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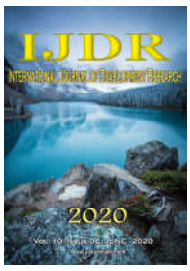

RESEARCH ARTICLE OPEN ACCESS

HEALTH-RELATED QUALITY OF LIFE IN CHILDREN WITH AUTISM SPECTRUM DISORDER AND CHILDREN WITH DOWN SYNDROME

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ABSTRACT

Purpose: The aim of this study was to examine health – related quality of life (HRQoL) in children with autism spectrum disorder (ASD) and children with Down syndrome (DS). **Methods***:* The study was based on measurements in a sample of 206 children with ASD (61), DS (55) and typical development (TD) (90), aged 5-10 years old, after administering anonymous questionnaires to their parents - caregivers. The Pediatric Quality of Life Inventory ™ 4.0 Generic Core Scales – Parent Report (PedsQL™ 4.0) was used to measure health-related quality of life. The one-way analysis of variance (one-way ANOVA) was applied to compare means of the three samples. **Results:** The post-hoc comparisons (Tukey) revealed that the statistically univariate effect was due to differences between the TD group and the other two groups, ASD and DS ($p<0.01$). The TD group scored higher in all comparisons. The ASD group achieved significantly lower scores than their peers with DS in the emotional functioning scale. The post-hoc analysis did not reveal any significant differences between the DS and the ASD group in the physical health, psychosocial health and the total PedsQL summary scores. **Conclusions:** Children with ASD and DS had significantly lower HRQoL compared to a TD population, and this finding was not affected by age**.** Children with ASD demonstrated a significantly lower score in the emotional functioning scale than children with DS and they scored as poorly as children with DS in the physical health scale. It is thus considered necessary to take the physical health scale into account when assessing and designing treatment for children with ASD. Future research study should focus on HRQoL indicators that could serve as a standard diagnostic tool for the development of the therapies and the outcome of assessment findings in ASD and DS.

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INTRODUCTION

Health-related quality of life (HRQoL) is an important measure not only of the physical health of the individuals but also of their mental health, as well as of the outcome of their treatment (Burgess & Gutstein, 2007. Kamp-Becker, Schroder, Remschmidt, & Bachmann, 2010). HRQoL is an approach to measuring health outcomes by evaluating an individual's psychosocial, emotional and physical well-being (Fayers & Machin, 2007). In the pediatric Quality of life (QoL) literature, domains that have been systematically addressed include: physical functioning, emotional functioning, social functioning and school functioning (Bastiaansen, Koot, Ferdinand, & Verhulst, 2004). Each domain can be broken down into indicators that are the actual factors measured. Utilizing QoL indicators as the standard for developing treatments and evaluating outcomes in autism is advantageous (e.g. social functioning can include indicators of the availability of social support, while emotional functioning may include happiness and mental health). Measuring health- related quality of life is very important for children with developmental disorders such as ASD and DS. Most quality of life studies focus on the parents of children with ASD and other disorders or

disabilities, whereas only few examine the quality of life of the children themselves (Kuhlthau, Orlich, Hall, Sikora, Kovacs, Delahaye, et al. 2010). ASD is a neurodevelopmental disorder, a chronic lifelong condition that starts from childhood and affects the outcomes of adulthood, having an impact on the quality of life of individuals with ASD, which in turn is not influenced by age and is lower compared to individuals without autism (Kuhlthau et al., 2010. Van Heijst, & Geurts, 2015). ASD is characterized by difficulties in social and communication development in addition to repetitive behaviors and limited interests and thus creates difficulties in employment and socialization of these individuals. Children with ASD and their parents report significantly worse HRQoL than their peers with typical development in terms of both psychosocial and emotional health (de Vries, Hilde Geurts, 2015. Ikeda, Hinckson, & Krägeloh, 2014. Ten Hoopen, de Nijs, Duvekot, Greaves-Lord , 2020. Wang, & Leslie, 2010). Children with ASD also exhibit greater rates of depression, stress and anxiety than typically developing (TD) children (Gurney, McPheeters, & Davis, 2006. Hill, Berthoz, & Frith, 2004a), (as well as poorer physical health (more sleep issues, gastrointestinal problems and allergies). They also have a worse quality of life than peers with chronic conditions (Kuhlthau et al., 2010) and demonstrate higher rates of attention deficit - hyperactivity disorder (Bastiaansen, et al., 2004. Lee, Harrington, Louie, & Newschaffer, 2008) and psychiatric disorders such as disorganized behavioral disorders, anxiety and emotional disorders (Bastiaansen et al., 2004).

