future

MDPI

Article

Overcoming Barriers: Trajectories for a School Environment That Promotes the Participation of Adolescents with Chronic Conditions

Ana Cerqueira [1,2,3,*], Fábio Botelho Guedes [1,2,3], Tania Gaspar [1,4], Emmanuelle Godeau [5,6], Celeste Simões [1,2] and Margarida Gaspar de Matos [1,3,7]

1 Institute of Environmental Health (ISAMB)/Aventura Social/Faculty of Medicine, University of Lisbon (FMUL), Av. Prof. Egas Moniz, Ed. Egas Moniz, Piso 0, Ala C, 1649-028 Lisbon, Portugal
2 Faculty of Human Kinetics, University of Lisbon/FMH-UL, Estrada da Costa, Cruz Quebrada, 1499-002 Lisbon, Portugal
3 Catholic Research Center for Psychological, Family and Social Wellbeing (CRC-W), Faculty of Human Sciences, Portuguese Catholic University, Palma de Cima, 1649-023 Lisbon, Portugal
4 Digital Human-Environment Interaction Labs (HEI-LAB), Lusófona University of Humanities and Technologies, Campo Grande 376, 1749-024 Lisbon, Portugal
5 French School of Public Health (Ecole des Hautes Études en Santé Publique, EHESP), 15 Avenue du Professeur Léon-Bernard—CS74312, 35043 Rennes, France
6 CERPOP—UMR 1295, Unité Mixte UMR INSERM—Université Toulouse III Paul Sabatier—Team SPHERE, 37 Allées J. Guesde, 31000 Toulouse, France
7 APPSYci/ISPA, Rua Jardim do Tabaco, 34, 1149-041 Lisbon, Portugal
* Correspondence: cerqueira.apm@gmail.com

Abstract: The characteristics of the school environment can influence students' participation. Therefore, exploring the existing barriers to school participation and academic success of students with chronic conditions (CCs) is essential since they are a population at an increased risk for impairments and difficulties in these areas. This specific study aimed to explore the personal and school-environment variables associated with the school participation of students with CCs. Additionally, it aimed to analyze the differences between (1) male and female adolescents concerning the impact of CCs on school participation and the personal and school-environment variables; and (2) adolescents with and without school participation affected by the existing CCs regarding personal and school-environment variables. This work included 1442 adolescents with CCs, 56.3% female (n = 769), with a mean age of 15.17 years (SD = 2.33), participating in the Health Behavior in School-Aged Children (HBSC) 2022 study. The results showed that girls and students with school participation affected by CCs are at greater risk regarding the personal and school-environment variables under study. In the multivariable logistic regression analysis of the association between these variables and the school participation of students with CCs, a greater weight of personal variables was observed, followed by those of the school environment related to interpersonal relationships and, finally, the physical environment and safety-at-school variables. The study highlights the relevance of considering the existing barriers to school participation and academic success of students with CCs. The results also underline the importance of aligning the intervention of health and education professionals and policymakers. All of these professionals must make a joint effort to overcome existing barriers in the school context and move towards an increasingly balanced environment that promotes and protects the equal participation of all students.

Keywords: adolescents; chronic conditions; school participation; school environment; barriers to school participation

Citation: Cerqueira, A.; Botelho Guedes, F.; Gaspar, T.; Godeau, E.; Simões, C.; de Matos, M.G. Overcoming Barriers: Trajectories for a School Environment That Promotes the Participation of Adolescents with Chronic Conditions. *Future* **2024**, *2*, 92–106. https://doi.org/10.3390/future2020008

Academic Editor: Yajun Chen

Received: 5 February 2024
Revised: 18 May 2024
Accepted: 6 June 2024
Published: 17 June 2024

1. Introduction

Chronic diseases are becoming more prevalent in children and adolescents [1,2], being already the leading cause of mortality and morbidity in Europe [3]. These health conditions include genetic, physiological, environmental, and behavioral factors [4].

The concept of chronic conditions (CCs) includes many health conditions. However, they all share the need for lifelong care (e.g., consultations, treatments, medication, and special equipment). This care can be on a larger or smaller scale depending on the characteristics and specificities of the existing health condition [3,5,6].

Advances in medicine regarding the diagnosis and prognosis of CCs allow children and adolescents to continue their academic path while undergoing the necessary treatments. However, these adolescents experience specific and added challenges compared to their healthy peers. These challenges are not limited to health and academic performance; they also encompass the social aspect through variables such as stigma, a feeling of being different, discrimination, bullying by peers, and teacher misunderstanding [2].

There are also factors of a non-medical nature that affect individuals and their health outcomes, which are called social determinants of health (SDHs). It is essential to consider these SDHs regarding health inequalities [7,8]. According to Healthy People 2030 [9], SDHs can be grouped into five categories: economic stability, access to and quality of education, access to and quality of healthcare, community environment, and social and community context. SDHs can have an even more significant impact on individuals with CCs due to their specific health and social needs [10].

A CC existence impacts adolescents' functioning in various domains of their lives [1], affecting their psychosocial well-being and quality of life [11–13]. The literature shows that chronically ill adolescents experience more challenges in participation, academic performance, and success [12,14,15].

Social participation is fundamental to adolescents' socio-emotional development and physical and psychological health [16]. However, adolescents with CCs have increased difficulties in this area, as they are more likely to experience restrictions in terms of participation in different contexts [17–19]. Therefore, it is crucial to consider the impact of different health conditions on adolescents' participation since compromises at this level translate into worse indicators regarding their psychosocial well-being and quality of life [12,13].

A study by Nap-van der Vlist et al. [17] with adolescents with CCs (aged between 8 and 18) showed that they consider participation far beyond just attending activities. They describe some critical elements for full participation: having a sense of belonging, being able to influence their social relationships, and keeping up with peers who do not have a CC.

The experience of a CC is often associated with higher levels of school absenteeism, which is also related to academic performance and results [20]. Evidence suggests that several personal and social factors (e.g., physical and mental health, violence, substance abuse, and absenteeism) influence students' learning. A better learning ability reflects a more excellent psychosocial balance [21]. Adolescents spend most of their time at school, so it is vital to consider the impact and influence that the characteristics of the school environment have on students' psychosocial well-being [22–24] and the construction of their identity [25].

