



# Youth with hearing loss: Emotional and behavioral problems and quality of life

Kristin Romvig Overgaard<sup>a,c,\*</sup>, Beate Oerbeck<sup>a</sup>, Karine Wagner<sup>b</sup>, Svein Friis<sup>a,c</sup>, Beate Øhre<sup>b</sup>, Pål Zeiner<sup>a,c</sup>

<sup>a</sup> Oslo University Hospital, Division of Mental Health and Addiction, Department of Research and Innovation, Norway

<sup>b</sup> Oslo University Hospital, Division of Mental Health and Addiction, Norwegian National Unit for Hearing Impairment and Mental Health, Norway

<sup>c</sup> University of Oslo, Institute of Clinical Medicine, Norway

## ARTICLE INFO

### Keywords:

Deaf  
Hard of hearing  
Child  
Adolescent  
Strengths and difficulties questionnaire  
Inventory of life quality in children and adolescents

## ABSTRACT

**Objectives:** To compare parent- and self-reported emotional and behavioral problems and quality of life (QoL) among youth with hearing loss (HL) to norms, and to investigate possible associations between emotional and behavioral problems and QoL among youth with HL.

**Methods:** We used the Strengths and Difficulties questionnaire (SDQ) and the Inventory of Life Quality in Children and Adolescents (ILC) to measure emotional and behavioral problems and QoL in youth with HL ( $n = 317$ , ages 6–18), where 78% had bilateral HL, 22% unilateral HL, 16% had cochlear implants, and 59% conventional hearing aids.

**Results:** The youth with HL had significantly more parent-reported (but not self-reported) emotional and behavioral problems and poorer parent- and self-reported QoL than hearing youth. SDQ and ILC total scores were significantly correlated ( $-0.47$  to  $-0.63$ ). **Conclusion** Emotional and behavioral problems and poor QoL appear closely related in youth with HL, suggesting that attending to these problems may improve QoL.

## 1. Introduction

### 1.1. Emotional and behavioral problems

Emotional and behavioral problems occur more frequently among youth with hearing loss (HL) than among hearing youth [1,2], about twice as frequent according to one review [3]. The Strengths and Difficulties Questionnaire (SDQ) is often used to measure emotional and behavioral problems in youth with HL [4]. SDQ consists of five five-item subscales (each ranging 0–10), where four problem subscales (Emotional problems, Conduct problems, Hyperactivity/Inattention, Peer problems) may be summarized into a total problem score [5]. A study including youth with HL aged 4–16 years ( $n = 233$ , 83% with cochlear implant (CI)), found substantially higher parent mean SDQ problem subscale scores among these youth compared to parent scores of 10–12-year-old community controls (mean total scores of 11.20 and 5.65, respectively) [6]. That study reported a relatively high mean parent total SDQ score compared to other studies of youth with HL using the SDQ, with total scores varying between 5.41 and 11.47 [6–16].

Among them, the lowest parent-reported SDQ total score (5.41) was found in a Swedish study of youth with CI ( $n = 22$ ), also reporting significantly higher self-reported SDQ total scores (11.55) [7]. The authors concluded that the parents underestimated the emotional and behavioral problems in their youth.

With regard to sex, parents rated boys ( $n = 120$ ) with significantly more problems on the SDQ Hyperactivity/Inattention subscale compared to girls ( $n = 93$ ) [15], resulting in a corresponding sex difference on the SDQ total score ( $p = .05$ ) [15], in line with other studies [1,10,12]. A pilot study reported significantly higher self-reported SDQ total scores in girls with HL enrolled in Child and Adolescent Mental Health Service compared to controls, but the study was limited by few participants (5 boys and 15 girls with HL) [17]. However, significant sex differences were not found on parent-reported SDQ scores in a Danish study of children with HL ( $n = 233$ ) [6], by self-reported scores from 45 adolescents (71% girls) [18], or in a longitudinal study of adolescents ( $n = 114$ ) [19].

\* Corresponding author. P.O. Box 4959, Nydalen, N-0424, Oslo, Norway.

E-mail address: [Kristin.romvig.overgaard@ous-hf.no](mailto:Kristin.romvig.overgaard@ous-hf.no) (K.R. Overgaard).

