that people can feel lonely even when they are surrounded by others, and they can feel just fine when they are alone (Luhmann & Hawkley, 2016). That's why loneliness is therefore referred to as perceived social isolation to distinguish it from objective social isolation.

Doing activities alone, having few ties on their social network, and having fewer social contacts are all markers of social isolation. The common thread across these is an objective and quantitative approach relative to a dearth of social contact and social network size. Whereas social isolation can be an objectively quantifiable variable, loneliness is a subjective emotional state. Loneliness is the perception of social isolation, or the subjective experience of being lonely (Holt-Lunstad et al., 2015).

Loneliness should not be used interchangeably with similar concepts such as social isolation, aloneness, and solitude. For example, Qualter and Munn (2002) found that individuals can be socially isolated without feeling lonely, while other individuals feel lonely without being socially isolated.

Loneliness seems to be distinguishable from the objective state of solitude, social isolation, or aloneness. While loneliness is, by definition, an undesirable condition, aloneness or solitude may be a positive and desirable condition allowing for identity formation, facilitating emotional self-regulation, fostering creativity, enhanced concentration, among others (Heinrich & Gullone, 2006).

Additionally, the definition adopted by us also highlights the importance of distinguishing the different facets of loneliness. Quality is not the same as quantity. Feeling a lack of a close and intimate relationship to another individual (quality) is not the same as feeling a lack of a network of social relationships (quantity).

The different approaches to loneliness

Different theoretical perspectives were used to conceptualize and explain the notion of loneliness which is experienced across life. There have been numerous attempts to define what loneliness is, given the complex, multidimensional, and subjective nature of this construct, and a range of definitions of this construct have been proposed. The main theories of loneliness that continue to be the most referred in the literature and used by researchers are the *social needs approach*, the *cognitive processes perspective*, and the *evolutionary theory of loneliness*.

Proposed by several theorists (e.g., Weiss, 1973), the *social needs perspective* conceptualizes loneliness as a reaction to deficits in relationships. The need for belonging (Baumeister & Leary, 1995) which is a fundamental human need, inherent to human nature, is present from infancy and continuous throughout life. When this need is not met loneliness could occur. According to this perspective, Weiss (1973) defines loneliness as the absence or deficit of a particular type of relationship or the absence of relational patterns, such as the relations with parents, family members, and peers. Weiss (1973) further argued that different types of relationships offer different types of provisions. People may feel lonely in their peer group but, at same time, feel very satisfied with the relation with parents. The idea of social provisions is a key contribution of Weiss (1973) social needs approach. Social provisions are defined as the benefits that someone derives from relationships, that is a key feature of relationships to promote psychological well-being.

Even though the deficits in relationships are emphasized, the theorists of social needs also have posited the existence of specific needs such as intimacy and social integration. Weiss argued that the non-fulfillment of these two types of needs would be associated with different forms of loneliness (the loneliness from emotional isolation and the loneliness from social isolation). In this sense, it is possible to distinguish two forms of loneliness. Social loneliness results from a lack of integration in social networks, with absence of companionship, that could provide a sense of connection with others and belonging to a group with whom it is possible to share activities and common interests. Emotional loneliness, meanwhile, results from an absence of intimacy in close relationships, or loss of close emotional connections which generate feelings of acceptance, attention, trust, and feelings of being understood and loved. Furthermore, the occurrence of these different facets of loneliness is not foreign to the social context.

On the other hand, the *cognitive processes perspective* highlights the importance of subjective appraisals in the experience of loneliness. This perspective assumes that deficits in social experiences do not directly influence, by itself, the emersion of loneliness, but the subjective evaluation that someone does about their social world is particularly relevant. People can be alone without being lonely or feel lonely in a crowd.

Loneliness is caused by an individual's perceived dissatisfaction regarding social relationships. Within this perspective, Peplau and Perlman (1982) define loneliness as an unpleasant feeling that occurs when someone perceives a discrepancy between desired and achieved levels of social relationships. There is evidence suggesting that discrepancies between desired and actual levels of social connectedness are linked to feelings of loneliness (Russell et al., 2012). Peplau and Perlman (1982) not only argued that loneliness results from deficiencies in social relationship of a person's network and, in addition, people experience loneliness both because of a perceived lack of social relationships and because of a perceived lack of quality in social relationships (Tzouvara, et al., 2015). Adopting an individualistic perspective on loneliness, this approach focuses more on how individuals perceive their social life and relationships. Two people in objectively identical social situations, or very similar, can experience loneliness very differently.

Considering the socio-cognitive models of loneliness, the perception of the self in relation to others also plays a crucial role (e.g., Cacioppo & Cacioppo, 2018, van Roekel et al., 2016). These models have the assumption that the perception of self and others is biased by loneliness. For example, negative perception might make lonely people behave more negatively, and that might elicit negative behavior from others that, by consequence, confirm the negative perception (Cacioppo & Cacioppo, 2018; Spithoven et al., 2017). Empirical research has been found that relatively lonely individuals tend to evaluate themselves and others more negatively and to expect more negative evaluations from others (Spithoven et al., 2017).

Even though loneliness is traditionally viewed as a painful sensation or a chronic distress, more recently has been conceptualized as a biological construct, in which loneliness is viewed as a signal to change behavior. Built on the 'need to belong' theory (Baumeister & Leary, 1995), this evolutionary theory emphasizes the evolutionary origins of loneliness. Like pain, hunger, or thirst are biological warning systems to motivate someone to act to minimize physical damages, loneliness emerges to motivate someone to reconnect with others and minimize social and emotional damages. In this sense, loneliness could be viewed as adaptive,

since it is a transient state, alerting and contributing to the maintenance or repair of meaningful social connections. As an innate biological warning system, loneliness signals that something is missing in personal and social relationships and improvements need to be made in social relationships (Cacioppo, et al., 2015). When meaningful social connections are perceived as unavailable or severed, loneliness can produce harmful effects on cognition and behavior (Cacioppo & Hawkley, 2005) that, in turn, increase the likelihood that loneliness becomes chronic (Cacioppo & Hawkley, 2009; Young, 1982).

Loneliness leads to cognitive biases, including a hypervigilance to social threat (e.g., heightened sensitivity to signs of rejection), a more negative interpretation of the behavior of others, and a self-defeating attributional style (Qualter et al., 2015). Thus, those who experience loneliness may see their social world as more threatening, may be more sensitive to rejection, and may interpret the behavior of others in a more negative way. On the other hand, the hypervigilance regarding social threat leads those who feel lonely to be more focused on negative aspects of social circumstances and behave in a way that elicits behaviors from others that reinforce their negative expectations.

Fortunately, for most adolescents, loneliness is transient once they are able to improve their social relationships and bolster their sense of belonging (Qualter et al., 2015).

Loneliness and adolescence

Loneliness is often considered a problem of the elderly (Hawkley et al., 2022), but it is a universal feeling, and all people of all ages may experience loneliness. However, this construct has been assigned special importance during adolescence, which has been regarded as a developmental period when loneliness peaks and has a particular relevance (Heinrich & Gullone, 2006; Qualter et al., 2015). During adolescence, youth are typically confronted with numerous social changes and challenges, making them vulnerable to the experience of loneliness. The need and the desire for autonomy and independence, that gradually emerge (Bowker et al., 2021), causes adolescents to distance themselves physically and emotionally from parents and family group (although continuing to need their support). In this circumstance, adolescents might experience some unmet social needs and consequently feel lonely in family context (Danneel et al., 2018). Simultaneously, peers are becoming increasingly important, representing sources of belonging and identity. Establishing satisfactory peer relationships

characterized by closeness and intimacy becomes important and adolescents that are unable to form these relationships can feel lonely (Eccles et al., 2020; Schinka et al., 2013).

Particularly during adolescence, loneliness may be a vulnerability factor when it comes to establishing positive relationships (e.g., Rubin et al., 2008) and, consequently, may have an impact on individuals' social and emotional development, as well as, on their well-being in general (Lasgaard et al., 2016).

Previous research on adolescents' loneliness has shown that these feelings are associated with poorer well-being (Hawkley & Capitanio, 2015; Heinrich & Gullone, 2006; Mahon et al., 2006; Qualter et al., 2015), with adjustment difficulties, such as dropping out of school and juvenile delinquency, as well as lower self-esteem (e.g., Vanhalst et al., 2013), anxiety, depressive symptoms, and suicidal ideation (Hawkley & Capitanio, 2015; Heinrich & Gullone, 2006; Mahon et al., 2006). Moreover, loneliness has been associated with physical problems, such as poor sleep and shorter sleep duration (Hawkley & Capitanio, 2015). It has been shown that it is also associated with intrapersonal factors, like introversion, shyness, and lower self-exposure (Mahon et al., 2006; Qualter et al., 2015), and with interpersonal factors, like insecure attachment, peer exclusion, and victimization, and a lack of quality in friendships relationships (Heinrich & Gullone, 2006; Mahon et al., 2006).

Associated with these difficulties and maladjustments, there is another aspect, as referred to previously, that is the presence of cognitive biases in social information processing (Spithoven et al. 2017). Specifically, adolescents who suffer from chronic loneliness associated with internalizing problems are often subject to negative interpretation biases and attention biases regarding social information (e.g., Spithoven et al. 2017).

According to the evolutionary theory (Cacioppo et al., 2015), loneliness could be viewed as an adaptive response to the experience of social disconnection, which braces individuals to cope with a potentially unsafe environment without the protection of others (e.g., Matthews et al., 2022). As a result, loneliness is accompanied by a high vigilance for social threats, reduced trust in others, and more negative expectations of social encounters (Spithoven et al., 2017).

Additionally, while these may help to maintain a distance from potentially hostile intents or circumstances, engaging in these defensive patterns of behavior could negatively bias how lonely individuals are perceived by others.

Some correlates of loneliness

Over the past decades, an extensive number of empirical studies have been focused on the correlates and consequences of loneliness. The development of positive and satisfactory peer relationships and the formation of friendships are crucial in helping adolescents accomplish developmental tasks such as forming their identity, developing social-cognitive skills and self-esteem, and establishing autonomy (see Rubin et al., 2015, for a review). Establishing satisfactory peer relationships characterized by closeness and intimacy becomes important and adolescents that are unable to form these relationships can feel lonely (Eccles et al., 2020; Schinka et al., 2013).

Previous studies have established an association between loneliness and some correlates such as sex, self-worth, and social functioning in the peer group. Social behaviors and intrapersonal characteristics may contribute to the extent of loneliness by making social interactions and relationships (such as friendship) more or less likely. Mahon et colleagues (2006) conducted a meta-analysis and revealed a large effect size for the link between sex, shyness / social withdrawal, and self-esteem. For example, shy or withdrawn behavior may result in fewer opportunities for socializing and fewer opportunities for establishing positive interactions (Spithoven et al., 2017).

In line with the theoretical assumptions on the association between loneliness and some characteristics of personality, shy adolescents may be perceived by their peers as less interesting interaction partners, resulting in lower social acceptance by the peer group, which in turn, could explain their higher levels of loneliness. Using peer nomination procedures, Woodhouse and colleagues (2012) also found that adolescents´ loneliness was associated with lower peer acceptance, greater likelihood of being victimized, and higher levels of shyness/social withdrawal.

Regarding self-esteem, a meta-analysis on the correlates of adolescents' loneliness (Mahon et al., 2006) indicated that the correlations between self-esteem and loneliness have a large effect. In adolescence, one's perception of social and personal relationships is of crucial importance to one's self-esteem. Adolescents who score high on loneliness score low on self-esteem (Geukens et al., 2020). Changes in loneliness were accomplished by changes in the opposite direction for self-esteem. These results seem to indicate that low self-esteem could play a role in the development and maintenance of loneliness.

The present thesis

Due to the complex and multifaceted nature of this construct, in the present thesis, our focus was on a better understanding of the construct of loneliness, considering understudied topics, addressing important gaps in the loneliness literature, considering inconsistencies in some research results, and trying to extend the existing knowledge about loneliness.

Embracing the multidimensional perspective of loneliness, a multi-informant approach, and powerful statistical techniques, this thesis tries to address previously identified gaps in the literature. Three empirical studies were conducted with the purpose to investigate the factorial structure of a particular measure of loneliness (RPLQ loneliness scale) that assesses simultaneously the different facets of loneliness, the cooccurrence of the different facets of loneliness, and the developmental course of loneliness across adolescence. Specifically, the three empirical studies presented in this thesis the focus on three relevant goals: (1) analyze factorial structure and the psychometric characteristics of a multidimensional loneliness measure that considers the different facets of loneliness and the social context where these feelings could occur, (2) examine whether there are groups of adolescents who share the same constellation of loneliness feelings, considering the possibility of the cooccurrence of the different facets of loneliness, and (3) investigate the stability and changes of loneliness during adolescent years considering three consecutive assessment timepoints. Throughout the entire study, a multidimensional perspective was adopted, as well as a person-centered approach, together with flexible and powerful statistical instruments which allowed to address developmental questions and analyze developmental processes.

To accomplish these goals, our first study is related to the factorial structure and psychometric adequacy of a multidimensional loneliness measure which is RPLQ (Relational Provision Loneliness Questionnaire; Hayden-Thomson, 1989).

Although researchers increasingly acknowledge the multidimensional nature of loneliness, and the importance of distinguishing the different facets of loneliness, in most studies, the focus is still on general loneliness (Geukens et al., 2022; Hyland et al., 2019). However, multidimensional measures are particularly important because they can offer a more comprehensive and differentiated perspective of loneliness (Maes et al., 2015). To assess the different facets of loneliness (social and emotional), considering simultaneously the social contexts where these feelings can occur, the Relational Provisions Loneliness Questionnaire

seems to be a good option. RPLQ has explicitly been developed to assess those two relational benefits (social provisions as defined by Weiss), namely personal intimacy (quality of relationships, also referred to as emotional loneliness) and group integration (quantity of relationships, also referred to as social loneliness) as they are provided in two social and relational contexts, which are the family and the peers contexts. A rather unique feature of this measure is the attempt to distinguish intimacy (emotional loneliness) from integration (social loneliness) (Terrell-Deutsch, 1999), two different aspects of relationships that can lead to loneliness. This measure also considers, simultaneously, the two more important social contexts where these feelings could occur – family and peers. Therefore, we begin the present thesis by examining the factorial structure and the psychometric properties of the RPLQ. Additionally, we also evaluated the measurement invariance across sex and age groups, and discriminant validity with an external criterion to provide extra evidence to support the assumption that loneliness facets represent distinct forms of the same construct.

Our second goal (second study) is related to the identification of groups of adolescents who share the same constellation of loneliness feelings considering the possibility of the cooccurrence of the different facets of loneliness.

Although the knowledge base on loneliness in adolescence is expanding, still only few studies adopt a multidimensional and a person-centered approach, and most of what we know about adolescents' loneliness is based on variable-centered research (Hyland et al., 2019). These studies were designed to describe mean differences or to compare lower with higher loneliness scores to classify loneliness by a predetermined cut-off point. However, it is particularly useful the identification of adolescents' homogeneous subgroups who could share the same configurations of the different forms of loneliness and analyze if distinct forms of loneliness naturally co-occur. A person-centered approach, instead of variable-centered, seems to be a better approach to gaining insight into how psychological constructs are manifested within individuals.

Previous studies that explore loneliness using a person-centered approach are scarce (Maes, et al., 2016) and studies considering simultaneously the different facets of loneliness (social and emotional loneliness) and their source (peer and family) are, to the best of our knowledge, inexistent. So, our focus was on the different facets of loneliness (social and emotional loneliness in the context of family and peers), and the cooccurrence of them in everyone. Adopting a multidimensional and person-centered approach, our aim was to identify

distinct groups of adolescents with similar patterns of social and emotional loneliness within peers and family and to examine if the distinct profiles of loneliness were differently associated with positive and negative features of social adjustment to the peer group. Additionally, sex-specific differences were also analyzed.

Finally, our third goal is related to the developmental course of loneliness during the developmental period of adolescence.

The knowledge on loneliness in adolescence is expanding but most of what we know about adolescents' loneliness is based on studies with cross-sectional designs which do not inform about developmental course of this negative feeling. However, longitudinal studies are scarce (Danneel et al., 2020, Hutten et al., 2021), and a limited number of them assumes that the development of loneliness is a continuum (e.g., Hutten et al., 2021). We consider that loneliness may be experienced as a discontinued process across time in which adolescents could be more or less likely to experience these feelings just in a particular point of time and nor in another. Research adopting this perspective is lacking.

In this sense, our study extended previous research by using a longitudinal approach, which is LTA, to analyze the development course of loneliness across adolescence assuming that the experienced feelings of loneliness over time are a discontinuous process. In our third study, our focus was on the stability and changes in loneliness profiles across adolescence. Our aim was to analyze the transitions and transition patterns among the loneliness profiles across the three consecutive assessment timepoints. Our purpose was to examine the stability and changes in membership profile over the course of three consecutive school years and observe if there were lasting effects of the first assessment timepoint one the last one. An in-depth investigation of the longitudinal course of loneliness and the association between loneliness and some of its strongest correlates, which is sex, shy/social withdrawal, and self-esteem completed our third aim.

Beyond the three empirical studies presented above, this thesis is composed of two other chapters which are related to a general introduction about the topic of loneliness and a general discussion about our results.

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Chapter II: Loneliness in adolescence: confirmatory factor analysis of the Relational Provisions Loneliness Questionnaire (RPLQ) in a Portuguese sample*.

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Ribeiro, O., Santos, A. J., Freitas, M., Rosado, A., & Rubin, K. (2019). Loneliness in adolescence: Confirmatory factor analysis of the Relational Provisions Loneliness Questionnaire (RPLQ) in a Portuguese sample. *International Journal of Behavioral Development, 43*(5), 457-465. http://dx.doi.org/10.1177/0165025419850893

Abstract

The present study assesses the factor structure, psychometric adequacy, and invariance across sex and age of the Relational Provisions Loneliness Questionnaire (RPLQ). Discriminant validity with an external criterion was also tested. In a sample of Portuguese adolescents, from 7th to 9th grade (N = 817), Confirmatory Factor Analyses (CFA) were conducted to test the four-factor model of loneliness (lack of integration and/or intimacy in peer group and/or family) proposed by Hayden-Thomson (1989). Results evidenced empirical support for the structure of the RPLQ loneliness scale, which fitted very well the proposed model, and provided adequate fit to the Portuguese data. There was substantial support for the construct validity (factorial, convergent, and discriminant) and reliability of the RPLQ. Measurement invariance (configural, metric, and scalar) was established across sex and age. Finally, it was assured discriminant validity, provided by the contrast with the social functioning dimensions in peer group. Overall, our findings support the conceptualization of loneliness in adolescence by peer- and family-related loneliness through lack of integration and intimacy. In a single instrument, the RPLQ loneliness scale combines measures of four important aspects of adolescents' social life. This seems to be an adequate instrument to be used in the study of adolescents' loneliness, in its different forms and across relational contexts.

Keywords: Loneliness, Adolescence, Factorial validity, Measurement invariance, Discriminant validity, Item parceling.

Introduction[1]

Loneliness is an unpleasant feeling that reflects an internal, subjective and emotional aspect of a person's social life, and may be indicative of dissatisfaction regarding either the quantity and/or quality of one's social relationships (Houghton et al., 2014; Peplau & Perlman, 1982; Mellor, Stokes, Firth, Hayashi, & Cummins, 2008). Adolescents, who face significant changes in social expectations, relationships, roles, and identity, might be particularly vulnerable to experiencing loneliness (Lasgaard, Armour, Bramsen, & Goossens, 2016; Rubin, Bukowski, Parker, & Bowker, 2008). It is imperative to have psychometrically sound rating scales to identify loneliness in order to promote effective assessment and intervention strategies (Bagner, Storch, & Roberti, 2004; Heinrich & Gullone, 2006).

Measurement of loneliness

Loneliness is a complex construct that can be measured as either a unidimensional or as a multidimensional concept. The former conceptualizes loneliness as a unitary phenomenon presenting similarities across different circumstances and relationships. It may be measured by a single scale (e.g., UCLA Loneliness Scale; Russell, Peplau, & Cutrona, 1980) or even a single item. However, Heinrich and Gullone (2006) have questioned the adequacy of unidimensional assessments, because these might not be able to reveal the complex (and probably different) associations between loneliness and other feelings. In contrast, the multidimensional approach accepts that loneliness might take multiple forms.

According to Weiss (1973), different relationships pose distinct challenges and inadequacy across social relationships leads to distinct forms of loneliness. In this sense, multidimensional measures are particularly strong because they offer a more comprehensive picture of loneliness than unidimensional measures do (Maes, Klimstra, van de Noortgate, & Goossens, 2015). Several researchers have provided strong evidence that loneliness is indeed a multidimensional construct (Bagner et al., 2004; Ditommaso & Spinner, 1997; Goossens & Beyers, 2002; Goossens et al., 2009; Houghton et al., 2014; Maes, Vanhalst, van de Noortgate, & Goossens, 2016).

At the scales level, previous studies that analyzed several loneliness measures, have shown that scales from different measures load on multiple factors rather than on a single one

[1] This manuscript has supplementary materials. See appendices: appendix A

(Cramer & Barry, 1999; Goossens & Beyers, 2002). In a sample of children, Goossens and Beyers (2002) have shown evidence that parent- and peer-related loneliness were two diverse constructs. In a sample of adolescents, Goossens et al. (2009) have later shown that the four-factor solution provided a better fit than the alternative models with one-, two-, and three-factors. Studies with adolescents also revealed that measures of loneliness as a unidimensional construct often load on the factor of loneliness within the peer-group (Cramer & Barry, 1999; Goossens et al., 2009).

Overview of the Relational Provision Loneliness Questionnaire (RPLQ)

The RPLQ loneliness scale, albeit being an unpublished scale (Hayden-Thomson, 1989), has an interesting conceptual basis. It is a multidimensional measure of loneliness conceived to be consistent with Weiss's (1973) Social Needs perspective. It draws particularly on the assumption that loneliness is a true lack of close relationships with significant others (Qualter & Munn, 2002). Assuming that different relationships offer distinct perspectives (Weiss, 1973), it is therefore plausible that loneliness may take multiples forms. The Hayden-Thomson measure considers the important distinction made by Weiss (1973) between the social and the emotional form of this construct. Social loneliness (or integration), associated with the absence of engagement, consists in a lack of integration in social networks that could offer a sense of connection with others. Emotional loneliness (or intimacy), associated with the absence of a satisfactory close relationship, refers to the lack of intimacy that could provide a sense of share and trust. It is an affective state, and it is not related to the number of friendships formed.

The RPLQ loneliness scale has explicitly been developed to assess those two relational benefits ('social provisions' as defined by Weiss), namely personal intimacy (also referred to as dyadic or emotional loneliness) and group integration (also referred to as social or relational loneliness) as they are provided in two relational contexts, the family, and the peer group. This scale comprises four subscales: Peer-group integration, Peer-personal intimacy, Family-group integration, and Family-personal intimacy. The distinction between 'lack of intimacy' and 'lack of group integration' mirrors the distinction between 'emotional loneliness' and 'social loneliness' proposed by Weiss.

A rather unique feature of this instrument is the attempt to distinguish intimacy from integration (Terrell-Deutsch, 1999). Moreover, this scale assesses loneliness experiences taking into account the two main agents of socialization: peers and family. For example, it is possible

for one to feel high satisfaction with the relationship with their parents, but conversely to feel very lonely with one's friends. Self-report measures such as the RPQL loneliness scale are probably the more appropriate methods for assessing this phenomenon (Heinrich & Gullone, 2006).

Goossens and Beyers (2002) found that the RPLQ peer-related construct was mainly defined by lack of group integration, which revealed a stronger standardized loading than the dimension of lack of peer intimacy. In contrast, family-related loneliness was determined by lack of both integration and intimacy within the family. Although these results were inconsistent, the model of childhood loneliness that considers family- and peer-related loneliness as two separate constructs has found empirical support (e.g., Goossens & Beyers, 2002; Houghton et al., 2014). More recently, Maes, Vanhalst, van de Noortgate and Goossens (2017) showed additional evidence for the construct validity of the peer's subscales of the RPLQ. Peer intimacy and Peer group integration subscales were correlated with the dimensions of Peer Dyadic Loneliness and Peer Network Loneliness from another multidimensional measure, the Peer Network and Dyadic Loneliness Scale (PNDLS; Hoza, Bukowski, & Berry, 2000). Additionally, previous research has shown evidence of high reliability ($\alpha > .80$; Terrell-Deutsch, 1999) except for the lack of peer intimacy dimension (.78; Goossens & Beyers, 2002). Substantial concurrent validity has also been verified (Goossens & Beyers 2002; McDougall & Hymel, 1998; Rubin, Chen, McDougall, Bowker, & McKinnon, 1995).