The literature relates the school environment to students' academic, socio-emotional, and health outcomes. The National School Climate Center identified five dimensions of the school environment: safety, interpersonal relationships, social media (i.e., students feeling safe in the virtual world), teaching and learning, and institutional environment [26]. Along the same lines, the US Department of Education (USDOE) has developed a school-environment model that encompasses three factors: safety (emotional, physical, and substance use), engagement (relationships, respect for diversity, and school participation), and environment (physical, academic, disciplinary, and well-being) [27,28].

A school environment characterized by community, belonging, and connection is related to students' social skills and well-being. In addition, an environment with these

characteristics is also associated with less exposure to bullying and violence, which is associated with greater well-being [29]. Therefore, the evidence indicates an association between an accepting and supportive school environment and students' greater psychosocial well-being [23,28,30,31].

There are various social relationships between the different educational agents, and these can be protective or risk factors regarding adolescents' psychological, social, and academic functioning [2]. These relationships influence students' psychosocial development and, in turn, their academic performance [32–34]. In addition, the quality of the student–teacher relationship is also reflected in their perception of the school environment, particularly concerning safety and fairness [35].

Considering the importance of personal and contextual factors and school participation for psychosocial well-being and quality of life [12,13,21,23], exploring the barriers in the school environment that can prevent or hamper this participation is crucial. The literature shows an association between adolescents' participation in activities inside and outside the school context and their psychosocial well-being [36–40]. More intrinsic (i.e., related to the individual) or more extrinsic (e.g., peer behavior) aspects can hinder the level of participation of adolescents with CCs [17]. Therefore, this study aimed to add to the existing knowledge regarding the school environment and the participation of students with CCs, making a significant contribution regarding the barriers that these students experience and how they reflect on their school participation.

Several studies already focus on the school environment as a context that promotes well-being and academic success. However, to the best of our knowledge, the link between the school environment and the participation of students with CCs is an area that has yet to be explored. Furthermore, studies focusing on specific barriers that influence the participation and academic success of adolescents with CCs are also scarce. Hence, the primary aim of this study is to enhance understanding of the school environment's attributes as a facilitator for the involvement of students with CCs, thereby elucidating specific barriers impeding their participation. More specifically, this study had the following objectives:

- Explore the influence of personal and school-environment variables on the school participation of students with CCs;
- Examine gender differences concerning the school participation of students with CCs and the personal and school-environment variables;
- Analyze differences between adolescents with and without school participation affected by CCs concerning the personal and school-environment variables under study.

2. Methods

This work was carried out within the Health Behavior in School-Aged Children (HBSC) 2022 study [41]. The HBSC study follows an international protocol and is developed every four years in collaboration with the World Health Organization (WHO) [42,43]. The HBSC aims to analyze the behaviors of adolescents in the different contexts of their lives and the influence of these behaviors on their health and well-being.

The HBSC 2022 study in Portugal had the approval of the Ethics Committee of the Lisbon Academic Medicine Center, Lisbon North Hospital Center, EPE, and the Directorate-General of Education and Science Statistics. The participation of school groups was voluntary, and students participated with informed consent given by their parents or legal guardians. The responses to the questionnaire were anonymous and obtained online. The national study report contains more details on data collection [41].

2.1. Participants

In total, 7649 adolescents participated in the HBSC 2022 study, 51.8% female (n = 3961), aged between 10 and 23 years (M = 15.05, SD = 2.36). This study includes only students with CCs in a sub-sample of 1442 adolescents, 56.3% female (n = 769), with a mean age of 15.17 years (SD = 2.33). The sub-sample of adolescents with CCs corresponds to participants

who answered "yes" to the question regarding having a long-term illness, disability, or medical condition diagnosed by a doctor.

2.2. Measures and Variables

Table 1 presents the variables considered in this study.

Table 1. Variables and measures considered in this study.

Variables	Measures
Gender	0—male; 1—female
School participation affected by the CC	Question regarding whether the CC adversely affect adolescents' school attendance and participation. 0—no; 1—yes
School environment has problems	0—no; 1—yes
Feeling safe at school	0—no; 1—yes
Being a bully	0—no; 1—yes
Being a victim of bullying	0—no; 1—yes
School physical environment as a barrier to participation and academic success	0—no; 1—yes
People's attitude towards CC's as a barrier to participation and academic success	0—no; 1—yes
Health condition as a barrier to participation and academic success	0—no; 1—yes
Perception of academic ability	0—bad perception; 1—good perception
Relationship with peers	Scale with three items on a five-point Likert scale, with 1 strongly agree and 5 strongly disagree. Higher values reveal a worse relationship with colleagues. $\alpha = 0.81$.
Relationship with teachers	Scale with three items on a five-point Likert scale, with 1 strongly agree and 5 strongly disagree. Higher values reveal a worse relationship with teachers. $\alpha = 0.84$.
Physical symptoms	Scale with five items (back pain, neck pain, headaches, dizziness, and stomach pain) on a five-point Likert scale, with 1 being almost every day and 5 rarely or never. Minimum score of 5 and maximum score of 25. The higher the result value, the fewer physical symptoms.
Psychological symptoms	Scale with four items (nervousness, irritation or bad mood, sadness, and fear), on a five-point Likert scale, with 1 almost every day and 5 rarely or never. Minimum score of 4 and maximum score of 20. The higher the result value, the fewer psychological symptoms.

2.3. Data Analysis

The data analysis was developed through version 28 for IOS of the Statistical Package for Social Sciences (SPSS). The sample was characterized using descriptive statistics. The chi-square test was used to analyze the differences in the distribution by gender and differences in the distribution by the effect of CCs on school participation (i.e., the CC affects/does not affect school participation) and (1) personal variables (i.e., health condition as a barrier to participation and academic success, and perception of academic ability) and

(2) variables of the school environment (i.e., problems in the school environment, feeling safe at school, bullying behavior (as a perpetrator and as a victim), people's attitudes, and the physical condition of the school as barriers to participation and academic success).

Independent sample *t*-tests were used to compare group means of personal variables (i.e., physical and psychological symptoms) and variables related to the school environment (i.e., peer and teacher relationships), between genders, and between those who reported that their CC adversely affected school participation and those who said that it did not. A multivariable logistic regression model was developed to analyze the association between school participation affected by the CC and (1) personal variables (i.e., the CC as a barrier to participation and academic success, perception of school ability, and physical and psychological symptoms), (2) the variables of the physical environment and safety at school (i.e., the school environment has problems, feeling safe at school, and the school physical environment as a barrier to participation and academic success), and (3) the variables of the school environment relating to interpersonal relationships (i.e., being a bully, being a victim of bullying, people's attitude towards CCs as a barrier to participation and academic success, and relationship with teachers and peers). The three regressions models were performed using the variables that showed statistical significance for at least one of the preliminary analyses. Regression analyses were adjusted for age and gender. The significance level considered was $p < 0.05$.