To better understand the HRQoL of people with ASD, further studies on the difference between individuals with ASD and individuals with other chronic physical and psychiatric disorders and / or mental disability are needed (Kose, Erermis, Ozturk, Ozbaran, Demiral, Bildik, et al., 2013). To our knowledge, no HRQoL studies have been performed on the differences between children with ASD and children with Down syndrome (DS) and very few studies have addressed the quality of life of children with DS (Bertoli, Biasini, Calignano, Celani, De Grossi, Digilio, et al., 2011. Van Gameren-Oosterom, Fekkes, Buitendijk, Mohangoo, Bruil, & Van Wouwe, 2011). Children with DS have more emotional and behavioral problems but less anxiety and depression than typically developing children and therefore worse HRQoL than their typical peers (Bertoli et al., 2011. Shields, Leonard, Munteanu, & Bourke, 2018). The purpose of this study was to investigate HRQoL in children with ASD and in children with DS in order to improve the provided services and treatment. We therefore hypothesized that, by means of traditional measures of HRQoL, children with ASD and DS would have poorer overall HRQoL than typically developing children and furthermore that children with ASD would demonstrate worse emotional and social functioning HRQoL scores than children with DS.

MATERIALS AND METHODS

Participants: Caregivers and their children (206) with ASD (61) and DS (55), along with TD children serving as a control group (90), were recruited from kindergartens, primary schools, DS parents' associations, ASD parents' associations as well as from various special treatment and rehabilitation centers for children. The inclusion criteria were children aged between 5 and 10 years old with a diagnosis of ASD, according to the DSM-IV-TR (American Psychiatric Association, 2000) and DS. Children with ASD and DS should have no other developmental disorders such as physical disabilities, epilepsy, etc., while typically developing children shouldn't have been diagnosed with any learning disabilities or chronic diseases. In order to participate in the study, parents needed to speak fluent Greek and give informed consent. Initially 280 questionnaires were handed out, of which 220 (78.6%) were returned. 14 of the answered questionnaires did not meet the inclusion criteria and were thus excluded. Eventually, the responses of 206 participants were taken into account. The study was approved by the National Institute for educational policy (PSE) and information leaflets, together with consent forms, were given to the participants recruited in the study.

Procedures: All study participants were recruited between 2011 and 2012. The Pediatric Quality of Life Inventory ™ 4.0 Generic Core Scales – Parent Report (PedsQL) questionnaire was used for the purpose of the study. Parents who met the inclusion criteria received a package containing an informative letter about the study and its purpose, a demographic questionnaire, the age-appropriate PedsQL questionnaire and a consent form. The questionnaires were filled in anonymously with codes and were returned within one month.

Measures: Demographic variables were collected from a parent - completed questionnaire and included children's age and gender. Measurement of health-related quality of life (HRQoL) was performed by utilization of the Pediatric Quality of Life Inventory ™ 4.0 Generic Core Scales – Parent Report (PedsQL) for ages 5-7 and 8–12. Due to troublesome communication and other related difficulties that are common among children with ASD and DS, the children's HRQoL was assessed using the parent-report version of the PedsQL.

PedsQL: The PedsQL questionnaire (Varni, Seid, & Kurtin, 2001) is a tool for assessing the health-related quality of life of children aged 2-18 years old. It is a 23-item questionnaire which includes four age-appropriate versions and takes approximately 7-10 minutes to complete. The parent proxy-report format assesses the parent's perceptions of the child's QoL. The instructions in each question ask how much of a problem an item has been for the child during the past month. PedsQL has a five-point rating scale and it evaluates four distinct areas of health-related functioning: physical functioning, emotional functioning, social functioning and school functioning. Consequently, the last three scales are merged into a summary score for psychosocial health, while the physical functioning scale gives rise to the physical health summary score. Eventually the total PedsQl score consists of the sum of all the items over the number of items answered on all the scales. The items on the PedsQL questionnaire are converted into a 0 - 100 scale with higher scores indicating better HRQoL. The total PedsQL score, as well as the summary and scale scores, are computed when at least 50% of the items are completed. The parent-report version of the PedsQL exhibits good psychometric properties for measuring HRQoL in healthy populations and in children with chronic diseases and acute health conditions (alpha 0.90- 0.92) (Varni, Burwinkle, Seid, & Skarr, 2003. Varni, Seid, & Kurtin, 2001) as well as in pediatric populations with psychiatric disorders (Bastiaansen, Koot, Bongers, Varni, & Verhulst, 2004. Bastiaansen, Koot, Ferdinand, & Verhulst, 2004). The current study used the Greek version of PedsQL, which accordingly shows good psychometric properties, in view of the fact that

all scales demonstrate good reliability (Cronbach alpha> 0.70). Factor analysis also manifested comparable results to the original version (Gkoltsiou, Dimitrakaki, Tzavara, Papaevangelou, Varni, & Tountas, 2008).