<https://doi.org/10.1016/j.ijporl.2021.110718>

Received 6 November 2020; Received in revised form 8 March 2021; Accepted 8 April 2021

Available online 19 April 2021

0165-5876/© 2021 Elsevier B.V. All rights reserved.

## 1.2. Quality of life

A complement to the assessment of emotional and behavioral problems is quantifying the perception of quality of life (QoL). Unlike the problem criteria, as rated by SDQ, QoL consists of various components of well-being and functionality from the subjective perspective of the individual raters. In addition to a total score, measures of QoL most often include scores on different subdomains (e.g., at school, at home, with peers, when alone, physical- and mental health). A review stated that poorer QoL is generally reported in youth with HL compared to their hearing peers, although the extent of these differences varied between studies (from no to small differences), and the used QoL measures [20]. A small but significant group difference has been replicated from self-reports (age 7–17 years) in a Finnish- [21], and a Turkish study [22] as well as in a Norwegian study of children with CI only, (age 5–12, self and parent-report) [23,24]. For youth with HL, the importance of poor QoL in the social- and school subdomains, areas considered to be crucial for development and learning in children, was underlined both in the review [20], in a study of children with CI [23,24], and in a longitudinal study of preschoolers with HL [25]. However, one study found that the self-reported QoL scores among youth with HL (aged 6–18 years;  $n = 212$ ) were similar, and even somewhat better on some subdomains, compared to the scores from a large sample of hearing youth [26], although the authors noted that selection biases of the recruited youth with HL may be responsible for this result.

The systematic review of QoL in youth with HL did not investigate sex differences [20], probably because studies seldom present results separately for boys and girls. However, one study of self-reported QoL noted that there were no sex differences [26], while in the pilot study on youth with HL in Child and Adolescent Mental Health Service ( $n = 20$ ), girls rated themselves with poorer QoL than boys [17].

## 1.3. Combined assessments of emotional and behavioral problems and QoL

In hearing youth ( $n = 344$ ), a significant but weak correlation ( $<0.34$ ) was found between self-reported emotional and behavioral problems (SDQ) and a self-reported QoL measure [27]. A longitudinal study ( $n = 840$ ) concluded that worsening of emotional and behavioral problems was strongly associated with a decrease in QoL, when the hearing youth were reassessed after three years [28].

In youth with HL, a combined consideration of emotional and behavioral problems and QoL from multiple informants was first presented in an Austrian sample ( $n = 99$ , aged 6–16 years). Using the SDQ, the study reported significantly more emotional and behavioral problems among the youth with HL compared to a German sample of hearing youth (according to parents) [14]. Using the generic Inventory of Life Quality in Children and Adolescents (ILC) [29], agreement between the QoL ratings from parents and their youth was generally low, with significant correlations only on the school- and family-subcales. The authors concluded that the parents appeared unaware of their children's poor life-quality. Also, the parent-rated SDQ was not found to be significantly associated with the self-reported ILC. Unfortunately, self-reported SDQ was not included in that study, therefore it is still open whether self-reported emotional and behavioral problems and QoL are significantly correlated in youth with HL. Furthermore, the authors acknowledged having too small a sample-size to make meaningful group comparisons, and by being overrepresented on participants with severe and profound HL [14]. The above-mentioned pilot study with youth enrolled in Child and Adolescent Mental Health Service, found similar QoL in youth with and without HL, but both groups in Child and Adolescent Mental Health Service had poorer QoL than normative controls [17]. This finding could suggest that QoL is more influenced by emotional and behavioral problems, than the HL per se, thus supporting correlating the two measures rated by parents and youth.

The literature reviewed above shows a striking variability in study

design, participants and QoL measures. Also, there is an overweight of small studies with narrow inclusion criteria (e.g. only profound HL, only children with CI etc.). Concerning bilateral and unilateral HL, studies comparing differences in emotional and behavioral problems and QoL are lacking, although one study reported significantly more school related behavioral problems in children with unilateral HL compared to their hearing siblings [30]. Despite some evidence that poor QoL may be associated with emotional and behavioral problems in youth with HL [14,17], this has not been directly investigated in this population.

## 1.4. The present study

In the present study, we aimed to investigate emotional and behavioral problems and QoL in a large sample of youth with HL, as rated by both parents and youth, by comparing them to Norwegian population samples. We extended previous research on youth with HL by investigating 1) sex differences in emotional and behavioral problems and QoL, 2) associations between emotional and behavioral problems and QoL from two raters, and 3) whether there are differences in emotional and behavioral problems and QoL between youth with bilateral and unilateral HL, and between youth with CI, conventional hearing aid or no device.