3. Results

Table 2 shows the participants' characterization and the analysis of gender differences in the participants with CCs. The bivariate analysis found statistically significant gender differences in school participation affected by the CC, being a bully, the CC as a barrier to participation and academic success, relationships with peers and teachers, and physical and psychological symptoms. Girls are the ones who most mentioned having their school participation affected by the CC and feeling that their health condition is a barrier to their participation and academic success, compared to boys. Girls also presented more physical and psychological symptoms (lower value, more symptoms). On the other hand, boys are the ones who most often reported bullying behaviors at school as perpetrators and a better relationship with their peers and teachers (lower value, better relationship).

Table 2. Population characteristics and bivariate analysis of gender differences.

	***M* ± *SD* or % (*n*)**			***p***
	Total (*n* = 1442)	**Male 43.7% (*n* = 597)**	**Female 56.3% (*n* = 769)**	
School participation affected by the CC [1]				
No	72.7 (1048)	**79.2** (473)	69.2 (532)	<0.001
Yes	27.3 (394)	20.8 (124)	**30.8** (237)	
School environment has problems [1]				
No	46.8 (535)	48.9 (222)	46.7 (290)	0.476
Yes	53.2 (607)	51.1 (232)	53.3 (331)	
Feeling safe at school [1]				
No	6.2 (71)	4.4 (20)	5.8 (36)	0.310
Yes	93.8 (1071)	95.6 (434)	94.2 (585)	
Being a bully [1]				
No	91.3 (1317)	88.8 (530)	**94.1** (724)	<0.001
Yes	8.7 (125)	**11.2** (67)	5.9 (45)	
Being a victim of bullying [1]				
No	81.6 (1176)	83.6 (499)	81.5 (627)	0.323
Yes	18.4 (266)	16.4 (98)	18.5 (142)	

Table 2. *Cont.*

	$M \pm SD$ or % (*n*)			*p*
	Total (*n* = 1442)	**Male 43.7% (*n* = 597)**	**Female 56.3% (*n* = 769)**	
School physical environment as a barrier to participation and academic success [1]				0.230
No	84.2 (1214)	86.1 (514)	83.7 (644)	
Yes	15.8 (228)	13.9 (83)	16.3 (125)	
People's attitude towards CCs as a barrier to participation and academic success [1]				0.367
No	95.2 (1373)	94.8 (566)	95.8 (737)	
Yes	4.8 (69)	5.2 (31)	4.2 (32)	
Health condition as a barrier to participation and academic success [1]				0.004
No	84.3 (1215)	**87.9** (525)	82.3 (633)	
Yes	15.7 (227)	12.1 (72)	**17.7** (136)	
Perception of academic ability [1]				0.812
Bad perception	7.7 (111)	7.2 (43)	7.5 (58)	
Good perception	92.3 (1331)	92.8 (554)	92.5 (711)	
Relationship with peers [2]	6.85 ± 2.62	6.42 ± 2.61	7.05 ± 2.51	<0.001
Relationship with teachers [2]	6.66 ± 2.65	6.08 ± 2.44	6.99 ± 2.65	<0.001
Physical symptoms [2]	20.44 ± 4.61	21.88 ± 3.77	19.33 ± 4.81	<0.001
Psychological symptoms [2]	13.88 ± 4.61	15.79 ± 3.97	12.36 ± 4.47	<0.001

[1] Chi-square. [2] Independent Sample *t*-test. Abbreviations: *M*, mean; *SD*, standard deviation. **Adjusted standardized residuals > 1.96 are bold.**

Table 3 presents the bivariate analysis of differences between adolescents who experience and who do not experience impairments in their school participation due to the existing CC. All the variables under study had statistically significant differences.

Table 3. Bivariate analysis of differences between adolescents with CCs who experience and who do not experience impairments in their school participation.

	$M \pm SD$ or % (*n*)		*p*
	School Participation Affected by the CC		
	No 72.7% (*n* = 1048)	**Yes 27.3% (*n* = 394)**	
School environment has problems [1]			
No	**50.5** (418)	37.3 (117)	<0.001
Yes	49.5 (410)	**62.7** (197)	
Feeling safe at school [1]			
No	4.1 (34)	**11.8** (37)	<0.001
Yes	**95.9** (794)	88.2 (277)	
Being a bully [1]			
No	**92.9** (974)	87.1 (343)	<0.001
Yes	7.1 (74)	**12.9** (51)	
Being a victim of bullying [1]			
No	**84.6** (887)	73.4 (289)	<0.001
Yes	15.4 (161)	**26.6** (105)	
School physical environment as a barrier to participation and academic success [1]			<0.001
No	**88.1** (923)	73.9 (291)	
Yes	11.9 (125)	**26.1** (103)	

Table 3. *Cont.*

	***M* ± *SD* or % (*n*)**		***p***
	School Participation Affected by the CC		
	No 72.7% (*n* = 1048)	**Yes 27.3% (*n* = 394)**	
People's attitude towards CCs as a barrier to participation and academic success [1]			
No	**98.0** (1027)	87.8 (346)	<0.001
Yes	2.0 (21)	**12.2** (48)	
Health condition as a barrier to participation and academic success [1]			
No	**92.2** (966)	63.2 (249)	<0.001
Yes	7.8 (82)	**36.8** (145)	
Perception of academic ability [1]			
Bad perception	5.8 (61)	**12.7** (50)	<0.001
Good perception	**94.2** (987)	87.3 (344)	
Relationship with peers [2]	6.68 ± 2.51	7.31 ± 2.84	<0.001
Relationship with teachers [2]	6.43 ± 2.53	7.26 ± 2.87	<0.001
Physical symptoms [2]	20.18 ± 4.50	16.97 ± 5.34	<0.001
Psychological symptoms [2]	13.83 ± 4.39	11.14 ± 4.80	<0.001

[1] Chi-square. [2] Independent Sample *t*-test. Abbreviations: *M*, mean; *SD*, standard deviation. **Adjusted standardized residuals > 1.96 are bold.**

The results demonstrated that the adolescents who mentioned the most that the school environment has problems and poses more barriers to their school participation (i.e., the physical condition of the school, people's attitude towards the health condition, and the health condition itself) are the ones who reported having compromises in their school participation. These adolescents also reported not feeling safe at school, more bullying behaviors (as perpetrators and victims), lower perception of academic ability, worse relationships with peers and teachers (higher is worse), and more physical and psychological symptoms (higher is less).