Statistical analysis: Descriptive statistics of baseline characteristics were obtained using Statistical Package for Social Sciences, software (SPSS, version 20.0). We described sample characteristics and presented means and standard errors for PedsQL scales. We compared the ASD sample data to published norms for typically developing children and DS children. Differences between the ASD group and each of the two comparison groups were computed using one-way analysis of variance.

RESULTS

Table 1 summarizes the baseline demographic characteristics of the 206 children. Out of the 61 children with ASD, 25 (41%) were diagnosed with Autistic Disorder, 8 (13.1%) with Asperger's Disorder and 28 (45.9%) with PDD-NOS. The age of the children ranged from 5 to 10 years old. Children with ASD had a mean age of 6.5 years (SD 1.30), children with DS 7.3 years (SD 1.51) and children with TD 7.2 years old (SD 1.36). The ASD group was predominantly male (85.2%) and only 14.8% were female, which is in accordance with the reported demographics for ASD. In the DS group, 60% were male and 40% female. Finally, in regard to TD children, 44.4% were male and 55.6% female. The differences between the groups were x2 = 25.38 *** (see Table 1).

First, we examined possible differences among the three groups across the various PedsQL scales. The one-way analysis revealed statistically significant differences among the three groups in all four domains. The post-hoc comparisons (Tukey) indicated that the statistically univariate effect was due to differences between the typically developing group and the other two groups (see Table 2), with the TD group consistently scoring higher in all four domains. Interestingly, the DS and the ASD group did not differ from each other with regard to the physical functioning, social functioning and school functioning scale. The only comparison that detected a statistically significant difference was the one concerning the emotional functioning scale; as anticipated, the ASD group had significantly lower scores than their peers with DS. Next, two composite scores were calculated, namely the psychosocial health summary score (representing the emotional, social and school functioning scales) and the total PedsQL score (the sum of all items over the number of items answered on all scales). Also included in Table 3 is the physical health summary score which corresponds to the physical functioning score presented in Table 2. Three one-way analyses of variance were conducted to examine possible differences among the three groups of children on the two summary scores of the PedsQL, as well as on the total composite score of the scale (total PedsQL score). In all comparisons, statistically significant differences were found. As expected, the TD group scored higher in all 3 comparisons. The significant differences between the TD group and the other two groups (DS and ASD) were subsequently confirmed in the post-hoc (Tukey) analyses performed. Interestingly, these post-hoc analyses did not reveal any significant differences between the DS and the ASD group. Nevertheless, as shown in Table 3, the ASD group scored lower than the DS group in the psychosocial health summary score and, by extension, in the total PedsQL score, reflecting the often cited lower quality of life that ASD children have in these domains.

Table 1. Demographic characteristics, (age and gender) of the children with Autism Spectrum Disorder (ASD), Down syndrome (DS) and Typical Development (TD)

	Autism Spectrum Disorder (N=61)	Down Syndrome (N=55)	Typical Development (N=90)
Mean age	6.5	7.3	7.2
(SD)	(1.30)	(1.51)	(1.36)
Male	52	33	40
%	85	60	44.4
Female	9	22	50
%	14	40	55.6

Table 2. Mean PedsQL scale scores for children with Autism Spectrum Disorder (ASD), Down syndrome (DS) and Typical Development (TD)

	Autism Spectrum Disorder (N=61)		Down Syndrome (N=55)		Typical Development (N=90)				
Parent- Proxy Report (PedsQL)	M.O	SD	M.O	SD	M.O	SD	F	η^2	*P*
Physical Functioning	74.29	17.61	73.98	17.5	90.90	14.05	27.39	.21	.001
Emotional Functioning	69,02	22,23	77,11	17,86	85,33	14,74	15,01	.13	.001
Social Functioning	54,40	24,83	61,84	18,03	90,28	14,25	76,37	.43	.001
School Functioning	65	20,35	67	15.71	88,22	13,5	47,13	.32	.001