Current research

Due to the existing gaps in the literature, the present study aimed to evaluate the factor structure, the psychometric adequacy (reliability and validity), and the measurement invariance across sex and age groups of the RPLQ loneliness scale, in a sample of Portuguese youth, from the 7th to the 9th grade. Additionally, we tested the discriminant validity with an external criterion to provide extra evidence to support the assumption that loneliness factors represent distinct forms of the same construct.

The main goal was to find empirical support for the Hayden-Thomson four-factor model (1989) of loneliness (lack of peer-group integration, lack of peer-personal intimacy, lack of family-group integration, and lack of family-personal intimacy) and to test whether this model provided an adequate fit in a sample of Portuguese youth. The proposed four-factor model was expected to fit the data well.

Another goal of this study was to verify the construct validity (factorial, convergent, and discriminant) and reliability (internal consistency) of the RPLQ factors.

Measurement invariance was also tested across sex and age groups. Establishing measurement invariance is essential to compare groups, in all psychological research (Byrne & Watkins, 2003). We expected to establish measurement invariance, meaning that the items, as well as the latent factors, were interpreted in the same way by boys and girls and, also, by all participants in the different age groups.

Finally, to establish the discriminant validity of this measure, the demonstration of differential relationships of the loneliness construct with external ones was required. This procedure provides extra evidence to support the assumption that loneliness factors represent distinct related constructs. We also investigated associations between the scores on the lack of integration and intimacy within the peer- and family-group and the dimensions of social functioning in the peer group, as reported by peers.

In summary, the hypotheses of our study were: (a) the RPLQ loneliness scale had a clear four-factor structure that reflected its underlying theoretical conceptualization; and (b) the subscales of a peer-nominations measure of adolescents' social functioning and reputation in the class group (i.e., the Extended Class Play) will allow for successful prediction of their self-reported peer- but not family-related loneliness.

Method

Participants

A total of 817 participants (397 boys), aged between 11 and 17 years old (M = 13.14, SD = 1.26) were recruited from three Portuguese public junior high schools (grade 7 through 9) in the Lisbon metropolitan area. This sample comprised 672 (82.3%) seventh-grade students (324 boys, 48.2%), 111 (13.6%) eighth-grade students (58 boys, 52.2%) and 34 (4.2%) ninth-grade students (15 boys, 44.1%). The mean age for the seventh-, eighth-, and ninth-grade groups were 12.87 (SD = .04), 14.05 (SD = .09), and 15.56 (SD = .18), respectively. The schools where data collection took place mainly have students from lower middle-class background.

From the original sample of 885 participants, 68 were removed: those whose involvement in scale completion appeared to be lower, who were unengaged, as evidenced by giving exactly the same response to every question (21 participants with SD = 0), and those

whose answers had missing values higher or equal to 5% (47 participants). This procedure yielded a final sample of 817.

Procedure

Data collection proceeded after we obtained permission from the school authorities and informed consent from the families. This study was carried out in accordance with the recommendations of APA Ethical Guidelines with written informed consent from all participants. Participants provided assent and were given written consent from their parents to participate in this study in accordance with the Declaration of Helsinki. The protocol was approved by ISPA-Instituto Universitário's Ethical Committee.

All assessments were performed in classroom during regular school hours, during a single 45-minute session. A research assistant was present in all classroom assessments to introduce the study and to answer questions. The given instructions emphasized the confidentiality of the data, the anonymous and voluntary participation, and the importance of completing the questionnaire individually.

Concerning the RPLQ, this questionnaire was translated from the original English version into Portuguese following the procedures outlined by the "Committee Approach" (Brislin, 1980), a methodology for cultural adaptation of psychological questionnaires. A first version was then applied to a small group of adolescents to ensure that all items were understandable and thus suitable.

Measures

Relational Provision Loneliness Questionnaire (RPLQ). The RPLQ (Hayden-Thomson, 1989) is a 28-item self-report instrument that aims to assess subjective feelings of loneliness through two aspects of social satisfaction (group integration and personal intimacy), experienced in two different social contexts – within peer group and family. This multidimensional measure comprises four subscales (7 items each): Peer-group integration (to what extent the participant feels accepted by his/her peers, e.g. "I feel in tune with other kids"), Peer-personal intimacy (if the participant has a friend with whom he/she share his/her feelings and thoughts, e.g. "I have a friend I can tell everything to"), Family-group integration (to what extent the participant feels integrated in his/her family, e.g. "I feel that I usually fit in with my family"), and Family-personal intimacy (whether the participant has a family member with

whom he/she can share his/her thoughts and feelings, e.g. “I have someone in my family I can tell everything to”).

Adolescents must rate how true each statement (or item) is for them, on a 5-point Likert scale ranging from 1 (not at all true) to 5 (always true), and scores on each subscale could range between 7 and 35. All items scores were reverse coded and summed across all of the items within each relationship (peers and family), considering a particular type of relational benefit (integration and intimacy), to arrive at estimates of adolescents’ various types of loneliness. Higher scores in each subscale indicated higher levels of loneliness. The RPLQ was initially created in Canada with English-speaking children (Hayden-Thomson, 1989) and its validity was established both in English-speaking countries (McDougall & Hymel, 1998; Rubin et al., 1995; Terrell-Deutsch, 1999), and in Europe (e.g., Goossens & Beyers, 2002).

The RPLQ reliability indices were good for all subscales. Cronbach’s α were .84 and .88, respectively for lack of integration and intimacy in peer group, and .90 and .92, respectively for lack of integration and intimacy in family group.

Extended Class Play (ECP). The ECP (Burgess, Wojslawowicz, Rubin, Rose-Krasnor, & Booth-LaForce, 2006) is a 37-item instrument that aims to assess peers’ evaluations of the participants’ social functioning and reputation. Participants completed a Portuguese version of this instrument (Correia, Santos, Freitas, Rosado, & Rubin, 2014), and were instructed to pretend to be the directors of an imaginary class play, and to nominate one boy and one girl among participating classmates for each of 37 positive and negative roles. This measure allows the assessment of six dimensions of social functioning and reputation: Aggression (e.g. “Gets in fights”), Shy / Social withdrawal (e.g. “Doesn’t talk much or talks quietly”), Exclusion (e.g. “Often left out”), Victimization (e.g. “Hit or kicked by others”), Prosocial behavior (e.g. “Helps others”), and Sociability / Popularity (e.g. “Everyone likes”). Peer nominations procedures are considered to be highly reliable and, in this study, Cronbach α are .80, .84, .81, .85, .69, and .73, respectively.

To eliminate possible sex stereotyping, we only considered same sex nominations (Zeller, Vannatta, Schafer, & Noll, 2003), and all item scores were standardized within sex and classrooms, to adjust for the number of received nominations and the number of nominators.

The ECP has been validated in several studies in different cultural settings (Bowker & Raja, 2011; Rubin et al., 2006). In Portugal, the six-factor model proposed by Menzer and

colleagues (Menzer, Oh, McDonald, Rubin, & Dashiell-Aje, 2010) has been supported by Correia and colleagues (2014).

Results

Data analyses

Several Confirmatory Factor Analyses (CFAs) in AMOS software (v. 22, SPSS IBM Company, Chicago, IL) were performed to test the model fit to data, using Maximum Likelihood Estimation of parameters (Arbuckle, 2005).

The presence of outliers was assessed by the square Mahalanobis distance (D^2) and the normal distribution of data by the skewness (Sk) and kurtosis (Ku) tests, in their uni- and multivariate forms. The Expectation Maximization algorithm (EM) was used for missing imputation (Tabachnick & Fidell, 2007).

The goodness of fit for each model tested was assessed with a range of commonly used fit indices (Chen, 2007; Hooper, Coughlan, & Mullen, 2008; Hu & Bentler, 1999; Vanderberg & Lance, 2000), including the Normed Chi-Square (χ^2/df), the Comparative Fit Index (CFI), the Root Means Square Error of Approximation (RMSEA) along with a small confidence interval (Roykov & Marcoulides, 2006), and the Standardized Root Mean Squared Residual (SRMR). Based on Hu and Bentler (1999), CFI $\geq$ .95, RMSEA $\leq$ .06, and SRMR $\leq$ .08 indicate a good fit. A normed Chi-Square (χ^2/df) < 5.0 is considered adequate and smaller values are indicative of a best fitting model (Wheaton, Muthén, Alwin, & Summens, 1977). Akaike Information Criterion (AIC; Bozdogan, 1987) and the Modified Expected Cross Validation Index (MECVI; Browne & Cudeck, 1989) were used as indices of increasing fit to calculate improvements over competing models, with lower values being indicative of the best fitting model. Additionally, when the external validation of a scale in a second sample is not possible, MECVI values may be used. Lower values of MECVI reflect a higher degree of cross-validity and greater stability of the model in the population.

Model modifications were supplemented based on empirical information from the CFA such as factor loadings, standardized residuals, modification indices (MI > 11; p<.001) and based on theoretical considerations.

As indicators of latent factors for CFAs, item parcels were used to reduce the model complexity and the number of parameters to be estimated without the necessity to eliminating

items and losing information that may contribute to the meaning of the latent variable (Nasser & Takahashi, 2003). For example, cross loadings can be eliminated through aggregating items in order to specify a cleaner latent construct. Moreover, item parceling has been adopted to improve the psychometric properties of a measure, such as reliability and communality (Little, Cunningham, Shahar, & Widaman, 2002; Little, Rhemtulla, Gibson, & Schoemann, 2014), and as a means of obtaining item distributions that are more continuous and normally distributed than item scores, under the condition of unidimensionality of the items being combined (Bandalos, 2002).

To assess measurement invariance, Multi-group Confirmatory Factor Analyses (MG-CFA) were performed. This procedure entails a hierarchical set of steps that begins with the determination of a well-fitting multi-group baseline model in which sets of parameters are tested in terms of equality, in a logically ordered and increasingly restrictive approach. Configural (equal structure), metric (constrained factor loadings) and scalar (constrained intercepts) invariance were tested. Following the guidelines proposed by Chen (2007) and Cheung and Rensvold (2002), metric invariance was considered to be established if the ΔCFI (CFI differences) between models with group-specific or common factor loadings was less than .010, ΔRMSEA (RMSEA differences) was less than .015 and ΔSRMR (SRMR differences) was less than .030. Scalar invariance was established if ΔCFI, ΔRMSEA and ΔSRMR between models were less than .010, .015, and .010, respectively. In addition, the Akaike Information Criterion (AIC) was used, which ideally should be as low as possible.

Finally, to analyze whether different loneliness forms showed differential relationships with social functioning dimensions in peer group, assessed by peer-nominations, beyond correlation, we preformed sets of hierarchical multiple regressions.

Screening data

The percentage of missing values was small (0.0 - 0.6%) and the Expectation Maximization algorithm was used to impute missing data. Also, 80 observations were considered as multivariate outliers ($p1, p2 < .001$) and were, thus, eliminated. The uni- and multivariate distribution of items was also checked. Considering the absolute values of the univariate skewness ($|Sk| > 3$) and kurtosis ($|Ku| > 7$) (Finney & Destefano, 2006; Kline, 2011), none of the items had values indicating the violation of the normal distribution (Sk [.65; 1.79] and Ku [-.64; 3.14]).

Confirmatory factor analyses of the RPLQ loneliness scale

First, the proposed factor structure (four-factor model) was checked for fit to the empirical data and if it provided an adequate fit in a sample of Portuguese adolescents. Fit indices are presented in Table 1. CFA analysis revealed a tolerable fit (χ^2/df = 3.12, CFI = .94, RMSEA = .05, SRMR =.04, MECVI = 1.63). However, the analysis of the modification indices (MI > 11, p < .001) showed the presence of factor cross-loadings (i.e., items that loaded on more than one factor).

Table 1
Fit indices for the tested structural models of RPLQ loneliness scale.

Model description	χ^2/df	CFI	RMSEA (90% CI)	SRMR	AIC	MECVI
1. Original 1st order four-factor model	3.12	.94	.05 (.05, .06)	.0389	1197.90	1.63
2. Improved 1st order four-factor model	2.69	.99	.05 (.04, .06)	.0216	186.34	.26

Note. Results from CFA analysis in a sample of Portuguese adolescents (N = 737); 1. Four-factor model proposed by Hayden-Thomson (1989); 2. Four-factor model improved by item parceling; χ^2/df, *Normed Chi-Square*; CFI, *Comparative Fit Index*; RMSEA, *Root Mean Square Error of Approximation*; CI (90%), *Confidence Interval*; SRMR, *Standardized Root Mean Squared Residual*; AIC, *Akaike Information Criterion*; MECVI, *Modified Expected Cross Validation Index*.

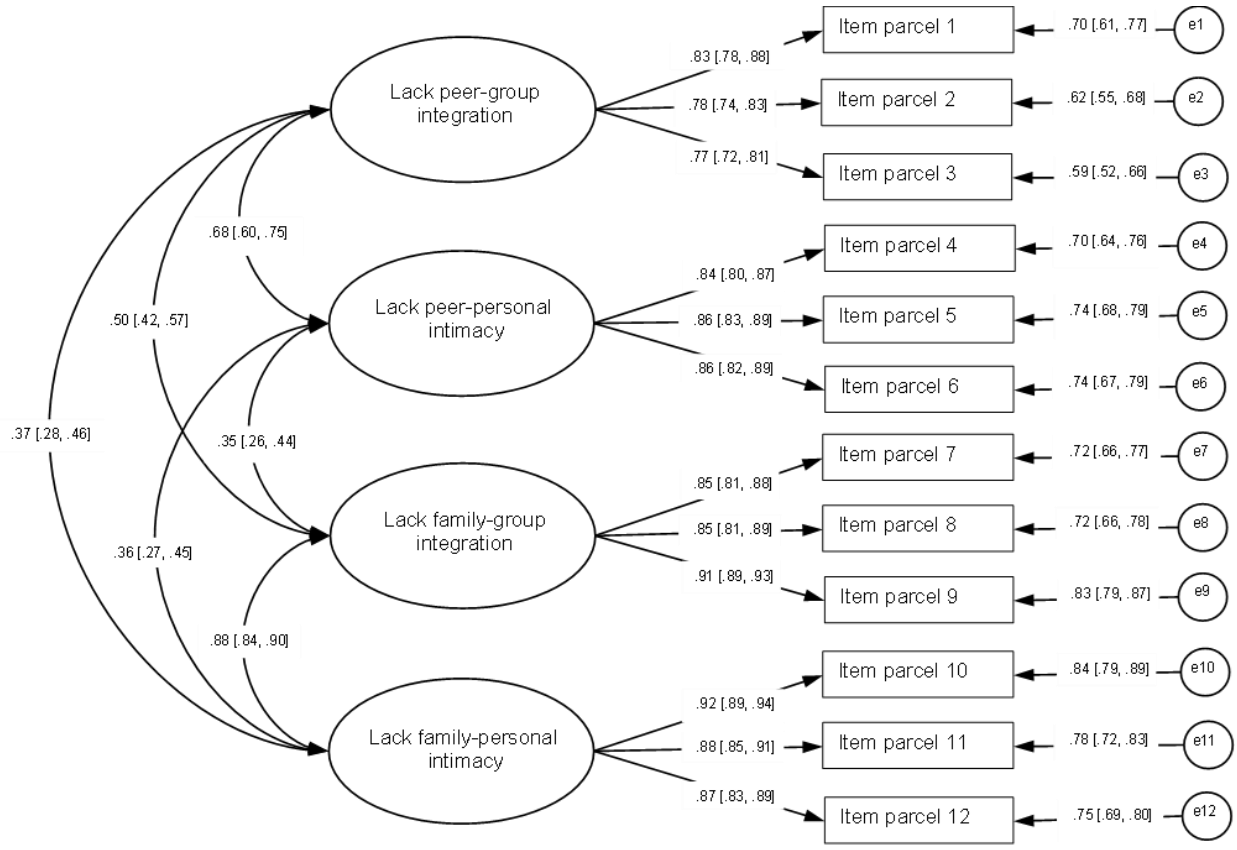
It was adopted a 'conservative' approach trying to maintain the original structure as much as possible, avoiding the temptation to develop a version optimally tailored to these sample, but that may not work that well with other samples. The cross loading can be eliminated through aggregating items in order to specify a clean latent construct. In order to construct item parcels that are equally balanced in terms of their difficulty and discrimination, once the subscales are unidimensional, the item-to-construct balance parceling was used as the building technique, as described by Little et al. (2002). Little et al. (2002) also suggested that the optimal number of indicators for a latent factor is three. Using the factorial weights as a guide, obtained for the total sample (three items of each subscale with higher factorial weight as anchors for the construction of the plots), two three-item parcels for each RPLQ subscales were created, resulting in a total of 12 item parcels (three parcels per latent factor). All item parcels had high factorial validity ($\lambda \geq .50$), with values ranging between .77 - .92, individual reliability (λ^2 = .25), with values ranging between .59 - .84, and internal consistency ($\alpha \geq .70$; peer-group integration, .84; peer-personal intimacy, .88; family-group integration, .90; family-personal intimacy, .92). The resulting model (Figure 1), with the same four-factor structure, obtained a very good fit (χ^2/df = 2.69, CFI = .99, RMSEA = .05, MECVI = .26). A χ^2 differences test

showed that the fit of this final model was significantly better than the original model ($\chi^2_{dif}(296) = 944.56$, $p = .000$), with a considerably lower MECVI (1.63 vs .26).

These results suggested that the four-factor model (distinguishing between integration and intimacy within peers and family) should be considered effective.

Figure 1

Standardized parameters and confidence intervals of the improved four-factor model of RPLQ loneliness scale.



Note. Results from Confirmatory Factor Analysis, improved by item parceling, in a sample of Portuguese adolescents (N = 737); Standardized parameters were all statistically significant at $p < .000$.

The analysis of intercorrelations also prove considerable support to a four-factor model of adolescence loneliness in which lack of integration, and intimacy within peers and family were clearly distinct (Table 2). The factors 'lack of peer-group integration' and 'lack of family-group integration' were only modestly correlated ($r = .44$), as well as 'lack of personal intimacy' with peers and family ($r = .31$) suggesting that they are different constructs. However, adolescents do not clearly distinguish integration from intimacy in the family as they do with their peers. Correlations between integration and intimacy were higher in family ($r = .79$) than in peers ($r = .58$).

Table 2.

Intercorrelations and correlations among the different forms of loneliness and social functioning dimensions.

	2.	3.	4.	Peer aggression	Shy / Social withdrawal behavior	Peer exclusion	Peer victimization	Prosocial behavior	Sociability / Popularity
1. Lack of peer-group integration	.58 **	.44 **	.32 **	-.08 *	.17 **	.23 **	.11 **	-.10 **	-.10 **
2. Lack of peer-personal intimacy		.31 **	.33 **	-.02	.10 **	.14 **	.03	-.08 *	-.10 **
3. Lack of family-group integration			.79 **	-.01	-.08 *	-.04	-.02	-.04	.05
4. Lack of family-personal intimacy				-.00	-.06	-.05	-.04	-.09 *	-.00

Note. Results from a sample of Portuguese adolescents (N = 737); ** $p < .01$, * $p < .05$

Measurement invariance across sex and age

Configural invariance was tested to examine whether the model obtained in the whole sample also fitted well for sex and age. Configural invariance was then analyzed by running CFA analyses with the four-factor structure for the samples separately for sex and age. The model fit indices (Table 3) suggested an excellent fit for sex and age groups (not so good for girls and younger range 13-14), indicating that the four-factor model of loneliness was supported in all groups.

Metric and scalar invariance were tested separately for sex and age by running MG-CFA. As a result of the configural invariance being supported, the factor pattern coefficients were then constrained to be equal in order to test for metric invariance (equal factor loadings across groups). The resulting model had good fit indices (Table 4) and the findings revealed metric invariance for sex (ΔCFI = .01, ΔRMSEA = .00, ΔSRMR = .0012) and for age groups (ΔCFI = .00, ΔRMSEA = .00, ΔSRMR = .0155). Thus, the obtained ratings can be compared across groups and the observed item differences will indicate group differences in the underlying latent construct.

Scalar (or intercept) invariance was tested by constraining the intercepts of items to be the same across groups. The resulting model also had good fit indices (Table 4) and findings showed scalar invariance for sex (ΔCFI = .02, ΔRMSEA = .01, ΔSRMR = .0002) and for age groups (ΔCFI = .01, ΔRMSEA = .01, ΔSRMR = .0012). This indicates that observed scores were related to latent scores – i.e., participants who achieved the same score on the latent construct would obtain the same score on the observed variables regardless of their group membership.

Table 3

Fit indices of the MG-CFA analysis of RPLQ loneliness scale for sex and age groups.

		N	χ^2/df	CFI	RMSEA (90% CI)	SRMR	AIC	MECVI
Sex	**Boys**	364	1.72	.99	.04 (.03, .06)	.026	142.38	.40
	Girls	373	2.22	.98	.06 (.04, .07)	.028	166.32	.45
Age	**11-12**	272	1.65	.99	.05 (.03, .07)	.029	139.32	.51
	13-14	353	2.55	.98	.07 (.05, .08)	.031	182.52	.53
	15-17	112	1.28	.99	.05 (.00, .08)	.031	121.43	1.17

Note. *N*, Sample number; χ^2/df, *Normed Chi-Square*; CFI, *Comparative Fit Index*; RMSEA, *Root Mean Square Error of Approximation*; CI (90%), *Confidence Interval*; SRMR, *Standardized Root Mean Squared Residual*; AIC, *Akaike Information Criterion*; MECVI, *Modified Expected Cross Validation Index*.

Table 4
Measurement invariance (configural, metric and scalar) across sex and age groups of the RPLQ loneliness scale.

		χ^2/df	CFI	RMSEA (90% CI)	SRMR	AIC	MECVI
Sex	**1. Configural invariance**	1.97	.99	.04 (.03, .04)	.026	356.70	.49
	2. Metric invariance	2.47	.98	.04 (.04, .05)	.038	410.32	.57
	3. Scalar invariance	3.02	.96	.05 (.05, .06)	.038	482.95	.66
Age	**1. Configural invariance**	1.83	.98	.03 (.03, .04)	.029	515.39	.73
	2. Metric invariance	1.90	.98	.03 (.03, .04)	.044	522.57	.73
	3. Scalar invariance	1.96	.97	.04 (.03, .04)	.045	531.71	.74

Note. Results from MG-CFA analysis in a sample of Portuguese adolescents (N = 737)*;* 1. Unconstrained model; 2. Constraining factor loadings; 3. Constraining intercepts; χ^2/df*, Normed Chi-Square;* CFI, *Comparative Fit Index;* RMSEA, *Root Mean Square Error of Approximation;* CI (90%), *Confidence Interval;* SRMR, *Standardized Root Mean Squared Residual;* AIC, *Akaike Information Criterion;* MECVI, *Modified Expected Cross Validation Index.*

Association between loneliness forms and social functioning dimensions

To investigate the associations between different forms of loneliness and different social functioning dimensions of in peer group, beyond correlations, we performed a set of hierarchical multiple regression analyses with each of loneliness forms as the dependent variables and the social functioning dimensions as predictor variables. To all analysis, at the first step, sex and age was entered as control variables, and, just then, the predictors was added. Standardized beta coefficients and ΔR^2-values (R square change) for the subsequent step are reported (betas reported were derived from the step on which the variable was entered to show the largest contribution of each significant predictor).

Regarding correlations, as expected, most of the significant correlations were associated to factors related to peer's context but they were small-to-moderate in magnitude (Table 2). Globally, the intercorrelations between the two measures are lower providing evidence that they are related but discriminate from each other.

Table 5.

Results of hierarchical regression analysis of the different social functioning dimensions on the different loneliness forms.

	Peer				Family			
	Lack of group integration		Lack of personal intimacy		Lack of group integration		Lack of personal intimacy	
	B	95% CI	B	95% CI	B	95% CI	B	95% CI
Step 1								
Sex	.01	(-.08, .10)	.36 ***	(.26, .47)	-.06	(-.17, .04)	-.05	(-.17, .06)
Age	.01	(-.03, .05)	.01	(-.04, .05)	.05 *	(.00, .09)	.06 **	(.01, .11)
Step 2								
Peer aggression	-.08 *	(-.16, .00)	-.01	(-.09, .08)	-.08	(-.17, .01)	-.05	(-.14, .05)
Shy/Social withdrawal behavior	.04	(-.04, .11)	.02	(-.06, .10)	-.08	(-.16, .00)	-.05	(-.14, .04)
Peer exclusion	.17 ***	(.09, .26)	.14 **	(.05, .24)	-.00	(-.10, .10)	-.04	(-.14, .07)
Peer victimization	-.02	(-.10, .06)	-.08 *	(-.16, .00)	.02	(-.07, .10)	-.00	(-.09, .09)
Prosocial behavior	-.08 *	(-.16, -.00)	-.06	(-.15, .02)	-.09 *	(-.18, -.01)	-.14 **	(-.23, -.40)
Sociability / Popularity	.01	(-.07, .09)	-.05	(-.13, .03)	.09 *	(-.00, .17)	.03	(-.07, .12)

Note. Results from a sample of Portuguese adolescents ($N = 692$); *B*, Unstandardized regression weight; *$p < .05$; **$p < .01$; ***$p < .001$.