Three multivariable logistic models were conducted to study the associations between school participation in students with CCs and personal variables (Table 4), school-environment variables related to the physical environment and school safety (Table 5), and school environment and interpersonal relationships (Table 6). These analyses involved the variables that displayed significance in the bivariate analysis and were adjusted for gender and age.

For the associations of school participation affected by the CC and personal variables (Table 4), an adjusted multivariable model was found (χ^2 = 263.252 (6) $p \leq 0.001$), with an estimated Coefficient of Determination of 24.2% (approximated by the Nagelkerke Pseudo-R-squared statistic). The health condition as a barrier to participation and academic success was positively associated with impaired school participation in students with CCs (OR = 5.65, $p < 0.001$). On the other hand, perception of academic ability (OR = 0.56, $p < 0.01$), physical symptoms (higher is less) (OR = 0.93 per unit change in score, $p < 0.001$), and psychological symptoms (higheris less) (OR = 0.95 per unit change in score, $p < 0.01$) were negatively associated with impaired school participation. Thus, the health condition as a barrier to participation and academic success, lower perception of academic ability, and more physical and psychological symptoms were associated with impaired school participation in students with CCs.

The associations between school participation affected by the CC and the physical environment and school safety variables are shown in Table 5. An adjusted multivariable model was found (χ^2 = 80.548 (5) $p \leq 0.001$), with an estimated Coefficient of Determination of 9.8% (approximated by the Nagelkerke Pseudo-R-squared statistic).

Table 4. Multivariable logistic regression of associations between personal variables (i.e., CCs as a barrier to participation and academic success, perception of academic ability, and physical and psychological symptoms) and school participation of students with CCs.

	School Participation Affected by the CC OR (95% CI)
Health condition as a barrier to participation and academic success	
No	1.00 (ref)
Yes	5.65 (4.11–7.77) ***
Perception of academic ability	
Bad perception	1.00 (ref)
Good perception	0.56 (0.36–0.87) **
Physical symptoms	0.93 [1] (0.90–0.95) ***
Psychological symptoms	0.95 [1] (0.92–0.98) **
Nagelkerke	0.242
(χ^2 = 263.252 (6) $p \leq 0.001$)	

The results were adjusted for age and gender. Abbreviations: OR, odds ratio; CI, confidence interval. [1] Per unit change in score.** $p < 0.01$, and *** $p < 0.001$.

Table 5. Multivariable logistic regression of associations between physical environment and school safety variables (i.e., school environment with problems, feeling safe at school, and physical condition of the school as a barrier to participation and academic success) and school participation affected by the CC.

	School Participation Affected by the CC OR (95% CI)
School environment has problems	
No	1.00 (ref)
Yes	1.56 (1.19–2.06) ***
Feeling safe at school	
No	1.00 (ref)
Yes	0.43 (0.26–0.72) ***
School physical environment as a barrier to participation and academic success	
No	1.00 (ref)
Yes	2.24 (1.56–3.22) ***
Nagelkerke	0.098
(χ^2 = 80.548 (5) $p \leq 0.001$)	

The results were adjusted for age and sex. Abbreviations: OR, odds ratio; CI, confidence interval *** $p < 0.001$.

Problematic school environment (OR = 1.56, $p < 0.001$) and physical environment as barriers to participation and academic success (OR = 2.24, $p < 0.001$) were positively associated with impaired school participation in students with a chronic health condition. On the other hand, feeling safe at school (OR = 0.43, $p < 0.001$) was negatively associated with impaired school participation for students with CCs. Thus, impairments in school participation were related to perceiving a problematic school environment, not feeling safe on school grounds, and perceiving the physical conditions of the school as a barrier to their participation.

Table 6 presents the associations between school-participation impairments due to the existing CC and school-environment variables associated with interpersonal relationships. An adjusted multivariable model was found (χ^2 = 116.271 (7) $p \leq 0.001$), with an estimated Coefficient of Determination of 11.2% (approximated by the Nagelkerke Pseudo-R-squared statistic).

Table 6. Multivariable logistic regression of associations between variables in the school environment related to interpersonal relationships (i.e., bullying as perpetrator and as victim, people's attitudes towards CCs as a barrier to participation and academic success, and relationships with teachers and peers) and school participation affected by the CC.

	School Participation Affected by the CC OR (95% CI)
Being a bully	
No	1.00 (ref)
Yes	1.50 (0.99–2.27)
Being a victim of bullying	
No	1.00 (ref)
Yes	1.50 (1.10–2.05) **
People's attitude towards CCs as a barrier to participation and academic success	
No	1.00 (ref)
Yes	6.16 (3.57–10.64) ***
Relationship with peers	1.06 [1] (1.01–1.12) *
Relationship with teachers	1.03 [1] (0.98–1.09)
Nagelkerke	0.112
(χ^2 = 116.271 (7) $p \leq 0.001$)	

The results were adjusted for age and gender. Abbreviations: OR, odds ratio; CI, confidence interval. [1] Per unit change in score. * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

School participation affected by the CC was associated with being a victim of bullying (OR = 1.50, $p < 0.01$), perceiving people's attitudes towards CCs as a barrier to participation and academic success (OR = 6.16, $p < 0.001$), and having poorer relationships with peers (OR = 1.06 per unit change in score, $p < 0.05$).

4. Discussion

This specific study aimed to analyze the impact of personal and school-environment variables (from the point of view of the physical environment and safety at school and interpersonal relationships) on the school participation of students with CCs. In addition, it aimed to explore differences in gender and CCs impacts on students' school participation in terms of the personal and school-environment variables under study.