Table 3. Mean PedsQL summary and total scores for children with Autism Spectrum Disorder (ASD), Down Syndrome (DS) and Typical Development (TD)

	Autism Spectrum Disorder (N=61)	Down Syndrome (N=55)	Typical Development (N=90)			
Parent-Proxy Report (PedsQL)	M.O SD	M.O SD	M.O SD	F	η^2	*p*
Physical health	74.29 (17.61)	73.98 (17.5)	90.90 (14.05)	27.39	.21	.001
Psychosocial health	62.81 (18.95)	68.65 (14.18)	87.94 (11.97)	59.22	.37	.001
Total score	65.68 (17.57)	69.98 (14.03)	88.68 (11.49)	56.59	.36	.001

The correlation analysis of HRQol with age showed no statistically significant relationship both in each separate HRQoL category (physical health and psychosocial health) and in the total PedsQL score for all three groups of children (TD r <.17, p> 0.05, ASD r <.08, p> 0.05, DS r <.20, p> 0.05) (see Table 4).

Table 4. Correlation analysis of HRQol with age for children with Autism Spectrum Disorder (ASD), Down Syndrome (DS) and Typical Development (TD)

	Physical health	Psychosocial health	PedsQL Total score	*p*
Autism Spectrum Disorder	.08	.07	.08	0.05
Down Syndrome	.20	.06	.11	0.05
Typical Development	.17	.11	.14	0.05

DISCUSSION

The results of the present study provide support for our initial hypothesis that children with ASD and DS would have poorer HRQoL than TD children. The parents of children with ASD and DS reported HRQoL scores for their children that were poorer than the corresponding scores reported by parents of typically developing children. In fact, significant differences were observed between these two groups in all HRQoL scales (physical, emotional, social and school functioning scales, as well as total HRQoL score). The findings of this study about the poorer HRQoL of children with ASD are similar to those of a previous meta-analysis of ten studies (from 2004 to 2012), which concluded that the observed poorer quality of life was not affected by age (Van Heijst & Geurts, 2015). In our study, the poorer physical health, mental health and overall quality of life of children with ASD, as reported by their parents, is in accordance with the results of previous studies (Bastiaansen, et al., 2004. Kuhlthau et al., 2010. Lee, Harrington, Louie, & Newschaffer, 2008. Limbers, Heffe, & Varni, 2009). ASD is a neurological disorder characterized by irregular social interaction and communication, repetitive behaviors and limited interests, impinging on many areas of the children's development and adversely affecting their functioning. Therefore, compared to TD children, children with ASD are expected to experience significant problems related to psychological, social and emotional health. Deficits in social skills and communication are evident (American Psychiatric Association, 2013). Children with ASD may also have higher rates of depression, stress, and anxiety (Gurney et al., 2006. Hill et al., 2004a). In this study, parents reported that the main problems of their children with ASD involved aspects of the social functioning. Similar results were reported in the study by Kuhlthau et al., (2010). In addition to the social and emotional difficulties, ASD children often face difficulties in school life, learning and academic functioning (Limbers et al., 2009). Moreover, according to the literature review, there are reports of some mild neurological findings related to ASD, such as motor impairment and motor developmental delay (De Bruin, de Nijs, Verheij, Hartman, & Ferdinand, 2007).

Frequently, sleep disorders, gastrointestinal problems and various allergies coexist in ASD children (Allik, Larsson, & Smedje, 2006. Cotton & Richdale, 2006) therefore affecting their physical health. As a result, developmental delays and difficulties in the above mentioned areas (social, educational, psychological, physical and mental) can cause poorer HRQoL in children with ASD. Regarding children with DS, not enough studies have examined their quality of life. In the current study, children with DS also show a lower HRQoL than their TD peers, according to their parents' responses, in all domains and regardless of age. These results are consistent with those of two previous studies (Van Gameren-Oosterom et al., 2011.Shields et al., 2018). Presumably, this is an expected finding since these children have developmental deficits (average developmental age lower than their TD peers), as well as more behavioral and emotional problems. The results of the current study indicate that Down syndrome has a stronger impact on all aspects of emotional functioning and also that DS children experience greater difficulties in social functioning than in other domains, as reported by their parents. Their social functioning is lower than that of TD children and this may be due to their behavioral problems and intellectual disability. The quality of life associated with school functioning also seems to be low and this could be attributed to their intellectual disability and dysfunction. Indeed, the latter is supported by a previous study (Weijerman & de Winter, 2010). The quality of life associated with physical functioning is also shown to be adversely affected and this may be related to the chronic diseases that co-exist in DS children (mainly respiratory diseases, congenital heart disorders, thyroid dysfunctions, etc.), as well as the delay in their motor development.

