EVALUATING QUALITY OF LIFE IN PEOPLE WITH DOWN SYNDROME: A LITERATURE REVIEW

Angela Palomba[1], Diego Perez[1,2] and Domenico Tafuri[2]

[1]Don Orione Rehabilitation Centre, Ercolano (NA), Italy
[2]Department of Sport Sciences and Wellness, Parthenope University, Naples, Italy

Review paper

Abstract
There are several suggestions that assessing quality of life (QoL) in people with Down syndrome (DS) could be desirable for clinical, scientific, economic reasons and beyond. The aim of the present work was to make a systematic literature review investigating useful instruments for the assessment of QoL in people with DS and the main results obtained through their application in comparisons with the ones of normal population; moreover, we asked whether it was possible to obtain the outcome measures directly by patients with DS and their reliability in comparison with the caregiver's ones. Our search led to seven articles, assessing QoL in different ways (most of them using scales not yet validated in people with DS), sometimes with contrasting qualitative and quantitative results. One only study used patient's direct point of view, showing good reliability. These findings could be the starting point to build a customized method for assessing QoL in people that could become a reliable tool for clinical practice, not only in experimental protocols.

Key words: *Down syndrome, quality of life, assessment.*

Introduction

Down Syndrome (DS) is the most common genetic cause of intellectual disability, with a prevalence of about 0.8 on 1000 children in the United States [1]. It represents a neurodevelopmental disorder based on the presence of an extra (partial or total) copy of chromosome 21, causing multiple systems involvement and affecting not only mental health but even provoking physical and behavioural disorders. Indeed, it has usually a high prevalence of health-related problems, such as cardiac, gastrointestinal, immunological, respiratory, endocrine, dental, sensory, and orthopaedic issues [2]. However, other aspects may also impact their quality of life (QoL), such as specific cognitive, social, emotional, behavioural, and contextual problems [3].

The World Health Organization (WHO) refers to health-realted QoL (HRQoL) as "individuals' perceptions of their position in life in the context of the culture and value systems in which they live in relation to goals, expectations, standards, and concerns" [4]. This concept evolved from quality of life, which is described as a state of well-being or life satisfaction from the individual perspective. HRQoL focuses on physical, emotional, and social functions and on the individual perception of ability and health. It is often used in the assessment of chronic diseases [5], as an outcome measure of medical and surgical interventions [5] and considered in the economic burden of health problems [6].An invited comment [7] underlines the need for determining an appropriate screening tool to assess the effect of new available therapies on quality of life in people with DS. As there are no validated quality of life instruments for DS, authors suggest that research should focus on developing instruments that can evaluate changes in quality of life not only in therapeutic trials. A recent review investigates the relationship between QoL and the exercise intervention in patients with DS [8]. The authors selected 19 papers in the period between 1987 and 2016. The results show a positive impact of exercise intervention on daily life activities and participation for people with DS. However, the authors underline the need of reliable outcome measures related to activity and participation. Indeed, they can be useful to demonstrate the functional impact of an intervention, as well as demonstrating the impact on quality of life.

Another recent review [9] investigates the relation between perspectives of adolescents with DS and their quality of life. Starting from 596 works, they selected two papers which included the perception of adolescents with DS. The analysis underlines how for adolescents with DS, social participation in their communities, friendships and family interactions and functional independence were important. However, this review included the analysis of well-being and quality of life but excluded the assessment of HRQoL. In this context, starting from a systematic literature review focusing on the original articles published in the last ten years, the present study aims to investigate: (i) which instrument(s) could be used for the assessment of HRQoL in DS; (ii) the main results obtained and the comparisons with the normal population; (iii) the reliability of the outcome measures directly obtained by patients with DS in comparison with caregiver's ones.

Methods

We searched two different online databases: PubMed (PM) and Web of Science (WoS).

The selection of articles was made through "Quality of Life" AND "Down Syndrome" [MESH] for PM database and through "Quality of Life" AND "Down Syndrome" for WoS database.

Papers Selection Criteria

The analysis of the two databases was made through the following criteria: (i) articles published between 2010 and 2019, in order to overview the most recent evidence about it; (ii) original articles, excluding reviews, commentary and proceeding papers; (iii) only full paper English written articles.After the first screening, two authors reviewed independently the founded articles with their title and abstract, in order to check the matching with the research aim. They selected papers dealing with QoL analysis in people with DS and combined the articles obtained by the two databases. Then, they checked the long paper of every of these articles excluding: (i) articles dealing with people with DS and other severe comorbidity (potentially influencing results); (ii) articles dealing with intellectual disability including DS in which results about participants with DS were not presented and analyzed separately; (iii) articles in which QoL is used as an outcome measure for clinical treatments; (iv) articles assessing only parents' QoL; (v) articles in which QoL is assessed without validated scales (for example using unstructured interviews).