Regarding the analysis of gender differences and differences in the impact of CCs on school participation (i.e., school participation affected/not affected by the CC), the results showed that girls are the ones who most mentioned having impairments regarding their school participation due to their health condition. The significant differences were more in personal factors for girls and in school-environment factors related to interpersonal relationships for boys. In this sense, girls were the ones who most experienced their health condition as a barrier to participation and academic success and who presented more physical and psychological symptoms. On the other hand, boys were the ones who most often reported bullying behaviors at school as perpetrators and a better relationship with their peers and teachers (lower value, better relationship). The literature already shows gender differences in well-being and mental health variables, with females weighing more heavily when it comes to worse results [44–46].

Regarding the differences between CCs affecting/not affecting school participation, the results demonstrated that adolescents whose school participation is affected by CCs presented worse indicators concerning the personal and school-environment variables under study. Therefore, these students reported feeling that their health condition is a barrier to participation and academic success. They also had lower perception of academic ability and experienced more physical and psychological symptoms. These findings are consistent with the literature, as there is evidence that adolescents with CCs tend to experience more emotional and behavioral problems and increasing difficulties academically [1,12,15,20]. It is crucial to highlight that the analysis of gender and the impact of chronic conditions

on school-attendance disparities is essential for devising effective strategies and interventions tailored to the distinct requirements of students with CCs. The results of this study underscore the imperative of offering supplementary support to high-risk demographics, particularly adolescents of the female gender and those facing limited participation due to their prevailing health conditions. These results suggest that impairments in terms of school participation reflect poorer outcomes in psychosocial well-being for adolescents with CCs, supporting existing evidence in the literature [12,13]. These findings must be considered when designing intervention strategies to promote equitable participation for all students, regardless of their health condition.

In addition to personal variables, attributes and features of the school environment influence students' well-being and mental health [22,24]. Therefore, these study results showed that students with CCs were the ones who most reported that the school environment has problems, that there is no sense of safety on school grounds, and that the physical condition of the school is a barrier to their school participation.

Furthermore, the school's relational environment characteristics are crucial concerning students with CCs' psychosocial well-being and participation [2,26–28]. The results reflect that adolescents with CCs presented more bullying behaviors (both as perpetrators and victims) and worse interpersonal relationships in school (i.e., with peers and teachers). In the case of chronically ill adolescents, bullying can arise from the stigma that often still emerges towards these students, and that influences their well-being and school participation [2]. However, evidence also points towards the involvement of students with CCs as aggressors in bullying situations [47–49].

In analyzing the association between personal and school-environment variables and the students with CCs' school participation, a greater weight of personal variables was observed, followed by those of the school environment related to interpersonal relationships and, finally, the physical environment and safety-at-school variables. Regarding personal variables, health condition as a barrier to participation and academic success, lower perception of academic ability, and more physical and psychological symptoms were associated with school participation affected by CCs. Adams et al. [11] demonstrated a relationship between the existence of a CC and an increased possibility of developing mental health difficulties. These authors' results also indicated the mediating effect of limitations on participation in activities regarding this relationship.

About the variables of the physical environment and safety at school, the perception of a school environment with problems, being unsafe and feeling the physical conditions of the school as a barrier to participation and academic success were associated with impaired school participation for students with CCs. Regarding school-environment variables related to interpersonal relationships, school participation affected by CCs was associated with being a victim of bullying, feeling people's attitudes towards CCs as a barrier to participation and academic success, and having a less positive relationship with the peer group.

The characteristics and composition of the physical environment of schools can constitute a barrier to the students with CCs' equal and adjusted participation in different activities (e.g., lack of adapted structures, inadequate temperature, lighting, and ventilation). Thus, the literature shows a relationship between the physical and social features of the school context and academic results, attendance, withdrawal from school, and emotional and behavioral difficulties [50,51]. In addition to physical-environment barriers, attitudes and institutional factors constitute risk factors for these students' school participation and are the most frequently reported in the literature [52]. Aspects such as the attitudes and behavior of peers (e.g., bullying and exclusion), the high number of absences due to constraints associated with CCs, and gaps in the adequacy of sources of support to existing needs influence students with CCs' school experience and participation opportunities [2,53].

The higher risk of experiencing difficulties or hurdles in social participation, along with the physical and psychological characteristics associated with their health condition are

factors that may contribute to a greater propensity for adolescents with CCs to be victims of bullying [48]. Sentenac et al. [54] analyzed the school experience through different dimensions (satisfaction with school, pressure with schoolwork, support from teachers, and victimization among peers) in adolescents from 19 European countries. Their results showed that students with CCs present a more negative school experience than their peers.

This specific study showed an association between barriers to participation (i.e., school physical conditions, attitudes towards CCs, and the health condition itself) and academic success and school participation affected by CCs. The results of an article by Cerqueira, Guedes, Marques-Pinto, et al. [15] with students in the first year of university (with an average age of 19.62 years) revealed that students with school participation affected by their health condition experience more barriers to school participation. This study's results align with these data, reinforcing the importance of working at a preventive and interventional level to contribute to more balanced and inclusive school environments for students with CCs throughout their academic careers.

The school environment is associated with the student's well-being and academic achievement. However, the connection between this context's characteristics and students with CCs' participation is a less explored area. Thus, this study makes relevant contributions to increase knowledge regarding the characteristics of the school context that can influence the school participation of students with CCs.

As a recommendation for future studies, it is crucial to delve into the barriers hindering the participation of students with CCs in school activities. Equally important is exploring the characteristics of the school environment that facilitate their involvement. This exploration will equip schools with the necessary tools and strategies to enhance inclusivity and equity, ensuring equal opportunities for student participation in both academic and social spheres. Moreover, conducting a thorough review of existing measures or programs to promote adolescents' social and school participation is also essential. The aim is to develop interventions tailored to the specific needs of students with CCs, who are at a heightened risk of experiencing compromises in this area.

Some limitations of this study must be recognized: (1) the self-report data (in which some bias on the part of young people is possible); (2) the results cover only adolescents who attend public education, not including those who attend private education who are not attending any educational establishment; and (3) the cross-sectional design of the study limits our capacity to infer causality and determine the direction of effects. Therefore, any generalizations should consider this limitation. Longitudinal data would be required to address this issue. However, the study has several strengths that must be mentioned: (1) the rigorous methodology, (2) the size and representativeness of the sample of Portuguese adolescents, and (3) the possibility of comparisons between the different years of the HBSC study and the countries involved.

