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PAEDIATRIC SHORT STATURE:
THE EFFECT OF COPING, HEIGHT-RELATED BELIEFS AND SATISFACTION WITH SOCIAL SUPPORT ON HEALTH-RELATED QUALITY OF LIFE

VOLUME 1

Dissertação no âmbito do Mestrado Integrado em Psicologia, na área da Psicologia Clínica, sub-área de Intervenções Cognitivo-Comportamentais nas Perturbações Psicológicas e na Saúde, orientada pela Professora Doutora Maria Cristina Cruz Sousa Portocarrero Canavarro e co-orientada pela Doutora Neuza Maria Bernardino da Silva e apresentada à Faculdade de Psicologia e Ciências da Educação da Universidade de Coimbra

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Paediatric short stature: The effect of coping, height-related beliefs and satisfaction with social support on health-related quality of life

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Resumo

Objetivos: A baixa estatura (BE) corresponde a uma altura mais de dois desvios-padrão abaixo da média populacional para o sexo e idade, sendo constituída por múltiplas etiologias. A literatura sugere que a BE pode estar associada a uma menor qualidade de vida relacionada com a saúde (QdVrS), todavia têm sido pouco explorados os aspectos que levam a esta associação. Assim, este estudo pretendeu analisar as variáveis clínicas, sociodemográficas e psicossociais associadas à BE, bem como o papel moderador das variáveis sociodemográficas e clínicas na relação entre suporte social, *coping* e crenças e a QdVrS.

Método: Foi realizado um estudo transversal utilizando uma amostra clínica de 89 crianças e adolescentes com idades compreendidas entre os 8 e os 18 anos, diagnosticados com défice de hormona de crescimento, baixa estatura idiopática ou outro diagnóstico associado à BE, tal como Síndrome de Turner, e recrutados na ala de Pediatria do Hospital de São João, Porto. Os participantes responderam à versão portuguesa de auto-relato do QoLISSY, um instrumento desenvolvido especificamente para a avaliação da QdVrS na BE, bem como à versão para crianças e adolescentes da Escala de Satisfação com o Suporte Social.

Resultados: Relativamente à QdVrS, não se verificaram diferenças estatisticamente significativas entre variáveis sociodemográficas e clínicas. Quanto ao *coping*, foram encontradas diferenças significativas para o desvio de altura actual, traduzindo-se em *scores* superiores de *coping* para sujeitos com BE actual comparativamente àqueles que atingiram uma altura normal. Constatou-se também um efeito principal significativo das crenças relacionadas com a altura na QdVrS, explicando 44% da variância. Análises de moderação revelaram efeitos de interacção estatisticamente significativos entre crenças e diagnóstico e entre *coping* e desvio de altura actual, explicando, respectivamente, 2 e 4% de variância adicional da QdVrS.

Conclusões: Os resultados obtidos sugerem que, ao nível sociodemográfico e clínico, não há diferenças estatisticamente significativas na QdVrS. Todavia, crenças positivas relacionadas com a altura e estratégias de *coping* eficazes poderão afigurar-se como importantes variáveis associadas à QdVrS e poderão ter implicação clínica concreta, dado a possibilidade de serem trabalhadas no contexto psicoterapêutico.

Palavras-chave: Baixa estatura; Qualidade de vida relacionada com a saúde; Crianças e adolescentes; Crenças relacionadas com a altura; Coping; Suporte social; QoLISSY.

Abstract

Objective: Short stature (SS) can be defined as height more than two standard-deviations below population norms for sex and age, containing multiple aetiologies. Literature suggest that SS may be associated with poorer health-related quality of life (HrQoL), however the aspects that contribute to this association have been underexplored. Thus, the present study aimed to analyse clinical, sociodemographic and psychosocial variables associated with SS, as well as the potential moderating role of sociodemographic and clinical variables on the relationship between social support, coping and height-related beliefs and HrQoL.

Methods: A cross-sectional study was conducted using a clinical sample of 89 children and adolescents aged 8 to 18, diagnosed with growth hormone deficiency, idiopathic short stature or other diagnoses with a phenotype that includes short-stature, such as Turner Syndrome, and recruited at the paediatric wing of Hospital de São João in Porto. Participant's HrQoL was assessed with the self-report Portuguese version of the QoLISSY instrument, a condition-specific instrument developed solely for short stature, as well as the youth version of the Escala de Satisfação com o Suporte Social, a self-report instrument designed to evaluate participant's satisfaction with their perceived social support.

Results: Regarding total HrQoL, statistically significant differences across sociodemographic and clinical variables were not found. For coping, we found statistically significant differences regarding height-deviation, as currently short-statured participants had higher coping scores compared to those who achieved normal height. We also found a main effect of height-related beliefs on HrQoL, explaining 44% of its variance. Moderation analyses revealed significant interaction effects between beliefs and diagnosis and between coping and height deviation, explaining 2% and 4% of additional variance in HrQoL, respectively.

Conclusion: The results suggest that, sociodemographic and clinical wise, there were no statistically significant differences in HrQoL. However, positive height-related beliefs and efficient coping strategies may play a key role in HrQoL and may be clinically relevant, as these variables are susceptible to be worked on through psychotherapy.

Key-words: Short stature; Health-related quality of life; Children and adolescents; Coping; Height-related beliefs; Social support; QoLISSY.

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List of abbreviations

GHD – growth hormone deficiency

HrQoL – Health-related quality of life

ISS – idiopathic short stature

QoLISSY – Quality of Life in Short Stature Youth

hrGH – human-recombinant growth hormone

SGA – small for gestational age

SS – short stature

Introduction

Paediatric short stature: Clinical and epidemiological features and psychosocial impact

According to the International Classification of Paediatric Endocrinal Diagnoses (IPCED, 2015), short stature (SS) can be defined as a body height below two standard-deviations (SD) for the population mean regarding sex and age. This statistical definition pertains to several aetiologies, and for the purpose of the present study, the focus was placed exclusively on three groups of the possible diagnoses – growth hormone deficiency (GHD), idiopathic SS (ISS) and other diagnoses with a phenotype that includes SS, such as Tuner Syndrome and being short for gestational age (SGA).

A diagnosis of GHD is given to children and adolescents with an impaired growth hormone secretion. Nonetheless, this diagnosis is relatively rare, with estimates of GHD making up only 5% of all SS diagnoses (ICPED, 2015; Lindsay, Feldkamp, Harris, Roberts, & Rallison, 1994). By contrast, attending to the nature of its heterogeneous aetiology, ISS is a much more common diagnosis given to children and adolescents whose SS is not explained by other causes, making up an estimate of 80% of the cases (Wit et al., 2008). Thus, a diagnosis of ISS is ascribed to patients who have SS with no evidence of hormone deficiency or chronic illness, with normal size at birth given gestational age, normal food intake and body proportions, and with no psychiatric disorder or severe emotional disturbance (IPCED, 2015; Ranke, 1996). However, should infants have a birth weight or length below two SD, they instead receive a diagnosis of SGA (Wit, 2007). Among others, another condition associated with SS is Turner Syndrome, a complex chromosome abnormality, associated with complete or partial monosomy of the X chromosome, thus only affecting women (Morgan, 2007). Its physical phenotype is varied and includes, among others, SS, thus most patients undergo treatment (Kesler, 2007).