Data extraction

From the selected papers the following data are extracted: (i) year of publication; (ii) participant characteristics (number, nationality, age, sex); (iii) exclusion criteria used for selecting participants; (iv) caregiver's characteristics; (v) methods for QoL assessment; (vi) rater(s); (vii) aim; (viii) results.

Results and discussion

The review process is shown in the flow-chart in Figure 1.

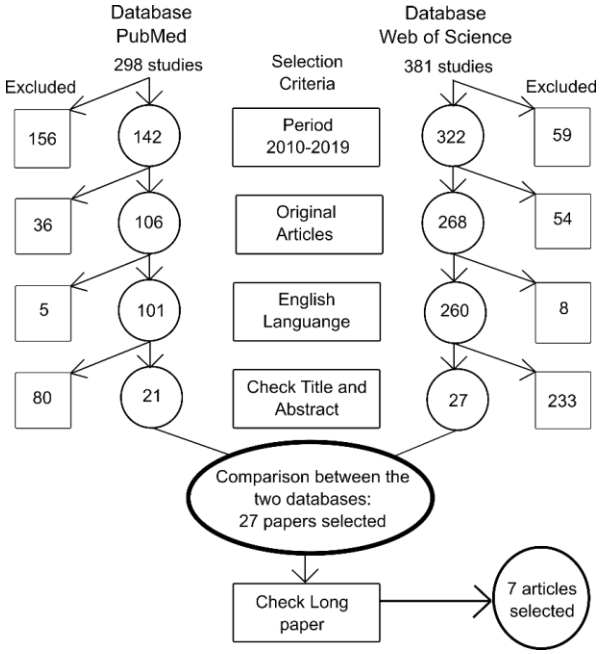

Figure 1. Flow chart representing the literature review process.

After applying the paper selection criteria mentioned before, we checked 27 long papers and excluded: 1 article dealing with people with DS and other severe comorbidity (influencing results); 2 articles dealing with intellectual disability including DS, in which it was not possible to extract results about participants with DS; 2 articles in which QoL is used as an outcome measure for clinical treatments; 11 articles assessing only parents' QoL; 4 articles in which QoL is assessed without validated scales. The selected articles were 7 and their main characteristics are shown in Table 1.

As we can see from Table 1, available studies cover most of the continents, but no study from Africa and Asia fulfilled our search. Number of total participants ranged from 60 to 405 and, considering that only three studies had less than 150 patients with a total number of involved DS people of 1280, it can be considered suitable. Male patient represented the 54.1% of the total considered patients. Most of the studies focused on children and adolescents, with only one study [11] focusing on adults and two other ones [13, 15] considering young people (until 30 years of age); we have to consider that the last two literature reviews about QoL in people with DS [8, 9] contained just one study considering people with more than 18 years. Exclusion criteria were not always clarified: three studies excluded people with comorbidities and one people who were not able to directly answer to the questionnaire. Even caregivers' characteristics were not always specified, some studies reported on their age and sex, showing that they were often females and they often had more than 45 years of age.

Table 1. Selected articles main characteristics (M: males; F: females; n.a.: not available).

Author and year	Nation(s) of participants	Total DS Participants Number (Number of male M)	Age range (mean ± SD)	Exclusion criteria	Caregivers' characteristics
van Gameren-Oosterom et al., 2011 [10]	Netherlands	325 (169 M)	7.8-9.1 years (8.14 ± 0.15)	n.a.	n.a.
Graves et al., 2016 [11]	U.S.A.	60 (30 M)	18–61 years (30.8 ± 9.6)	Inability to answer the questionnaire	44–79 years of age (60.6 ± 7.18), 54F 6M
Xanthopoulos et al. 2017 [12]	U.S.A.	150 (66 M)	10-20 years (14.6 ± 3.3)	Comorbidity	126F 21M
Rofail et al., 2017 [13]	Argentina / France / Spain / Italy / Canada / UK / USA	90 (49 M)	12-30 years (2 groups: 14.5 ± 1.6; 22.7 ± 3.4)	Comorbidity	n.a.
Shields et al, 2018 [14]	Australia	75 (43 M)	5-18 years (13.17 ± 7.67)	Comorbidity	n.a.
Haddad et al., 2018 [15]	Australia	175 (97 M)	16-31 years	n.a.	7.6% mothers: 38–45 years, 39.8% mothers: 46–55 years, 52.6% mothers: > 56 years. 44.0% fathers: 42–55 years, 40.1% fathers: 56–65 years, 15.9% fathers: > 66 years.
Gomez et al., 2019 [16]	Spain	405 (238 M)	4-21 years (12.1 ± 4.7)	n.a.	21-61 years of age (45.3 ± 6.8)