5. Conclusions

The experience of a CC impacts adolescents' well-being, affecting their physical and psychosocial functioning. Therefore, the characteristics of social contexts/lifeworlds that can facilitate or hinder the participation of adolescents with CC must be considered, particularly in the school context.

Our results highlighted important clues towards helping schools become friendly environments that increasingly promote the participation and well-being of all students, regardless of their health condition. In addition, they reinforced the importance of intervening at a preventive and interventional level, paying particular attention to groups at greater risk, that is, girls and adolescents whose school participation is affected by CCs.

It is of utmost importance to consider the personal factors that may impact this participation, taking gender differences as a guideline for implementing strategies and interventions for adolescents with CCs. These strategies must consider the ecological perspective, in which the different contexts influence the individuals and vice versa. The school

environment should be a friendly and protective ecosystem for promoting participation, academic success, and well-being of students with CCs.

Both personal and school-environment variables influence the school participation of students with CCs. Identifying the barriers to these students' participation and academic success helps to outline strategies and interventions duly adjusted to their needs without losing sight of the most vulnerable groups.

The school is an ecosystem of health and learning, in which systematic work to raise awareness of students, families, and educational agents is crucial. It is essential to coordinate the work of health and education professionals and policymakers to overcome existing barriers in the school context and move towards an increasingly inclusive environment. These coordinated efforts will help promote and protect the participation and well-being of the students with CCs. Hence, it is imperative to heed these findings while (1) developing school-environment assessment tools that are sensitive to the different characteristics and needs of students; (2) addressing the quality of the relational school environment while prioritizing the integration of personal and socio-emotional skill promotion within school curricula; (3) fostering awareness and providing training for all stakeholders within the educational realm regarding CCs while considering the barriers stemming from attitudes towards these health conditions; and (4) formulating and implementing preventive and intervention measures concerning school violence, with due consideration to the heightened vulnerability of students with CCs.

In short, three key ideas based on the results of this study that may impact the lives of pupils with CCs are as follows:

(1) It is important to take into account the most vulnerable groups regarding the students' school participation (i.e., girls and adolescents with CCs and impaired school participation);
(2) It is relevant to evaluate the specific features of the school environment concerning participation and well-being, as the school must be a context that values diversity and equal opportunities for all students;
(3) It is necessary to reinforce interventions to minimize the impact of existing barriers to the participation of students with CCs, emphasizing the importance of interpersonal relationships regarding the characteristics of the school environment.

Author Contributions: Conceptualization, A.C.; formal analysis, A.C. and F.B.G.; methodology, A.C., F.B.G., T.G. and M.G.d.M.; supervision, M.G.d.M., E.G. and C.S.; validation, T.G., E.G., C.S. and M.G.d.M.; writing—original draft, A.C. and F.B.G.; writing—review and editing, T.G., E.G., C.S. and M.G.d.M. All authors have read and agreed to the published version of the manuscript.

Funding: Ana Cerqueira—Foundation for Science and Technology (FCT) Grant (SFRH/BD/148403/2019). Fábio Botelho Guedes—Foundation for Science and Technology (FCT) Grant (SFRH/BD/148299/2019).

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the Lisbon Academic Medicine Center, Lisbon North Hospital Center, EPE, and the Directorate-General of Education and Science Statistics. (Ref.[a] No. 281/21, 5 November 2021).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Mitchell, A.E.; Morawska, A.; Mihelic, M. A systematic review of parenting interventions for child chronic health conditions. *J. Child Health Care* **2020**, *24*, 603–628. [CrossRef] [PubMed]
2. Runions, K.C.; Vithiatharan, R.; Hancock, K.; Lin, A.; Brennan-Jones, C.G.; Gray, C.; Payne, D. Chronic health conditions, mental health and the school: A narrative review. *Health Educ. J.* **2020**, *79*, 471–483. [CrossRef]