With respect to treatment options for GHD, the standard protocol has been daily sub-cutaneous injections of synthetic human-recombinant growth hormone (hrGH), made abundantly available since 1985 (Tanaka et al., 2002). The rationale behind this practice is to enable short children to reach a normal height in adulthood, therefore alleviating the psychosocial impact of SS, as well as the physical limitations that stem from having a well below-average height and, later in life, assuring better adaptation to social life

regarding the multiple aspects that might have been impaired by their stature (Tanaka et al., 2002). However, outside of the United States, human-recombinant growth hormone therapy is only made available to patients diagnosed with GHD, but not to those with ISS (Richmond & Rogol, 2010), and despite some evidence showing good results in terms of reached adult height, the current recommendations for hormone therapy in this population is a case-by-case decision after medical assessment of the physical and psychological burdens of hormone therapy, along with a discussion of its risks and benefits (Grimberg et al., 2016; Savage, 2009).

The physical limitations that stem from shortness may pose an environmental barrier to children's autonomy development (Quitmann, Bullinger, Sommer, Rohenkohl, & Silva, 2016). Likewise, research suggests that SS is associated with social isolation and stigmatisation (Sandberg & Colsman, 2005), negative comparisons with peers and parental expectations, height-related stereotyping, and bullying (Bullinger et al., 2009; Voss & Mulligan, 2000). However, it is important to note that the association between SS and impaired psychological functioning is not entirely consensual, as well as the effect of hormonal treatment in the betterment of children's and adolescents' quality of life (QoL; Quitmann et al., 2016; Sandberg & Gardner, 2015).

Given that children with SS often look younger than their biological age, they may be treated in accordance with the first, rather than the latter, resulting in reduced social demands being placed on the child (Sandberg & Gardner, 2015). Similarly, the lack of social experiences adjusted to biological age might result in the alienation and abandonment of their peers, choosing instead to associate with adults or children of a younger age (Sandberg & Gardner, 2015). Taking into consideration the findings described above, understanding how the clinical and developmental characteristics of this paediatric population may influence and interact with the physical, psychological, and social adaptation outcomes is of foremost relevance.

Adaptation processes and outcomes in children and adolescents with short stature

The understanding of psychosocial adaptation processes in children and adolescents with SS can be conceptualized within the generic theoretical models of adaptation to paediatric chronic health conditions. Specifically, the disability-stress-coping model (Wallander et al., 1988) advocates that, for any chronic condition, there is

an interaction between risk and protective factors of multiple aetiologies, the latter having a possible moderating role in adaption outcomes. Thus, in accordance to this model, risk factors include condition parameters (e.g., the severity of the disability), functional independence (e.g., the ability to meet the demands of daily activities in relation to age-appropriate expectations), and psychosocial stress (i.e., psychosocial problem events pertaining to the illness, general major life events, and everyday problems; Wallander et al., 1988). The impact of these factors may then be moderated by several protective factors – although the nonexistence of these can be understood as an additional risk factor – divided into intrapersonal factors (e.g., sex, personality, intelligence), socioecological factors, such as social support, parental adaptation and socioeconomical level, and lastly stress processing factors (i.e., cognitive beliefs and coping strategies; Visser-van Balen, Sinnema, & Geenen, 2006; Wallander et al., 1988).

With respect to the evaluation of health-related outcomes, it becomes essential to define two concepts that have become entwined with this objective, those of *Quality of Life* (QoL) and *Health-Related Quality of Life* (HrQoL). The first one, as defined by the World Health Organisation, relays an "individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns" (The WHOQOL Group, 1996, p. 354). Therefore, QoL is a multidimensional construct that comprises physical health, psychological well-being, social relationships, environmental factors, and personal beliefs (The WHOQOL Group, 1996). Additionally, the concept of HrQoL was later introduced into the healthcare field as a specific component of the broader QoL construct and defined as "a multi-dimensional construct covering physical, emotional, mental, social, and behavioural components of well-being and function as perceived by patients and/or other observers" (Bullinger, Schmidt, Petersen, & Ravens-Sieberer, 2006). Moreover, it is possible to assess HrQoL according to four distinct levels: (1) *generic*, regardless of the presence or absence of a health condition, (2) *chronic-generic*, focused on chronic condition, but disregarding the idiosyncratic characteristics of a specific diagnosis within a non-categorical approach (Stein & Jessop, 1989), (3) *condition-specific*, customised to the peculiarities of a specific health-condition, and (4) *treatment-specific*, attending to patient perspective of the treatment they are receiving (Brüt et al., 2009). Thus, it becomes necessary to account for the peculiarities of SS as a paediatric

health condition, evaluating it on both a *condition-specific* level and, when applicable, *treatment-specific* level.

Research by Tanaka et al. (2009), showed that children with GHD reported lower QoL than population-based groups with normal height; however, the authors found this difference to only be statistically significant for boys, and not for female participants. For children with ISS aged 4 to 11, this difference was found to be statistically significant in both sexes. The authors also found that QoL tended to be lower in ISS than in GHD for all age groups except for that of 12- to 15-year girls, despite these group differences not reaching a significant level (Tanaka et al., 2009). A recent study also found that patients with current SS presented lower condition-specific HrQoL than those with achieved normal height due to hrGH treatment or normative growth, with untreated patients reporting lower generic HrQoL than children and adolescents undergoing hormonal therapy (Quitmann et al., 2016).

Considering the conceptual model previously described (Wallander et al., 1988) and tailoring it to SS, the emphasis of this study was on psychosocial variables, explicitly coping strategies, height-related beliefs and satisfaction with social support. Despite the aforementioned risk factors for decreased HrQoL in children/adolescents with SS, further research has described coping strategies, height-related beliefs, and social support as relevant protective factors in this paediatric population. Defined in 1984 by Lazarus and Folkman, coping pertains to the "constantly changing cognitive and behavioral [*sic*] efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person" (p. 141). Regarding the effects of coping on HrQoL, a paper by Quitmann and colleagues (2015) reported strong correlations between using Acceptance and Distance coping strategies and better HrQoL, whilst strategies like Wishful Thinking and Emotional Reaction showed a negative impact in the subjects' HrQoL.

Secondly, height-related beliefs can be defined as the cognitive appraisals that an individual makes in regard to height. In light of this definition, a child or adolescent may evaluate being tall as either something very important or of little to no significance. According to the disability-stress-coping model (Wallander et al., 1988), positive cognitive height-beliefs can be a stress processing protective factor and, thus, result in higher HrQoL. A study with a large European sample of paediatric patients with SS

showed significant associations between HrQoL and height-related beliefs, having additionally found a statistically significant negative correlation between patient-reported psychological problems and height-related beliefs (Quitmann et al., 2016).

Finally, social support is a wide-ranging term that comprises the supportive ways in which different individuals behave in the social environment, branching into two distinct types: structural support, which pertains exclusively to the existence of social relationships, while functional support refers to the resources provided by the individual's network, that is, the perceived quality of these relationships (Helgeson, 2003). Referring once over to the disability-stress-coping model (Wallander et al., 1988), the perception of satisfaction with one's social support may constitute a socioecological protective factor. To our best knowledge, there are no previous studies examining the protective effect of social support on HrQoL for youth with SS. However, findings from a study by Cheng and colleagues (2014) reported higher HrQoL in paediatric pacemaker recipients that benefited from social support, particularly that of family and friends. Likewise, a study examining the effect of social support in depression and QoL of children with sickle cell disease found that higher levels of parent social support were significantly associated with better QoL, and fewer depression symptoms (Sehlo & Kamfar, 2015).