## 2. Materials and method

### 2.1. Participants

In the present study, a total of 317 parents responded to questionnaires about their youth (mean age 11.5 years, standard deviation (SD) = 3.7; age range 6–18 years), where 199 were children ( $\leq 12$  years old), and 118 adolescents ( $\geq 13$  years old). Self-report questionnaires were distributed to the adolescents, and 88% ( $n = 104$ ) of those with parent questionnaires responded (mean age 15.9 years (SD = 1.3)). In addition, 17 adolescents responded to the self-report questionnaires, but did not have parent responders, and were excluded from the present study. Fifty-four percent ( $n = 170$ ) of the participants were recruited through twelve Norwegian audiology departments, 35% ( $n = 112$ ) from two user-organizations with members from all over Norway, and 11% ( $n = 35$ ) from three schools for youth with HL located around the Norwegian capital (Oslo). Questionnaires were sent to parents of youth with HL, and self-report questionnaires to their adolescents. In total, the response rate to the parent- and adolescent self-report questionnaires were 22% (317/1449) and 17% (104 + 17/696), respectively. As only data on participants was collected, a comparison of participants and non-participants was not possible.

### 2.2. Measures

#### 2.2.1. Background measures

Parents reported whether they were living together or not, whether there was HL in the family, and maternal/paternal education level as “finished high school or less”; “college or university, < 4 years”, and “college or university,  $\geq 4$  years”. Parents also reported child age, sex, whether the HL was bilateral or unilateral, hearing device at present (CI, conventional hearing aid or none), whether the child was enrolled in ordinary school or not, preferred language (spoken, sign) and whether the child was taught sign language or not. Also, parents responded to a question about child developmental “Are you concerned about your child's development at present?” (yes/no).

Background characteristics are presented in Table 1. Among those with parent questionnaires, 51% were boys ( $n = 161$ ), while boys comprised 41% of the self-reports ( $n = 43$ ).

#### 2.2.2. Strengths and Difficulties Questionnaire (SDQ)

We used the Norwegian versions of parent- and self-reported SDQ [5], consisting of 25 items rated on a three-point Likert scale (not true,

**Table 1**  
Characteristics of the participating youth (n = 317).

	n/N (%)
Sex, boys	161/315 (51)
Age group ≤ 12 years	199/317 (63)
Parents living together, yes	232/311 (75)
Maternal; paternal education	
High school	94/315 (30); 146/312 (47)
College/University < 4 years	113/315 (36); 82/312 (26)
College/University ≥ 4 years	108/315 (34); 84/312 (27)
Hearing loss in the family, yes	130/316 (41)
Enrolled in ordinary school	271/316 (86)
Spoken language preferred, yes	277/304 (91)
Taught sign language, yes	99/315 (31)
Bilateral; unilateral hearing loss	246/317 (78); 71/317 (22)
Cochlear implant; Conventional hearing aid; no hearing device	51/317 (16); 188/317 (59); 78/317 (25)
Concern about child development at present, yes	108/314 (34)

somewhat true and certainly true; range 0–2). There are five SDQ subscales (each with five items) on Emotional problems, Conduct problems, Hyperactivity/Inattention, Peer problems and Prosocial behavior. The first four are summarized into a total problem score. The psychometric properties of the SDQ have generally been found to be strong with good capacity to discriminate problems from normative behavior among hearing youth [5,31–33]. In samples of youth with HL, the SDQ five-factor structure was found overall superior to others [6,15]. Several population studies report parent SDQ scores for hearing Norwegian youths, with only minor age differences [34]. For comparison of parent scores in the present study with normative data, we chose a large population study of hearing Norwegian youth (11–13 years, n = 5285), reporting a mean SDQ total score of 5.10 (SD = 4.82) [35]. Another large study provided comparison data for self-reported scores (age 10–19, n = 29,631), reporting a mean SDQ total score of 10.70 (SD = 5.50) [36]. In the present study, Cronbach's alphas for the SDQ total scores were 0.81 for the parent-reported version and 0.78 for the self-report.