With regards to hierarchical multiple regression analysis (Table 5), after controlling the sex and age, the results showed that the amount of the additional explained variance by social functioning dimensions (step 2) was a significantly 6.7% (sig. F change = .000) [R^2 = .068, F(8,692) = 6.26, p < .000] in peer-group integration, but the same model only accounted for a non-significant 1.6% of variance in family-group integration (non-sig. F change = .076) [R^2 = .024, F(8,692) = 2.13, p < .05]. Also, the strongest significant predictors of peer-group integration were exclusion (β = .208, t = 3.929, p < .000), aggression (β = -.080, t = -1.938, p < .05) and prosocial behaviors (β = -.085, t = -2.023, p < .05) but for family group integration, the predictor were prosocial behaviors (β = -.091, t = -2.113, p < .05), and sociability / popularity (β = .085, t = 1.939, p < .05).

Considering the factors related to intimacy, the results also revealed different relationships with the predictors within the context of both peer and family relationships. The amount of the additional explained variance by social functioning dimensions was a significantly 3.2% (sig. F change = .000) [R^2 = .099, F(8,692) = 9.45, p < .000] in peer-personal intimacy, but the same model only accounted for a non-significant 1.6% of variance in family-personal intimacy (non-sig. F change = .081) [R^2 = .025, F(8,692) = 2.26, p < .05]. For instance, whereas exclusion (β = .156, t = 2.993, p < .01) and victimization (β = -.090, t = -1.931, p < .05), were the strongest and significant predictors to lack of peer-personal intimacy, the strongest and significant predictors to lack of family-personal intimacy was prosocial behaviors (β = -.120, t = -2.795, p < .01).

The subscales of the ECP allowed for successful perdition of lack of peer-group integration and lack of peer-personal intimacy, but not of family integration and intimacy. For each of them there was no significant increase in R^2 when adding ECP scales.

Overall, correlations and regression showed that the four factors of loneliness held different relationships with the dimensions of social functioning.

Discussion

The present study makes a valuable contribution and expands the available knowledge on the measurement of adolescence loneliness, and particularly the RPLQ measure. The main goals of the present study were (a) to test the four-factor structure of the RPLQ loneliness scale, reflecting its underlying theoretical conceptualization; and (b) to explore whether adolescents'

peer-reported social functioning and reputation successfully predicted their self-reported loneliness.

First, the suggested multidimensional structure of the RPLQ loneliness scale was confirmed in a sample of Portuguese adolescents from 7th to 9th grade. After analyzing a wide range of information supplemented by empirical indices to refine and improve the factorial validity of the RPLQ loneliness scale, the Portuguese version achieved an excellent fit. CFA results revealed that the four-factor model fitted the data very well. Considerable empirical support was found for this model of adolescents' loneliness, in which lack of integration and intimacy within peers and family were distinguished.

However, as suggested by Hayden-Thomson (1989), adolescents (as children) might not distinguish integration from intimacy in the family context as clearly as they do with their peers. Perhaps integration and intimacy occur together in this particular relational context, that is, family. In short, our findings support the conceptualization of loneliness in adolescence by family- and peer-related loneliness through lack of integration and intimacy.

Multidimensional measures, such as the RPLQ loneliness scale, are particularly important because they can offer a more comprehensive and differentiated perspective of loneliness than unidimensional measures do (Maes et al., 2015). For example, group differences may emerge differently depending on the particular kind of loneliness under analysis (Musetti, Corsano, Majorano, & Mancini, 2012). Considering the distinction between quantitative and qualitative features of social relationships, the RPLQ loneliness scale has a solid and interesting conceptual basis, being one of the few instruments that clearly differentiates intimacy from integration in two different relational contexts. Considering peer relationships, the Peer Network and Dyadic Loneliness Scale (PNDLS; Hoza, Bukowski, & Beery, 2000) was also developed to evaluate intimate and relational loneliness. However, these two forms of loneliness can also occur in the context of the family.

The RPLQ loneliness scale is used much less frequently than other loneliness measures and, to our knowledge, this study was perhaps the first to test the complete factor structure on a single sample (to avoid issues of comparability across samples) and compare it with other parsimonious structures.

Overall, our results demonstrated that the Portuguese version of the RPLQ loneliness scale presented very good psychometric characteristics. All items had high factorial validity

and individual reliability also proved appropriate. Regarding internal consistency, all factors showed evidence of high reliability. Convergent and discriminant validity were also confirmed. In conclusion, the items reflecting a factor were not correlated with other factors and the factors defined by each set of items were considerably different from each other.

To our knowledge, this study was also the first to establish measurement invariance across sex and age to this measure. The establishment of measurement invariance when comparing groups has been considered essential in all psychological research (Byrne & Watkins 2003). For such a comparison to be valid, a questionnaire should assess identical constructs with the same structure across distinct groups. Using MG-CFA, we were able to establish configural, metric, and scalar invariance across sex and age groups. Our results showed that both boys and girls equally understood the items and the underlying latent factors, regardless of the age range. Therefore, the RPLQ scores may be meaningfully compared, not only across sex, but also across this wide age difference.

Considering the second major hypothesis of our study (ECP prediction), results showed that it was almost completely confirmed. Our results revealed that the ECP dimensions allowed for successful prediction of integration and intimacy in peer relationships, but not in family integration and intimacy. The ECP, and prosocial behavior in particular, predicted lower lack of family-group integration and family-personal intimacy. Perhaps peer-directed prosocial behavior extends across relational contexts and contributes to better overall relationships and greater perceived integration and intimacy in the family group.

Adequate discriminant validity was further evidenced by differential associations with dimensions of social functioning. Thus, different forms of loneliness (peers and family-related loneliness through lack of integration an intimacy) and different dimensions of social functioning constitute distinct factors that, albeit related, present a substantial amount of unshared variance.

Despite the innovations within the present study, some limitations should be acknowledged. First, the findings should be replicated using representative samples and a more heterogeneous group of participants, such as other cultural and socioeconomic contexts. Furthermore, this study was conducted in a particular country in Europe, which is Portugal. Given the salience related to equality, solidarity and support to others (European Commission,

2012), the threshold for loneliness in this societal setting may be relatively low. It would also be interesting to verify if the results are similar in clinical groups of adolescents.

Our results suggest that the RPLQ loneliness scale is a valid choice for researchers who want to study loneliness. Loneliness is harmful to mental and physical health at all ages, and we hope that the present study will provide motivation for further research in the field.

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Chapter III: Loneliness profiles in adolescence: association with sex and social adjustment to the peer group*.

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Abstract

Loneliness is a complex feeling associated with socio-emotional adjustment difficulties, particularly during adolescence. Such construct is often treated as unidimensional rather than multidimensional, moreover, studies consisting of both peer and family contexts, are very scarce. Adopting a multidimensional and person-centered approach, our study aimed to identify distinct clusters of adolescents with similar patterns of social and emotional loneliness with peers and family and to examine their differences in peer reported social adjustment, controlling for sex. Self-report and peer nomination data were collected from 691 participants (48.36% boys) aged between 11 and 16 years (M = 12.95, SD = 1.15). After controlling for age and preference for solitude, results revealed four clusters with specific configurations of loneliness forms and with different associations with positive or negative features of social adjustment to peer group. Two clusters exhibited adaptive profiles (lower vulnerability to maladjustment): *less-lonely,* and *family-related loneliness* profile, in which adolescents were viewed by peers as exhibiting more prosocial behaviors. The other two clusters displayed maladaptive profiles (higher vulnerability to maladjustment): *more-lonely*, and *peer-related loneliness* profile, in which adolescents were more likely viewed by their peers as socially withdrawn, peer-excluded, and peer-victimized. Additionally, our results revealed sex differences, with girls in the *more-lonely profile* showing significant higher social loneliness related to peer group, and higher social and emotional loneliness in family context. Our results highlight the importance of recognizing different forms of loneliness given the differences in adjustment to social contexts observed, shedding further light on this complex construct.

Keywords: social loneliness, emotional loneliness, cluster analysis, peer exclusion, peer victimization.

Highlights

● We investigated the existence of different groups of adolescents who experienced different forms of loneliness (social and emotional, within peers and family context).

● We analyzed the different loneliness profiles and their association with social adjustment difficulties to peer group and sex.

● Our results revealed four loneliness profiles among adolescents, with different vulnerably to social adjustment difficulties, which were the more-lonely profile, peer-related loneliness profile, family-related loneliness profile, and the less-lonely profile.

● Sex differences were also found. Girls who share the more-lonely profile showed higher social loneliness in peer group context, and higher social and emotional loneliness in the family group.

● These results highlight the importance of recognizing different forms of loneliness to prevent and reduced the risk of developmental adjustment difficulties.

Introduction

Loneliness is an unpleasant and subjective feeling (Peplau & Perlman, 1982) that is related to the amount of social contact (quantity), and also to features that define social relationships (quality), such as intimacy and trust. Particularly during adolescence, loneliness may be a vulnerability factor when it comes to establishing positive relationships (e.g., Rubin et al., 2008) and, consequently, may have an impact on individuals' social and emotional development, as well as on their general well-being (Lasgaard et al., 2016). A clear understanding of this complex construct, considering the different forms that loneliness may take, and their associations with sex and adjustment difficulties is needed to prepare more accurate interventions in order to prevent and reduce the risk of developmental maladjustment.

Loneliness and adolescence

Adolescence is the developmental period when interactions and relationships with peers become increasingly more important (Qualter et al., 2015; Rubin et al., 2009) and belonging to a peer group becomes a subject of major concern (Rubin et al., 2008). At the same time, it is a period of increased risk for the occurrence of feelings of loneliness (Heinrich & Gullone, 2006; Majorano et al., 2015). Adolescents must cope with significant changes in social expectations and relationships that may make them more vulnerable to experiencing loneliness (Rubin et al., 2008). They are faced with conflicting developmental challenges that include (a) establishing new social networks and closer relationships with peers; (b) reducing their dependence on the family, but at same time feeling supported by them; and (c) emerging as a separate self through autonomy, individuality, and identity formation (Majorano et al., 2015; Musetti et al., 2012). During this developmental period, being alone and preferring solitary activities may, to some extent, be regarded as normative, thus providing opportunities for self-reflection and identity work (Goossens & Marcoen, 1999; Qualter et al., 2015). However, spending much time alone may lead to missing many opportunities to interact with peers, which places youths at risk for maladaptive developmental pathways (Wang et al., 2013). The development of positive and satisfactory peer relationships and the formation of friendships are crucial in helping adolescents accomplish developmental tasks such as forming their identity, developing social-cognitive skills and self-esteem, and establishing autonomy (see Rubin et al., 2015, for a review).

It has been shown in previous studies that loneliness is associated with the difficulties that adolescents experience with peer relationships (Cassidy & Asher, 1992; Vanhalst et al., 2014; Woodhouse et al., 2012). For example, a strong and stable correlation between shyness and loneliness was found, with shyness being a predictor of loneliness at various ages (Mahon et al., 2006; Vanhalst et al., 2014). Using peer nomination procedures, Woodhouse and colleagues (2012) also found that adolescents´ loneliness was associated with lower peer acceptance, greater likelihood of being victimized, and higher levels of shyness/social withdrawal. Moreover, persistent and chronic loneliness among young people has been found to be a significant risk factor for psychopathology, depression, suicidal feelings, and inadequate social skills (see Heinrich & Gullone, 2006). Although the links between loneliness and social adjustment are well-established, there are still gaps and inconsistent findings due to multiple factors such as the way loneliness is measured (single-item vs. multiple-items scale), the conceptualization of the construct (uni- vs. multi-dimensional), and the way individuals are classified as lonely (e.g., cut-off score).

Although loneliness is a complex construct, it is often treated as an unidimensional one, under the assumption that it takes the same form across distinct situations and relationships (Hyland et al., 2019). However, deficits in social relationships may result from differences in the quantity and/or quality of these relationships. In order to capture the multidimensionality of loneliness, and according with the social needs' perspective, Weiss (1973) proposed a distinction between social and emotional loneliness. The social form of loneliness is associated with lack of social engagement and integration in social networks that may offer a sense of connection to others. On the other hand, the emotional form of loneliness is associated with the absence of a satisfactory close relationship and refers to a lack of intimacy that may provide a sense of share and trust. Moreover, different social relationships, such as peers and family, may offer distinct social provisions, and also have different social functions (Weiss, 1973). Several researchers have provided strong evidence for the multidimensionality of loneliness (e.g., De Jong Gierveld & Van Tilburg, 2010; Goossens & Beyers, 2002; Goossens et al., 2009; Maes et al., 2015; Ribeiro et al., 2019), contributing to a more comprehensive understanding of this phenomenon. A multidimensional approach to loneliness seems to offer a more differentiated perspective of this complex construct (Heinrich & Gullone, 2006; Maes et al., 2016).

Furthermore, most of what we know about adolescents' loneliness is based on variable-centered studies, which are designed to describe mean differences or compare lower versus

higher loneliness scores that classify loneliness by a predetermined cut-off point (Hyland at al., 2019). A person-centered approach, however, seeks to identify individuals who resemble each other and who differ from other groups of individuals (Howard & Hoffman, 2017). It is particularly useful in identifying youths' homogeneous subgroups who share the same salient configurations on the different forms of loneliness, recognizing that distinct forms of loneliness may naturally co-occur. This approach makes the adolescents the focus of the analysis, allowing insight into how psychological constructs, such as loneliness, are manifested within individuals.

Only a few studies have explored this construct using a person-centered approach (Maes et al., 2016), and most were conducted with middle-aged and older adults (Hyland et al., 2019; Shevlin et al., 2014). So far, the scarce studies available, either with cross-sectional (Maes et al., 2016) or longitudinal designs (Hutten et al., 2021; Vanhalst et al., 2013), have focused only on peer- or parent-related loneliness, or both. Although these studies have found meaningful clusters in samples of youths, they did not consider relationship quality or quantity (social and emotional loneliness) in the two social contexts of interest. It is relevant to consider the different sources of loneliness, which may differ across the lifespan, but it is also crucial to consider whether such relationships, either with family or with peers, can satisfy, or fail to satisfy, social and emotional needs (thus leading to social or emotional loneliness).

The influence of adolescents' sex and age

According to previous research, interpersonal relationships may differ depending on sex (e.g., Rose & Rudolph, 2006). In line with this perspective, it is reasonable to theorize that sex differences may vary depending on the different forms of loneliness, but also according to specific relationships (peers and family). However, whether or not sex differences do exist remains unclear, because the results of previous studies are contradictory and there are inconsistencies in the literature that supports this notion (Weeks & Asher, 2012). Some researchers claim that girls report more loneliness, while others claim that it is the boys who feel lonelier, and still there are others reporting no sex differences on loneliness. Despite this controversy, only few studies have analyzed sex differences in a relationship-specific type of loneliness (Maes et al., 2019). Age differences have also been investigated in prior studies (Luhmann & Hawkley, 2016), again finding inconsistent results. Mahon et al. (2006) conducted a meta-analysis of 95 studies of adolescent loneliness and revealed a large effect size for the link between loneliness and sex and a very low effect size for the association between loneliness

and age. Since empirical studies have not yet achieved consensus regarding the influence of sex and age on loneliness, future research needs to take into account these variables.

The present study

Although the knowledge base on loneliness in adolescence is expanding, still only few studies adopt a multidimensional and person-centered approach, considering simultaneously the different forms of loneliness (emotional and social loneliness) and their source (peers- and family-related, the two major socialization contexts). To the best of our knowledge, no previous research has examined loneliness in this manner during adolescence.

Building on the gaps and inconsistent results found in literature, our study adopted a multidimensional and person-centered approach. Our purpose was to identify groups of adolescents with similar patterns of social and emotional loneliness scores (through lack of integration and intimacy) related to the two major agents of youths' socialization (their peers and their family). Social and emotional loneliness, as well as family- and peer-related loneliness, may all be present to a certain extent in every individual. Our purpose was to investigate whether there were groups of adolescents who experience one form of loneliness but not another, and within one social context but not within another. Preference for solitude was used as a covariate because it has been associated with loneliness and with having fewer intimate friends (Liu et al., 2014), which in turn predicts relationship difficulties with peers (Bowker & Raja, 2011). Additionally, we examined sex-specific differences, which may be crucial for identifying heterogeneity between boys and girls given that sex differences in the prevalence of each form of loneliness have been reported. Finally, we analyzed how the distinct profiles of loneliness might be differentially associated with positive and negative features of social adjustment to the peer group. We adopted a multi-informant approach that is multidimensional peer nominations. For a better understanding of social behavior and functioning of lonely adolescents, studies using multi-informants' approach are needed, because it considers the multiple dimensions, both positive and negative, of adolescents' social behaviors. Such assessments take into account the perspectives of various observers, and peers are privileged informants of the interactions and relationships within the group of those being evaluated.

In sum, the main goals of our study were as follows: (1) to investigate whether distinct profiles of loneliness could be identified in a sample of Portuguese adolescents aged 11–16

years; (2) to characterize them in terms of different forms of loneliness (emotional and social) within the two major contexts of socialization (family and peers), controlling for age and preference for solitude; (3) to examine how each loneliness profile was associated with different dimensions of social adjustment to peer group, again controlling for age and preference for solitude; and finally, (4) to consider the effect of sex. We expected to find groups of adolescents with different configurations of social and emotional loneliness. Specifically, we expected some adolescents to report no integration or intimacy difficulties in either peer or family contexts, as opposed to others whom we expected to report integration or intimacy difficulties in both social contexts. In accordance with previous studies (e.g., Majorano et al., 2015) that showed adolescents' decreasing dependence on the family and increasing autonomy linked to identity construction, we further anticipated that, some adolescents would exhibit similar difficulties in integration and intimacy within their family, and others still, within the peer context. We hypothesized that these different profiles of loneliness would reveal specific links with positive or negative features of social adjustment. Finally, given the inconsistent findings in the literature regarding sex, we had no particular expectation regarding the effect of this variable.

Method

Participants

A total of 691 participants (334 boys; 48.36%), aged between 11 and 16 years (M = 12.95, SD = 1.15), were recruited from three Portuguese public junior-high schools (grades 7 through 9) in the Lisbon metropolitan area. The sample comprised 633 (91.6%) seventh-grade students, 34 (4.9%) eighth-grade students, and 24 (3.5%) ninth-grade students. The mean age of the seventh-, eighth-, and ninth-grade groups was 12.80 (SD = 1.04), 14.15 (SD = 0.96), and 15.21 (SD = 0.83) years, respectively.

Procedure

Approval from the school authorities, as well as written informed consent and assent from all participating families and young adolescents were obtained. Data were then collected, in regular school hours, in class, during a single 45-minute session. A research assistant was always present to introduce the study and to answer any questions. Participants were informed that there were no right, or wrong answers and all instructions emphasized the confidentiality of the data and the voluntary nature of participation. Personal data collection and processing were carried out in accordance with recommendations of APA Ethical Guidelines, in

compliance with the Declaration of Helsinki, ensuring the privacy and confidentiality of participants' information. The assessment protocol was also approved by the University Ethical Committee.

Measures

Self-Reported Loneliness

Loneliness was measured with a Portuguese version (Ribeiro et al., 2019) of the Relational Provision Loneliness Questionnaire (RPLQ; Hayden-Thomson, 1989). This 28-item self-report instrument assesses subjective feelings of loneliness through two aspects of social satisfaction (group integration and personal intimacy) experienced in two different social contexts: peer group and family. This multidimensional measure comprises four subscales of seven items each: (1) peer-group integration, which assesses to what extent respondents feel accepted by their peers (e.g. "I feel in tune with other young people"); (2) peer-personal intimacy, which assesses whether respondents have a friend with whom they share their feelings and thoughts (e.g. "I have a friend I can tell everything to"); (3) family-group integration, which assesses to what extent respondents feel integrated into their family (e.g. "I feel that I usually fit in with my family"); and, (4) family-personal intimacy, which assesses whether respondents have a family member with whom they can share their thoughts and feelings (e.g. "I have someone in my family I can tell everything to"). None of the items refers directly to loneliness and the word loneliness does not appear in the set of items. Respondents must rate how true each statement is for them, on a five-point Likert scale ranging from 1 (*not at all true*) to 5 (*always true*). In the current study, all item scores were reverse coded, with higher scores on each subscale indicating higher levels of loneliness. In our sample, reliability indices were high (.84 for lack of peer-group integration; .88 for lack of peer-personal intimacy; .90 for lack of family-group integration; and .92 for lack of family-personal intimacy), and 90% of the sample was the same in which the RPLQ was validated in Portugal (Ribeiro et al., 2019).

Peer Assessment of Social Adjustment

Social adjustment and reputation were assessed by a Portuguese version (Correia et al., 2014) of the Extended Class Play (ECP; Burgess et al., 2006). This 37-item instrument assesses peers' evaluations of respondents' social functioning and reputation. Participants were instructed to pretend to be the directors of an imaginary class play and to nominate one boy and one girl from among their participating classmates for each of 37 positive and negative roles.

Only same-sex nominations were considered, in order to eliminate possible sex stereotyping (Zeller et al., 2003). All item scores were standardized in terms of sex and classroom, to adjust for possible differences in the numbers of nominations and nominators. The ECP taps six dimensions of social functioning and reputation: (1) aggression (6 items; e.g., "Gets into fights"); (2) shyness/ social withdrawal (3 items; e.g., "Doesn't talk much or talks quietly"); (3) peer exclusion (3 items; e.g., "Often left out"); (4) peer victimization (3 items; e.g., "Hit or kicked by others"); (5) prosocial behavior (4 items; e.g., "Helps others"); and, (6) sociability/ popularity (4 items; e.g., "Everyone likes"). Peer nomination procedures are highly reliable, and in this study the Cronbach α for each subscale was as follows: .83 for aggression; .86 for shyness/ social withdrawal; .80 for peer exclusion; .85 for peer victimization; .73 for prosocial behavior; and .73 for sociability/ popularity.

Self-Reported Preference for Solitude

Preference for solitude was assessed using a Portuguese version of the Social Withdrawal Scale (SWS; Terrel-Deutsch, 1999). The SWS is a self-report measure that consists of a three-item indicator comprising the following: "I like spending time alone more than being with other young people"; "I would rather be with other young people than be alone" (reversed); "I spend time alone because I want to be alone more than I want to be with other young people." Answers range from 0 (*not at all true*) to 5 (*always true*). In our study, internal reliability of this scale was acceptable (.67).

Plan of analysis

Data analyses were performed using the IBM SPSS Statistical Package (version 25). Descriptive statistics were computed for sample characterization, in addition to correlations to determine all variable associations. In order to identify loneliness profiles based on RPLQ subscales, we conducted a cluster analysis. This analysis was performed in a two-step procedure, using a combination of hierarchical and non-hierarchical clustering approaches. Such an approach is recommended because it allows clusters with high internal and external homogeneities to be formed (e.g., Hair & Black, 2000).

In the first step, we conducted a hierarchical cluster analysis, using Euclidian distances for the initial observations and Ward's method to identify the number of clusters. The decision as to how many clusters to retain was based on R^2 (sum of squares between groups). We opted for the solution with the smallest number of clusters that retained a considerable proportion of

the total variance, offering more parsimony and interpretability. Second, we performed an additional procedure, the k-means method, to optimize the cluster solution in terms of participants' distribution in each cluster.

We performed multivariate analyses of covariance (MANCOVAs) to test for differences among the loneliness profiles in the different forms of loneliness and dimensions of social adjustment to peer group, taking into account adolescents' sex and using age and preference for solitude as covariates. Pillai's Trace criterion (*V*) was selected as the multivariate test to assess the statistical significance of the effects, due to its robustness with unequal sample sizes (Tabachnick & Fidell, 2007). Where significant multivariate effects were identified, subsequent univariate analyses of covariance (ANCOVAs) were performed, followed by *post-hoc* multiple comparisons with Bonferroni correction. We performed simple main effects analyses to explore interaction effects. The effect size was reported for all ANCOVAs using partial eta-squared (η^2_p).

Results

Prior to main analyses, descriptive statistics, and correlations for all variables, including sex and age, were examined in order to determine whether they should be included as grouping factors or covariates in subsequent analyses.