Current gaps in literature and study objectives

The literature review allowed the identification of several research gaps. First, it is worth noting the unclear nature of the association between SS and impaired psychosocial functioning. This lack of clarity could be in part explained by the use of generic instruments to assess adaptation outcomes, since these may be less sensitive to detect the specific impairments resulting from SS and/or its treatment (Brüt et al., 2009). Furthermore, current research lacks studies that focus on risk and protective factors in SS - namely social support -, and on the processes through which these variables influence and predict adaptation outcomes.

Therefore, the present study aimed to better understand the psychosocial risk and protective factors for better adaptation outcomes in children and adolescents with SS, as well as the clinical and sociodemographic conditions in which they operate and influence condition-specific HrQoL. Thus, specific objectives were: (1) to test the group differences in coping, height-related beliefs, social support and HrQoL according to

sociodemographic (i.e., sex and age group) and clinical characteristics (i.e., diagnosis, current height-deviation, and hormonal treatment); and (2) to examine the associations between the psychosocial variables (coping, height-related beliefs, and social support) and the HrQoL of children and adolescents diagnosed with GHD, ISS or other diagnosis associated with SS phenotypes, as well as the moderating role of clinical and sociodemographic variables on these associations.

Bearing in mind these objectives, we hypothesised better HrQoL outcomes for female patients, younger children (aged 8 to 12 years), patients diagnosed with GHD, those that had reached normal height, and undergoing hormonal treatment. We also expected that HrQoL positively correlated with psychosocial variables, namely satisfactory social support, positive height-related beliefs, and effective coping strategies. Additionally, we expected both sex and age group to moderate the association between social support and HrQoL, an association we expected would be stronger for adolescents and male subjects. Finally, we anticipated the moderating role of diagnosis, hormonal treatment and height-deviation on the associations between coping/height-related beliefs and HrQoL. Hence, we expected positive associations between coping and HrQoL to be stronger for children/adolescents with ISS, not undergoing hormonal treatment, and who had not yet reached a normative height, whilst children and adolescents with GHD and undergoing hormonal treatment were expected to show stronger positive association in terms of height-related beliefs and HrQoL.

By identifying psychosocial modifiable variables that are associated with better HrQoL, as well as the conditions in which these associations occur, might contribute to develop psychological interventions tailored to SS, as well as to identify which subjects are at a higher risk of maladaptation and, thus, require priority intervention.

Method

Participants and Procedures

This study was part of a larger project, aimed to translate and psychometrically validate the Portuguese version of the QoLISSY- *Quality of Life for Short Statured Youth* questionnaires for children between 8 and 18 years of age and for parents of children between 4 and 18 years of age. This ongoing project results from a partnership between

the *Relationship, Development & Health* research group of CINEICC – Centre for Research in Neuropsychology and Cognitive and Behavioural Intervention from the University of Coimbra; the Centro Hospitalar e Universitário de São João, a University Hospital located in Oporto, Portugal; and the Department of Medical Psychology of the UKE – Universitätsklinikum Hamburg-Eppendorf (Germany).

Regarding ethical procedures, the QoLISSY study was approved by two ethic committees, the Hospital's (Comissão de Ética para a Saúde do Centro Hospitalar de São João, E.P.E), and that of the Faculty of Psychology and Educational Sciences of the University of Coimbra (Comissão de Ética e Deontologia da Investigação da FPCE-UC). Additionally, research was conducted in compliance with the American Psychological Association's ethical principles regarding research with human participants (American Psychological Association [APA], 2010), and the Helsinki Declaration (World Medical Association, 2008). All participants and respective parents/legal guardians were informed of the study's objectives and procedures, and were assured of its anonymous and confidential nature, as well as the possibility to withdraw their previously given consent at any given moment. Moreover, participants were also asked to give additional permission to consult their clinical records. Given the vulnerable and sensitive nature of any paediatric population, as well as a minor's legal inability to grant their consent, this responsibility fell upon the parent or legal guardian. However, participants over the age of 13 were asked to verbally assent to participate, having this symbolic consent prevailed over the one granted by the adult. To assure confidentiality, all consent forms were saved in the Hospital and were never associated with their respective questionnaires. In order to safeguard anonymity, all participants were assigned and referred to via number, and anonymised data was entered in a database, created solely for the present study and shared exclusively with the researchers involved with the project.

For this broader cross-sectional psychometric study, participants are currently being recruited by a child psychologist and main researcher of the QoLISSY Project in Portugal, in the Paediatric wing of Centro Hospitalar e Universitário de São João, at time of their routine paediatric endocrinology appointments. For the present study, the recruitment process lasted from February 4th to June 6th 2019. The data was selected from that of the broader study according to the following study-specific inclusion criteria: (1) a previous clinical diagnosis of GHD or ISS; (2) a height-deviation more than two

standard-deviations below population norms adjusted for age and sex at time of diagnosis; (3) age between 8 and 18 years old; (4) having Portuguese nationality; and (5) cognitive capacity to understand and respond to the questionnaires. To allow for a more robust study, patients with a diagnosis other than GHD or ISS were included in our sample, since they represented a fairly large portion of it. Exclusion criteria for the present study were: (1) patients aged 4 to 7, because only parent-reports were available for the pre-schooled aged children; (2) those with severe psychological comorbidities as reported by their parents.

Measures

The Quality of Life in Short Stature Youth (QoLISSY) – self-reported version

Children's and adolescents' self-reported HrQoL was assessed by means of the QoLISSY questionnaire (The European QoLISSY Group, 2013; Portuguese version: Silva, Almeida, Canavarro, Fontoura-Magalhães, & Bullinger [ongoing psychometric studies]), a cross-cultural condition-specific instrument developed for the assessment of 8-18 years old patients with a clinical diagnosis of SS. The questionnaire comprised 50 items answered with a 5-point Likert scale (ranging from 1 = *Not at all/Never* to 5 = *Extremely/Always*). Out of these items, 22 comprise the three core domains of the instrument (physical, social, and emotional). The physical domain assessed everyday physical limitations that may stem from being short-statured (e.g., "Because of my height, I have problems reaching things"). Secondly, the social domain related to the ways that SS might have influenced the participant's social life, for instance being bullied or isolating themselves (e.g., "I am laughed at and teased"). Lastly, the emotional domain evaluated emotional responses to being short-statured, such as sadness and insecurity (e.g., "I am insecure because of my height"). For this study, only the general global score of HrQoL, calculated from the sum scores of the three core domains, was used. This score was then standardized to scores ranging from 0 to 100, with higher scores indicating better HrQoL.

The remaining 28 items of the QoLISSY questionnaire assessed the psychosocial determinants of HrQoL in SS (treatment, coping, and beliefs). The coping scale (10 items) related to the way subjects dealt with negative feelings derived from SS (e.g., "I try to get

used to my height"); the beliefs scale (4 items) evaluated the subject's cognitive appraisals about height (e.g., "Life is better if you are tall"); and the treatment scale (14 items) assessed the impact and expectations concerning hormonal treatment (e.g. "My treatment really helps me grow"), only applicable to children and adolescents undergoing treatments. All scales were positively coded, in the sense that higher scores indicate more adaptive coping strategies, height-related beliefs assessed as less important, and less adverse effects of treatments in children/adolescents' HrQoL.

The questionnaire's original version demonstrated good reliability for the six scales, with Cronbach's alpha ranging from .82 to .88 for scales, and .95 for the HrQoL global score (The European QoLISSY Group, 2013). Likewise, the pilot study for the Portuguese version of the instrument showed adequate alphas, ranging from .70 to .87 for each scale and .90 for the overall score (N. Silva, P. Almeida, M. Bullinger, M. Fontoura-Magalhães, & M. C. Canavarro, personal communication, September 2018). Furthermore, the present study also demonstrated robust psychometric properties, with Cronbach's alpha of .93 for the global score of HrQoL, .86 for the coping scale, .80 for height-related beliefs, and .87 for the treatment scale.