Table 2 shows details of the selected studies about their methodologies, raters, aims and main results.

Table 2. Detailed information of the selected studies, with method for QoL assessment, rater, aim and main results.

Author and year	Method(s) for QoL assessment	Rater(s)	Aim(s)	Main results
van Gameren-Oosterom et al., 2011 [10]	TNO-AZL Children's Quality of Life questionnaire (TACQOL)	caregiver	To investigate the developmental skills, problem behaviour, and Health-Related Quality of Life (HRQoL) in Dutch children with DS, compared to normative data from the general population.	Mean scores of the TACQOL were significantly worse in people with DS, with very large effects on autonomy, cognitive functioning and gross motor skills and a small effect on social functioning scales.
Graves et al., 2016 [11]	Short Form-12 version 2 (SF-12v2)	person with DS and caregiver	To provide preliminary psychometric properties of the SF-12v2 with adults with DS, and to examine the agreement between self- and caregiver-reported HRQoL of adults with DS.	All HRQoL scores were better than means of the SF-12v2 normative sample and fell within one standard deviation. Self- and caregiver-reported HRQoL scales were similar, with the exception of role physical scores, which were lower when obtained by caregiver-report.
Xanthopoulos et al. 2017 [12]	Pediatric Quality of Life Questionnaire (PedsQL); Impact of Weight on Quality of Life - Kids (IWQOL-Kids)	caregiver	To describe caregiver-reported quality of life in youth with Down syndrome and to examine the role of obesity on QoL.	Caregiver-reported total QoL, physical health, psychosocial health, social and school functioning summary scores were all lower in the DS group compared with the non-DS controls. Emotional functioning did not differ between DS and non-DS groups. No differences were reported between youth with DS with and without obesity. On the Impact of Weight on Quality of Life – Kids, caregivers of youth with DS reported greater body esteem and social life scores than caregivers of non-DS youth. Caregivers of youth with obesity, regardless of DS status, reported significantly lower weight-specific QoL scores than caregivers of youth without obesity.
Rofail et al., 2017 [13]	KIDSCREEN-27 questionnaire	caregiver	To assess of HRQoL for individuals with DS.	HRQoL domain scores were found to be similar to those in the KIDSCREEN-27 European normative

				group data set on the physical well-being, psychological well-being, autonomy and parent relations domains. Compared with the normative data set, the adolescent participants with DS in the current study were found to have worse scores on the social support and peers domain and better scores than the normative group on the school environment domain.
Shields et al, 2018 [14]	KIDSCREEN-27 questionnaire	caregiver	To describe HRQoL of Australian children and adolescents with DS and compare it with normal reference data.	Total group mean scores for psychological well-being, autonomy and parent relation, and school environment dimensions were within normal threshold values, whereas mean scores for physical well-being, social support and peers domains were lower. Adolescents (13–18 years) with DS had lower scores on all dimensions than children (5–12 years) with DS.
Haddad et al., 2018 [15]	KIDSCREEN-27 questionnaire; KIDSCREEN-10 questionnaire	caregiver	To investigate from caregivers the factors that influence the QoL of young people with DS	Global impact of illness as well as impact of mental health and bowel conditions were all negatively associated with the young person's quality of life. Young people who had three or more friends had better quality of life than those with no friends. Scores were lower (reflecting poor quality of life) in individuals who had more behavioural problems.
Gómez et al., 2019 [16]	field-test version of the KidsLife scale	caregiver or care-staff	To identify and select the most reliable QoL items for children and youth with DS and to adapt the KidsLife scale for this population (KidsLife-Down)	The new KidsLife-Down scale comprises the same number of items as the original KidsLife scale [22], but the actual pool of items varied by 30%. The domains that differed most from the original scale were personal development, interpersonal relationships, and self-determination; the most similar was rights. The KidsLife-Down scale showed good psychometric properties based on the internal structure of the scale, and adequate convergent and discriminant validity in this population.