Preliminary analyses: descriptive statistics, sex, and age differences

Means and standard deviations are shown in Table 1. We performed two one-way ANOVAs to test, separately, for sex and age differences between the different forms of loneliness, preference for solitude, and all dimensions of social adjustment. Regarding sex, statistically significant differences were found only in lack of peer-personal intimacy, $F(1, 689) = 40.88$, $p < .001$, and preference for solitude, $F(1, 689) = 7.71$, $p = .006$. Specifically, boys reported significantly higher scores on intimacy difficulties with their peer group and on preference for solitude than girls. Regarding age, adolescents were distributed in three groups (group 1: 11-12 years old; group 2: 13-14 years old; group 3:15-16 years old) to ensure that the proportion of participants in each group was equivalent, and there were statistically significant differences among groups in lack of integration, $F(2, 690) = 7.99$, $p < .001$, lack of intimacy, $F(2, 690) = 6.82$, $p < .001$, in the family context, and in preference for solitude, $F(2, 690) = 5.49$, $p < .001$. Older youths reported significantly higher scores in all those variables than adolescents in the two younger age groups. Regarding social adjustment, younger adolescents

(aged 11-12) were significantly more likely to be nominated by peers as excluded, $F(2, 676) = 3.80$, $p = .023$, and victimized, $F(2, 677) = 4.72$, $p = .009$, than youths in the two older age groups.

Preliminary analyses: correlational analyses

Pearson's correlations are presented in Table 2. We found moderate significant positive correlations between lack of integration in both peer and family social contexts ($r = .40$, $p < .001$), and between lack of intimacy in both social contexts ($r = .34$, $p < .001$). We also found strong significant positive correlations between lack of peer integration and intimacy ($r = .50$, $p < .001$), and between lack of family integration and intimacy ($r = .65$, $p < .001$). These results support the distinction between all forms of loneliness which were analyzed, and between the two types of relational provisions— integration and intimacy.

Regarding preference for solitude, we found: (1) a weak but significant positive association with sex ($r = .11$, $p = .006$) and age group ($r = .13$, $p < .001$); (2) weak to moderate positive correlations with all forms of loneliness (between .15 and .42; $p < .001$); and (3) a significant weak positive association with all negative dimensions of social interactions with peer group, i.e., social withdrawal ($r = .11$, $p = .006$), peer exclusion ($r = .12$, $p = .001$), and peer victimization ($r = .08$, $p = .046$).

Regarding positive and negative features of social adjustment, socially withdrawn behavior, peer exclusion, and peer victimization were positively associated with lack of peer integration ($r = .21$, $r = .26$, $r = .15$, respectively; $p < .001$), and lack of peer intimacy ($r = .12$, $r = .17$, n.s., respectively; $p < .001$). Conversely, sociability/ popularity, and prosocial behavior were negatively associated with lack of peer integration ($r = -.13$, $r = -.12$, respectively; $p < .001$) and peer intimacy ($r = -.10$, $r = -.09$, respectively; $p = .010$, $p = .013$). Overall, as expected, positive dimensions of social adjustment were associated with fewer difficulties in integration and intimacy with peer group, while negative dimensions were associated with more difficulties in integration and intimacy in the same social context.

Finally, we found a weak but significant positive association between age group and lack of family integration ($r = .14$, $p < .001$) and family intimacy ($r = .12$, $p = .002$), as well as a weak but significant negative association with peer victimization ($r = -.10$, $p = .003$). We also found weak correlations between sex and lack of peer intimacy ($r = .24$, $p < .001$) and preference for solitude ($r = .11$, $p < .001$).

Table 1

Descriptive Statistics and Comparison of Adolescents' Sex and Age for all Forms of Loneliness, Preference for Solitude, and all Dimensions of Social Adjustment to Peer Group.

Study variables	**Boys**	**Girls**	**1. Age** 11-12	**2. Age** 13-14	**3. Age** 15-16	**Sex**		**Age**		
Loneliness forms:	*M (SD)*	*M (SD)*	*M(SD)*	*M (SD)*	*M (SD)*	F	*p*	F	*p*	Diff.
Lack of peer-group integration	.01 (1.00)	.03 (1.03)	.00(1.05)	.02 (.95)	.11 (1.11)	.06	.81	.42	.66	
Lack of peer-personal intimacy	.25 (1.04)	-.23 (.92)	-.03(.98)	-.02 (1.01)	.14 (1.09)	40.88	.00 ***	.92	.40	
Lack of family-group integration	-.09 (.91)	.05 (1.07)	-.18(.87)	.07 (1.02)	.25 (1.25)	3.33	.07	7.99	.00 ***	1. < 2., 3.
Lack of family-personal intimacy	-.05 (.90)	.00 (1.06)	-.18(.90)	.07 (.99)	.18 (1.16)	.46	.50	6.82	.00 ***	1. < 2., 3.
Preference for solitude	.11 (1.03)	-.10 (.96)	-.13(.98)	.06 (.99)	.23 (1.04)	7.71	.01 *	5.49	.00 ***	1. < 2., 3.
Social adjustment:										
Aggression	.00 (.63)	.00 (.68)	-.01(.65)	.01 (.66)	.04 (.67)	.00	.96	.23	.80	
Social withdrawal	.00 (.79)	.01 (.81)	.06(.84)	-.03 (.77)	-.07 (.77)	.00	.98	1.33	.27	
Peer exclusion	.00 (.81)	.00 (.80)	.10(.88)	-.08 (.75)	-.03 (.64)	.00	.99	3.80	.02 *	1. < .2
Peer victimization	.01 (.82)	.01 (.82)	.11(.92)	-.05 (.75)	-.16 (.58)	.00	.97	4.72	.01 **	1. < .2, .3.
Prosocial behavior	.00 (.68)	.02 (.67)	.04(.70)	.00 (.67)	-.06 (.61)	.14	.71	.69	.50	
Sociability/Popularity	.02 (.70)	.02 (.69)	-.04(.67)	.07 (.71)	.06 (.71)	.01	.93	2.06	.13	

Note: * p < .05; ** p < .01; *** p < .000

Table 2

Correlations among Study Variables.

Study Variables	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Sex	.09 *	-.01	.24 **	-.07	-.03	.11 **	.00	.00	.00	.00	-.02	.00
2. Age		.06	.06	.14 **	.12 **	.13 **	.05	-.04	-.06	-.10 **	-.07	.07
3. Lack peer-group integration			.55 **	.40 **	.28 **	.42 **	-.07	.21 **	.26 **	.15 **	-.13 **	-.12 **
4. Lack peer-personal intimacy				.31 **	.34 **	.30 **	-.01	.12 **	.17 **	.05	-.10 **	-.09 *
5. Lack family-group integration					.65 **	.19 **	-.02	-.05	.00	-.02	-.07	.01
6. Lack family-personal intimacy						.15 **	.01	-.04	-.04	-.06	-.09 *	-.03
7. Preference for solitude							-.07	.11 **	.12 **	.08 *	-.04	-.07
8. Aggression								-.31 **	-.01	.16 **	-.20 **	.15 **
9. Social withdrawal									.50 **	.23 **	-.02	-.23 **
10. Peer exclusion										.63 **	-.20 **	-.29 **
11. Peer victimization											-.21 **	-.23 **
12. Prosocial behavior												.40 **
13. Sociability/Popularity												

Note: * p < .05; ** p < .01

Identification and characterization of loneliness profiles

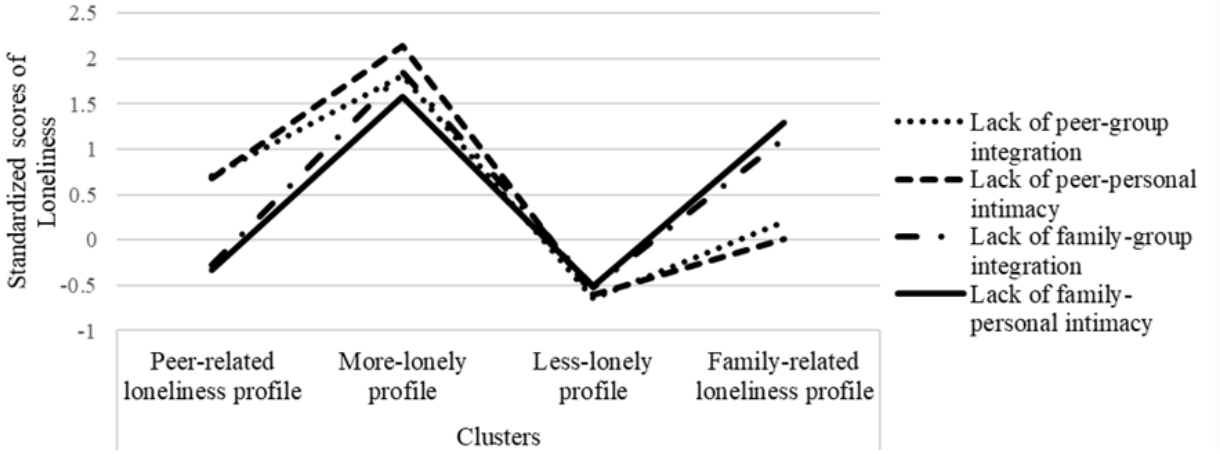
Given the main goals of our study, we conducted a cluster analysis on the four subscales of the RPLQ to identify adolescents with similar patterns of social and emotional loneliness, through lack of integration and intimacy in peer and family contexts. This procedure revealed a four-cluster solution (Figure 1), each one with a specific configuration of different forms of loneliness. Based on our analysis of the dendrogram, applying parsimony and interpretability, followed by the R^2 criterion, the four clusters retained explained 59% (R^2 = 0.59) of the total variance. The four-cluster solution also explained 56% (R^2 = 0.56) of the variance in peer-group integration, 59% (R^2 = 0.59) in peer-personal intimacy, 60% (R^2 = 0.60) in family-group integration, and 62% (R^2 = 0.62) in family-personal intimacy.

The largest cluster, labeled the *Less-lonely profile*, comprised 50.4% (n = 348; 159 boys and 189 girls) of the sample. Adolescents in this cluster had moderately low scores on lack of integration and intimacy relating to both social contexts. That is, adolescents in this cluster reported having no integration or intimacy difficulties with either their peers or their family. By contrast, the smallest cluster, labeled the *More-lonely profile*, comprised just 5.8% (n = 40; 27 boys and 13 girls) of the sample and was characterized by moderately high scores on all four subscales of the RPLQ. Therefore, this cluster comprises adolescents who reported greater integration and intimacy difficulties with both peers and family. The remaining two clusters lie somewhere in between these two extremes. The cluster labeled as *Peer-related loneliness profile*, containing 25.8% (n = 178; 97 boys and 81 girls) of the total sample, included adolescents who scored moderately high on lack of integration and intimacy with peers, but low on the same dimensions in relation to family. Finally, the cluster labeled as *Family-related loneliness profile,* comprising 18.1% (n = 125; 51 boys and 74 girls) of the total sample, included adolescents who scored high on lack of integration and intimacy in relation to family but low on the same dimensions in relation to peers.

To ensure that each loneliness profile had a unique configuration of the different forms of loneliness, after controlling for age and preference for solitude, we conducted MANCOVA to analyze the effects of loneliness profiles and sex on the RPLQ four subscales. Results showed significant differences across profiles in the distinct forms of loneliness, V = 1.33, F(12, 2040) = 136.21, $p < .001$, $\eta^2_p = .45$, $\pi = 1.00$, with regard to sex, V = .08, F(4,678) = 14.71, $p < .001$, $\eta^2_p = .08$, $\pi = 1.00$, and a significant interaction effect between loneliness profiles and sex, V = .06, F(12,2040) = 3.62, $p < .001$, $\eta^2_p = .02$, $\pi = 1.00$.

Figure 1

Final Four-Cluster Solution based on Standardizing Scores for Social (Integration) and Emotional (Intimacy) Loneliness considering Peers and Family Social Contexts.



Subsequent ANCOVAs revealed statistically significant profile differences (Table 3) for all RPLQ dimensions. *Post-hoc* multiple comparisons with Bonferroni correction showed that all loneliness profiles were statistically different from each other in all forms of loneliness ($p < .001$). Specifically, adolescents with the More-lonely profile scored higher on all forms of loneliness, followed by those with the Peer-, then the Family-related loneliness profiles, and finally those with the Less-lonely profile displaying the lowest scores.

Regarding sex (Table 3), univariate analyses revealed statistically significant differences for all forms of loneliness. In the peer group context, girls scored significantly higher on lack of peer-group integration than boys, whereas boys scored significantly higher on lack of peer-personal intimacy than girls. In the family social context, girls scored significantly higher on both lack of integration and lack of intimacy than boys.

Finally, a significant interaction effect between loneliness profiles and sex (Table 3), regarding peer-group integration, family-group integration, and family-personal intimacy was found. Our results revealed that, although the loneliest profile (More-lonely profile) is the one with the highest scores in all forms of loneliness, girls who share this profile have even higher scores when compared to boys, and other loneliness profiles. These results are consistent and corroborate those we have found in the significant main effect related to sex but go further.

A significant multivariate age effect was found, $V = .03$, $F(4,678) = 5.42$, $p < .001$, $\eta^2_p = .03$, $\pi = .98$, for integration and intimacy in the family context only. We also found a

significant multivariate effect for preference for solitude, $V = .09$, $F(4,678) = 17.27$, $p < .001$, $\eta^2_p = .09$, $\pi = 1.00$, for integration and intimacy in the peer context only. Because measurement invariance for sex and age was established at scale level (Ribeiro et al., 2019), we can assume that adolescents interpret the items of the RPLQ (loneliness measurement) in a similar way across age, and between sex.

Adolescents' loneliness profiles and social adjustment to peer group

With regard to social adjustment in the peer social context, after controlling for age and preference for solitude, our MANCOVA showed a statistically significant multivariate effect for loneliness profiles, $V = .06$, $F(18, 1968) = 2.33$, $p = .001$, $\eta^2_p = .02$, $\pi = .99$. No sex effects, $V = .01$, $F(6, 654) = .64$, $p = .700$, $\eta^2_p = .01$, $\pi = .26$, or interaction effects, $V = .03$, $F(18, 1968) = 1.19$, $p = .264$, $\eta^2_p = .01$, $\pi = .83$, were observed. Subsequent ANCOVAs (Table 3) revealed statistically significant differences for all dimensions of social adjustment, except for aggression and sociability/ popularity. *Post-hoc* multiple comparisons with Bonferroni correction showed that adolescents in the More-lonely profile and those in the Peer-related loneliness profile had significantly higher scores on shyness/ social withdrawal and peer exclusion than adolescents in the Less-lonely profile and Family-related loneliness profile. Additionally, adolescents in the More-lonely profile were marginally significantly more likely to be nominated by their peers as being victimized than were adolescents in the Family-related loneliness profile. Adolescents in the Family-related loneliness profile displayed statistically lower levels of prosocial behavior than adolescents in the Less-lonely profile, who had the highest scores on this dimension.

A significant multivariate age effect was found, $V = .03$, $F(6, 654) = 3.75$, $p = .001$, $\eta^2_p = .03$, $\pi = .96$, for peer exclusion, peer victimization, and sociability/ popularity. We also found a significant multivariate effect for preference for solitude, $V = .02$, $F(6, 654) = 2.08$, $p = .054$, $\eta^2_p = .02$, $\pi = .75$, with regard to aggression, shy/socially withdrawn behavior, and peer exclusion.

Table 3

Comparison of Adolescents' Loneliness and Social Adjustment to Peer Group by Loneliness Profiles.

Study Variables	1. Peer-related loneliness profile		2. More-lonely profile		3. Less-lonely profile		4. Family-related loneliness profile		Profile			Sex			Interactions		
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls									
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*F*	*p*	η^2_p	*F*	*p*	η^2_p	*F*	*p*	η^2_p
Loneliness forms:																	
Lack peer-group integration	.56 (.76)	.96 (.91)	1.83 (.93)	2.02 (1.00)	-.67 (.52)	-.59 (.55)	.14 (.57)	.25 (.79)	220.37 ***	.00	.49	13.28 ***	.00	.02	2.70 *	.05	.01
Lack peer-personal intimacy	.84 (.84)	.53 (.92)	2.18 (.87)	2.20 (1.08)	-.46 (.47)	-.72 (.33)	.29 (.66)	-.23 (.68)	265.65 ***	.00	.54	14.50 ***	.00	.02	1.95	.12	.01
Lack family-group integration	-.30 (.49)	-.25 (.59)	1.57 (.96)	2.47 (1.21)	-.59 (.36)	-.47 (.46)	1.00 (.80)	1.28 (1.04)	329.96 ***	.00	.59	29.66 ***	.00	.04	5.28 ***	.00	.02
Lack family-personal intimacy	-.23 (.52)	-.42 (.40)	1.36 (1.11)	1.75 (1.25)	-.53 (.42)	-.49 (.42)	1.07 (.71)	1.41 (1.10)	311.13 ***	.00	.58	5.42 *	.02	.01	5.07 ***	.00	.02
Social adjustment:																	
Aggression	.04 (.70)	-.02 (.65)	-.04 (.57)	-.04 (.64)	.00 (.63)	-.02 (.68)	-.06 (.53)	.08 (.71)	.18	.91	.00	.01	.94	.00	.47	.70	.00
Social withdrawal	.04 (.85)	.32 (.97)	.30 (.99)	.51 (1.17)	-.01 (.76)	-.11 (.71)	-.19 (.55)	-.12 (.70)	6.47 ***	.00	.03	2.25	.14	.00	2.25	.08	.01
Peer Exclusion	.08 (.86)	.291 (.01)	.22 (1.07)	.72 (1.07)	-.08 (.77)	-.09 (.70)	.00 (.62)	-.18 (.57)	6.84 ***	.00	.03	2.58	.11	.00	2.42	.07	.01
Peer Victimization	.02 (.76)	.21 (.94)	.12 (.98)	.48 (1.24)	.01 (.86)	-.03 (.80)	-.06 (.74)	-.18 (.57)	2.70 *	.05	.01	1.29	.26	.00	1.35	.26	.01
Prosocial behavior	-.01 (.69)	-.08 (.66)	-.18 (.41)	-.24 (.65)	.10 (.75)	.08 (.71)	-.23 (.47)	.01 (.56)	3.81 **	.01	.02	.04	.84	.00	1.37	.25	.01
Sociability/Popularity	.02 (.71)	-.06 (.59)	-.12 (.57)	-.30 (.36)	.08 (.71)	.04 (.74)	-.10 (.68)	.07 (.70)	1.20	.31	.01	.24	.63	.00	.95	.42	.00

Note: * p < .05; ** p < .01; *** p < .000

Discussion

The study of loneliness during adolescence is a relevant issue because the challenges and changes that characterize this developmental period may increase the risk of occurrence of feelings of loneliness and may harm social adjustment of youths. The present study was designed to contribute for the existing knowledge on loneliness by adopting a multidimensional and a person-centered approach, and also by examining sex differences across the various forms of loneliness. This procedure allowed us to examine how different forms of loneliness are combined to create distinct loneliness profiles, thereby providing more detailed and richer information about the experience of loneliness. In all analyses, adolescents' sex was considered.

Although it is widely accepted that loneliness is a multidimensional construct, most studies have assessed loneliness as a global measure, whereas other studies have considered only mean-level differences (Hyland et al., 2019; Mund et al., 2020). Thus, given that this construct has not been accurately conceptualized, empirical results regarding predictors, outcomes and the prevalence of loneliness are likely to be misleading. Furthermore, the different forms of loneliness may be analyzed separately, but they should also be combined to investigate the co-occurrence of such diverse forms of loneliness within individuals.

Globally, the main goals of our study were (1) to identify distinct profiles of young adolescents with similar patterns of social and emotional loneliness, as reflected in integration and intimacy difficulties, in both family and peer context; (2) to compare such profiles and analyze sex differences; (3) analyze how the distinct loneliness profiles might be differentially associated with positive and negative features of social adjustment to peer group dimensions, again taking adolescents' sex into account. It was our intention to assess the vulnerability of adolescents to social maladjustment to their peer group in each loneliness profile. For this purpose, we used a multidimensional self-report measure and a multidimensional peer-nomination measure.

Preliminary considerations

Before proceeding with the main analyses of our study, we performed a preliminary analysis of the data to control for variables that could also influence loneliness. At a means level, our results revealed that boys reported higher emotional loneliness regarding their peer group, and a higher preference for solitude than girls. Similarly, correlations showed a weak

but significant association between sex and preference for solitude, and a positive association between sex and emotional loneliness in the peer context.

As for age, our findings showed that older adolescents felt lonelier in the context of family and had a higher preference for solitude. We found a weak but significant association between age and social and emotional loneliness in the family context. Adolescents are expected to gain more autonomy and independence as they grow older, although they continue to perceive their parents as supportive, even if they spend less time with them (e.g., Musetti et al., 2012). Finding the right balance between establishing distance from their parents and staying sufficiently connected to them may result in more family-related loneliness (Danneel et al., 2018; Musetti et al., 2012). Regarding younger youths, they were more likely to be excluded and victimized by their peers. Correlations showed a weak but significant association between age and victimization. Moreover, victimization was associated with a lack of integration (social loneliness) but not a lack of intimacy (emotional loneliness), in the peer context. Perhaps the lack of social engagement and integration in social networks enhances feelings of loneliness and negative social experiences (Rubin et al., 2008). Globally, both social and emotional loneliness in peer's context were positively associated with all negative dimensions of social functioning (socially withdrawn behavior, peer exclusion, peer victimization), and negatively associated with positive dimensions (prosocial behavior, sociability/ popularity).

Finally, the result of preliminary analyses may support the idea that preference for solitude, despite being normative and playing a constructive role in their development, may place adolescents at risk for maladjustment to their peer group (Wang et al., 2013). Preference for solitude was weakly associated with negative features of social functioning and social behavior, and moderately associated with all different forms of loneliness in both peer and family contexts. Our results also suggest that solitude, social withdrawal, and loneliness — all of which draw adolescents away from social contexts — are distinct constructs, even though they share the same features of low social contact and social support. Loneliness does not appear to be synonymous with social isolation (solitude), even though it is related to the amount of social contact (quantity). It is also related to defining features of social relationships such as intimacy and trust (quality) (Heinrich & Gullone, 2006). Based on the results obtained in preliminary analyses, we considered age and preference for solitude as covariates in subsequent analyses.

Loneliness profiles and sex differences

Our findings revealed significant heterogeneity in how adolescents experience feelings of loneliness. After controlling for age and preference for solitude, we found four groups of adolescents with specific profiles of loneliness that could be differentiated in an understandable way. In other words, we found groups of youths who share the same constellation of the various forms of loneliness, but who are different from other groups of youths who also present feelings of loneliness. In line with previous studies, these results support the model of multidimensionality of loneliness (e.g., Goossens et al., 2009; Goossens & Beyers, 2002; Maes et al., 2016; Ribeiro et al., 2019), and provided empirical evidence to the argument regarding the existence of distinct forms of loneliness that reflect unmet particular relational provisions (Weiss 1973). Indeed, when differences are found between family- and peer-related loneliness, they may result from the difference in social context (family vs. peers) or in loneliness form (emotional vs. social). Moreover, our results also offer empirical evidence for the coexistence of different forms of loneliness that occur naturally during adolescence (Hyland et al., 2019; Maes et al., 2016; Shevlin et al., 2014). In that sense, our findings show the importance of distinguishing different groups among lonely adolescents, particularly those who experience heightened feelings of loneliness across their two main socialization contexts, to better act on the prevention of risk for socioemotional maladjustment.

The largest group of adolescents that was identified, labeled Less-lonely profile, comprises youths who reported low levels of social and emotional loneliness (few difficulties with integration and intimacy) in both family and peer group social contexts. As expected, most adolescents in our sample were able to successfully deal with the developmental challenges and changes in their social world, that are typical of adolescence. Conversely, the smallest group of youths that was identified, labeled More-lonely profile, comprises adolescents who reported high levels of social and emotional loneliness (high integration and intimacy difficulties) in both social contexts. They present feelings of loneliness regarding both social contexts and relationships, family and peer group, which are perceived as unsatisfactory. As a result, adolescents in this group experience a lack of belongingness and emotional closeness. Additionally, two more different groups were identified. One, labeled Peer-related loneliness profile, includes adolescents who reported moderate levels of social and emotional loneliness (integration and intimacy difficulties) in the peer context, and low levels in the family context. Finally, the last group, labeled Family-related loneliness profile, contains youths who reported

high levels of social and emotional loneliness regarding family, and low levels of loneliness relative to the peer group context.

During this developmental period, adolescents strive for autonomy and independence, decreasing family dependence, by distancing themselves physically and emotionally from their family members. Consequently, youths might experience unmet social needs. If some adolescents are able to substitute time spent with family with time spent with peers, others might not, thus experience loneliness. Furthermore, adolescents need to cope with changes in social expectations and relationships with their peers, which could lead them to rethink and question their peer relationships, and loneliness appears. Our results showed heterogeneity in how adolescents experience feelings of loneliness.

Considering sex, our results showed a significant interaction effect between sex and loneliness profiles regarding lack of peer-group integration, lack of family-group integration, and family-personal intimacy. Adolescent girls who share the More-lonely profile showed significantly higher social loneliness related to peer's context, and higher social and emotional loneliness related to family context. This finding is particularly important considering the potential consequences of loneliness, not only on the adjustment difficulties, but also on internalizing difficulties, such as depression and anxiety, suicidal ideation, poor social skills, among other negative consequences. This finding may contribute to the literature by demonstrating that it is not only a matter of how lonely someone can feel. Being a girl increases the risk of suffering negative consequences of loneliness, during adolescence.