Escala de Satisfação com o Suporte Social para crianças e adolescentes (ESSS)

Participants' satisfaction with their social support was assessed with the Escala de Satisfação com o Suporte Social para crianças e adolescentes (Gaspar, Pais-Ribeiro, Matos, Leal, & Ferreira, 2009) a Portuguese instrument developed as a shorter version of the adult counterpart, aimed at youth aged 10 to 16. This questionnaire is comprised by 12 questions answered using a Likert 5-point scale (ranging from 1 = *Totally Disagree* to 5 = *Totally Agree*). This instrument is subdivided into two scales, Satisfaction with Social Support and Need for Activities Related to Social Support. Moreover, the original instrument demonstrated adequate internal reliability, with Alphas of .84 and .69 for each subscale, respectively. For this study, only the total score computed as the mean score of the 12 items was considered as a measure of general satisfaction with social support. In the present study, this global scale showed acceptable internal consistency ($\alpha = .79$).

Sociodemographic and clinical data

Additional data referring to sociodemographic and clinical information was gathered via a sheet composed by questions regarding the participant's sex, date of birth, school year, diagnosis and its date, comorbidities, height, treatments and their respective date of initiation and, if applicable, termination, and, lastly, if the subject had undergone psychotherapy and, if so, the motive behind therapy.

This sheet was filled out by the clinician before handing the questionnaires, by directly asking the participants or their parent/legal guardian or, should information still be missing, through checking their clinical record. Height deviation in relation to population norms for age and sex was computed for each child using the Growth Charts UK-WHO application (Paediatrics.co.uk, 2017), based on date of birth, date of assessment, height at the time of assessment and sex.

Data Analysis

The data analyses were performed using the Statistical Package for the Social Sciences for Windows, version 23.0 (SPPS; IBM Corp, 2015), as well as the PROCESS Macro for SPSS, version 3.3 (Hayes, 2019). Results were considered significant at a 95% confidence interval ($p \leq .05$).

Descriptive statistics were obtained for sociodemographic and clinical variables -- means [*M*] and standard-deviations [*SD*] for continuous variables, and absolute (*n*) and relative (%) frequencies for categorical ones. Likewise, the homogeneity of sample characteristics across the three diagnoses was examined by one-way analysis of variance (ANOVA) for continuous variables, and chi-square tests for categorical variables. For significant ANOVA results, *post hoc* tests with Bonferroni correction were performed. For significant results found in categorical variables, we performed additional chi-square tests pairing the three diagnoses manually. The clinical and socio-demographic variables that were significantly different across the clinical groups were included as covariates in the subsequent analyses.

One-way univariate analyses of covariance (ANCOVAs) were conducted to examine mean differences in HrQoL as assessed by the QoLISSY total score, Coping, height-related Beliefs, and Satisfaction with Social Support, across sociodemographic and clinical groups: sex (i.e., males vs. females), age group (i.e., children 8-12 years vs.

adolescents 13-18 years), diagnosis (i.e., ISS vs. GHD vs. other diagnoses), treatment status (i.e., GH-treated vs. untreated), and current height-deviation (i.e., current SS vs. reached normal height). The remaining factors, as well as children's education (number of school years), were controlled for by including them as covariates.

To examine the effect of the Coping score, height-related Beliefs score, and Satisfaction with Social Support on HrQoL (QoLISSY total score), a hierarchical linear regression analysis was performed. The sociodemographic variables (i.e., sex and age group) were entered in the first block, the clinical variables (i.e., diagnosis [dummy-coded], current height deviation and treatment status) in the second block, and the psychosocial variables (i.e., Coping, height-related Beliefs and Satisfaction with Social Support) were entered in the third block of the regression equation.

Finally, the PROCESS Macro for SPSS was used to examine the moderating effects of the sociodemographic and clinical variables on the relationships between the psychosocial variables (Coping, height-related Beliefs and Satisfaction with Social Support) and HrQoL (the total QoLISSY score). For each moderation analysis, the remaining sociodemographic and clinical variables were included in the model as covariates. Statistically significant interaction effects were plotted in Excel, using the data for visualizing the conditional effects provided by the PROCESS Macro and the strength and significance of simple slopes was examined.

Results

Sample characteristics

In total, our sample consisted of 89 subjects diagnosed with SS, aged 8 to 18, with a mean age of 12.67 years (SD = 2.54). The majority of subjects was male (n = 55; 61.8%), adolescent (n = 47; 52.8%), currently short-statured (n = 50; 56.2%), diagnosed with ISS (n = 39; 43.8%), and not undergoing hormonal treatment (n = 56; 62.9%). Further characterisation of the sample is displayed in Table 1.

Preliminary analysis showed that the distribution of participant's sociodemographic characteristics across the three diagnosis groups was homogenous, namely for sex, $\chi^2_{(2)} = 0.72$, $p = 0.699$; age, $F_{(2,86)} = 2.95$, $p = 0.057$; and age group, $\chi^2_{(2)} = 5.84$, $p = 0.054$. The only exception was observed for number of school years, $F_{(2,83)} =$

3.32, p = 0.041. *Post hoc* comparisons using the Bonferroni correction showed that children with ISS had statistically significant fewer school years than those with GHD (*MD* = -1.53, *SE* = 0.60, p = 0.036). Accordingly, this variable was controlled in subsequent analyses.

Table 1. *Sociodemographic and clinical characteristics of the sample.*

Sociodemographic characteristics			
	GHD (n = 28)	**ISS** (n = 39)	**Other** [a] (n = 22)
Sex (n, %)			
Male	16 (57.1)	26 (66.7)	13 (59.1)
Female	12 (42.9)	13 (33.3)	9 (40.9)
Age in years (*M*, *SD*)	13.57 (2.38)	12.08 (2.50)	12.59 (2.61)
Age group (n, %)			
Children 8-12	8 (28.6)	21 (53.8)	13 (59.1)
Adolescents 13-18	20 (71.4)	18 (46.2)	9 (40.9)
Years of school (*M*, *SD*)	8.00 (2.45)	6.47 (2.26)	6.95 (2.44)
Clinical characteristics			
Height in cm (*M*, *SD*)	147.39 (12.15)	136.51 (11.22)	136.46 (10.45)
Current height deviation (*M*, *SD*)	-1.70 (0.71)	-2.15 (0.54)	-2.42 (1.11)
Height-deviation (n, %)			
Short-stature	12 (42.9)	26 (66.7)	12 (54.5)
Normal height	16 (57.1)	13 (33.3)	10 (45.5)
GH treatment (n, %)			
Treated	26 (92.9)	0 (0.0)	7 (31.8)
Untreated	2 (7.1)	39 (100.0)	15 (68.2)
Comorbidities [b] (n, %)			
Yes	10 (35.7)	15 (38.5)	9 (40.9)
No	18 (64.3)	24 (61.5)	13 (59.1)

[a] These diagnoses were heterogeneous, but all had a phenotype that included SS, such as being small for gestational age (n = 7) and Tuner Syndrome (n = 4).
[b] the most reported comorbidity was asthma (n = 22), followed by coeliac disease (n = 2).