### 2.2.3. Inventory of life quality (ILC)

The Norwegian version of the generic Inventory of Life Quality in Children and Adolescents (ILC) was used [29,37]. ILC consists of seven items. Six items address subjective well-being at school, in the family, with peers, when alone, and perception of physical and mental health, and the seventh is a global life quality item. Each item is rated on a 1–5 scale (1 = very good through 3 = mixed, to 5 = very bad). A review from 2013 on the Norwegian ILC version concluded that although there is limited documentation for the psychometric properties of the Norwegian ILC, the four published studies up until 2013 were of good quality, including satisfactory norms and measures of validity and reliability in samples from the general population [38].

The present study report two ILC scores:

- I. The ILC Life Quality total score (LQ<sub>0-28</sub>) calculated as a sum of the seven single items and transformed so that the scores range from 0 to 28, where a value of zero indicates very low QoL and 28 very high QoL. A mean LQ<sub>0-28</sub> score of 22.59 (SD = 3.88) was reported by hearing Norwegian youth aged 8–16 years (n = 1987), while the mean parental score was 24.42 (SD = 3.15) (n = 2563) [37]. The Norwegian norms extend only up to age 16 years, and shows a tendency of poorer QoL with age [37]. Furthermore, youth aged 10–16 years self-reported poorer QoL with age [39]. We therefore investigated whether age at assessment correlated with QoL scores but found no significant age-related differences in the present study (results not shown).
- II. Mean ILC subscale scores, using the 1–5 ratings on the seven subscales (mean subscale norms are not provided in the Norwegian manual).

Cronbach's alphas for the ILC total scores (LQ<sub>0-28</sub>) were 0.85 for the parent-reported version and 0.84 for the self-report.

### 2.3. Ethical approval

Written informed consent was provided by the parents and youth (from age 11 years). The Regional Committee for Medical and Health Research Ethics approved the study (2014/2356).

### 2.4. Data analysis

Statistical analyses were performed using the Statistical Package for the Social Science (SPSS, version 26). Descriptive statistics using mean/standard deviation (SD) or number/percentage of participants are presented for the parent- and adolescent self-report SDQ and ILC, for all participants and separately for boys and girls. Internal consistencies were analyzed using Cronbach's alpha, and differences between means of continuous variables were measured by independent sample *t*-tests, and analyses of variance. The level of significance was defined as  $p < .05$ . We used free statistical calculators to compare our sample with samples of hearing Norwegian youth, specifically independent *t*-tests and estimations of effect sizes (Cohens *d*). A guideline for interpreting *d*-values: 0.20 = small, 0.50 medium, and >0.80 large effects [40]. Intercorrelations between the SDQ total scores and the ILC QoL scores (LQ<sub>0-28</sub>) were calculated using the Pearson coefficient.

## 3. Results

### 3.1. Emotional and behavioral problems

Among youth with HL (age range 6–18 years), the mean parent SDQ total score was 7.16 (SD = 5.40), a significantly higher level of problems than for hearing Norwegian youth with a mean SDQ total score of 5.10 (SD = 4.82), a difference of small to medium effect size ( $d = 0.42$ ). The Peer problem subscale explained much of this difference in total scores,

**Table 2**  
Mean SDQ scores for all participants and separately for boys and girls.

SDQ	All (n = 317)	Boys (n = 160)	Girls (n = 154)	<i>t</i>	<i>p</i>
<b>PARENT-REPORTED</b>					
	Mean (SD)	Mean (SD)	Mean (SD)		
Emotional problems	1.59 (1.77)	1.48 (1.81)	1.72 (1.73)	1.18	.24
Conduct problems	0.87 (1.19)	1.01 (1.27)	0.74 (1.10)	-1.98	.05
Hyperactivity/Inattention	2.63 (2.34)	2.93 (2.41)	2.32 (2.24)	-2.30	.02
Peer problems	2.04 (2.09)	2.40 (2.16)	1.68 (1.95)	-3.11	.002
Prosocial behavior	8.15 (1.93)	7.85 (2.10)	8.44 (1.69)	2.76	.006
Total score	7.16 (5.40)	7.81 (5.72)	6.52 (4.97)	-2.13	.03
<b>SELF-REPORTED</b>					
	All (n = 104)	Boys (n = 43)	Girls (n = 61)		
Emotional problems	3.47 (2.72)	2.58 (2.29)	4.10 (2.83)	3.03	.003
Conduct problems	1.31 (1.37)	1.23 (1.27)	1.37 (1.44)	.50	.62
Hyperactivity/Inattention	3.84 (2.17)	3.93 (1.89)	3.77 (2.36)	-.37	.71
Peer problems	2.49 (1.95)	2.53 (1.96)	2.45 (1.96)	-0.22	.83
Prosocial behavior	8.35 (1.60)	7.95 (1.85)	8.62 (1.36)	2.02	.05
Total score	11.11 (5.72)	10.27 (5.52)	11.70 (5.84)	1.25	.21