Table 2 underlines that most of the studies assessed QoL asking the caregiver/care-staff point of view, only one of them [11] asked people with DS directly. Three studies [13,14,15] used the KIDSCREEN-27 questionnaire (or its short form) and one [10] the TNO-AZL Children's Quality of Life questionnaire (TACQOL), valid measures of HRQoL in able children and adolescents [17,18], not already validated in the DS patients. Graves et al. [11] used the Short Form-12 version 2 (SF-12v2), a valid instrument for able bodied adults [19], never used in DS patients before. While, Xanthopoulos et al. [12] apply the Pediatric Quality of Life Questionnaire (PedsQL), a validated scale for children with intellectual disability [21], but not tested on only DS people; moreover they used the Impact of Weight on Quality of Life - Kids (IWQOL-Kids), approved for able kids and adolescents [21]. Gómez et al. [16] validated a specific scale for assessing QoL in people with DS, starting from a field-test version of the KidsLife scale, a validated scale in people with intellectual disability [22]. Most of the studies compared DS people data with normal reference data of the used scale, only the [12] had a control group, matched to the experimental one. About the achieved results, there are important differences between studies. For studies aiming at measuring QoL in people with DS and comparing scores with the ones of normal population, most of them showed worse QoL levels in DS subjects. In particular, [10] found major impact on autonomy, cognitive and gross motor functioning; physical health, psychosocial health, social and school functioning summary scores influenced negatively total QoL scores in [12]; in [13,14] DS group had lower scores for social support and peers domains, even physical well-being in the only [14], while higher for school environment domain were found in [13]. The only study with better results in QoL scores in DS population was [11], also showing similar results for self and caregiver reported scores, apart from role physical score. In a deeper view, [12] found caregivers of youth with DS reported greater Body Esteem and Social Life scores, while caregivers of youth with obesity, regardless of DS status, reported significantly lower weight-specific QoL scores. Moreover, [14] reported that adolescents with DS had lower scores on all dimensions than children with DS. As for the studies focusing on the factors mainly influencing QoL in people with DS, [15] found that global impact of illness, the impact

of mental health and bowel conditions, having no or less than three friends and behavioural problems were the most important factors. In the most recent work [16], a validated questionnaire for QoL assessment in people with intellectual disability was adapted and validated for DS patients changing a higher number of items in the fields of personal development, interpersonal relationships and self-determination. An extremely detailed statistical process for validation is presented, but QoL data for DS people measured with the two different questionnaires are not reported.

Conclusion

There is growing interest in measuring QoL in people with DS, not only as a screening measure, but even for using it as an outcome for multidisciplinary therapies and for addressing economic resources in the most relevant field for individual QoL. The available results show a variable range of findings, due to differences in the used assessing method (often not validated for people with DS) and in the population screened.

Further investigation is needed in order to achieve the best customized method for assessing QoL in people with DS and to spread it worldwide, so that it could become a reliable tool for clinical practice, not only in experimental protocols. Another important achievement could be assessing DS people QoL directly from patients' point of view, starting from the promising results of the only work addressing them as questionnaire audience.

References

Sherman, S. L., Allen, E. G., Bean, L. H., & Freeman, S. B. (2007). Epidemiology of Down syndrome. *Mental retardation and developmental disabilities research reviews*, 13(3), 221-227.

Bittles, A. H., Bower, C., Hussain, R., & Glasson, E. J. (2007). The four ages of Down syndrome. *European journal of public health*, 17(2), 221-225.

Nadel, L. (1999). *Down syndrome in cognitive neuroscience perspective. Neurodevelopmental disorders*, 197-221.

Group, T. W. (1998). The World Health Organization quality of life assessment (WHOQOL): development and general psychometric properties. *Social science & medicine*, 46(12), 1569-1585.

Draper, P., & Thompson, D. R. (2001). The quality of life-a concept for research and practice. *NT Research*, 6(3), 648-657.

Brown, R. I., MacAdam–Crisp, J., Wang, M., & Iarocci, G. (2006). Family quality of life when there is a child with a developmental disability. *Journal of Policy and Practice in Intellectual Disabilities*, 3(4), 238-245.