Regarding the sample clinical characteristics, significant differences between the diagnosis groups were found for height (in cm) at the time of assessment, $F_{(2,86)}$ = 8.86, p

< 0.001 and current height deviation, $F_{(2,86)} = 5.84$, $p = 0.004$, with patients with GHD being taller and having smaller deviation from the norms than those with ISS (*MD* = 10.88, *SE* = 2.81, $p = 0.001$ and *MD* = 0.46, *SE* = 0.19, $p = 0.054$, respectively) or with other diagnosis (*MD* = 10.93, *SE* = 3.23, $p = 0.003$ and *MD* = 0.72, *SE* = 0.22, $p = 0.004$, respectively). In addition, differences in treatment status were found, $\chi^2_{(2)} = 60.58$, $p < 0.001$, with children/adolescents with GHD being more likely to be treated than children with ISS ($\chi^2_{(2)} = 59.18$, $p < 0.001$) or other diagnosis ($\chi^2_{(2)} = 20.46$, $p < 0.001$), and children with other diagnosis being more frequently under treatment that children with ISS ($\chi^2_{(2)} = 14.02$, $p < 0.001$). No differences were found for the distribution of comorbidities across the diagnosis groups, $\chi^2_{(2)} = 0.14$, $p = 0.931$, or for the dichotomized groups of current height deviation, $\chi^2_{(2)} = 3.79$, $p = 0.151$.

Descriptive statistics and analyses of covariance for HrQoL, Coping, height-related Beliefs, and Satisfaction with Social Support across sociodemographic and clinical groups

Concerning sociodemographic variables, univariate analysis of covariance showed no significant differences between males and females or between children between 8 and 12 years of age and adolescents between 13 and 18 years of age, regarding the total HrQoL (QoLISSY core domains total score), Coping, height-related Beliefs and satisfaction with social support. Detailed results of these analyses can be found in Tables 2 and 3.

Table 2. *Univariate analysis of covariance for HrQoL and psychosocial variables between sexes.*

	Sex				
	Male (*M*, *SD*)	**Female** (*M*, *SD*)	$F_{(1,77)}$	***Sig.*** *(p-value)*	η^2_p
HrQoL total score	75.52 (18.55)	77.76 (16.61)	0.21	0.652	0.003
Height-related beliefs	63.74 (26.74)	73.3 (23.14)	0.86	0.357	0.011
Coping	51.86 (23.34)	64.10 (24.00)	2.31	0.132	0.029
Satisfaction with Social Support	4.02 (0.62)	3.93 (0.57)	1.17	0.282	0.016

Table 3. *Univariate analysis of covariance for HrQoL and psychosocial variables between age groups.*

	Age group				
	Children (*M*, *SD*)	**Adolescents** (*M*, *SD*)	$F_{(1,77)}$	***Sig.*** *(p-value)*	η^2_p
HrQoL total score	77.61 (18.27)	75.36 (17.35)	0.00	0.988	0.000
Height-related beliefs	74.53 (19.11)	61.16 (29.15)	0.02	0.880	0.000
Coping	59.77 (24.23)	54.09 (24.18)	0.00	0.962	0.000
Satisfaction with Social Support	4.06 (0.58)	3.92 (0.61)	0.00	0.997	0.000

For clinical variables, univariate analysis of covariance showed that the three diagnosis groups did not statistically differ in relation to HrQoL total score, or other psychosocial variables (Table 4).

Table 4. *Univariate analysis of covariance for HrQoL and psychosocial variables across diagnoses.*

	Diagnosis					
	ISS (*M*, *SD*)	**GHD** (*M*, *SD*)	**Other** (*M*, *SD*)	$F_{(2,76)}$	***Sig.*** *(p-value)*	η^2_p
HrQoL total score	72.00 (19.72)	78.50 (15.28)	81.54 (15.81)	1.37	0.260	0.035
Height-related beliefs	64.25 (25.82)	68.29 (26.74)	72.02 (24.50)	0.91	0.409	0.023
Coping	57.47 (22.51)	53.56 (23.85)	59.72 (28.37)	0.38	0.684	0.010
Satisfaction with Social Support	3.95 (0.62)	3.93 (0.68)	4.10 (0.44)	0.47	0.627	0.013

Similarly, univariate analysis of covariance showed no significant differences between current height deviation groups, except for Coping scores, as currently short-statured participants demonstrated significantly higher coping scores than those who had reached normal height (Table 5).

Lastly, no significant differences were found for all four psychosocial variables for participants undergoing, or not, hormonal treatment (Table 6).

Table 5. *Univariate analysis of covariance for HrQoL and psychosocial variables between current height deviation groups.*

	Current height deviation				
	Short stature (*M*, *SD*)	**Normal height** (*M*, *SD*)	$F_{(1,77)}$	***Sig.*** *(p-value)*	η^2_p
HrQoL total score	72.87 (18.16)	81.18 (16.18)	3.54	0.064	0.044
Height-related beliefs	62.93 (25.07)	73.61 (25.58)	3.15	0.080	0.039
Coping	62.56 (23.64)	48.87 (23.05)	5.96	0.017	0.071
Satisfaction with Social Support	3.96 (0.60)	4.02 (0.61)	0.03	0.867	0.000

Table 6. *Univariate analysis of covariance for HrQoL and psychosocial variables between treatment statuses.*

	Treatment				
	Treated (*M*, *SD*)	**Untreated** (*M*, *SD*)	$F_{(1,77)}$	***Sig.*** *(p-value)*	η^2_p
HrQoL total score	80.26 (14.05)	74.19 (19.33)	0.50	0.481	0.006
Height-related beliefs	71.98 (24.20)	64.85 (26.37)	1.38	0.244	0.017
Coping	56.34 (24.81)	57.00 (24.11)	0.07	0.797	0.001
Satisfaction with Social Support	3.96 (0.62)	4.00 (0.59)	0.03	0.856	0.000

Main and interaction effects of sociodemographic, clinical and psychosocial variables on HrQoL

The results from hierarchical linear regression analysis examining the main effects of sociodemographic, clinical and psychosocial variables on children/adolescents' HrQoL are displayed in Table 7. Sociodemographic and clinical variables explained a small and non-significant portion of the variance in HrQoL (zero and 12%, respectively). Conversely, the psychosocial variables explained 44% of the variance in HrQoL. Specifically, while controlling for sex, age group, diagnosis, current height deviation and treatment status, higher scores in height-related beliefs (i.e., height-related beliefs scored as less important) were associated to better HrQoL.

Table 7. *Main effects of sociodemographic, clinical and psychosocial variables on HrQoL.*

	Step 1: Sociodemographic variables $\Delta R^2 = 0.00$, $\Delta F_{(2.75)} = 0.06$		**Step 2: Clinical variables** $\Delta R^2 = 0.12$, $\Delta F_{(4,71)} = 2.41$		**Step 3: Psychosocial variables** $\Delta R^2 = 0.44$, $\Delta F_{(3,68)} = 22.89$***	
	ß	*t*	ß	*t*	ß	*t*
Sex [a]	0.01	0.04	0.01	0.08	-0.03	-0.36
Age group [b]	-0.04	-0.33	-0.02	-0.01	0.12	1.34
Diagnosis (ISS vs. GHD/Other)			-0.23	-1.49	-0.23	-2.13*
Diagnosis (GHD vs. ISS/Other)			-0.17	-0.88	-0.13	-0.94
Current height deviation [c]			-0.20	-1.69	-0.06	-0.65
Treatment status [d]			0.16	0.80	0.05	0.36
Height-related beliefs					0.66	7.30***
Coping					-0.17	-1.94
Satisfaction with Social Support					0.13	1.52
MODEL SUMMARY	$R^2 = 0.00$, $F_{(2.75)} = 0.06$		$R^2 = 0.12$, $F_{(6.71)} = 1.63$		$R^2 = 0.56$, $F_{(9.68)} = 9.72$***	

[a] Sex: 0 = male, 1 = female; [b] Age group: 0 = children 8-12 years, 1 = adolescent 13-18 years; [c] = Current height deviation: 0 = achieved normal height, 1 = current short stature; [d] Treatment status: 0 = untreated, 1 = treated.
* $p \leq 0.050$, ** $p \leq 0.010$, *** $p \leq 0.001$, two-tailed.