Additionally, after controlling for age and preference for solitude, our findings revealed significant sex differences, for all forms of loneliness experienced in the two different social contexts. In the peer context, girls reported feeling more social loneliness (i.e., higher lack of integration), whereas boys reported experiencing more emotional loneliness (i.e., higher lack of intimacy). In the family context, girls reported feeling more social and emotional loneliness (i.e., higher integration and intimacy difficulties) than boys. Prior studies have suggested that interpersonal relationships may differ depending on sex (e.g., Rose & Rudolph, 2006). Boys tend to engage with larger groups of peers, colleagues, or friends, whereas girls tend to be more intense and exclusive in their friendships (e.g., Gifford-Smith & Brownell, 2003). Specifically, girls engage in closer dyads or small groups of friends, where intimacy is greater, thus experiencing richer friendships than those of boys (Parker & Asher, 1993; Rose & Rudolph,

2006). Therefore, these differences in interpersonal relationships may explain why girls experienced less emotional loneliness, whereas boys experienced less social loneliness.

Regarding the family context, prior studies suggest that girls tend to be more protected through greater family support than boys (Maes et al., 2015; Musetti et al., 2012). Furthermore, as suggested by Danneel et al. (2018), girls may face greater difficulties establishing a balance between distancing themselves from their family (parents) and staying connected with them. This may increase adolescent girls' vulnerability to experiencing (social and emotional) loneliness in their family during this developmental period.

Despite these results, sex differences related to different forms of loneliness have not yet been analyzed extensively and future research in needed to examine whether they also hold for adolescents of different ages in different cultures. Heinrich and Gullone (2006) have argued that sex differences may be the result of methodological issues, but the majority of studies doesn't consider the complexity of the loneliness construct.

Loneliness profiles and social adjustment to peer group

As expected, our results suggest that different forms of loneliness may co-exist within the same individual. Furthermore, such forms of loneliness may be organized in specific ways that form distinct profiles in adolescents, which, in turn, differ in how their peers view and behave towards them. The four groups of adolescents, which reveal specific profiles of loneliness, were compared regarding positive and negative features of social adjustment to peer group, reported by peer nominations.

Regarding social functioning and social adjustment to peer group, the largest group of adolescents in our study, Less-lonely profile, showed the most adaptive profile (lower vulnerability to maladjustment to peer group), followed by those with the Family-related loneliness profile. According to their peers, adolescents in the Less-lonely profile scored highest on prosocial behaviors and were more likely to exhibit such behaviors than adolescents in the Family-related loneliness profile.

Prior research has shown that adolescents who exhibit socially appropriate and competent behaviors (e.g., engaging, helping, sharing, and cooperating) are more socially accepted and popular (e.g., Freitas et al., 2019), which in turn contributes to lower levels of loneliness (Woodhouse et al., 2012). Prosocial behavior described as intentional and voluntary

behavior that benefits another, has been identified as an important indicator of peer acceptance and of social competence (LaFontana & Cillessen, 2002). This is a behavior that is valued and appreciated by peers (Rubin et al., 2009)

Social relationships with peers are the context in which individuals, particularly youth, develop skills such as communication, conflict management and resolution, reciprocity, and interpersonal intimacy (Heinrich & Gullone, 2006). Young adolescents learn, in the social experiences they have with their peers, about what constitutes normative behavior and, therefore, being well-adjusted has a fundamental relevance for their development. The peer group context becomes increasingly important during adolescence, but family group also maintains its importance.

Adolescents in the Peer-related loneliness profile and, particularly, those in the More-lonely profile displayed the most maladaptive profiles (higher vulnerability to maladjustment to peer group). Both sets of adolescents presented higher socially withdrawn behavior and suffered more interpersonal adversity, such as peer exclusion, than their counterparts. Previous research that also used peer nominations has found a strong link between socially withdrawn behavior, peer victimization and internalizing difficulties such as loneliness (Woodhouse et al., 2012). Moreover, Cacioppo et al. (2000), for example, showed that, compared with non-lonely individuals, lonely individuals normally deal with loneliness and stress by behaviorally disengaging, seeking either instrumental support (information, assistance, guidance) or emotional support (understanding, moral support). Lonely individuals appear to be more passive in their attempts to cope with feelings of loneliness and to behave in a socially ineffective manner towards others, leaving them more vulnerable to being perceived by their peers as withdrawn and more likely to be excluded.

Adolescents in the More-lonely profile were also more victimized by their peers than adolescents who felt lonely in the family context. By withdrawing from or avoiding social interaction and by displaying submissive behavior, these youths may be considered as vulnerable for peer maltreatment because they are perceived to be easy targets (Rubin et al., 2009). Conversely, adolescents who lack relationships and feel lonely may be less motivated to behave prosocially towards others. The development of positive peer relationships and friendships is crucial in helping youths accomplish developmental tasks such as forming their identity, developing social-cognitive skills and self-esteem, and establishing autonomy. Relational difficulties, however, may result in limited social involvement or negative peer

interactions, which can lead to negative self-perceptions and fewer opportunities to practice and refine social skills.

The present findings corroborate those of previous studies and add to our existing knowledge about loneliness. Our results showed that adolescents' sex may truly represent a vulnerability factor for loneliness. Researchers and policy makers need to pay increasing attention to loneliness and continue to explore aspects that make youth vulnerable to feelings of loneliness.

Although the present study has strengths, it also has limitations. Our results need to be replicated in a large sample with a more heterogeneous groups of participants, i.e., including other cultural and socioeconomic contexts. Moreover, the findings are based on cross-sectional data, which prevent any conclusions about causation or long-term effects from being made. Hence, future longitudinal research is also needed. Additionally, the participants in our research were recruited using a convenience sampling method, limiting the possibility to generalize results. Furthermore, this study was conducted in a specific European country, namely Portugal. Given the salience to good manners, sense of responsibility, tolerance, solidarity, and support for others (Ramos & Magalhães, 2021), the threshold for loneliness in this societal setting may be relatively low. At the same time, even if interdependent cultures protect their communities from being alone, they may not protect them from feelings of loneliness.

This study brings new insight to our knowledge of the construct of loneliness. Our results may help to identify adolescents at risk of severe loneliness and thereby support the implementation of policies and public health interventions throughout adolescence. Protecting youths from adverse experiences and risk factors that may impact their potential to develop are critical, not only for their well-being during adolescence, but also for their psychological and physical health in adulthood.

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Chapter IV: Stability and changes on loneliness profiles across adolescence: the effects of intraindividual characteristics on the transitions across time*.

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Abstract

Adopting the perspective that loneliness across time may be experienced as a discontinuous process, and a multidimensional and person-centered approach with longitudinal data, our study aims to analyze the stability and transition patterns of loneliness across three consecutive school years. Lasting effect of loneliness was also examined and the effect on transitions of intraindividual characteristics such as sex, self-worth, and social withdrawn behavior. Self-report and peers' nomination data were collected annually from an initial sample of Portuguese adolescents (721; 47.9% boys). LTA was conducted and the results revealed four distinct loneliness profiles with a specific constellation on the different facets of loneliness, in each of the three assessment timepoints. The Less-lonely profile was the more stable in the transitions, and the More-lonely presented the lowest stability although stability increasing across time. Peer- and Family- related loneliness profiles were moderately stable, with the first increasing and the later decreasing the stability over time. The adolescents that showed a tendency to transition to other profiles shifted into another with lower loneliness experience, except for the Family-related loneliness profile, in which adolescents were more prone to transition to the More-lonely profile. Our results also suggest that there was a lasting effect of adolescent loneliness, as those with a history of such feelings were more likely to report being lonely later. Overall, our findings highlight the importance of recognizing the different facets of loneliness and the importance of assuming that loneliness may be experienced over time as a continuous or discontinuous process.

Keywords: Loneliness development; Facets of Loneliness; Latent Transition Analysis; Adolescence.

Introduction[2]

Loneliness is currently defined as a painful and distressful feeling experienced when someone perceives deficiencies in their social and personal relationships, particularly emerging when it is perceived as a discrepancy between their actual social relations and those they would like to have (Perlman & Peplau, 1982). This discrepancy can be expressed in terms of the quantity, quality, or both, of their relationships (Hyland et al., 2018; Qualter et al., 2015).

This complex construct has special importance during adolescence, which continues to be regarded as a developmental period when loneliness peaks and is particularly relevant (Heinrich & Gullone, 2006; Qualter et al., 2015). During adolescence, youth are typically confronted with numerous social changes and challenges, making them more vulnerable to experiencing loneliness. The gradual need and the desire for autonomy and independence causes adolescents to distance themselves physically and emotionally from their parents and family group, even though continuing to need their support (Bowker et al., 2021). In this circumstance, adolescents might experience some unmet social needs and consequently feel lonely in the family context (Danneel et al., 2018). Simultaneously, peers are increasingly important, representing sources of belonging and identity. Establishing satisfactory peer relationships characterized by closeness and intimacy becomes important and adolescents unable to form these relationships can feel lonely (Eccles et al., 2020; Schinka et al., 2013).

In this context, some researchers have been emphasizing the importance of considering distinct types of loneliness which may be related with different developmental consequences. For example, Weiss (1973) argued that different types of relationships offer different provisions and distinguished two types of loneliness resulting from deficits in different relationships. Social loneliness results from a lack of social integration into an engaging social network and emotional loneliness results from the lack of emotional intimacy in a close dyadic relationship. For a clear understanding of loneliness, it is relevant to consider the sources of loneliness and it is crucial to consider whether relationships, either with family or with peers, can satisfy or not social and emotional needs.

Although researchers increasingly acknowledge the importance of distinguishing the different forms of loneliness, most still focus on global loneliness (Geukens et al., 2022,). For example, a recent meta-analysis reported that 62% of the studies assessed global loneliness, and

[2] This manuscript has supplementary materials. See appendices: appendix B

only a rare number of them assessed multiple facets simultaneously (Mund et al., 2020). Moreover, each of these different facets of loneliness have been analyzed using a variable-centered approach, thereby neglecting the co-occurrence between the different facets of loneliness and the social contexts where these feelings occurred. Social and emotional loneliness, within family or peers' social contexts, are all present to a certain extent in each individual and in a certain period of life.

In the scarce previous studies adopting a person-centered approach, two of them were based on two relation-specific types of loneliness (parents and peers) and in positive and negative attitudes toward being alone (Maes et al., 2015; Vanhalst et al., 2010); another was based on social and emotional loneliness (Shevlin et al., 2014); and only one was based simultaneously on social and emotional loneliness occurring within family and peers social context (Ribeiro et al., 2022). Altogether, these studies have reported between four to six distinct loneliness clusters characterized by different mean levels on the different facets of loneliness. Some (Maes et al., 2015; Ribeiro et al., 2022; Vanhalst et al., 2010) revealed groups of adolescents who score higher on both parent- and peer-related loneliness, those who score lower on both, and those who score higher only in peers' context or in family context. Shevlin et al. (2014) revealed both quantitative (low, moderate, and high loneliness) and qualitative (high level of social loneliness) differences.

In addition to being rare, such studies were cross-sectional and didn't inform about the developmental course of loneliness. Overall, longitudinal studies are also very uncommon (Danneel et al., 2018, 2020, Hutten et al., 2021).

Although the prevalence of loneliness is well established during adolescence (e.g., Qualter et al., 2015), less is known about the developmental course of these negative feelings during this period of development (Hutten et al., 2021). Previous studies revealed an age distribution of loneliness with higher levels in adolescence and old age. However, the meta-analysis of longitudinal data conducted by Mund et al. (2020) concluded that loneliness remains stable during life. Such conclusion does not preclude heterogeneity in the development of loneliness, as recent studies showed between three to six distinct trajectories from middle childhood to young adulthood, characterized by different mean levels and directions of change (Eccles et al., 2020; Qualter et al., 2013; Schinka et al., 2013; Vanhalst et al., 2013). Overall, results consistently showed that the largest portion of adolescents experiences stable and low levels of loneliness. Across time, some studies revealed a slight decrease (e.g., Vanhalst et al.,

2013; Qualter et al., 2013), or both, an increase of the peer-related type and a decrease in parent-related loneliness (e.g., Danneel et al., 2018).

Furthermore, the limited number of existing longitudinal studies assumed the development of loneliness as a continuum (e.g., Vanhalst et al., 2013; Qualter et al., 2013; Schinka et al., 2013; Hutten et al., 2021; Danneel et al., 2018). To date, there is a lack of longitudinal studies investigating the developmental trends for social contexts in which loneliness can occur, including both peer-and family-related loneliness, and considering simultaneously the different facets of loneliness (social and emotional). Adopting a person-centered approach with longitudinal data and the perspective that loneliness over time may also be experienced as a discontinuous process, the main goal of our study was to analyze the developmental course of loneliness considering simultaneously the different social contexts and the different facts of this construct.

Influence of intrapersonal characteristics on transitions among loneliness profiles

Over the past decades, an extensive number of empirical studies focused on the correlates and consequences of loneliness. Previous studies have established an association between loneliness and some correlates such as sex, self-worth, and social functioning in the peer group. Social behaviors and intrapersonal characteristics may contribute to the extent of loneliness by making social interactions and relationships (such as friendship) more or less likely. Mahon et colleagues (2006) conducted a meta-analyze and revealed a large effect size for the link between sex, shy/social withdrawal, and self-esteem. For example, shy or withdrawn behavior may result in fewer opportunities for socializing and establishing positive interactions (Spithoven et al., 2017).

The association between loneliness and self-esteem showing that low self-esteem could play a role in the development and maintenance of loneliness is also well established (Geukens et al., 2020; Valhalst et al., 2013). Perceived social acceptance and close friendship might be expected to be also related to loneliness. Whether these intraindividual differences predict movements between different loneliness profiles is not known.

A developmental approach to loneliness with Latent Transition Analysis

From a person-centered approach, a flexible and powerful way of addressing developmental questions and analyzing developmental processes, such as the experience of

loneliness, can be provided by LTA (Collins & Lanza, 2010). Growth curve and autoregressive models, which is the case of LTA, are the most common longitudinal models, but they address different research questions. For example, growth models allow the description of an average rate of change in loneliness, within a given time frame, during which the growth process is assumed to be continually occurring at the same rate (Nylund, 2007). In contrast, autoregressive models allow the description of the probability of an adolescent transitioning from one loneliness profile to another between consecutive time points assessment. LTA assumes the perspective that loneliness over time may be experienced as a discontinuous process, in which adolescents are more or less likely to experience loneliness at each particular point in time. Studies using this perspective are lacking.

In our study, we used LTA (Latent Transition Analysis) to analyze the stability and changes among loneliness profiles through three consecutive school years. LTA involves a measurement model that allows capturing latent profiles (LPA) and a structural component that models change among profiles over time. LTA, a direct extension of the Latent Profile Analysis (when using continuous indicators), in which an adolescent's latent profile membership is not assumed to be stable over time, can provide shed light on the developmental process.

With the measurement parameters of an LTA model with LPA it is possible to estimate mutually exclusive profiles (or classes) which were characterized by a specific response pattern, such that adolescents within a profile evidence similar patterns but were distinct from adolescents in other profiles. LPA not only provides information on the probability of membership in a profile based on one’s overall response pattern but also allows for analyzing how groups differ in their probabilities of responding to individual items. Structural parameters of the LTA extend the LCA measurement model and provide a basis for analyzing changes in profile membership over time (Collins & Lanza, 2010), namely the size of each profile and the movement among them. In addition to modeling year-to-year changes in loneliness profiles, it is possible to add a second-order transition effect to test whether there is a longer impact of early loneliness profile (first assessment timepoint) on later loneliness (last assessment timepoint).

Finally, the possibility to use covariates is an important addition to the model, due to the possibility to describe the heterogeneity in transitions and differences in the developmental course of loneliness.

The present study

To the best of our knowledge, no previous studies have used latent transition models to analyze the development of loneliness during adolescence. Building on the gaps found in the literature, our study extended prior research on the domain of loneliness by using a longitudinal approach to examine loneliness profile membership, and stability and transition in profile membership over time.

The first aim of our study, corresponding to the first step to build the longitudinal model, was to empirically identify distinct profiles of adolescents based on the experiences of loneliness, considering simultaneously social and emotional loneliness related to peers and family, that are social contexts in which loneliness can emerge, using LPA. We expected to find a group with higher values in all forms of loneliness, a group with lower values in all the loneliness forms, a group with high values in social and emotional loneliness in the peer context, and a group with low values on social and emotional loneliness on family context. This cross-sectional analysis was done for all the three consecutive assessment timepoints, to verify the validity of the profiles and their structural stability across school years (i.e., the same profiles for each of the three consecutive years). Consistent with previous studies, we expected to identify at least four different profiles, that would be quantitatively (in terms of severity) and qualitatively (in terms of the distinct combination in each profile) different, in each of the three assessment timepoints.

Our second aim was to extend previous research by analyzing the transitions and transition patterns among the loneliness profiles across the three consecutive assessment timepoints, using LTA. It was our purpose to examine the stability and changes in membership profile over the course of three consecutive school years. Additionally, our third aim was to test whether the adolescents' early loneliness profile predicted the later one.

This approach (LTA) enables us to explore important questions, not only about the development of loneliness, but also how it is related to key intraindividual variables such as sex, perceived social acceptance, close friendship, self-worth, and social withdrawn behavior perceived by peers. Thus, our fourth aim was to include such covariates to the model to investigate potential heterogeneity in transitions that can help to understand differences in the developmental course of loneliness. Previous research has established the association between

loneliness and these variables. However, whether these intraindividual differences predict movement between different loneliness profiles is not known.

Method

Participants

For three consecutive academic years, the students in grades 7 through 9, attending three Portuguese public junior high schools in the Lisbon metropolitan area, were invited to participate in our study. First, the participants completed the measures as sevens graders and annually thereafter.

The sample comprised 721 adolescents (345 boys; 47.9%) in the first assessment time point, 455 (229 boys; 50.3%) in the second assessment time point, and 252 (128 boys; 50.8%) in the third assessment time point. The mean age for the first, second, and third assessment time points were 12.66 (*SD* = .83), 13.59 (*SD* = .81), and 14.61 (*SD* = .75), respectively.

Procedure

During the second trimester of each academic year (February – March), following the approval by the University Ethical Committee and the School Authorities, as well as, obtaining written informed consent from families and assent of young adolescents, participating students completed the measurement protocol using paper-and-pencil format, during one period of a regular school day. A research assistant was always present to introduce the study and answer any questions. Participants were informed that there were no right or wrong answers and about the importance of completing the questionnaires individually. All instructions emphasized the confidentiality of the data and the voluntary nature of participation. Personal data collection and processing were carried out following the recommendations of APA Ethical Guidelines, in compliance with the Declaration of Helsinki, ensuring the privacy and confidentiality of participants' information.

Measures

Adolescents' self-reports and peers' reports were administered in all three assessment time points, and the psychometric properties and reliability of all instruments are well-established.

Self-reported Loneliness

Participants completed the Portuguese version of the Relational Provision Loneliness Questionnaire (RPLQ; Hayden-Thomson, 1989, Ribeiro et al., 2019) to assess social and emotional loneliness. This 28-item multidimensional measure assesses subjective feelings of loneliness through two aspects of social satisfaction (lack of group integration, that is social loneliness; and lack of personal intimacy, that is emotional loneliness) experienced in two different social contexts. The measure comprises four subscales of seven items each: (1) peer-group integration (e.g. "I feel in tune with other young people"); (2) peer-personal intimacy (e.g. "I have a friend I can tell everything to"); (3) family-group integration (e.g. "I feel that I usually fit in with my family"); and, (4) family-personal intimacy (e.g. "I have someone in my family I can tell everything to"). Participants rate how true each statement is for them, on a five-point Likert scale ranging from 1 (*not at all true*) to 5 (*always true*). In the current study, all item scores were reverse coded, with higher scores on each subscale indicating higher levels of loneliness. In our sample, reliability indices were high ranging between .85 and .92.

Peers perceived Social Withdrawal Behavior

The Extended Class Play (ECP; Burgess et al., 2006, Correia et al., 2014) a peer nominations questionnaire was used to measure adolescents' social withdrawal behavior. Participants were instructed to pretend to be the directors of an imaginary class play and to nominate one boy and one girl from among their participating classmates for each of 37 positive and negative roles (37-item instrument). To eliminate possible sex stereotyping, only same-sex nominations were considered (Zeller et al., 2003) and, additionally, to adjust for the numbers of nominations and nominators, all item scores were standardized in terms of sex and classrooms. This measure assessed six dimensions of social functioning and reputation, as follows: aggression, social withdrawal, peer exclusion, peer victimization, prosocial behavior, and sociability/popularity. In the present study, only the social withdrawn behavior subscale was used (e.g., "Doesn't talk much or talks quietly"). Peer nomination procedures are highly reliable (Burgess et al., 2006), and Cronbach' α for the subscale was .87.

Perceived Social Acceptance, Close Friendships, and Self-Worth

To assess self-perception of social acceptance, the ability to make and keep close friendships, and self-worth, participants completed the Portuguese version (Peixoto, Alves-Martins, Mata & Monteiro, 1996) of the Self-Perception Profile for Adolescents (SPPA; Harter,

1988). This 40-items instrument assesses seven specific domains, such as: scholastic competence, social competence, athletic competence, physical appearance, romantic appeal, behavioral conduct, and close friendship. In addition, an eight subscale taps global self-worth (the job competence subscale was left out due to not applicable to our population sample). The items format was presented through two opposing statements (e.g., 'Some teenagers do very well at their classwork' BUT 'Other teenagers don't do very well at their classwork'), and the participants needs first to choose the statement that was more like him or her, and then, chose *sort of true for me* or *very true for me*. This structured format of response was designed to offset the tendency to give socially desirable responses and to provide participants with a range of response choices. For each domain, half of the items were worded with the negative statement first to ensure balance. Responses were rated on a 4-point scale, where 1 indicates the lowest perceived competence, and 4 reflects the highest level of competence. In our study only the subscales of social acceptance ('Some teenagers understand how to get peers to accept them' BUT 'Other teenagers don't understand how to get peers to accept them'), close friendship ('Some teenagers are able to make really close friends' BUT 'Other teenagers find it hard to make really close friends'), and global self-worth ('Some teenagers like the kind of person they are' BUT 'Other teenagers often wish they were someone else') were used. In our study, Cronbach's alphas were, respectively, .75, .85, and .75.

Results

Plan of analysis

Data analyses were performed using Mplus (version 7.4) Statistical Package (Muthén & Muthén, 1998-2015). We conducted a latent variable modelling with cross-sectional and longitudinal data, which were Latent Profile Analysis (LPA) and Latent Transition Analysis (LTA). LTA incorporates and expands the LPA measurement models and provides a basis for analyzing changes in the members of profiles, over time (Collins & Lanza, 2010). All models were estimated using full information maximum likelihood estimation, to get along with missing data. Steps recommended by Nylund (2007) were followed. First, our analyses involved a careful selection of the measurement model that accurately captured the different constellations of loneliness and allowed to examine the co-occurrence of the different types of loneliness, within family and peers group. LPA was used to specify an underlying categorical latent variable which identifies profiles, and the model building process requires fitting several alternative LPAs. Consequently, for each of the three measurement timepoints, a series of LPA

models were conducted, beginning with one-profile model, and continuing to explore models with more profiles (till 6), to determine the best number of profiles at each time point to identify subgroups of adolescents based on similar patterns, or profiles, of loneliness. The number of latent profiles was systematically increased until empirical support was not evidenced for additional profiles, but it was also considered the interpretability of the different profiles provided by the different solutions.

Models were specified using standardized mean scores from the four subscales of RPLQ which are peer group integration (PGI), peer personal intimacy (PPI), family group integration (FGI), and family personal intimacy (FPI) as indicators of different types of loneliness and social contexts where those feelings occurred. We used composite variables, rather than individual scale items, as indicators in the model, following methodological recommendations (Morovati, 2014) suggesting that redundant indicators (e.g., scale items) would not provide additional information helping the definition of latent profiles, and for simplicity (i.e., reduce complexity and increase model convergence). Because LPA is a parameter-intensive model that estimates profile-specific means and variances for each indicator included in the model, the choice to use the subscale means scores (rather than items within each subscale) reduced the number of parameters estimated (Morovati, 2014).