Goodman, M. J., & Brixner, D. I. (2013). New therapies for treating Down syndrome require quality of life measurement. American *journal of medical genetics Part A*, 161(4), 639-641.

Hardee, J. P., & Fetters, L. (2017). The effect of exercise intervention on daily life activities and social participation in individuals with Down syndrome: a systematic review. *Research in developmental disabilities*, 62, 81-103.

Sheridan, C., O'Malley-Keighran, M. P., & Carroll, C. (2019). What are the perspectives of adolescents with Down syndrome about their quality of life? A scoping review. *British Journal of Learning Disabilities*.

van Gameren-Oosterom, H. B., Fekkes, M., Buitendijk, S. E., Mohangoo, A. D., Bruil, J., & Van Wouwe, J. P. (2011). Development, problem behavior, and quality of life in a population based sample of eight-year-old children with Down syndrome. *PloS one*, 6(7).

Graves, R.J., Graff, J.C., Esbensen, A.J., Hathaway, D.K., Wan, J.Y., & Wicks, M.N. (2016). Measuring health-related quality of life of adults with Down syndrome. *American journal on intellectual and developmental disabilities*, 121(4), 312-326.

Xanthopoulos, M.S., Walega, R., Xiao, R., Prasad, D., Pipan, M.M., Zemel, B.S., ... & Kelly, A. (2017). Caregiver-reported quality of life in youth with Down syndrome. *The Journal of pediatrics*, 189, 98-104.

Rofail, D., Froggatt, D., de la Torre, R., Edgin, J., Kishnani, P., Touraine, R., ... & D'Ardhuy, X. L. (2017). Health-related quality of life in individuals with Down syndrome: Results from a non-interventional longitudinal multi-national study. *Advances in therapy*, 34(8), 2058-2069.

Shields, N., Leonard, H., Munteanu, S., Bourke, J., Lim, P., Taylor, N. F., & Downs, J. (2018). Parent-reported health-related quality of life of children with Down syndrome: a descriptive study. Developmental Medicine & Child Neurology, 60(4), 402-408.

Haddad, F., Bourke, J., Wong, K., & Leonard, H. (2018). An investigation of the determinants of quality of life in adolescents and young adults with Down syndrome. *PloS one*, 13(6).

Gómez, L. E., Verdugo, M. A., Rodríguez, M., Morán, L., Arias, V. B., & Monsalve, A. (2020). Adapting a Measure of Quality of Life to Children with Down Syndrome for the Development of Evidence-based Interventions. *Psychosocial Intervention*, 29(1), 39-48.

Ravens-Sieberer, U., Auquier, P., Erhart, M., Gosch, A., Rajmil, L., Bruil, J., ... & Mazur, J. (2007). The KIDSCREEN-27 quality of life measure for children and adolescents: psychometric results from a cross-cultural survey in 13 European countries. *Quality of Life Research*, 16(8), 1347-1356.

Vogels, T., Verrips, G. H. W., Verloove-Vanhorick, S. P., Fekkes, M., Kamphuis, R. P., Koopman, H. M., ... & Wit, J. M. (1998). Measuring health-related quality of life in children: the development of the TACQOL parent form. *Quality of life research*, 7(5), 457-465.

Tan, M.L., Wee, H.L., Salim, A., Lee, J., Ma, S., Heng, D., ... & Thumboo, J. (2016). Validity of a revised Short Form-12 Health survey version 2 in different ethnic populations. *Ann Acad Med Singapore*, 45(6), 228-236.

Viecili, M. A., & Weiss, J. A. (2015). Reliability and validity of the Pediatric Quality of Life Inventory with individuals with intellectual and *developmental disabilities. American journal on intellectual and developmental disabilities*, 120(4), 289-301.

Kolotkin, R. L., Zeller, M., Modi, A. C., Samsa, G. P., Quinlan, N. P., Yanovski, J. A., ... & Roehrig, H. R. (2006). Assessing weight-related quality of life in adolescents. *Obesity*, 14(3), 448-457.

Gómez, L. E., Alcedo, M. Á., Arias, B., Fontanil, Y., Arias, V. B., Monsalve, A., & Verdugo, M. Á. (2016). A new scale for the measurement of quality of life in children with intellectual disability. *Research in Developmental disabilities*, 53, 399-410.

Received: March 3, 2019
Accepted: March 18, 2019
Correspondence to:
Angela Palomba
Don Orione Rehabilitation Centre, Ercolano (NA), Italy
E-mail: angelapalomba0@gmail.com