Lastly, moderation analyses testing whether sociodemographic and clinical variables played a moderating role regarding the relationship between psychosocial variables (coping, beliefs, and satisfaction with social support), and HrQoL. Table 8 presents the portion of additional variance explained by the introduction of the respective interaction term to the model, as well as the coefficients and significance of individual interaction effects on HrQoL. The results showed statistically significant interaction effects between height-related beliefs and diagnosis and between coping and current height deviation, which explained, respectively, 2% and 4% of additional variance in HrQoL.

The plots for the significant moderation effects are presented in Figures 1 and 2. Regarding the moderating effect of diagnosis, the positive associations between height-related beliefs and HrQoL were stronger for the group diagnosed with ISS (*b* = 0.59, *SE*

= 0.08, t = 7.54, p < 0.001), although also significant for children/adolescents with GHD (b = 0.48, SE = 0.06, t = 8.54, p < 0.001) and with other diagnoses (b = 0.37, SE = 0.08, t = 4.64, p < 0.001).

Table 8. *Interaction effects between sociodemographic, clinical and psychosocial variables on HrQoL.*

	ΔR^2	$\Delta F_{(1,78)}$	b (SE)	t	p
Height-related beliefs X Sex	0.00	0.07	0.03 (0.12)	0.26	0.799
Height-related beliefs X Age group	0.00	0.54	-0.10 (0.13)	-0.74	0.465
Height-related beliefs X Diagnosis	0.02	4.03*	-0.14 (0.07)	-2.01	0.048
Height-related beliefs X Height deviation	0.00	0.06	-0.03 (0.11)	-0.24	0.809
Height-related beliefs X Treatment status	0.00	0.56	-0.09 (0.12)	-0.75	0.457
	ΔR^2	$\Delta F_{(1,78)}$	b (SE)	t	p
Coping X Sex	0.01	0.97	0.16 (0.17)	0.98	0.331
Coping X Age group	0.01	0.65	0.13 (0.16)	0.80	0.424
Coping X Diagnosis	0.02	1.95	0.14 (0.10)	1.40	0.166
Coping X Height deviation	0.04	3.90*	0.35 (0.18)	1.97	0.052
Coping X Treatment status	0.01	0.45	-0.11 (0.17)	-0.67	0.503
	ΔR^2	$\Delta F_{(1,72)}$	b (SE)	t	p
Social support X Sex	0.00	0.10	2.12 (6.70)	0.32	0.752
Social support X Age group	0.03	2.43	10.16 (6.52)	1.56	0.124
Social support X Diagnosis	0.00	0.00	0.08 (4.62)	0.02	0.987
Social support X Height deviation	0.00	0.02	0.88 (6.52)	0.14	0.893
Social support X Treatment status	0.02	1.76	-8.68 (6.55)	-1.33	0.189

* $p \leq 0.050$, ** $p \leq 0.010$, *** $p \leq 0.001$, two-tailed.

The direction of associations between coping and HrQoL differed depending on the current height deviation: for children and adolescents who achieved normal height, the higher the coping levels, the lower their HrQoL, while for patients with current short stature, higher coping levels were linked to better HrQoL. However, the simple slopes did not reach statistical significance for none of the groups, with b = -0.22, SE = 0.14, t = -1.66, p = 0.102 for achieved normal height and b = 0.12, SE = 0.11, t = 1.13, p = 0.264.

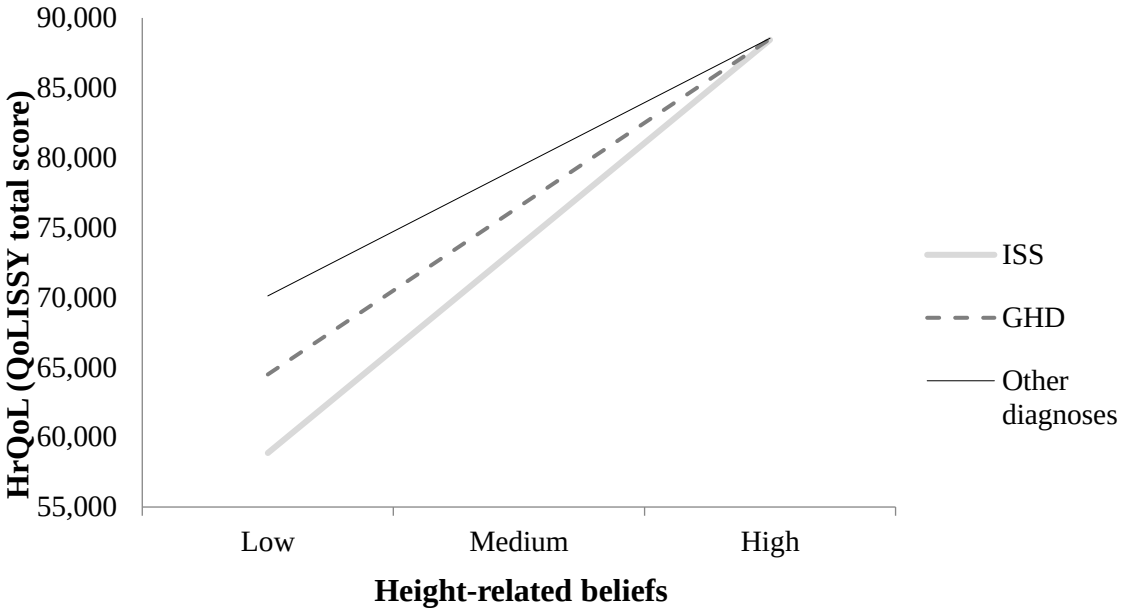

Figure 1. The moderating effect of diagnosis on the association between height-related beliefs and children/adolescents' HrQoL.