To determine the best model with an optimal number of loneliness profiles, a combination of criteria was used because there are no single fit indices that provide the identification of the correct number of profiles in an LPA. Bayesian Information Criterion (BIC), and adjusted SABIC (Sample-Size Adjusted BIC) are the indices most often used. The smallest value on these indices indicates the best-fitting model. In addition, regarding the comparison of models that are different in the number of classes it was used the Vuong−Lo−Mendell−Rubin Adjusted Likelihood Ratio Test (VLMR-LRT) and the Bootstrapped Likelihood Ratio Test (BLRT), which provide p values assessing whether adding a class leads to a statistically significant improvement in model fit (Nylund et al., 2007). A significant *p* value for these two tests indicates an improvement of k profiles over k-1 profiles. Entropy of the models, a measure of classification accuracy, is also reported. Ranging between 0 and 1, where 1 is the perfect classification, higher values indicate better classification accuracy and a clear delineation of classes (Celeux & Soromenho, 1996).

To evaluate class separation, the Average Posterior Probabilities (AvePP) was revised for each profile of each model solution. Values higher than .70 indicating distinct and well-

separated profiles. However, it is also important to always consider the interpretability of the classes provided by the examined solutions.

Once the measurement model for each assessment time point was established, a model-building approach was used to identify the best-fitting LTA model. Our analyses explored important LTA model specifications such as measurement invariance, stationary transition probabilities, and first and second-order effect and compared them using likelihood ratio tests (LRTs). Finally, the effects of covariates in the transition were examined, using regression coefficients.

Descriptive Statistics of all Variables

Means and standard deviations for the different forms of loneliness, peers' perception of social withdrawn behaviors, and self-perception of social acceptance, close friendship, and self-worth, at each assessment time point, are presented in Table S1 (Supplementary material). Correlations among the variables, also considering all assessment time points, are presented in Table S2 (Supplementary material). These correlations were in line with previous research and the majority were significant. Globally, loneliness correlated positively with socially withdrawn behaviors reported by peers and negatively with the self-perception of social acceptance, capacity to start close friendships and with self-worth.

Latent Profiles Solutions of Loneliness for each of the three Assessment Timepoints.

In the cross-sectional approach, a series of models were estimated using Latent Profile Analysis (LPA), and solutions from 1 to 6 profiles were analyzed for each of the three-time points assessment, separately.

Table 1 presents the information about the models that were used to evaluate each of them, including not only fit statistical indices for each model specification, but also entropy values, and the class prevalence proportions. For all the three assessment time points considered in our study, results revealed that as the number of profiles increased, the model fit was enhanced, with a continuous decrease in BIC (Bayesian Information Criterion), SABIC (Sample-Size Adjusted BIC), and an increase in LL (Loglikelihood). Also, the *p value* associated with BLRT (Bootstrapped Likelihood Ratio Test) remained significant for all solutions pointing towards an improvement when more profiles were added to the model. Nevertheless, at assessment timepoint 1, VLMR-LRT *p value* showed a significantly better

model fit for four profiles when compared with three profiles ($p < .036$), and a non-significant improvement with the five profiles solution. This result was almost replicated in timepoint 2 ($p < .071$), but not replicated in time 3 ($p < .111$), where a four profiles solution did not provide a significant VLMR-LRT *p value* when compared with the three profiles model. This result suggests that the three profiles solution is sufficient, and the four profiles are not really needed. However, BLRT *p value* suggests that four profiles are indeed better than three profiles. Besides, BLRT *p value* remained significant for all solutions pointing towards an improvement in the loglikelihood difference distribution, when other profiles were added to the model, in all assessment timepoints. Because BLRT seems to be more reliable (Nylund et al., 2007), and the four-profiles solution fits theoretical expectations, the four-profile solution seems to be the better choice, as the best-fitting model.

Table 1

Model Statistical Fit Indices for Latent Profile Analysis (LPA) Solutions of Loneliness, ranging from 1 to 6 Profiles by each Measurement Timepoints.

N^{er} Classes	N^{er} Parameters	LL	BIC	SABIC	VLMR-LRT p Value	BLRT p Value	Entropy	Class prevalence (%)
Assessment Timepoint 1_LPA (n = 527)								
1	8	-3080.52	6211.17	6185.78	_____	_____	_____	100
2	13	-2800.03	5681.53	5640.26	0.000	0.000	0.89	77, 23
3	18	-2736.88	5586.58	5529.44	0.044	0.000	0.84	23, 67, 10
4	23	-2666.15	5476.45	5403.45	0.036	0.000	0.89	66, 14, 17, 3
5	28	-2640.96	5457.40	5368.52	0.580	0.000	0.87	65, 8, 17, 3, 7
6	33	-2618.20	5443.21	5338.46	0.194	0.000	0.88	65, 7, 13, 10, 3, 1
Assessment Timepoint 2_LPA (n = 379)								
1	8	-2193.39	4434.28	4408.90	_____	_____	_____	100
2	13	-1967.75	4012.70	3971.45	0.000	0.000	0.91	74, 26
3	18	-1921.63	3950.14	3893.03	0.664	0.000	0.90	72, 17, 11
4	23	-1876.30	3889.16	3816.19	0.071	0.000	0.88	60, 15, 16, 9
5	28	-1676.07	3518.38	3429.54	0.017	0.000	0.98	52, 12, 23, 9, 5
6	33	-1265.25	2726.44	2621.73	0.146	0.000	0.98	52, 12, 5, 7, 2, 23
Assessment Timepoint 3_LPA (n = 221)								
1	8	-1311.48	2666.14	2640.79	_____	_____	_____	100
2	13	-1164.46	2399.09	2357.89	0.000	0.000	0.88	72, 29
3	18	-1123.22	2343.61	2286.57	0.081	0.000	0.90	70, 10, 20
4	23	-1084.82	2293.79	2220.90	0.111	0.000	0.89	57, 20, 11, 11
5	28	-1067.23	2285.59	2196.87	0.423	0.000	0.89	56, 18, 13, 10, 4
6	33	-1046.16	2270.45	2165.87	0.347	0.000	0.87	6, 52, 10, 16, 13, 04

Note. LL = Loglikelihood; BIC = Bayesian Information Criterion; SABIC = Sample-Size Adjusted BIC; VLMR-LRT = VUONG-LO-MENDELL-RUBIN Likelihood Ratio Test; BLRT = Bootstrapped Likelihood Ratio Test.

Further analyses of fit statistical criteria, across all assessment timepoints, also seem to support the four-profiles solution. The entropy values for the four-profiles solutions approximated high levels of entropy, with values ranging from .89 (time 1), .88 (time 2), and .89 (time 3), indicating that for at least 88 to 89% of the times, adolescents were correctly classified in the latent profiles (Clark & Muthén, 2009).

Regarding profile separation, the Average Posterior Probability (AvePP) was evaluated for each profile of each model solution, and obtained values revealed classification accuracy (Table 2). The accuracy of classification in each loneliness profile across all assessment timepoints was high (> .80), with latent class probabilities, within each of the four profiles, ranging from .85 to .98 (time 1), .90 to .97 (time 2), and .87 to .96 (time 3), indicating a good profiles separation.

Finally, considering profiles size, all profiles included at least 1% of the total sample, allowing to support generalizability and replicability (e.g., Nylund et al., 2007). All profiles were psychologically meaningful and seem to be supported by theory.

As the statistical fit indices did not reveal that there was a clear solution for all three assessment timepoints, our decision criteria were based on the interpretability, and parsimony of the model, and we selected the most interpretable and simplest solution.

Table 2

Average Posterior Probability (AvePP) of the most likely Latent Profile Membership by Latent Loneliness Profile.

Assessment Timepoints	**Most likely profile membership**	**Classification probability**			
		1.	**2.**	**3.**	**4.**
Timepoint 1	1. Less-Lonely profile	**.97**	.02	.01	.00
	2. Peer-related loneliness profile	.11	**.85**	.04	.01
	3. Family-related loneliness profile	.06	.04	**.89**	.01
	4. More-Lonely profile	.00	.00	.02	**.98**
Timepoint 2	1. Less-Lonely profile	**.95**	.04	.01	.00
	2. Peer-related loneliness profile	.05	**.90**	.02	.03
	3. Family-related loneliness profile	.03	.01	**.91**	.05
	4. More-Lonely profile	.00	.01	.02	**.97**
Timepoint 3	1. Less-Lonely profile	**.96**	.03	.01	.00
	2. Peer-related loneliness profile	.06	**.87**	.02	.05
	3. Family-related loneliness profile	.05	.01	**.93**	.02
	4. More-Lonely profile	.00	.03	.02	**.95**

Note. Values in bold were indicative of the accuracy of classification, e.g., the Average Posterior Probabilities associated with the profiles to which adolescents were assigned.

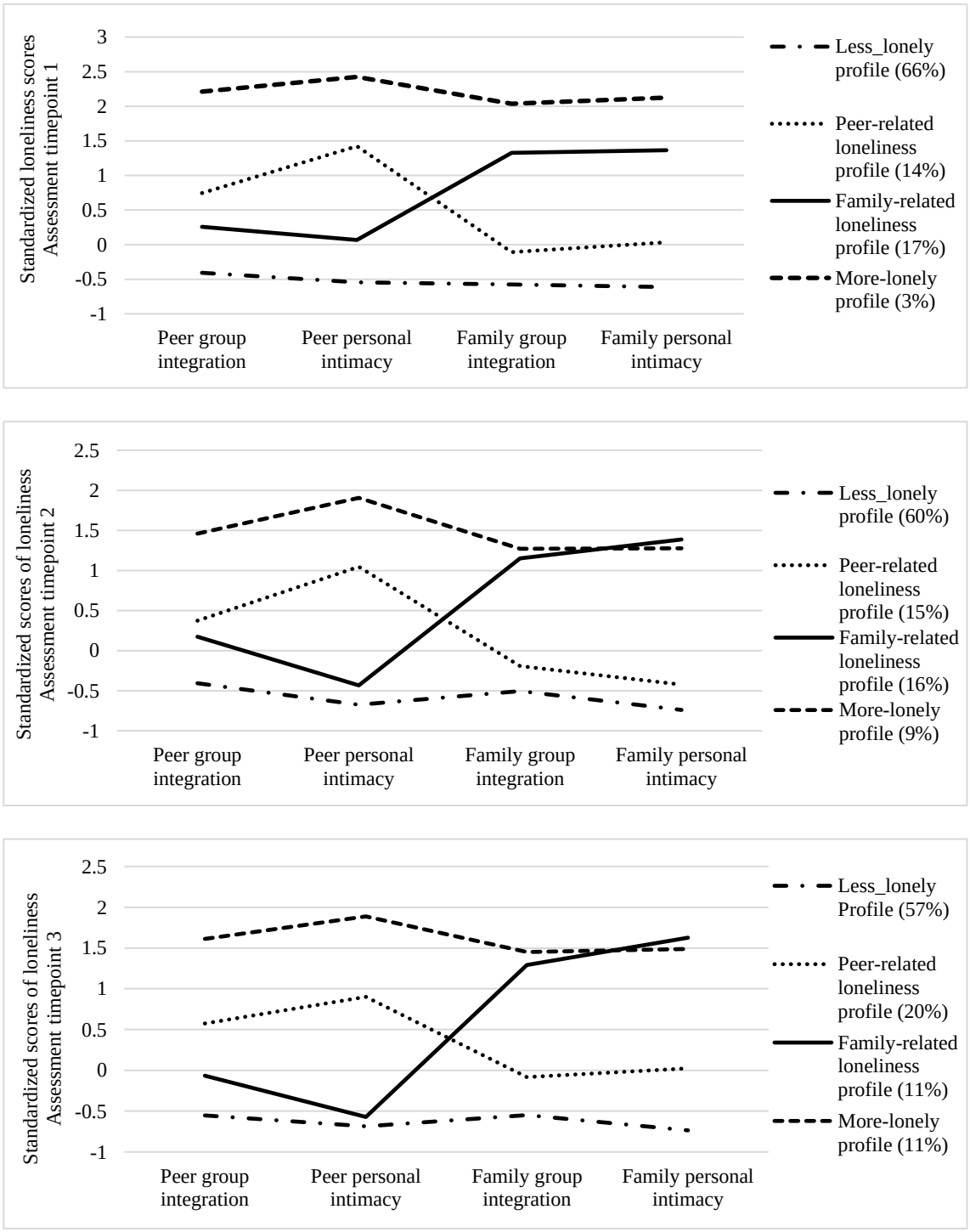
The four emerging profiles, across each assessment timepoint, were labeled based on the pattern of standardized mean scores, across the different types of loneliness (Figure 1). Profile 1, the largest in all assessment timepoints (66% in time 1; 60% in time 2; 57% in time 3), contains (on average) adolescents with the lowest standardized means scores, on each of loneliness type, in both social contexts (peers and family), and so, was labeled ‘Less-lonely profile'. Profile 2 contains those adolescents with the highest scores on social and emotional loneliness, but only in peer’s social context, which was labeled ‘Peer-related loneliness’. Profile 3 contains adolescents with the highest scores on social and emotional loneliness, but only in family’s social context, that was labelled ‘Family-related loneliness’. Finally, profile 4, the smallest in all assessment timepoints (3% in time 1; 9% in time 2; 11% in time 3), that contains adolescents with the highest scores on each of loneliness types, both in peers and family social contexts, labelled ‘More-lonely profile’.

While the four loneliness profiles remained consistent across each of assessment timepoints, the size of each of the profiles did change. Table S3 (Supplementary Material) presents class proportions of the four loneliness profiles for time 1 through time 3. Comparing the class sizes, our results showed that the less-lonely profile was consistently the largest profile, the more-lonely profile was always the smallest, and the other two classes were somewhere in the middle. The size of less-lonely class decreased from 66% in time 1 to 57% in time 3, which indicates that the less-lonely profile decreases in size as adolescents move up the time. At the same time, the more-lonely profile increased from 3% in time 1 to 11% in time 3.

Regarding the social contexts in which loneliness feelings can emerge, peer group loneliness decreases from time 1 to time 2, but increases from time 2 to time 3, while family loneliness increased from time 1 to time 2 and decreased from time 2 to 3. These results were based only on a cross-sectional analysis, but they can be illustrative of the type of movements among the four loneliness profiles over time. The size of profiles informs about the relative distribution of the adolescents that comprise entire sample, across the loneliness profiles, for the three assessment timepoints.

Figure 1

Final four-cluster solution based on Z-scores for peer group integration (social loneliness in peer group), peer personal intimacy (emotional loneliness in peer group), family group integration (social loneliness in family), and family personal intimacy (emotional loneliness in family).



Model Specification of LTA Model Without Covariates

Measurement Invariance

LPA models, for the three assessment timepoints, showed the same number of latent profiles over time, and the types of profiles were similar at each timepoint. To build the longitudinal model based on the results of LPA, our analyses were ongoing considering the measurement invariance of the model. Using LRTs (Likelihood Radio Tests), it was compared a full measurement invariance model (assuming equal profile structures in all timepoints), with full measurement non-invariance (freely estimated model), and partial measurement invariance (assuming equal profile structure for some types of loneliness). The results revealed that the full measurement non invariance model obtained a better fit when compared with a full measurement invariance model ($\Delta\chi^2$ = 68.724, *df* = 32, $p < .00001$), but a worse fit when compared with partial measurement invariance model ($\Delta\chi^2$ = -31.213, *df* = 16, $p < .00001$). However, considering the fit indices (Table S4, Supplementary Material) there was not a clear superior specification. For this reason, and for practical reasons, we assumed the full measurement invariance model. This decision will allow us for a straightforward interpretation of transition probabilities, implying that the four loneliness profiles are the same across assessment timepoints, and no restrictions are made on the profile size.

Transitions Patterns with First- and Second-order Effects

In line with previous analyses, it is also important to compare the assumed full measurement invariance model with different specifications regarding first- and seconder-order effect transition patterns, to explore the stability and changes among loneliness profiles across all assessment timepoints. This procedure is important to explore if there is a lasting effect of a state. For instance, a second-order effect implies that an adolescent's state at one timepoint is dependent on not only the previous timepoint, but also two timepoints previous. Thus, the second-order effect may uncover to what extent loneliness feelings assessed at time 3 are directly related to time 1, beyond the relation through time 2. So, three models were fitted, one with an estimated first-order effect, other with an estimated first- and second-order effect, and other with a first-order effect excluding assessment time 2 (Table S5, Supplementary Material). The LRT comparing fit of these three models indicated that the model with the second-order transition provide a better fit ($\Delta\chi^2$ = 84.349, *df* = 9, $p < .00001$), suggesting that there is a lasting

effect of an adolescent's loneliness experience in assessment timepoint 1 that carries through to assessment timepoint 3.

To explore the impact that early loneliness feelings have on adolescents' trajectory, transition probabilities were analyzed. Table 3 presents the latent transitions probabilities between time 1 and time 2, and between time 2 and time 3, based on a second-order effect and assuming equal profile structures in all timepoints.

Table 3

Latent Transition Probabilities between Assessment Timepoint 1 to 2, and between Assessment Timepoint 2 to 3, based on the Estimated Model (Full Measurement Invariance) with Second Order Effect.

	Assessment timepoint 2 (n=379)			
Assessment timepoint 1 (n=527)	1_Less-lonely Profile	2_Peer-related loneliness Profile	3_Family-related loneliness Profile	4_More-lonely Profile
1_Less-lonely Profile	**.78**	.10	.00	.11
2_Peer-related loneliness Profile	.18	**.66**	.14	.02
3_Family-related loneliness Profile	.15	.09	**.38**	.38
4_More-lonely Profile	.42	.00	.26	**.33**
	Assessment timepoint 3 (n=221)			
Assessment timepoint 2 (n=379)	1_Less-lonely Profile	2_Peer-related loneliness Profile	3_Family-related loneliness Profile	4_More-lonely Profile
1_Less-lonely Profile	**.82**	.02	.03	.13
2_Peer-related loneliness Profile	.19	**.60**	.12	.10
3_Family-related loneliness Profile	.00	.16	**.66**	.18
4_More-lonely Profile	.44	.02	.15	**.39**

Our results revealed that most of the adolescents who were in the Less-lonely and in the Peer-related loneliness profiles at time 1 remained in the same profile at time 2. The Less-lonely profile showed the highest stability, with 78% of the adolescents remaining in the same profile at time 2. The adolescents assigned to the Peer-related loneliness profile had a stability of 66%, with a similar rate of change towards Less-lonely profile (18%), and Family-related profile (14%) at time 2.

Also, a great percentage of adolescents who were in the Family-related loneliness and More-lonely profiles at time 1 remained ate the same profile at time 3 (38% and 33%, respectively). The stability of adolescents assigned to the Family-related loneliness profile was 38%, with most of its 'movers' transitioning to More-lonely profile (38%), although some had also moved to the Less-lonely profile (15%). The profile with the lowest stability was the More-lonely profile, with 33% of adolescents remaining in this profile at time 2, and 42% transitioning towards Less-lonely profile and 26% to Family-related loneliness, at time 2.

Regarding transitions between time 2 and time 3, the results showed similar probability rates of stability and change that in time 1 to time 2, except for Family-related loneliness profile. Nevertheless, the results revealed an increasing stability for the Less-lonely (78 to 82%) and More-lonely profiles (33 to 39%), and a stability decreased for Peer-related loneliness profile, with the same pattern of 'movers'. The Family-related loneliness profile showed the greatest change on stability, with a great increasing stability from time 2 to time 3 (66%), and with a similar rate of transitioning to Peer-related loneliness (16%) and More-lonely (18%) profiles.

The results in table 4 showed again the lasting impact of time 1 loneliness feelings on adolescents' trajectories. Regardless of what happened to those adolescents in time 2, 30% of the More-lonely adolescents in time 1 remained in the same profile in time 3, although some of them could transition to Family-related loneliness (41%) and Less-lonely (26%) profiles. Considering the other extreme, 52% of the Less-lonely adolescents in time 1 remained in the same profile in time 3, although some of them could transitioning to More-lonely (28%) profile. Regarding adolescents who were assigned to Peer-related loneliness profile, 85% of them remained in the same profile at time 3. Finally, adolescents who were assigned to Family-related loneliness profile in time 1 had nearly an equal chance to ending up in any of the four profiles at time 3.

Table 4

Latent Transition Probabilities between Assessment Timepoint 1 to 3, based on the Estimated Model (Full Measurement Invariance), collapsing Timepoint 2.

	Assessment timepoint 3 (n=221)			
Assessment timepoint 1 (n=527)	1_Less-lonely Profile	2_Peer-related loneliness Profile	3_Family-related loneliness Profile	4_More-lonely Profile
1_Less-lonely Profile	**.52**	.01	.19	.28
2_Peer-related loneliness Profile	.04	**.85**	.03	.08
3_Family-related loneliness Profile	.39	.30	**.21**	.10
4_More-lonely Profile	.26	.03	.41	**.30**

In general, if an adolescent has a history of loneliness feelings (feels lonely at measurement timepoint 1), that adolescent was more likely to be a lonely person at a later point, regardless of whether those adolescent experiences a period of time without feeling lonely, than those without a history of loneliness, with the exception of those who feels lonely in the context of family. These latter ones, although they may have felt loneliness in the family context, at time 1, seem that they could be transitioning to any of the loneliness profiles at time 3, but with a smaller possibility of transitioning to the loneliest ones (10%).

LTA Model with Covariables

Although the selection of the measurement model was considered without covariates, covariables were included in the second-order LTA model, with the purpose to being analyzed differences in latent profile membership and transition among the assessment timepoints. LTA regression models for each covariable were analyzed independently using the 'More-lonely profile' as the reference group. Table 5 showed the regression coefficients.

Table 5

Regression Coefficients and Odd Ratios of Latent Profile Membership at Assessment Timepoint 1 and across Time Transitions among Latent Profiles.

	Less-lonely Profile		**Peer-related Loneliness Profile**		**Family-related Loneliness Profile**	
Effects	**B (S.E.)**	**Odds Ratio**	**B (S.E.)**	**Odds Ratio**	**B (S.E.)**	**Odds Ratio**
Assessment time point 1						
Sex (0 – girls)	**-1.00** (.31)**	.37	**-1.79*** (.43)**	.17	-.06 (.50)	.94
Social Withdrawn Behavior	.82 (.55)	2.26	**1.76* (.69)**	5.82	**1.35* (.65)**	3.86
Self-report social acceptance	.10 (.33)	1.11	-.28 (.42)	.75	**-1.57** (.53)**	.21
Close friendship	**1.07** (.36)**	2.91	**1.16** (.40)**	3.20	-.96 (.52)	.38
Self-worth self-report	.82 (.49)	2.26	-.81 (.54)	.45	-.24 (.52)	.79
Assessment time point 2						
Girl (0 = girls)	**-1.25* (.53)**	.29	**-2.05** (.64)**	.13	**-1.54* (.64)**	.21
Social Withdrawn Behavior	.38 (.33)	1.46	.22 (.47)	1.25	.18 (.50)	1.20
Self-report social acceptance	-.22 (1.13)	.80	-1.14 (1.15)	.32	-2.23 (1.18)	.11
Close friendship	1.65 (1.98)	5.18	.95 (2.20)	2.59	.40 (2.17)	1.49
Self-worth self-report	-.26 (.69)	.77	-.75 (.93)	.47	**-2.03* (.90)**	.13
Assessment time point 3						
Girl (0 = girls)	-2.94 (3.04)	.05	-2.56 (1.76)	.08	-3.25 (2.21)	.04
Social Withdrawn Behavior	-0.09 (.47)	.92	.67 (.50)	1.96	.57 (.51)	1.76
Self-report social acceptance	1.21 (.87)	3.34	**-47.74*** (2.64)**	.00	**-48.77*** (1.84)**	.00
Close friendship	5.43 (1.63)	228.33	3.50 (6.22)	33.25	-1.36 (2.42)	.26
Self-worth self-report	**1.40* (.58)**	4.07	-1.71 (1.98)	.18	-3.75 (2.47)	.02

The sex logistic regression coefficient for the first assessment timepoint indicated that being a girl instead of a boy decreased the odds of being in the Less-lonely and Peer-related loneliness profile relative to the More-lonely profile (-1.00, $p < .01$ and -1.79, $p < .000$, respectively). At the second assessment timepoint regression coefficients were also significant, expanding to Family-related loneliness profile. These results were not verified at the last assessment timepoint, with no significant effects, which indicates that for this assessment timepoint, boys and girls were equally likely to be in all loneliness profiles.

Considering the other covariates there was a significant social withdrawn behavior effect for both the Peer-related and Family-related loneliness profiles, but only for the first

assessment timepoint (1.76, $p < .05$ and 1.35, $p < .05$, respectively). Being viewed by peers as more social withdrawal increased the odds of being in the Peer-related and in the Family-related loneliness profiles, compared to More-lonely profile. At the other assessment timepoints, adolescents with more, or less social withdrawn behavior were equally likely to be in all loneliness profiles.