3. World Health Organization; Regional Office for Europe; European Observatory on Health Systems and Policies; Busse, R.; Blümel, M.; Scheller-Kreinsen, D. Tackling Chronic Disease in Europe: Strategies, Interventions and Challenges. 2010. Available online: https://apps.who.int/iris/handle/10665/326484 (accessed on 9 August 2023).
4. World Health Organization. World Health Organization: Noncommunicable Diseases—Fact Sheet. 2018. Available online: http://www.who.int/mediacentre/factsheets/fs355/en/ (accessed on 9 August 2023).
5. World Health Organization. Noncommunicable Disease Education Manual. A Primer for Policy-Makers and Health-Care Professionals. 2018. Available online: https://apps.who.int/iris/handle/10665/260505 (accessed on 9 August 2023).
6. World Health Organization. Noncommunicable Diseases in the Western Pacific. 2020. Available online: https://www.who.int/westernpacific/health-topics/noncommunicable-diseases (accessed on 9 August 2023).
7. Centers for Disease Control and Prevention (CDC). Social Determinants of Health at CDC. 2022. Available online: https://www.cdc.gov/about/sdoh/index.html (accessed on 9 August 2023).
8. World Health Organization. Social Determinants of Health. 2023. Available online: https://www.who.int/health-topics/social-determinants-of-health#tab=tab_1 (accessed on 9 August 2023).
9. Healthy People 2030. Social Determinants of Health. 2020. Available online: https://health.gov/healthypeople/priority-areas/social-determinants-health (accessed on 9 August 2023).
10. Van Cleave, J.; Taft, K.; Ware, A.; Stille, C. Assessing and addressing social determinants of health among children and youth with special health care needs. *Acad. Pediatr.* **2022**, *22*, S28–S33. [CrossRef]
11. Adams, J.S.; Chien, A.T.; Wisk, L.E. Mental illness among youth with chronic physical conditions. *Pediatrics* **2019**, *144*, e20181819. [CrossRef] [PubMed]
12. Cerqueira, A.; Gaspar, T.; Botelho Guedes, F.; Godeau, E.; Gaspar de Matos, M. Chronic Conditions, School Participation and Quality of Life of Portuguese Adolescents: Highlights from the Health Behavior in School aged Children study-HBSC 2018. *Child Indic. Res.* **2022**, *15*, 297–313. [CrossRef]
13. Cerqueira, A.; Guedes, F.B.; Gaspar, T.; Godeau, E.; Gaspar de Matos, M. Shedding Light on the Lifestyle and Participation of Portuguese Adolescents with Chronic Conditions—Data from the HBSC 2018 Study. *Children* **2022**, *9*, 1717. [CrossRef] [PubMed]
14. Berger, C.; Valenzuela, J.; Tsikis, J.; Fletcher, C. School professionals' knowledge and beliefs about youth with chronic illness. *J. Sch. Health* **2018**, *88*, 615–623. [CrossRef] [PubMed]
15. Cerqueira, A.; Guedes, F.B.; Marques-Pinto, A.; Branco, A.; Galvão, C.; Sousa, J.; Goulao, L.F.; Bronze, M.R.; Viegas, W.; Gaspar, T.; et al. Chronic Conditions and School Participation of First-Year University Students—HOUSE ULisbon Study. *Children* **2022**, *9*, 1397. [CrossRef] [PubMed]
16. Bärwalde, T.; Hoffmann, L.; Fink, A.; Völlm, C.; Martin, O.; Bernard, M.; Gebhard, B.; Richter, M. The Adolescent Concept of Social Participation—A Qualitative Study on the Concept of Social Participation from Adolescents with and without Physical Disabilities. *Qual. Health Res.* **2023**, *33*, 143–153. [CrossRef]
17. Nap-van der Vlist, M.M.; Kars, M.C.; van der Sprenkel, E.E.B.; Nijhof, L.N.; Grootenhuis, M.A.; van Geelen, S.M.; van der Ent, C.K.; Swart, J.F.; van Royen-Kerkhof, A.; van Grotel, M.; et al. Daily life participation in childhood chronic disease: A qualitative study. *Arch. Dis. Childh.* **2020**, *105*, 463–469. [CrossRef]
18. Nap-van der Vlist, M.M.; van der Sprenkel, E.E.B.; Nijhof, L.N.; Grootenhuis, M.A.; van der Ent, C.K.; Swart, J.F.; van Royen-Kerkhof, A.; van Grotel, M.; van de Putte, E.M.; Nijhof, S.L.; et al. Daily life participation in childhood chronic disease: A qualitative study on the child's and parent's perspective. *BMJ Paediatr. Open* **2021**, *5*, e001057. [CrossRef] [PubMed]
19. Schlebusch, L.; Huus, K.; Samuels, A.; Granlund, M.; Dada, S. Participation of young people with disabilities and/or chronic conditions in low-and middle-income countries: A scoping review. *Dev. Med. Child Neurol.* **2020**, *62*, 1259–1265. [CrossRef] [PubMed]
20. Schlecht, J.; König, J.; Kuhle, S.; Urschitz, M.S. School absenteeism in children with special health care needs. Results from the prospective cohort study ikidS. *PLoS ONE* **2023**, *18*, e0287408. [CrossRef] [PubMed]
21. Kolbe, L.J. School health as a strategy to improve both public health and education. *Annu. Rev. Public Health* **2019**, *40*, 443–463. [CrossRef] [PubMed]
22. Ford, T.; Degli Esposti, M.; Crane, C.; Taylor, L.; Montero-Marín, J.; Blakemore, S.J.; Bowesm, L.; Byford, S.; Dalgleish, T.; Greenberg, M.T.; et al. The role of schools in early adolescents' mental health: Findings from the MYRIAD study. *J Am Acad Child Adolesc. Psychiatry* **2021**, *60*, 1467–1478. [CrossRef] [PubMed]
23. Oberle, E. Early adolescents' emotional well-being in the classroom: The role of personal and contextual assets. *J. Sch. Health* **2018**, *88*, 101–111. [CrossRef] [PubMed]
24. Patalay, P.; O'Neill, E.; Deighton, J.; Fink, E. School characteristics and children's mental health: A linked survey-administrative data study. *Prev. Med.* **2020**, *141*, 106292. [CrossRef] [PubMed]
25. Verhoeven, M.; Poorthuis, A.M.; Volman, M. The role of school in adolescents' identity development. A literature review. *Educ. Psychol. Rev.* **2019**, *31*, 35–63. [CrossRef]
26. National School Climate Center (NSCC). What Is School Climate and Why Is It Important? 2021. Available online: https://schoolclimate.org/school-climate/ (accessed on 7 August 2023).
27. Bradshaw, C.P.; Waasdorp, T.E.; Debnam, K.J.; Johnson, S.L. Measuring school climate in high schools: A focus on safety, engagement, and the environment. *J. Sch. Health* **2014**, *84*, 593–604. [CrossRef]