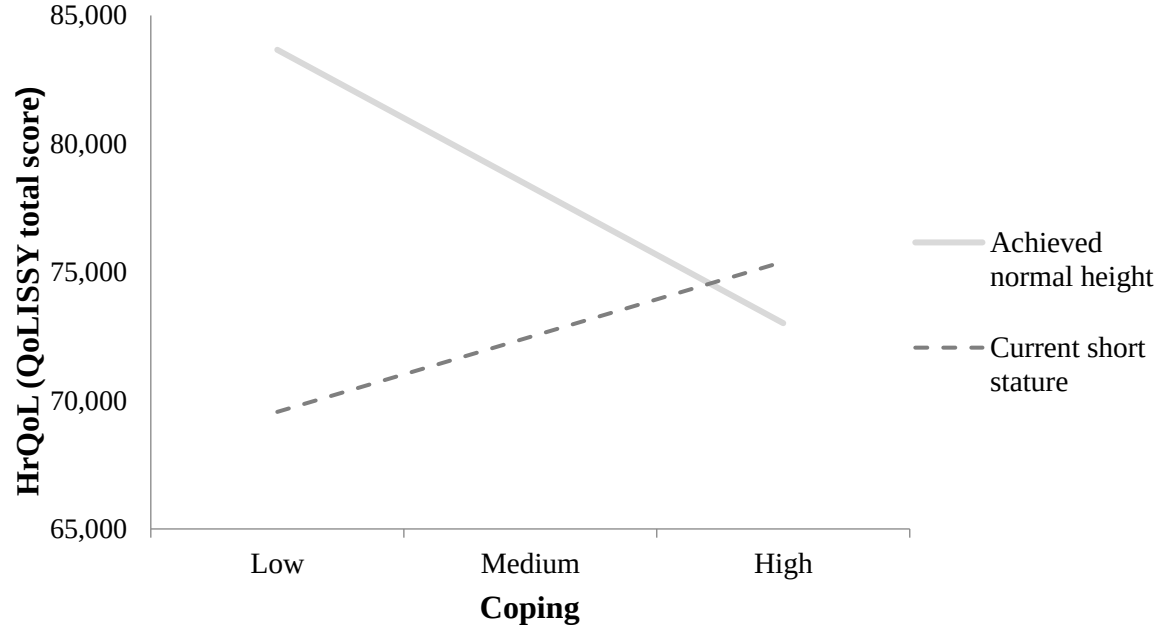

Figure 2. The moderating effect of current height deviation on the association between coping and children/adolescents' HrQoL.

Discussion

The present study aimed to better comprehend the differences in adaptation outcomes for children and adolescents diagnosed with SS according to their sociodemographic and clinical characteristics, as well as the associations between psychosocial variables and better condition-specific HrQoL, and the sociodemographic and clinical conditions in which they operate and influence this outcome.

In terms of sociodemographic variables, we hypothesised that female participants and children would report better HrQoL than their male, adolescent counterparts. The rationale for this hypothesis was that popular height-related stereotypes, such as its association with attractiveness, status, and success, would play a larger role for boys than for girls. Likewise, pre-pubescent children may be shorter than their peers, however they are still to reach puberty and, consequentially, their adult height, a realisation that does not hold true for adolescents. Similarly, peer-relations and romantic relationships flourish during adolescence, therefore matters such as self-esteem and attractiveness may be hindered by being short-stature, resulting in less self-reported HrQoL. Regarding clinical variables, our hypothesis was that participants with GHD, undergoing hormonal treatment, and having reached normal stature would report higher HrQoL. The logic behind these assumptions is that unlike ISS and some other conditions associated with SS, GHD is treatable via daily growth-hormone injections, thus allowing for the effective treatment of the condition. Thus, it was expected that participants who were able to receive treatment or were no longer short-statured would report higher levels of HrQoL that those unable to do so.

Our results, however, disproved these hypotheses. While mean differences between the several groups were in fact reported in the direction we anticipated (e.g., girls reporting better QoLISSY scores than male participants), none were of statistical significance. As previously mentioned, whether SS results in impaired HrQoL and psychological well-being remains a controversial matter, in part due to the lack of research conducted using condition-specific instruments, this methodological shortcoming was accounted for in the present study by the use of the QoLISSY instrument. Despite our hypotheses having been refuted, our results are in line with literature that challenges this view of SS as an impairment and adaptation risk (Sandberg

& Gardner, 2015). Given that some of the beforementioned research was also conducted with use of chronic-generic and generic HrQoL instruments, we find our results to be an important step in clarifying this controversial subject, particularly by suggesting the absence of specific sociodemographic and clinical groups at risk of poorer adaptation. However, it is important to note that these findings pertain to the Portuguese population and must be interpreted considering cultural specificities. On average, the Portuguese are shorter in comparison with other populations - for adult males the median height is 172.9 cm, 163.0 cm for females (NCD Risk Factor Collaboration, 2016); also, worldwide, the Portuguese are ranked 74th tallest men and the 48th tallest women (NCD Risk Factor Collaboration, 2016). Hence, this absence of statistically significant differences in outcomes may be in partially explained by the fact that in a shorter population, being short-statured poses less psychosocial challenges and HrQoL impairments.

Another relevant finding is the absence of a statistically significant difference in self-reported HrQoL between treated and untreated participants. A recent longitudinal study conducted with the German version of the QoLISSY instrument found a significant interaction effect between time and treatment status, with participants who had undergone hormonal treatment reporting a significant increase in HrQoL from baseline assessment to 1-year follow up (Quitmann et al., 2019). Our results, despite cross-sectional were not in line with this study, but it is important to note that treatment benefits may be hindered by the burden associated with daily hormonal injections, as well as the need for frequent medical appointments (Sheppard et al., 2006). Also, given that our participants were recruited at a district-level Hospital, not all resided within the immediate metropolitan area of Porto, which may result in an additional logistical burden stemming from the need of frequent Hospital visits.

Beside understanding which sociodemographic and clinical variables were associated with poorer self-reported HrQoL, we sought to understand how psychosocial variables differ. Primarily, we studied how psychosocial variables (coping, height-related beliefs, and satisfaction with social support) differed for participants across all the aforementioned groups (diagnosis, treatment status, sex, current height-deviation, and age group), and then how these variables associated with total self-reported HrQoL. Firstly, our results showed no statistically significant differences between psychosocial variables and sociodemographic variables and clinical variables, apart from current height-

deviation, as we found that currently short-statured individuals demonstrated significantly higher coping strategies than those of current normal height. A possible explanation for this fact is that those who are currently of SS may experience more negative emotions resulting from their condition and, therefore, require significantly more coping strategies to deal with these emotions than those unburdened by their height.

Secondly, by analysing the main effects of sociodemographic, clinical, and psychosocial variables on self-reported HrQoL, we sought to understand which of these variables were responsible for explaining the variance in children and adolescent's HrQoL. Thus, our hypothesis was that HrQoL would be positively correlated with psychosocial variables, namely satisfactory social support, positive height-related beliefs, and effective coping strategies. The rationale for this hypothesis was in line with research suggesting that these variables acted as protective factors for better adaptation in SS (Quitmann et al., 2015; Quitmann et al., 2016), or other chronic paediatric conditions (Sehlo & Kamfar, 2015). Our findings supported this hypothesis, showing that sociodemographic and clinical variables did not contribute significantly to improved HrQoL, yet one of the psychosocial variables, height-related beliefs, explained 44% of outcome variance. Specifically, positive height-related beliefs translate to the individual not attributing great importance to the perception of height or their shortness, in summary adaptive beliefs regarding height. These findings are in line with the theoretical framework of Cognitive Behavioural Therapy, defending that psychological distress is dependent on cognitions, the beliefs the individual holds regarding certain aspects of their experience (Beck, 2011). Thus, results suggest that height itself might not be the issue, rather the importance that the individual attributes to height. It is important to note that these beliefs are established early in life, during childhood (Beck, 2011), and that research has suggested that height-related stereotypes are assimilated at an early age (Sandberg & Voss, 2002). In light of this, a possible explanation for the importance of height-relative beliefs is the way in which they may influence self-esteem and body image of children and adolescents with SS. Research regarding the impact of SS and height-related stereotypes has largely focused on aspects such as bullying, teasing and peer-relationships (Sandberg et al., 2004), however aspects such as body image and self-esteem have been overlooked, and the formation of these beliefs is yet to be explored. Thus, it may be possible that these beliefs stem from peer-comparison and media pressure, as research

has shown that children and adolescents prefer to compare themselves to peers of the same age and gender (Dumas et al., 2005). Likewise, since children and adolescents are increasingly exposed to idealised bodies through media, it is likely that these figures become important for social comparison (Tatangelo & Ricciardelli, 2015). These authors also found that children frequently employed social comparisons on several domains, including appearance and physical abilities, with peers being more frequently compared to than media figures. As SS is a condition that expresses itself directly in physical appearance and indirectly in physical abilities, as being short may hinder athletic performance, this may explain the early formation of maladaptive height-related beliefs and how these may result in poorer HrQoL.