Similar results were found for the self-perception of the capacity to start and maintained close relationships, such as friendship. Close friendship covariable only has significant effects at the first assessment timepoint. Logistic regression coefficient for the first assessment timepoint (1.07, $p < .01$) indicated there was a significant difference in close friendship for adolescents in the Less-lonely profile compared to More-lonely profile. Specifically, for a one-unit increase in the capacity of start and maintained close relationships, the odds of being in the Less-lonely profile increased compared to More-lonely profile. Similar results were found for the Peer-related loneliness profile (1.16, $p < .01$). Adolescents who felt more capable of establishing close relationships were more likely to be in the Peer-related loneliness profile compared to More-lonely profile. This result seems to point to the ability to make friends as a protective factor against more chronic loneliness. At the second and third assessment timepoints no significant effects were found.

Regarding self-perception of social acceptance, regression coefficient for the first assessment timepoint (-1.57, $p < .01$) revealed there were significant differences in feelings of social acceptance for adolescents in the Family-related loneliness profile, compared to More-lonely profile. For a one-unit increase in feelings of social acceptance, the odds of being in the Family-related loneliness decreased, compared with the More-lonely profile. At the second assessment timepoints no significant effects were found, revealed that adolescents who felt more, or less social accepted were equally likely to be in all loneliness profiles. At the third assessment timepoint significant results were found. Regression coefficient showed again there were significant differences in felt social accepted for adolescents in the Peer-related and Family-related loneliness profiles (-47.74, $p < .000$ and -48.77, $p < .000$), when compared to More-lonely profile. Adolescents who felt more social accepted were significantly less likely to be in the Peer-related and Family related loneliness profiles.

Finally, there were no self-worth differences at the first assessment timepoint. At the second assessment timepoints, regression coefficient (-2.03, $p < .05$) revealed significant differences in self-worth for adolescents in the Family-related loneliness profile, compared to

More-lonely profile. For a one-unit increase in self-worth, the odds of being in the Family-related loneliness decreased, compared with the More-lonely profile. At the third assessment timepoint, another significant effect was found. Regression coefficient (1.40, $p < .05$) revealed there were significant differences in self-worth for adolescents in the Less-lonely profile, compared to More-lonely profile. Adolescents who felt more self-worth were more likely to be in the Less-lonely profile compared to the More-lonely profile.

Discussion

Loneliness is not merely an unpleasant negative feeling, but it is associated with psychosocial difficulties that may harm psychological well-being and harmonious development, especially during adolescence. The current study contributes to the existing knowledge on loneliness, addressing gaps in the literature, and extending prior research on the development of loneliness during adolescence. Using an analytic approach that integrates the analysis of latent structures (LPA) and the stability and the transitions in membership group over time (LTA), allowed to analyze the heterogeneity on the development of loneliness, in which latent profile membership adolescents was not assumed to be stable across time.

Globally, using a different longitudinal approach, such as LTA, our main goals were: (1) identify distinct profiles of adolescents based on their self-reported experiences of loneliness, considering simultaneously the different facets of loneliness (social and emotional loneliness) related to peers and family, (2) analyze transitions and transition patterns across loneliness profiles throughout three consecutives school years, (3) the lasting effect of loneliness, and (4) considering the effect of covariates, namely sex, perceived social acceptance, close friendship, self-worth, and social withdrawn behavior perceived by peers, on the transitions, that can help to understand differences in the developmental course of loneliness.

Adolescents' Loneliness Profiles by Assessment Timepoints.

Results of our cross-sectional latent profile analyses across three consecutive time points conceptually replicate those of Maes et al. (2016) and Ribeiro et al. (2022) and lend further support to the notion that loneliness may be best empirically defined by the different facets that loneliness could take in different relationships. For each of the three assessment time points, the cross-sectional approach using LPA revealed four homogeneous groups of adolescents who share the same pattern of the different facets of loneliness. These groups of adolescents have specific profiles and could be distinguished in a meaningful and understandable way on the

different facets of loneliness (social and emotional) and on the social context where the loneliness feelings can occur (peers and family). In addition, these results also indicated that four distinct groups of adolescents reported different loneliness experiences, revealing the heterogeneity in the way adolescents' experiences feelings of loneliness in line with previous studies (Schinka et al., 2013; Vanhalst et al., 2013; Eccles et al., 2020). Moreover, the present results showed evidence for the coexistence of different forms of loneliness during adolescence (Maes et al., 2016; Shevlin et al., 2014). Understanding the social contexts of loneliness matters because the emotional experience of loneliness does not happen spontaneously, and even considered distinct experiences, social and emotional seem to be associated.

As expected in a normative developmental course through adolescence, most adolescents do not experience substantial levels of loneliness, however, our results revealed a small group of adolescents who reported high levels of loneliness. According to previous studies, the percentage of youth that reported feeling lonely 'sometimes' or 'often' was estimated between 11% and 20% (Qualter et al., 2015). There appears to be a small group of youth who are at risk for prolonged feelings of loneliness, but such youths seem not to be identified in analyses that focus on mean levels of loneliness (Qualter et al., 2015). This group comprises adolescents who report persistent loneliness over time and are feeling socially or emotionally distant from others. Moreover, longitudinal studies investigating developmental trajectories of loneliness also have indicated that between 3% and 22% of adolescents experience prolonged loneliness (Qualter et al., 2013; Schinka et al., 2013; Vanhalst et al., 2013; Vanhalst, Rassart, et al., 2013).

Our analyses identified four loneliness profiles ('Less-lonely profile, Peer-related loneliness profile, Family-related loneliness profile, and More-lonely profile) . The largest group of adolescents identified, labeled Less-lonely profile, comprised adolescents who reported low levels of social and emotional loneliness (lower lack of integration and intimacy) in both contexts of social development (family and peers). Conversely, the smallest group (More-lonely profile), was comprised of adolescents who reported high levels of social and emotional loneliness (high lack of integration and intimacy) in both social contexts. Two more different profiles were identified, a Peer-related loneliness profile, including adolescents who reported moderate levels of social and emotional loneliness (integration and intimacy difficulties) only in the peer social context. The Family-related loneliness profile comprised

adolescents who reported higher levels of social and emotional loneliness (integration and intimacy difficulties) only in the family social context.

Our findings support the model of multidimensionality of loneliness (e.g., Goossens et al., 2009; Maes et al., 2016) and provide empirical evidence to the idea regarding the existence of the different facets of loneliness (quantitative and qualitative deficits in relationships) reflecting unmet distinct relational provisions (Weiss, 1973). Moreover, our findings also showed empirical evidence for the coexistence of the different forms of loneliness that occur naturally during adolescence (Maes et al., 2016; Shevlin et al., 2014). Social and emotional are two complementary types of loneliness but not interchangeable. Adolescents want to be liked by a close friend or a close family member, however, they also have the desire to be liked by the whole peer or family group (Vanhalst et al., 2013, 2014).

The same for adolescent's loneliness profiles remained consistent across each of assessment timepoints while the size of each one did slightly change. The Less-lonely profile was always the largest, but our results showed a slight decrease from time 1 to time 3. Conversely, the More-lonely profile was always the smallest but there was an increase from time 1 to time 3. Regarding the social context in which loneliness feelings can occur, the size of Peer-related loneliness profile decreased from time 1 to time 2, but increased from time 2 to time 3, while the size of Family-related loneliness profile increased from time 1 to 2 and decreased from time 2 to 3. Based only on a cross-sectional analysis these results could be illustrative of the transition among the four loneliness profiles across time.

Stability and changes among loneliness profiles across time.

Another contribution of this study was the use of LTA to explore the stability and changes among loneliness profiles across the three assessment time points. To our knowledge, no other study has used LTA to explore the course of loneliness, and the scars longitudinal research on this topic has assumed that the development of loneliness was a continuous process. Our study adopts the perspective that the experienced feelings of loneliness during adolescence are a discontinuous process. Several interesting patterns of stability and transitions emerged from the cross-classification of the different profiles of loneliness.

Our results revealed that the more stable profile was the Less-lonely profile. This profile showed the highest stability in the transition between assessment timepoints 1 to 2, with most of adolescents who were in this profile in time 1 remaining in the same profile at time 2. The

stability also slightly increased in the transition to time 3. Like previous studies, our findings revealed that most adolescents can successfully navigate the developmental changes and challenges that characterize adolescence (e.g., Qualter et al., 2013; Schinka et al., 2013; Vanhalst et al., 2013; Hutten et al., 2021).

Peer-related loneliness profiles also revealed the highest stability in the transition between time 1 and time 2, but the stability decreased from time 2 to time 3 with a similar probability to change towards Less-lonely and Family- related loneliness profiles. Conversely, the Family-related loneliness profile has a moderate stability in the transition to time 2, with most adolescents who were assigned to the Family-related loneliness profile at time 1 changing to More-lonely profile at time 2. However, the transition from time 2 to time 3 showed the greatest increase in stability. Thus, loneliness seems to have a different meaning in parents versus peer relationships (Goossens et al., 2009). Previous research attempting to identify different groups of adolescents based on their loneliness experiences in different relationships found distinct groups comprised adolescents that reported experiencing loneliness in the relation with their peers without experiencing loneliness with their family and the contrary for another group (Maes et al., 2016). In addition, longitudinal studies showed that the development of loneliness development during adolescence runed in different directions, there were parent-related loneliness increases throughout adolescence whereas peer-related loneliness decreases (Dannell et al., 2018; Geukens et al., 2022). Additionally, parent- and peer-related loneliness were found to be stable over time and were concurrently related to each other (Geukens et al., 2022).

Finally, our results showed that the More-lonely profile has the lowest stability in the transition from time 1 to time 2, with a higher percentage of adolescents transitioning towards Less-lonely profile, even some of them transitioning to Family-related loneliness, in time 2. The transition between time 2 and time 3 showed increased stability.

These results revealed interesting patterns of movements among the different loneliness profiles across time. In general, more stability in loneliness was observed for the Less-lonely profile than for the other profiles. Peer-related loneliness profile also showed high stability, but these results seem to be plausible since in adolescence the focus is on peer relations which could amplify feelings of being different and cause loneliness (e.g., Schinka et al., 2013). Further even though adolescents showed a tendency to transition to other profiles, they tend to be transitioned into a loneliness profile with lower loneliness, except for Family-related loneliness profile, in

which adolescents has great probability to transition to More-lonely profile. Our findings showed the importance of distinguishing different groups of lonely adolescents and emphasized the perspective that the development of loneliness is a discontinuous process.

Additionally, in our study it was also explored if there is a lasting effect of a loneliness state, and our results suggested that there are a lasting effect of adolescent's loneliness experiences in assessment timepoint 1 that carries throughout to assessment timepoint 3. Adolescents who have a history of loneliness feelings were more likely to be a lonely person at a later point regardless of whether thar adolescent experiences a period of time without feeling lonely. Once again, our study extends the knowledge on the development of loneliness through adolescence.

Effects of intrapersonal covariates in the transitions.

Harnessing the analytic flexibility of LTA, our study intent to analyze the effects of intrapersonal covariates that could be associated with changes in the experience of loneliness across adolescence. It was examined the effect of namely sex, perceived social acceptance, close friendship, self-worth, and social withdrawn behavior perceived by peers, on the transitions, that can help to understand differences in the developmental course of loneliness.

Considering sex in the transition from first to the second assessment timepoint, our results showed that being a girl decreased the probability to change to a profile with less loneliness, such as Peer-lonely profile or Family-related loneliness profile, compared to boys. Nevertheless, in the last assessment timepoint, boys and girls were equally likely to be in all loneliness profiles.

Social withdrawn behavior has been found to uniquely predict loneliness (e.g., Vanhalst et al., 2013). Conversely, it is unknown the effect of this covariable in the transitions among the different profiles of loneliness. Our results revealed that social withdrawn behavior reported by peers by peers has a significant effect in the transition to second assessment timepoint. Being viewed by peers has social withdrawn increased the probability to be in Peer-related loneliness profile and in the Family-related loneliness profile, compared to More-lonely profile. In other assessment timepoints, adolescents with either more or less withdrawn behavior were equally likely to be in all loneliness profiles.

Self-worth was also a significant predictor of loneliness (e.g., Vanhalst et al., 2013; Geukens et al., 2020). For this covariable, our results showed no significant effect at the first assessment timepoint. Nonetheless, in the third assessment timepoint, adolescents who felt with higher self-worth were more likely to transition to Less-lonely profile compared to More-lonely profile.

Summing up, our study has several strengths such as a person-centered approach in a longitudinal design, based on state-of-art statistical techniques that integrate modeling latent structures in membership profiles and the stability of their transitions over time. A major problem with previous longitudinal research on loneliness concerns the lack of a common measure used at various time points. Another contribution of our study is the use of the same instrument, which is a well-established loneliness measure standing for different types of loneliness, at each of the three time points.

Concluding, we analyzed the two important dimensions of self-worth for understanding the sources of loneliness, namely, the self-perception of social acceptance and the self-perception of the capacity to start and maintain close relationships, such as friendship. Our results revealed effects of the close friendship covariable only in the first assessment timepoint. Having a positive self-perception for making friends increased the probability for transitioning to the Less-lonely profile or to the Peer-related loneliness profile, when compared to the More-lonely profile. Overall, this result seems to point out that the ability to make friends is a protective effect against more chronic loneliness, at least in the transition to the second assessment timepoint. Finally, self-perception of social acceptance, globally showed that adolescents who felt more accepted were significantly less likely to transition to the Peer-related loneliness profile or to the Family-related loneliness profile. Accordingly, the self-perception of social acceptance may not provide protection from more chronic feelings of loneliness.

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Chapter V: General discussion

General discussion

Development of positive peer relationships and friendships is crucial in helping youths accomplish developmental tasks such as forming their identity, developing social, emotional, and cognitive skills, self-esteem, and establishing autonomy namely from their parents. Relational difficulties, however, may result in limited social involvement or negative interactions, which can lead to negative developmental consequences. During adolescence, facing important changes and challenges in social relationships, expectations, and roles, youth may be particularly vulnerable to experiencing feelings of loneliness. Loneliness impacts negatively not only this developmental period but also psychological and physical health in adulthood.

Has it been argued by J. Baarck and M. Kavacic (2022) in the Technical Report published by Join Research Center (JRC), of the European Commission (EC), '… *loneliness was increasingly recognized as a serious policy problem with detrimental effects on mental and physical health, as well as on social cohesion and community trust*. They continue with the idea that '… *To effectively tackle the complex (and multifaceted) issue of loneliness, a clear understanding of the phenomenon and its main drivers is needed*.' (Page 3). This was the idea that led us to the realization of this thesis and that crossed all the presented studies: a better understanding of the construct of loneliness, specifically during the developmental period of adolescence. Addressing important gaps in loneliness literature, considering some inconsistencies in results founded in previous studies, or considering understudied topics, we tried to go deeper and extent the existing knowledge about loneliness.

This final chapter summarizes the main findings that emerge from our empirical studies presented in this thesis, discusses these findings within the current loneliness literature, and addressing new questions arising from this thesis.

Factorial structure and psychometric properties of a multidimensional loneliness measure

This thesis begins with a concern about how to measure loneliness in a way that reflects the complexity of the construct. In the literature, some authors argued that it is imperative to have psychometrically sound rating instruments to assess and identify loneliness, to promote effective assessment and intervention strategies (Heinrich & Gullone, 2006). Several instruments have been developed, each of one with their own and unique characteristics and

their own strengths and weaknesses. However, the subjective nature of this construct has posed challenges regarding assessment instruments, that should be valid and reliable.

In general, researchers have been using single- or multi-item measures. The single-item measures are a direct way to assess loneliness, that includes a specific word which is ‘lonely’ or ‘loneliness’. For this reason, the use of these instruments has been criticized, due to social desirability bias. Beyond this bias, individuals tend to underestimate their own negative behavior and overestimate their own positive social behavior (Junttila et al., 2015). Additionally, there is a strong social stigma about loneliness, especially during adolescence when peers became increasingly important (Lasgaard, et al., 2016; Heinrich & Gullone, 2006). Youths may feel some apprehension regarding the way others may react if they talk about or exhibited their loneliness, because they felt to be abnormal in their peer context.

The fact that these instruments are unidimensional must also be considered. The adequacy of the unidimensional assessments has been questioned because these might not be able to reveal the complex association between loneliness and other feelings. Also, this direct way approach may underestimate the true extent of loneliness.

On the other hand, the most used scales are multi-item, comprised by a set of questions concerning one’s subjective feelings and behavioral patterns known to diverge between lonely and non-lonely individuals. Many researchers argue that the subjective evaluations of individuals' satisfaction with their personal social relationships are more valid questions while studying the phenomenon of loneliness (loneliness is a subjective feeling). Likewise, some of these multi-item measurement instruments consider loneliness as a unidimensional phenomenon, while others have been developed under the perspective that loneliness is a multidimensional phenomenon. For example, Heinrich and Gullone (2006) highlight the importance of assigning things of loneliness to different social characteristics. While loneliness is often caused by a quantitative lack of social networks, it is maybe more greatly influenced by the qualitative characteristics of these social networks, such as the satisfaction with existing personal relationships, the perceived social acceptance, and feelings of connectedness and closeness with others. The multidimensional approach accepts that loneliness might take multiple forms. Deficits in social relationships may result from differences in the quantity and/or quality of these relationships. Moreover, different social relationships, such as peers and family, may offer distinct social provisions and also have different social functions (Weiss, 1973). Several researchers have provided strong evidence for the multidimensionality of

loneliness (e.g., De Jong Gierveld & Van Tilburg, 2010; Goossens & Beyers, 2002; Goossens et al., 2009; Maes et al., 2015; Ribeiro et al., 2019).

In this sense, multidimensional measures are particularly important. They can offer a more comprehensive and differentiated perspective of loneliness (e.g., Maes et al., 2015). To assess the different facets of loneliness (social and emotional), considering simultaneously the social contexts where these feelings can occur, the Relational Provisions Loneliness Questionnaire (RPLQ) seems to be a good option. RPLQ has explicitly been developed to assess those two relational benefits (social provisions as defined by Weiss), namely personal intimacy (also referred to as emotional loneliness) and group integration (also referred to as social loneliness), provided in two social and relational contexts, which are the family and the peers contexts, the most important agents of socialization. Understanding the social contexts of loneliness matters because the emotional experience of loneliness does not happen spontaneously. Social environments such as where an individual feels they do fit or not fit, can promote loneliness, and reinforce loneliness (Qualter et al., 2015).

Therefore, we begin the present dissertation, examining the factorial structure and the psychometric properties of the RPLQ. To our knowledge, this study was perhaps the first to test the complete factor structure of this instrument and on a single sample (to avoid issues of comparability across samples) and compare it with other parsimonious structures. Additionally, we also evaluated the measurement invariance across sex and age groups, and discriminant validity with an external criterion to provide extra evidence to support the assumption that loneliness factors represent distinct forms of the same construct.

Even RPLQ loneliness scale is used less frequently than other loneliness measures, our results suggest that this scale is a good and valid choice for researchers, either clinicians, who want to study, identify, or assess loneliness. We found considerable empirical support for the model of adolescents' loneliness, in which lack of integration and intimacy within peer group and family were distinguished. These results reinforce the perspective of multidimensionality of loneliness and showed that social (lack of integration) and emotional (lack of intimacy) loneliness were clearly distinguishable. In other words, social and emotional loneliness are distinguishable between them, and in different social contexts. Loneliness develops within social and developmental contexts, and understanding these contexts may help to interpret and contextualize loneliness experiences, as well as their mechanisms and risk factors. Measurement invariance across sex and age was also established. Both boys and girls equally

understood the items and the underlying latent factors, regardless of the age range. Therefore, RPLQ scores may be meaningfully compared, not only between sex, but also across age groups. Discriminant validity was also evidenced by differential associations with different dimensions of social functioning. The four factors of loneliness held different relationships with the positive and negative dimensions of social functioning.

With this first study, we think that we made a valuable contribution, expanding the available knowledge on the measurement of adolescent loneliness.

Distinguishing among different facets of loneliness

Although loneliness is a complex and multifaceted construct, it is often treated as unidimensional (Hyland et al., 2019) and most studies still focus on global loneliness (Geukens et al., 2022, Mund et al., 2020). In this sense, the different facets of loneliness are still an understudied subject, until during adolescence. As two indicators of interpersonal difficulties in adolescence, social and emotional loneliness received less attention in youth development research. On the other hand, while considering the different facets of loneliness, most of what we know about adolescents' loneliness is based on variable-centered studies, which describe mean differences or compare lower versus higher loneliness scores to classify loneliness (e.g., Hyland at al., 2019). Only a few studies have explored this construct using a person-centered approach (Maes et al., 2014). The advantage of using a person-centered approach is that person-centered analysis seeks to identify unobserved subgroups of individuals who are more similar to each other on particular attributes or relations among attributes, than individuals from different subgroups, recognizing that the distinct facets of loneliness may naturally co-occur in the same individual. Youth who feel social loneliness may be more prone to feel emotional loneliness given that social loneliness often prevents social interactions and relationships.

On the other hand, youth who experience emotional loneliness may also be more prone to social loneliness because, in a general way, loneliness is likely to promote social difficulties. A person-centered approach allows us to identify subgroups of adolescents where social and emotional loneliness occur, as well as subgroups where they do not. Additionally, loneliness develops within social (e.g., peers and family) and developmental contexts (adolescence) and understanding these contexts may help to a better understanding of loneliness experiences. Therefore, such an approach may provide additional insight into complex nature of the interrelations between the different facets of loneliness in adolescence. Furthermore, a person-

centered perspective seems to be more beneficial for developing interventions that are sensitive to the diverse needs of individuals with distinct psychological profiles exploring the associations among the variables of interest at individual level.

Thus, adopting a multidimensional and a person-centered approach, the major aim of our second study was to examine the extent to which the different facets of loneliness cooccur during a period of high prevalence of this emotional distressing feels (i.e., adolescence). Our purpose was to identify groups of adolescents with similar patterns of social and emotional loneliness related to the two major agents of adolescents' socialization, which are peers and family. In this second study it was also examined sex-specific differences, which may be crucial for identifying heterogeneity between boys and girls given that sex differences have been reported in previous studies. It was also analyzed how the distinct profiles of loneliness may be differentially associated with positive and negative features of social adjustment to the peer group, such as aggressive behaviors, social withdrawal behaviors, prosocial behaviors, peer exclusion, peer victimization, and sociability/ popularity perceived by others.

Using a hierarchical cluster analysis, the results of our second study showed the existence of four distinct profiles of adolescents' loneliness with a specific configuration and with different associations with positive and negative features of social adjustment to peer group. Two of them seems to be more adaptative profiles – less-lonely, and family-related loneliness profile – comprised by adolescents who were viewed by peers as exhibiting more prosocial behaviors, and two others with more maladaptive profiles – more-lonely, and peer-related loneliness profile – in which adolescents were more likely viewed by their peers as socially withdrawn, peer-excluded, and peer-victimized. As expected in a normative developmental course through adolescence, the largest profile was the Less-lonely profile (comprises adolescents with low scores on lack of integration and intimacy relating to peers and family). However, our results also showed a small profile comprised by adolescents who reported greater integration and intimacy difficulties with both peers and family, labeled the More-lonely profile.

These results revealed, not only the heterogeneity of the construct of loneliness, but also the significant heterogeneity in how adolescents experience feelings of loneliness and provided empirical evidence to the argument regarding the existence of distinct forms of loneliness that reflect unmet particular relational provisions (Weiss 1973). Moreover, our results also offer empirical evidence for the coexistence of different forms of loneliness that occur naturally

during adolescence (Hyland et al., 2019; Maes et al., 2016; Shevlin et al., 2014). In that sense, our findings show the importance of distinguishing different groups among lonely adolescents, particularly those who experience heightened feelings of loneliness across their two main socialization contexts, to better act on the prevention of risk for socioemotional maladjustment.

Considering sex, girls who share the More-lonely profile showed significantly higher social loneliness related to peer's context, and higher social and emotional loneliness related to family context. Additionally, we find differences between sexes considering social contexts. In the peer context, girls reported feeling more social loneliness, whereas boys reported experiencing more emotional loneliness. In the family context, girls reported feeling more social and emotional loneliness than boys.

It is not only a matter of how lonely someone can feel, but being a girl increases the risk of suffering negative consequences of loneliness, during adolescence. These findings are particularly important considering the potential consequences of loneliness, not only on the adjustment difficulties but also on internalizing difficulties, such as depression and anxiety, suicidal ideation, poor social skills, among other negative consequences. Heinrich and Gullone (2006) argued that the inconsistencies in the results regarding sex differences may be the result of methodological issues, because most studies don't consider the complexity of the loneliness construct.

It is our belief that this study brings new insight to our knowledge of the construct of loneliness. Our results may help to identify adolescents at risk of severe loneliness and thereby support the implementation of policies and public health interventions throughout adolescence. Protecting youths from adverse experiences and risk factors that may impact their potential to develop is critical, not only for their well-being during adolescence, but also for their psychological and physical health in adulthood.