Our hypothesis in this study, that children with ASD would achieve poorer Qol scores than children with DS, was not confirmed for all scales of HRQoL except for emotional functioning. Given that emotional impairment is a defining characteristic of ASD but not of DS, it is not surprising that children with ASD were found to have lower emotional functioning scores than children with DS. Children with ASD have deficits in the cognitive processing of emotions, both with themselves and with others. They actually face difficulties in both identifying and describing emotions. They are also more frequently depressed than TD children (Hill et al., 2004a), whereas, in a previous study, children with DS demonstrated better scores than TD children in the anxiety/depression scale (Van Gameren-Oosterom et al., 2011]. In addition, children with ASD have more difficulty in recognizing facial expressions compared to children with other developmental disorders, e.g. with schizophrenic disorder, and this poses an additional family burden (Bolt & Poustka, 2003). Similar to children with cognitive disabilities and children with speech disorders, children with ASD exhibit greater difficulty in recognizing expressions and emotions such as sadness, joy, anger, surprise, etc. (Gross, 2004).

Although the group of children with ASD scored lower in all HRQoL scales, there did not appear to be any statistically significant differences in the physical health, psychosocial health and the total PedsQL summary scores, when compared to their peers with DS. Given the hypotonia of the children with DS, as well as their physical condition and the various health problems they usually encounter (respiratory, heart diseases, hypothyroidism, etc.), it was expected that children with ASD would have a better quality of life related to physical health. However, what may be surprising is the fact that children with ASD scored as poorly as children with DS in the physical health scale, especially considering the fact that ASD has not traditionally been thought to have a substantial impact on physical health, while many other chronic diseases of children with DS do. These results reinforce the view of a previous study that the physical health of children with ASD should be taken into consideration (Kuhlthau et al., 2010) based on the finding that their physical health was similar to that of children with chronic diseases. It is therefore necessary to take the physical health scale into account when assessing and designing treatment for children with ASD. Empowering and maintaining the physical health of children with ASD may need to be addressed intensively, in conjunction with the

psycho-emotional health (emotional and social functioning), which is an integral part of the ASD. Comparison of HRQoL across diagnostic groups might help clinicians and families understand their experience with ASD in the context of other developmental disorders. A better understanding of similarities across diagnostic groups may also result in a greater collaboration among advocacy groups for improving HRQoL in children with DS. Despite the advances in early detection, intensive intervention and therapeutic approaches, QoL in children with ASD and DS remains poor. Few studies have utilized specific QoL indicators in order to evaluate treatment outcomes in children with ASD and DS, leaving this area of study largely untapped (Burgess et al., 2007). The present study has several limitations. First, reports of HRQoL are based on parent proxy-report and not on child self-report due to the severe cognitive and communication issues faced by a majority of our study sample; most children would not have been able to reliably self-report. Although we used a validated methodology for children, this does not exclude the possibility of parenthood subjectivity through providing reports on behalf of their children. Second, despite the fact that the sample was selected at random and represented geographical areas across Greece, parental participation in the study was voluntary and the study participants constituted a convenience sample.

Conclusion

The present study explored the health-related quality of life (HRQoL) in children with Autism Spectrum Disorder (ASD) and in children with Down syndrome (DS). Children with ASD and DS had significantly lower HRQoL compared to a group of typically developing children (TD), irrespective of age. When compared to data from children with DS, children with ASD demonstrated a worse HRQoL in the emotional functioning scale, but did not exhibit differing scores neither in the total HRQoL and the psychosocial health score nor in the social functioning, school functioning and physical functioning scales. These results indicate that the physical health of children with ASD should consistently be taken into consideration. Contrary to DS, ASD has not traditionally been thought to have a substantial impact on physical health. It is therefore essential to take physical health into account whenever assessing the quality of life as well as when designing treatments for children with ASD. Knowing which domains of HRQoL are affected in children with ASD and DS can help clinicians focus on particular HRQoL domains during the diagnostic process and to define adequate treatment goals. A future research step must emphasize on HRQoL indicators in order to build up a future assessment and diagnostic tool in an attempt to develop a variety of therapies for ASD and DS children. A plethora of therapies that support HRQoL can contribute to greater happiness and overall well-being for children with ASD and DS in their environment.

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