Note: SDQ Strengths and Difficulties Questionnaire; Missing data on sex (n = 3).

as the parent mean peer problem score was 2.04 (SD = 2.09) in youth with HL (Table 2), while the mean was 1.0 (SD = 1.7) in the hearing Norwegian youth, a difference of a medium effect size ( $d = 0.64$ ). For the other problem subscales, the differences in effect sizes varied from non-significant for Conduct problems ( $d = 0.08$ ), and small for Emotional problems ( $d = 0.27$ ) and Hyperactivity/Inattention ( $d = 0.21$ ) (See Table S1 for details). Among adolescents with HL, the mean self-reported SDQ total score was 11.11 (SD = 5.72) (Table 2), not significantly different from hearing Norwegian youth (mean = 10.70, SD = 5.50). There were some differences in subscale scores though, largely that boys and girls reported more Emotional and Peer problems, and less Conduct problems, in our sample than among hearing Norwegian boys and girls (see Table S2 for details).

Within the present sample, there were significantly higher parent problem scores in boys than in girls on all subscales, except on the emotional problem subscale, and parent scored boys with significantly less prosocial behavior than girls (Table 2). Adolescent girls self-reported significantly more emotional problems than adolescent boys, and better prosocial behavior (Table 2).

### 3.2. Quality of life

The parent-reported mean ILC total score (LQ<sub>0-28</sub>) was 22.76 (SD = 4.49) and represents significantly poorer QoL than those reported by parents of hearing Norwegian youth with LQ<sub>0-28</sub> mean 24.42 (SD = 3.15)  $p < .0001$ , a difference with medium effect size ( $d = 0.51$ ).

The adolescents with HL had a mean self-reported total score (LQ<sub>0-28</sub>) of 21.01 (SD = 4.58). These scores represent a significantly poorer QoL than those reported in Norwegian youth (mean LQ<sub>0-28</sub> of 22.59 (SD = 3.88,  $p = .0001$ ), a difference with small to medium effect size ( $d = 0.40$ ).

Mean ILC scores are presented in Table 3, for all participants and for boys and girls separately. There were no significant sex differences on the ILC total scores and only minor differences on the ILC subscales,

**Table 3**  
Mean ILC scores (QoL) for all participants, and separately for boys and girls.

ILC scores	All (n = 317)	Boys (n = 160)	Girls (n = 154)	t	p
<b>PARENT-REPORTED</b>	Mean (SD)	Mean (SD)	Mean (SD)		
At School	2.13 (1.10)	2.29 (1.11)	1.97 (1.07)	-2.72	.007
With family	1.32 (.59)	1.38 (.65)	1.26 (.52)	-1.49	.14
With peers	1.95 (1.04)	2.06 (1.07)	1.83 (1.00)	-1.79	.08
When alone	1.71 (.89)	1.74 (.91)	1.68 (.88)	-.49	.62
Physical health	1.66 (.81)	1.66 (.85)	1.66 (.77)	-.002	.99
Mental health	1.77 (.86)	1.81 (.85)	1.74 (.88)	-.71	.48
Global QoL rating	1.74 (.79)	1.84 (.78)	1.64 (.78)	-2.29	.02
ILC total score; LQ <sub>0-28</sub> <sup>a</sup>	22.76 (4.49)	22.25 (4.64)	23.26 (4.30)	1.92	.06
<b>SELF-REPORTED</b>	All (n = 104)	Boys (n = 43)	Girls (n = 61)		
At School	2.17 (.97)	2.14 (.92)	2.20 (1.01)	.30	.77
With family	1.57 (.86)	1.49 (.80)	1.62 (.90)	.78	.43
With peers	1.95 (.86)	1.88 (.82)	2.00 (.89)	.68	.50
When alone	2.05 (1.0)	2.00 (.93)	2.08 (1.05)	.41	.68
Physical health	2.16 (1.04)	2.05 (1.00)	2.25 (1.08)	.96	.34
Mental health	2.09 (1.0)	1.79 (.89)	2.30 (1.02)	2.61	.01
Global QoL rating	2.02 (.92)	1.81 (.85)	2.17 (.95)	1.95	.05
ILC total score; LQ <sub>0-28</sub> <sup>a</sup>	21.01 (4.58)	21.84 (4.16)	20.41 (4.81)	-1.57	.12