28. O'Brennan, L.; Bradshaw, C.; Johns Hopkins Center for the Prevention of Youth Violence. Importance of School Climate. National Education Association. 2013. Available online: https://cdpsdocs.state.co.us/safeschools/Resources/NEA%20National%20Education%20Association/NEA%20Importance%20of%20School%20Climate.pdf (accessed on 7 August 2023).
29. Prati, G.; Cicognani, E.; Albanesi, C. The impact of sense of community in the school, social skills, and exposure to aggression and victimization on students' well-being. *Soc. Indic. Res.* **2018**, *140*, 637–651. [CrossRef]
30. Arslan, G. Exploring the Association between School Belonging and Emotional Health among Adolescents. *Int. J. Educ. Psychol.* **2018**, *7*, 21–41. [CrossRef]
31. VanLone, J.; Freeman, J.; LaSalle, T.; Gordon, L.; Polk, T.; Rocha Neves, J. A practical guide to improving school climate in high schools. *Interv. Sch. Clin.* **2019**, *55*, 39–45. [CrossRef]
32. Kiuru, N.; Wang, M.T.; Salmela-Aro, K.; Kannas, L.; Ahonen, T.; Hirvonen, R. Associations between adolescents' interpersonal relationships, school well-being, and academic achievement during educational transitions. *J. Youth Adolesc.* **2020**, *49*, 1057–1072. [CrossRef] [PubMed]
33. Lavy, S.; Naama-Ghanayim, E. Why care about caring? Linking teachers' caring and sense of meaning at work with students' self-esteem, well-being, and school engagement. *Teach. Teach. Educ.* **2020**, *91*, 103046. [CrossRef]
34. Magby, N.; Cerna, R. Understanding School Climate: An Overview of School Climate Domains. 2023. WestEd. Available online: https://www.wested.org/wp-content/uploads/2023/02/V13_CCSC_Understanding-School-Climate_FINAL-ADA.pdf (accessed on 7 August 2023).
35. Coyle, S.; Weinreb, K.S.; Davila, G.; Cuellar, M. Relationships matter: The protective role of teacher and peer support in understanding school climate for victimized youth. *Child Youth Care Forum* **2022**, *51*, 181–203. [CrossRef]
36. Bethell, C.; Forrest, C.B.; Stumbo, S.; Gombojav, N.; Carle, A.; Irwin, C.E. Factors promoting or potentially impeding school success: Disparities and state variations for children with special health care needs. *Matern. Child Health J.* **2012**, *16*, 35–43. [CrossRef] [PubMed]
37. Forgeron, P.A.; King, S.; Stinson, J.N.; McGrath, P.J.; MacDonald, A.J.; Chambers, C.T. Social functioning and peer relationships in children and adolescents with chronic pain: A systematic review. *Pain Res. Manag.* **2010**, *15*, 27–41. [CrossRef]
38. Forgeron, P.; King, S.; Reszel, J.; Fournier, K. Psychosocial interventions to improve social functioning of children and adolescents with chronic physical conditions: A systematic review. *Child. Health Care* **2018**, *47*, 326–355. [CrossRef]
39. Lum, A.; Wakefield, C.E.; Donnan, B.; Burns, M.A.; Fardell, J.E.; Jaffe, A.; Kasparian, N.A.; Kennedy, S.E.; Leach, S.T.; Lemberg, D.A.; et al. Facilitating engagement with school in students with chronic illness through positive education: A mixed-methods comparison study. *Sch. Psychol.* **2019**, *34*, 677. [CrossRef]
40. Noonan, K.; Reichman, N.E.; Corman, H.; Jiménez, M.E. School and community involvement of adolescents with chronic health conditions. *J. Adolesc. Health.* **2020**, *67*, 576–582. [CrossRef]
41. Gaspar, T.; Guedes, F.B.; Cerqueira, A.; Matos, M.G.; Equipa Aventura Social. A Saúde dos Adolescentes Portugueses em Contexto de Pandemia—Dados Nacionais do Estudo HBSC 2022 (Ebook) [The Health of Portuguese Adolescents in the Context of a Pandemic—National Data from 2022 HBSC Study]. 2022. Available online: https://aventurasocial.com/wp-content/uploads/2022/12/HBSC_Relato%CC%81rioNacional_2022-1.pdf (accessed on 15 August 2023).
42. Inchley, J.C.; Currie, D.B.; Young, T.; Samdal, O.; Torsheim, T.; Augustson LMathison, F.; Aleman-Diaz, A.; Molcho, M.; Weber, M.; Barnekow, V. (Eds.) *Growing up Unequal: Gender and Socioeconomic Differences in Young People's Health and Well-Being: Health Behaviour in School-Aged Children (HBSC) Study: International Report from the 2013/2014 Survey*; World Health Organization (WHO) Regional Office for Europe: Geneva, Switzerland, 2016.
43. Matos, M.G.; Equipa Aventura Social. A Saúde dos Adolescentes Portugueses Após a Recessão. Relatório do Estudo Health Behaviour in School Aged Children (HBSC) em 2018 (Ebook). [The Health of Portuguese Adolescents after the Recession. Report of the Study Health Behavior in School Aged Children (HBSC) in 2018 (Ebook).]. 2018. Available online: https://aventurasocial.com/dt_portfolios/a-saude-dos-adolescentes-portugueses-em-tempos-de-recessao-2018/ (accessed on 15 August 2023).
44. Campbell, O.L.; Bann, D.; Patalay, P. The gender gap in adolescent mental health: A cross-national investigation of 566,829 adolescents across 73 countries. *SSM-Popul.* **2021**, *13*, 100742. [CrossRef] [PubMed]
45. Högberg, B.; Strandh, M.; Hagquist, C. Gender and secular trends in adolescent mental health over 24 years–the role of school-related stress. *Soc. Sci. Med.* **2020**, *250*, 112890. [CrossRef] [PubMed]
46. Otto, C.; Reiss, F.; Voss, C.; Wüstner, A.; Meyrose, A.K.; Hölling, H.; Ravens-Sieberer, U. Mental health and well-being from childhood to adulthood: Design, methods and results of the 11-year follow-up of the BELLA study. *Eur. Child Adolesc. Psychiatry* **2021**, *30*, 1559–1577. [CrossRef] [PubMed]
47. Beckman, L.; Hellström, L.; von Kobyletzki, L. Cyber bullying among children with neurodevelopmental disorders: A systematic review. *Scand. J. Psychol.* **2020**, *61*, 54–67. [CrossRef] [PubMed]
48. Pinquart, M. Systematic review: Bullying involvement of children with and without chronic physical illness and/or physical/sensory disability—A meta-analytic comparison with healthy/nondisabled peers. *J. Pediatr. Psychol.* **2017**, *42*, 245–259. [CrossRef] [PubMed]
49. Rupp, K.; McCoy, S.M. Bullying perpetration and victimization among adolescents with overweight and obesity in a nationally representative sample. *Child. Obes.* **2019**, *15*, 323–330. [CrossRef] [PubMed]

50. Bradley, B.; Green, A.C. Do health and education agencies in the United States share responsibility for academic achievement and health? A review of 25 years of evidence about the relationship of adolescents' academic achievement and health behaviors. *J. Adolesc. Health* **2013**, *52*, 523–532. [CrossRef]
51. Georgiev, S.; Kamburova, M.S.; Un, M. A Healthy School Environment as a Precondition for the Welfare of Students and Staff. *Int. J. Health Adm. Educ. Congr. (Sanitas Magisterium)* **2015**, *1*, 31–43. [CrossRef]
52. Pivik, J.; McComas, J.; Laflamme, M. Barriers and facilitators to inclusive education. *Except. Chil.* **2002**, *69*, 97–107. [CrossRef]
53. Runions, K.C.; Cross, D.S.; Vithiatharan, R.; Everard, M.; Hall, G. Bullying and psychosocial adjustment among children with and without asthma. *J. Psychol. Couns. Sch.* **2021**, *31*, 36–45. [CrossRef]
54. Sentenac, M.; Santos, T.; Augustine, L.; Michelsen, S.I.; Movsesyan, Y.; Ng, K.; Małkowska-Szkutnik, A.; Godeau, E. Chronic health conditions and school experience in school-aged children in 19 European countries. *Eur. Child Adolesc. Psychiatry* **2022**, *32*, 1711–1721. [CrossRef] [PubMed]