Finally, we anticipated a moderating role of diagnosis, hormonal treatment and height-deviation on the associations between coping/height-related beliefs and HrQoL. Hence, we expected positive associations between coping and HrQoL to be stronger for children/adolescents with ISS, not undergoing hormonal treatment, and who had not yet reached a normative height, whilst children and adolescents with GHD and undergoing hormonal treatment were expected to show stronger positive association in terms of height-related beliefs and HrQoL. Likewise, we hypothesised positive associations between satisfaction with social support and HrQoL to be stronger for adolescents and male participants. Our results confirmed that diagnosis moderated the relationship between height-related beliefs and HrQoL and that height-deviation moderated the relationship between coping and HrQoL, despite explaining only a small percentage of outcome variance, 2% and 4%, respectively. Regarding the moderating role of diagnosis, this effect was stronger for participants with ISS, followed by those with GHD and other diagnoses. This fact may be explained by the fact that ISS is the only diagnosis group for which hormonal treatment is entirely unavailable, as well as being the diagnosis group with the larger percentage of currently SS participants in our sample, thus their adaptation to SS may be more dependent on cognitive processing than for participants undergoing treatment, those with GHD and some of the heterogeneous diagnoses. Another possibility is that children and adolescents with GHD or another diagnosis that is eligible for hormonal treatment may have expectations regarding treatment and the possibility for achieving normal height, thus the impact of maladaptive beliefs regarding height may have a lower impact on HrQoL. On the other hand, those diagnosed with ISS lack a clear

diagnosis with established treatment and cause, as theirs is a diagnosis by exclusion, so this uncertainty regarding the causes and the adult height may further accentuate the impact of dysfunctional beliefs on their HrQoL.

For coping, the association with our outcome was moderated by current height deviation – for patients currently short-statured, higher coping levels were associated with better self-reported HrQoL, although for those who were of normative height these associations were inverse, with higher coping levels associated with poorer HrQoL. However, it is important to notice that since the simple slopes did not reach significance for the two groups. In view of this fact, our explanations should be taken with careful consideration, as these results need to be further explored in supplementary studies done with a larger sample. With that in mind, since the QoLISSY coping scale assesses strategies specifically related to SS, when they are employed by children and adolescents who achieved normal height, they may no longer be effective or event counterproductive. For instance, if a child or adolescent that no longer appeared to be short-statured talked to a family or friend regarding negative emotions about their height, this could induce adverse reactions, as their condition would no longer be manifest to others. These hypotheses, however, are only exploratory in nature and require further investigation.

Limitations and future directions for research

The main limitations of the present study are of a methodological nature. Firstly, the small sample size which posed restrictions to the statistical power of our analyses, particularly for detecting smaller interaction effects. Additionally, due to the small sample size, we chose to include heterogenous diagnoses with a phenotype that includes SS, which introduced considered within-group heterogeneity and made it difficult to draw conclusions regarding this fairly large, assorted group of participants. Likewise, since it was a cross-sectional study, we could only identify bidirectional associations between variables and we were unable to evaluate the effect of clinical, namely treatment status, and psychosocial variables over time. Longitudinal studies done with larger samples are needed in SS, as they are necessary to not only clarify the impact of treatment on HrQoL, but to establish if the psychosocial variables, namely height-related beliefs, can be predict this outcome over time for this paediatric population.

Furthermore, the actual impact of SS on HrQoL of children and adolescents remains unclear. We identified the lack of research with condition-specific instruments for SS as a gap in current literature, as generic and chronic-generic instruments may not be adequate in accounting for the particularities of this diagnosis. Although we accounted for this limitation by using the condition-specific QoLISSY questionnaire, further investigation should also include comparisons with the population norms, or as advised by Gerharz, Eiser, and Woodhouse (2003), with peer groups. Summarising, further research in this field should be conducted with condition-specific instruments, such as the QoLISSY questionnaire, whilst not neglecting the importance of clarifying the effect of SS on HrQoL.

Further research pertaining to the effect of coping on SS is also needed. As we assessed HrQoL only considering the global QoLISSY score, it may be necessary to understand how these strategies impact the three nuclear domains of HrQoL separately, clarifying whether it plays a larger role on the physical, social or emotional domain. Likewise, the QoLISSY coping scale evaluates coping strategies tailored specifically toward SS, such as "*I tell myself that it is okay to be short*". It does not, however, distinguish between different strategies nor their different efficacies.

To the best of our knowledge, this was the first study to examine the association between satisfaction with social support and HrQoL in SS. Our findings did not show an association between these two variables, although it could be due to the small sample size and the consequent limited power of statistical analyses. Alternatively, it could be explained by SS being a visible condition, which may elicit greater support and understanding from friends and family. As so, future research should seek to explore the impact of satisfaction with social support and HrQoL, in its different domains.

In conclusion, very little research analysing the impact of psychosocial variables on HrQoL of children and adolescents with SS has been published. Most of the literature focused on general HrQoL outcomes assessed by the aforementioned chronic-generic instruments, excluding aspects like beliefs, coping, and social support, aspects that are relevant as they can be worked in a therapeutic setting. The purpose of assessing HrQoL in any paediatric group is to determine what challenges each condition poses to the individual, on what levels do they manifest (e.g., social, physical, and emotional), which individuals are at higher risk of maladaptation, and what interventions can be drawn to

lessen the burden of illness in this population. Nonetheless these interventions should not be limited to the field of medicine. As a construct, HrQoL can be defined as a multi-dimensional construct (Bullinger, Schmidt, Petersen, & Ravens-Sieberer, 2006). As such, research exploring the impact, effect and interactions of psychosocial variables, could help shape better psychological interventions, promoting better adaptation and integrating a holistic approach to improving HrQoL in paediatric patients.

Clinical implications

We found our results to be particularly interesting, mainly regarding implications for clinical practice. Unlike sociodemographic and clinical variables – if not subjected to treatment - psychosocial variables are changeable and susceptive to psychotherapeutic intervention, namely Cognitive-Behavioural Therapy. As previously mentioned, the rationale behind this model of intervention is that psychological distress is dependent on cognitions, the beliefs the individual holds regarding certain aspects of their experience, and through therapy individuals learn to re-evaluate their thinking in a more adaptive way, resulting in better emotional and behavioural states (Beck, 2011). Consequently, since our findings suggested that the largest contributor to better HrQoL in children and adolescents with SS were positive height-related beliefs, Cognitive-Behavioural Therapy focused on reframing negative height-related beliefs can prove itself very beneficial to improve HrQoL in this population. As pointed out by Noeker (2009), a child or adolescent with severe short stature in conjunction with adaptive cognitions regarding height may demonstrate better psychological adaptation than one who is less short yet has maladaptive negative height-related beliefs. These results suggest that height itself might not be the problem, but the way the individual perceived their stature and what significance they attributed to it.

To conclude, our last set of results is also of clinical relevance. By identifying the conditions in which clinical variables influence the relationship between psychosocial variables, coping and height-related beliefs, it is possible to determine which participants are at higher risk for poor adaptation and may require priority intervention. Since coping plays a larger role for subjects who are currently short-statured, clinicians and therapists may prioritize teaching adaptive coping strategies to these children and adolescents.

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