Note ILC Inventory of Life Quality in Children and Adolescents, a Quality of Life (QoL) measure.

<sup>a</sup> Higher scores on the ILC subscales indicate poorer QoL, while higher scores on the ILC total score LQ<sub>0-28</sub> indicate better QoL; Missing data on sex (n = 3).

where parents rated boys with significantly poorer QoL on the school- and the global subscale compared to girls. Also, adolescent girls self-reported significantly poorer QoL on the mental health- and the global subscale than did boys.

### 3.3. Combined assessments of emotional and behavioral problems and QoL

Table 4 shows medium to large significant correlations between scales within raters and between raters for the SDQ and ILC total scores. There were similar correlations for boys and girls separately (results not shown).

There was a significantly poorer parent-reported mean ILC total score among youth with bilateral HL (22.46, SD = 4.64) compared to those with unilateral HL ((23.79, SD = 3.81);  $t = 2.19, p = .03$ ). Between youth with bilateral and unilateral HL, there were no significant differences in mean self-reported ILC total scores (20.84, SD = 4.52; and 21.87, SD = 4.88;  $t = 0.95, p = .35$ ), or in the parent- and self-reported SDQ total scores (results not shown). There were no significant differences in parent- and self-reported SDQ and ILC total scores when comparing youth with CI, conventional hearing aid or no hearing device ( $p$ -values ranged from 0.42 to 0.81).

## 4. Discussion

### 4.1. Emotional and behavioral problems

In the present study, we found significantly more parent-reported emotional and behavioral problems among youth with HL than in a population sample of hearing Norwegian youth, suggesting that it is important with available mental health services for youth with HL. This finding was in line with earlier studies [1,2,41], and a review [3]. The difference in parent-rated SDQ total scores between the youth with HL and the Norwegian normative sample, gave an effect size of 0.42, slightly larger than the meta-analysis quantifying the magnitude of these differences (Hedges'  $g = 0.23 - 0.34$ ) [4]. Still, we found a lower parent-rated SDQ mean total score (7.16) than in most other international HL samples, with SDQ total scores varying 5.41 to 11.47 [6-16]. In fact, only the small Swedish study of children with CI [7] had lower SDQ scores than our study. That the Swedish study only included participants with CI, may not entirely explain their low scores, since a higher parent-rated SDQ mean total score (10.1) were reported by a multicenter study from Austria and Germany with only CI participants [13]. Rather, the low scores in our study, and perhaps in the Swedish study, may be explained by cross-cultural differences in parent ratings, in line with a study, concluding that the lower SDQ scores in Norway compared to Great Britain reflected substantial cultural differences [42].

In the present study, there were significantly more SDQ peer problems among the youth with HL compared to hearing Norwegian youth, in line with a meta-analysis that found peer problems to be the most consistent and deviant SDQ subscale among youth with HL [4].

The adolescents with HL in our study did not self-report significantly

**Table 4**  
Pearson correlations between parent- and self-reported total scores on SDQ and ILC.

Variables	1.	2.	3.	4.
1 Parent-reported SDQ total score	-			
2 Self-reported SDQ total score	.46**	-		
3 Parent-reported ILC total score, LQ <sub>0-28</sub>	-.78**	-.47**	-	
4 Self-reported ILC total score, LQ <sub>0-28</sub>	-.52**	-.63**	.63**	-

Note SDQ Strengths and Difficulties Questionnaire.

Higher scores on the SDQ total scores indicate more problems.

ILC Inventory of Life Quality in Children and Adolescents.