Developmental approach of the different facets of loneliness

Although the prevalence of loneliness is well established during adolescence (e.g. Qualter et al., 2015), less is known about the developmental course of these negative feelings across adolescence (Hutten et al., 2021). Longitudinal studies are scars (Danneel et al., 2018, 2020, Hutten et al., 2021), and although researchers increasingly acknowledge the importance to distinguishing the different forms of loneliness, most of them still focus on global loneliness (Geukens et al., 2022, Mund et al., 2020). In a recent meta-analysis about longitudinal studies

on the topic of loneliness conducted by Mund and colleagues (2020) 62% of the studies assessed global loneliness, and only a scarce number of them have assessed multiple facets simultaneously.

Further, in the limited number of longitudinal studies existing has assumed that the development of loneliness was a continuum (e.g., Vanhalst et al., 2013; Qualter et al., 2013; Schinka et al., 2013; Hutten et al., 2021; Danneel et al., 2018). However, it is important to consider the perspective that loneliness may be experienced as a discontinuous process over time in which adolescents could be more or less likely to experience loneliness just in a particular point of time but not in another one. Research adopting this perspective is lacking.

Our third study, using LTA, aimed to analyze the stability and changes among loneliness profiles across three consecutive school years (7 to 9 grade), assuming that the experienced feelings of loneliness over time are a discontinuous process. Youth can feel lonely in a specific time of their life and don´t feel at other times.

To the best of our knowledge, no previous studies have used latent transition models to analyze the development of loneliness during adolescence. Building on the gaps found in the literature, our study extended prior research on the domain of loneliness by using a longitudinal approach to examine loneliness profile membership and stability and transition in profile membership over time. It was also analyzed whether adolescents´ early loneliness' profile can predict later loneliness profile. Finally, the effect on the transition of intraindividual characteristics, such as sex, perceived social acceptance, close friendship, self-worth, and social withdrawn behavior perceived by peers, was analyzed. Our results revealed, for the three assessment timepoints, the same number of profiles over time, and the different types of profiles were similar at each timepoint. The four distinct loneliness profiles have a specific constellation of the different facets of loneliness in each of the three assessment timepoints.

Less-lonely profile was the more stable in the transitions, and the More-lonely has the lowest stability although stability increased across time. Peer- and Family- related loneliness profiles were moderately stable, with peer-related loneliness increasing and family-decreasing stability over time. Even adolescents that showed a tendency to transition to other profiles, they tend to be transitioned into a profile with lower loneliness, except for the Family-related loneliness profile, in which adolescents has a great probability to transition to a More-lonely profile. Our results also suggest there was a lasting effect of adolescent's loneliness with those

who have a history of these feelings were more likely to be lonely person later. Finally, considering covariates, the effects were on the transition to second assessment timepoint with girls being less likely to change to profile with less loneliness, social withdrawal adolescents more likely to change to peer- or family-related loneliness, when compared to more-lonely profile. The exception was self-worth, which seems to have no effect on the transition to second assessment timepoint but in the transition to third timepoint higher self-worth increasing the probability to change to Less-lonely profile.

Strengths and future research

Throughout the different empirical chapters of this thesis, we think that we go deeper in the understanding of the construct of loneliness, especially during the developmental period of adolescence. To acquire new insights on this topic, we applied different state-of-the-art statistical techniques, such as structural equation modeling, hierarchical cluster analyses, latent variable modeling with cross-sectional and longitudinal data which were LPA and LTA; with different statistical packages, such as SPSS, Amos, Mplus statistical package; using cross-sectional and longitudinal data; using multi-informant data (self- and peer reported data); and adopting in all empirical studies a multifaceted and a person-centered approach, considering simultaneously the two major agents of socialization, that are family and peers. Addressing significant gaps in previous literature, the findings from the present thesis also raised new questions, which might have the potential to stimulate future studies.

The focus in this thesis was on social and emotional loneliness experienced in the social context of family and peers. However, it may also be important to consider specific relationships, such as mother, father, siblings which are family members with significant impact on adolescents' adjustment. Conversely, it is also important to consider peers beyond school context: peers associated with extracurricular activities, such as leisure time, or sports, among others. Future research should expand the knowledge of other types of loneliness. In addition to social and emotional loneliness, a third type of loneliness (or even a fourth) is sometimes referred to in literature.

For example, in a model proposed by Cacioppo and other authors (2015), it is distinguishable among intimate (the same as emotional loneliness), relational (the same as social loneliness), and collective loneliness. However, a better understanding is needed because collective loneliness is a rather new concept and a better conceptualization of this type of social

need is needed. Collective loneliness has been defined as perceived deficits in one's connections with similar others who constitute a broader group. Thus, for example, future studies could clarify if children and adolescents of migrant or refugee families may be afflicted by similar perceptions due to the separation and lack of communication with their reference groups.

Furthermore, some authors call our attention to a heavy hitter, designated as existential loneliness (Bolmsjö et al., 2019; Ettema et al., 2010; van Tilburg, 2021). Existential loneliness has been defined as the perception that someone experiences when he feels that was born into the world alone, will leave this world alone, and will go through life between these events alone. It will arrive when someone feels a disconnection from their existence and the world. Existential loneliness is often associated with feelings of meaninglessness and lack of purpose. No matter how many qualitative or quantitative relationships someone has, those who feel in this way miss closeness and intimacy. Bolmsjö et al. (2019) distinguished several key aspects of existential loneliness, which characterize the disconnection with others and the world outside, namely, alienation, feelings of isolation, emptiness, and abandonment. Overall, besides the crucial importance of the earliest detection and risk reduction, it will be a daunting challenge to create existential meaning for such people and reduce their loneliness.

Finally, as the social world, mind, and behavior of individuals should expand and complexify during their development, a variety of different social contexts will become important and different social needs will be fulfilled. Thus, it is important to replicate studies with representative samples of different socioeconomic, cultural, and ethnic backgrounds as well as promote the study of social reality beyond western civilization.

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Appendices

Appendix A

Supplementary materials

Tested Models of the RPLQ Loneliness Scale

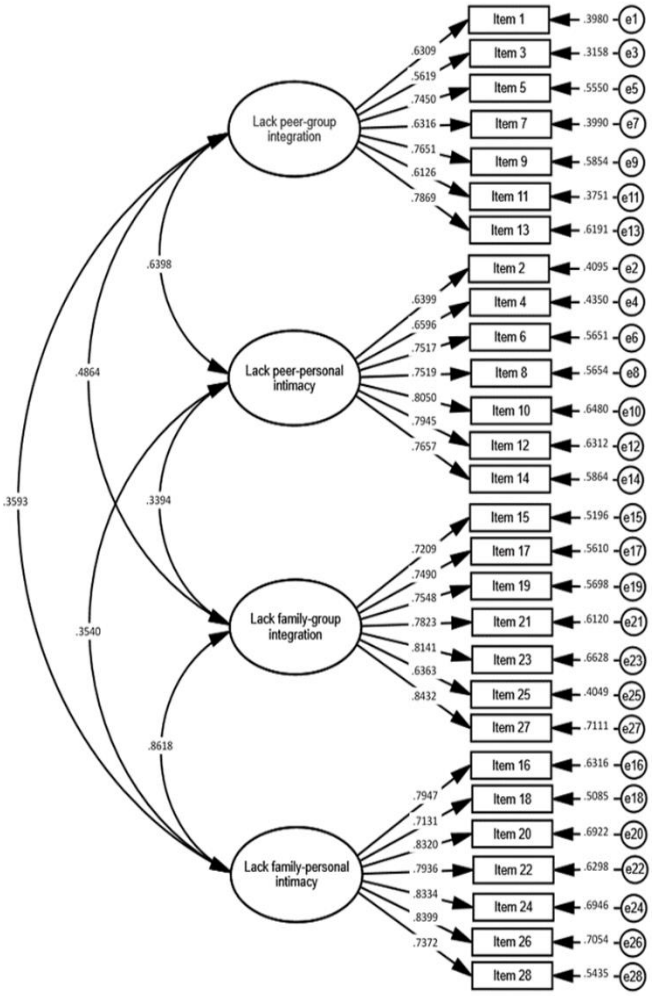

Figure 1. *Four-factor model of the original structure of RPLQ loneliness scale.*

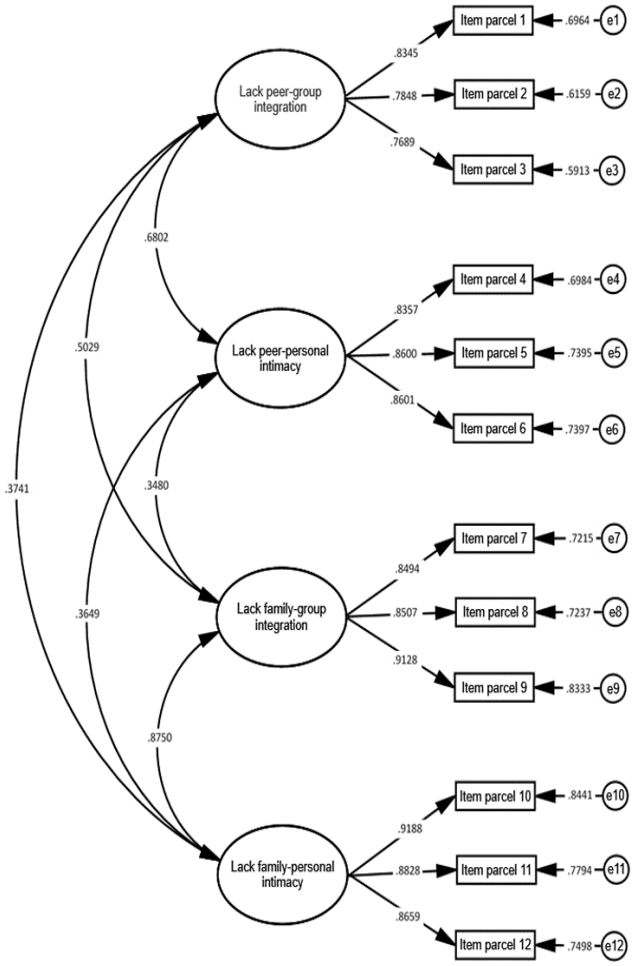

Figure 2. *The improved four-factor model of the RPLQ loneliness scale (item parceling).*

The Item Parceling Construction of RPLQ Loneliness Scale

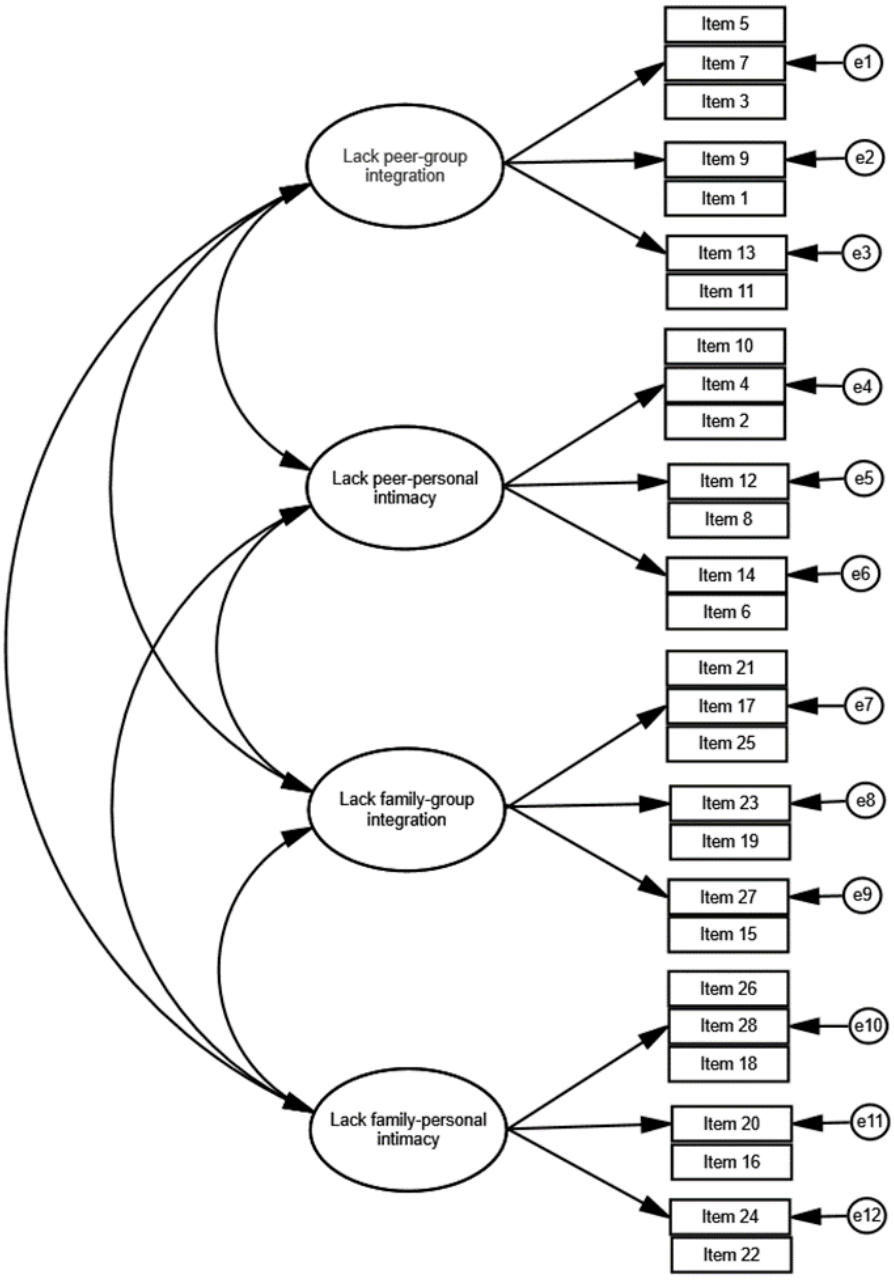

Figure 3. *Improved structure of the RPLQ loneliness scale with items aggregation (the construction of item parcels).*

Descriptive Statistics, Factorial Validity, Individual Reliability, and Construct Reliability of the RPLQ Loneliness Scale

Table 1.
Descriptive statistics, factorial validity, individual reliability, and construct reliability of subscales of RPLQ loneliness scale.

		Original structure					Improved structure			
Subscales		***M***	***SD***	λ	λ^2		***M***	***SD***	λ	λ^2
Lack of peer-group integration	Item 1	1.91	.93	.63	.40	Item parcel 1	1.78	.74	.83	.70
	Item 3	2.37	.88	.56	.32	Item parcel 2	1.97	.78	.78	.62
α = 85	Item 5	2.09	.89	.75	.56	Item parcel 3	2.21	.72	.77	.59
	Item 7	2.19	.92	.63	.40	α = 84				
	Item 9	2.04	.88	.77	.59					
	Item 11	1.71	.82	.61	.38					
	Item 13	1.85	.89	.79	.62					
Lack of peer-personal intimacy	Item 2	1.71	.91	.64	.41	Item parcel 4	1.71	.79	.84	.70
	Item 4	1.85	1.07	.66	.44	Item parcel 5	1.81	.89	.86	.74
α = 89	Item 6	1.43	.77	.75	.57	Item parcel 6	1.51	.71	.86	.74
	Item 8	1.88	1.06	.75	.57	α = 88				
	Item 10	1.57	.90	.81	.65					
	Item 12	1.75	.93	.79	.63					
	Item 14	1.59	.83	.77	.59					
Lack of family-group integration	Item 15	1.71	.96	.72	.52	Item parcel 7	1.62	.80	.85	.72
	Item 17	1.80	.95	.75	.56	Item parcel 8	1.68	.80	.85	.72
α = 90	Item 19	1.73	.92	.75	.57	Item parcel 9	1.74	.73	.91	.83
	Item 21	1.51	.79	.78	.61	α = 90				
	Item 23	1.62	.86	.81	.66					
	Item 25	1.91	.97	.64	.40					
	Item 27	1.53	.82	.84	.71					
Lack of family-personal intimacy	Item 16	1.46	.84	.79	.63	Item parcel 10	1.59	.77	.92	.84
	Item 18	1.61	.98	.71	.51	Item parcel 11	1.50	.78	.88	.78
α = 92	Item 20	1.53	.87	.83	.69	Item parcel 12	1.66	.91	.87	.75
	Item 22	1.70	.98	.79	.63	α = 92				
	Item 24	1.61	1.00	.83	.69					
	Item 26	1.70	.94	.84	.71					
	Item 28	1.46	.81	.74	.54					

Note. N = 737; All factor loadings were significant at $p < .000$.

Appendix B

Supplementary material

Table S1

Descriptive Statistics of all Study Variables at each Assessment Time Point, considering the Total Sample, Boys, and Girls.

			Assessment time points								
			Time 1			Time 2			Time 3		
			Total Sample	*Boys*	*Girls*	*Total Sample*	*Boys*	*Girls*	*Total Sample*	*Boys*	*Girls*
		Range	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Peers group	**Social Loneliness**	1 – 5	2.10 (.72)	2.10 (.75)	2.10 (.69)	1.93 (.64)	1.90 (.65)	1.96 (.64)	1.87 (.68)	1.88 (.68)	1.85 (.67)
	Emotional Loneliness	1 – 5	1.77 (.82)	1.99 (.87)	1.57 (.71)	1.66 (.76)	1.84 (.78)	1.47 (.68)	1.67 (.84)	1.83 (.76)	1.51 (.88)
Family group	**Social Loneliness**	1 – 5	1.73 (.77)	1.67 (.71)	1.78 (.83)	1.80 (.78)	1.70 (.68)	1.90 (.86)	1.80 (.82)	1.73 (.76)	1.87 (.88)
	Emotional Loneliness	1 – 5	1.63 (.80)	1.62 (.76)	1.63 (.84)	1.73 (.88)	1.62 (.72)	1.85 (1.01)	1.72 (.90)	1.75 (.85)	1.69 (.94)
Peers-report	**Social Withdrawn Behavior**	-1 – 3	.07 (.75)	.05 (.73)	.09 (.77)	-.01 (.68)	.05 (.73)	-.03 (.69)	.00 (.72)	.05 (.74)	-.05 (.70)
Self-report	**Social Acceptance**	1 – 4	3.12 (.62)	3.19 (.63)	3.06 (.60)	3.23 (.60)	3.28 (.60)	3.18 (.60)	3.17 (.62)	3.21 (.61)	3.13 (.63)
	Close Friendships	1 – 4	3.23 (.80)	3.06 (.82)	3.39 (.74)	3.38 (.72)	3.26 (.72)	3.48 (.70)	3.34 (.83)	3.15 (.85)	3.54 (.76)
	Self-Worth	1 – 4	3.13 (.64)	3.23 (.61)	3.04 (.65)	3.21 (.63)	3.30 (.60)	3.14 (.65)	3.24 (.59)	3.26 (.58)	3.23 (.61)

Table S2

Correlations Among all Study Variables at each Assessment Time Point.

	1_	2_	3_	4_	5_	6_	7_	8_	9_	10_	11_	12_	13_	14_	15_	16_	17_	18_	19_	20_	21_	22_	23_
1_ Social Loneliness in peers' group (T1)																							
2_ Social Loneliness in peers' group (T2)	.51**																						
3_ Social Loneliness in peers' group (T3)	.35**	.53**																					
4_ Emotional Loneliness in peers' group (T1)	.59**	.35**	.32**																				
5_ Emotional Loneliness in peers' group (T2)	.39**	.61**	.36**	.53**																			
6_ Emotional Loneliness in peers' group (T3)	.27**	.37**	.70**	.45**	.49**																		
7_ Social Loneliness in family group (T1)	.45**	.32**	.37**	.35**	.23**	.34**																	
8_ Social Loneliness in family group (T2)	.23**	.47**	.41**	.13*	.30**	.27**	.52**																
9_ Social Loneliness in family group (T3)	.20*	.40**	.57**	.20*	.23**	.41**	.54**	.69**															
10_ Emotional Loneliness in family group (T1)	.35**	.17**	.15	.41**	.22**	.28**	.72**	.40**	.32**														
11_ Emotional Loneliness in family group (T2)	.21**	.37**	.30**	.17**	.32**	.28**	.46**	.76**	.56**	.53**													
12_Emotional Loneliness in family group (T3)	.15	.44**	.44**	.26**	.34**	.47**	.42**	.60**	.79**	.41**	.60**												
13_Peers-reported Social withdrawn behavior (T1)	.24**	.03	.10	.15**	.05	.06	-.03	-.09	-.04	-.07	-.05	-.05											
14_Peers-reported Social withdrawn behavior (T2)	.29**	.19**	.11	.26**	.10*	.07	.05	-.01	-.05	.04	-.01	-.06	.54**										
15_Peers-reported Social withdrawn behavior (T3)	.26**	.10	.22**	.29**	.16*	.21**	.15	-.01	.00	.08	.09	-.01	.54**	.59**									
16_Self-reported social acceptance (T1)	-.50**	-.38**	-.21*	-.23**	-.20**	-.08	-.27**	-.19**	-.10	-.14**	-.13*	-.00	-.23**	-.27**	-.20*								
17_Self-reported social acceptance (T2)	-.42**	-.51**	-.26**	-.24**	-.30**	-.12	-.29**	-.26**	-.13	-.17**	-.18**	-.13	-.15**	-.25**	-.16*	.62**							
18_Self-reported social acceptance (T3)	-.30**	-.41**	-.48**	-.19*	-.23**	-.29**	-.29**	-.26**	-.36**	-.12	-.18*	-.32**	-.04	-.10	-.13	.33**	.51**						
19_Self-reported close friendships (T1)	-.24**	-.21**	-.20*	-.47**	-.42**	-.30**	-.07	-.08	-.06	-.14**	-.10	-.20*	-.08	-.08	-.15	.26**	.20**	.11					
20_Self-reported close friendships (T2)	-.30**	-.31**	-.07	-.44**	-.57**	-.21**	-.17**	-.11*	-.02	-.18**	-.16**	-.09	-.06	-.12*	-.10	.31**	.34**	.16*	.50**				
21_Self-reported close friendships (T3)	-.16*	-.22**	-.50**	-.30**	-.45**	-.67**	-.31**	-.19**	-.32**	-.25**	-.16*	-.39**	-.01	-.02	-.21**	-.01	.11	.37**	.29**	.23**			
22_Self-reported self-worth (T1)	-.37**	-.24**	-.26**	-.13**	-.14*	-.10	-.39**	-.32**	-.32**	-.25**	-.27**	-.20*	-.05	-.03	-.10	.51**	.37**	.30**	.16**	.14*	.12		
23_Self-reported self-worth (T2)	-.22**	-.31**	-.19**	-.10	-.23**	-.06	-.35**	-.37**	-.29**	-.27**	-.32**	-.25**	-.07	-.07	-.11	.35**	.52**	.34**	.12	.24**	.14*	.51**	
24_Self-reported self-worth (T3)	-.23**	-.24**	-.41**	-.13	-.10	-.23**	-.34**	-.32**	-.45**	-.18*	-.29**	-.34**	-.01	.02	-.07	.26**	.35**	.64**	.03	.13	.37**	.43**	.39*

Table S3
Percent of Adolescents in the Loneliness Profiles across Assessment Timepoints 1 through 3, based on Cross-sectional LPA Results.

Loneliness Profiles	Assessment Time Points		
	Time 1	**Time 2**	**Time 3**
1. Less-Lonely profile	66% (n=347)	60% (n=226)	57% (n=126)
2. Peer-related loneliness profile	14% (n=73)	15% (n=57)	20% (n=45)
3. Family-related loneliness profile	17% (n=90)	16% (n=62)	11% (n=25)
4. More-Lonely profile	3% (n=17)	9% (n=34)	11% (n=25)

Table S4
Model Fit Information considering Measurement Invariance

	# Par	LL	SCF	AIC	BIC	SABIC	Entropy
Full measurement invariance	37	-5670.32	1.7671	11414.64	11578.837	11461.367	0.605
Full measurement non invariance	69	-5627.27	1.5286	11392.54	11698.745	11479.68	0.612
Partial measurement invariance	53	-5649.03	1.5692	11404.05	11639.254	11470.987	0.611

Note. # Par = Number of free parameters; LL = Loglikelihood; SCF = Scaling Correction Factor for MLR; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; SABIC = Sample-Size Adjusted BIC.

Table S5
Model Fit Information considering First- and Second Order Effect among the Three Assessment Timepoints.

	# Par	LL	SCF	AIC	BIC	SABIC	Entropy
Full measurement invariance: 1 order effect	55	-5568.067	1.5106	11246.134	11490.211	11315.593	0.691
Full measurement invariance: 2 order effect	64	-5557.277	1.4141	11242.554	11526.570	11323.379	0.712
Full measurement invariance: excluding 2 timepoint	39	-3741.184	1.4476	7560.368	7731.325	7607.513	0.723

Note. # Par = Number of free parameters; LL = Loglikelihood; SCF = Scaling Correction Factor for MLR; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; SABIC = Sample-Size Adjusted BIC.