Higher scores on the ILC total score LQ<sub>0-28</sub> indicate better QoL.



more emotional and behavioral problems than hearing youth in Norway. This contrasts to the Swedish study suggesting that parents may underreport problems, as they found self-reported problems to be significantly higher [7]. Rather, our findings are in line with the meta-analysis (based on four self-report studies), showing a pattern where adolescents rate themselves with fewer problems than parents [4]. A more recent study of adolescents (13–20 years) corroborated the lack of significant difference in self-rated SDQ total scores between participants with HL (mean = 9.74) and hearing controls (mean = 9.13) [19]. Together, this underlines the importance of comparing self-reported scores from youth with HL to scores from hearing youth.

As for sex differences on SDQ subscales, the parents in our study reported significantly more conduct, hyperactivity/inattention and peer problems in boys than in girls. This is in accordance with some previous studies reporting more behavioral problems in boys compared to girls, both among youth with HL [1,9,15] and among hearing youth [32], but contrary to a large Danish study with no significant sex differences [6]. By self-report, girls reported significantly more emotional problems than boys in our sample, contrary to a study with no sex differences in self-reported scores [18]. However, that study was limited by few participants and an uneven sex distribution (n = 45, 71% girls).

#### 4.2. Quality of life

In the present study, both parents and youth with HL reported significantly poorer QoL than what has been found among hearing youth in Norway (differences in total scores gave medium effect sizes). A review on QoL in youth with HL identified 16 studies (with a variety of QoL measures) where 11 of these found poorer QoL among those with HL than the hearing on at least one measure or subscale [20]. A study using the same QoL measure as the one in the present study (ILC) found significantly poorer parent-reported QoL in youth with HL on some subdomains (family, when alone, physical health) compared to the norm sample, but unlike us, no significant difference on the ILC total score (LQ<sub>0-28</sub>) [14]. Also, Fellinger et al. (2008) found a tendency ( $p = .07$ ) for poorer self-reported ILC total scores among youth with HL (n = 91) compared to his normative sample. The mean self-reported ILC total score in our study (21.01, SD = 4.58) was relatively close to the score reported by Fellinger et al. (21.75, SD = 3.43), and higher than what is found among youth with HL who were patients in Child and Adolescent Mental Health Service (17.44, SD = 6.35) [17]. However, the latter small study found no significant differences when comparing youth with and without HL in Child and Adolescent Mental Health Service, perhaps suggesting that the poorer QoL scores could be mostly related to emotional and behavioral problems, and not HL per se.

In line with the published norms [37], parents in our study tended to rate QoL slightly higher than the youth themselves (a difference of 1–2 points), as also reported for youth with HL [14]. Although we found no significant sex differences in QoL, a trend was noted ( $p = .06$ ) with parents rating boys with somewhat lower QoL than girls, mostly due to lower QoL-scores on the School subscale. Adolescent girls rated themselves with lower QoL on the Mental health subscale, in line with recent findings reported by children with CI [24]. However, these studies did not examine sex differences. Our finding of significantly lower parent-rated QoL at school in boys, suggests it being worthwhile investigating sex difference in future studies of youth with HL.

#### 4.3. Combined assessments of emotional and behavioral problems and QoL

In the present study, we found that more emotional and behavioral problems were significantly correlated with poor QoL (Table 4). This is not surprising, as the two measures share content validity by some item overlap, such as peer problems and mental health. However, our findings differ from the previous study with no significant correlation between the parent-rated SDQ and the self-reported ILC among youth with

HL [14]. Rather, our finding is in line with a study of hearing youth (n = 2863), that found markedly poorer parent-reported QoL scores in youth with emotional and behavioral problems (SDQ) compared with those without emotional and behavioral problems ( $d = 1.29$ ), a stronger effect size than for their subgroup of youth with special health care needs compared to those without such needs ( $d = 0.58$ ) [43]. A previous longitudinal study of hearing youth, showing the interrelationship between worsening of emotional and behavioral problems and decreasing QoL after three years, may support attending to emotional and behavioral problems to improve QoL [28]. Our findings are also in line with a recent Turkish study (n = 45, age 7–17 years), concluding that youth with HL should be closely monitored and undergo rehabilitation processes for both emotional and behavioral problems and QoL, although that study did not consider the interrelationship between the two [22].

Contrary to the SDQ scores in the present study, where only parents (not the youth with HL themselves) reported more problems compared to hearing youth, QoL was rated poorer by both raters. This may suggest that self-reported QoL is a particularly important complement in the assessment of youth with HL.

Finally, we found significantly poorer parent-reported QoL (lower LQ<sub>0-28</sub>) for youth with bilateral HL compared to those with unilateral HL. However, this difference was small, and we found no other significant differences between the bilateral and unilateral HL groups, although we may have had too small a sample size to detect significant differences in self-reported emotional behavioral problems or QoL. To our knowledge, a direct comparison between and bilateral and unilateral HL has not previously been done, although a review identified studies reporting poorer QoL (of small effect sizes) in both youth with bilateral and unilateral HL when these two groups were separately compared to hearing youth [20]. When comparing youth with CI, conventional hearing aid or no hearing device, there were no significant group differences for any of the parent- and self-reported SDQ and ILC total scores. Although not directly comparable, this is similar to a study that found no significant differences in parent- and self-reported QoL ratings by degree of HL [14].

#### 4.4. Strengths and limitations

The present study has its strengths in a relatively large sample size and the inclusion of measures from both parents and youth, validated in samples with HL [6,26]. There were also limitations. There was a low response rate and no information about non-participants, making it difficult to estimate selection-bias. However, in line with other population-based studies where nonparticipants have been found to have lower socioeconomic status and education level [44,45], a majority of the parents in the present study were well-educated. We checked with Statistics Norway, reporting that about 10% of men and women ( $\geq 16$  years) were registered with  $\geq 4$  years of college/university education in 2019, less frequent than in our samples where about 30% of the parents had this education level. Statistics Norway also reported that about 77% of parents to youth 0–17 years in Norway live together, similar to the 75% in our sample. Overall, our results may not apply to a population with more variation in the parental education level. Also, we had limited specific information about the HL of the participants, but most participants were enrolled in ordinary schools and most preferred spoken language. Still, 34% of the parents were concerned about their child's development at present, in line with studies reporting neurodevelopmental disorders in 30–40% of youth with HL [46–48]. Furthermore, we had to rely on normative samples with somewhat different age-ranges than the present study, but when checking other available norm samples, there were only minor differences between studies with different age-spans.

In conclusion, this study confirmed earlier findings that youth with hearing loss have more emotional and behavioral problems and poorer quality of life than hearing youth, but also extends previous research by showing that emotional and behavioral problems and QoL are strongly

correlated in this population, underlining the need for available mental health services. Clinicians should be aware of this interrelationship in youth with HL, and that attending to emotional and behavioral problems may improve their QoL. Specifically, when youth with HL present with these problems, clinicians should enquire about relations to peers.

### Declaration of competing interest

None of the authors had any conflicts of interest.

### Acknowledgements

This work was funded by Oslo University Hospital. We are grateful to the participating families who took part in this study. We thank librarian Ellen Bjoernstad, Oslo University Hospital, for the literary searches.

### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijporl.2021.110718>.

### References

- [1] S.C. Theunissen, C. Rieffe, M. Kouwenberg, et al., Behavioral problems in school-aged hearing-impaired children: the influence of sociodemographic, linguistic, and medical factors, *Eur. Child Adolesc. Psychiatr.* 23 (4) (2014) 187–196, <https://doi.org/10.1007/s00787-013-0444-4>.
- [2] T. van Gent, A.W. Goedhart, P.A. Hindley, P.D. Treffers, Prevalence and correlates of psychopathology in a sample of deaf adolescents, *JCPP (J. Child Psychol. Psychiatry)* 48 (9) (2007) 950–958, <https://doi.org/10.1111/j.1469-7610.2007.01775.x>.
- [3] J. Fellinger, D. Holzinger, R. Pollard, Mental health of deaf people, *Lancet* 379 (9820) (2012) 1037–1044, [https://doi.org/10.1016/S0140-6736\(11\)61143-4](https://doi.org/10.1016/S0140-6736(11)61143-4).
- [4] J. Stevenson, J. Kreppner, H. Pimperton, S. Worsfold, C. Kennedy, Emotional and behavioural difficulties in children and adolescents with hearing impairment: a systematic review and meta-analysis, *Eur. Child Adolesc. Psychiatr.* 24 (5) (2015) 477–496, <https://doi.org/10.1007/s00787-015-0697-1>.
- [5] R. Goodman, Psychometric properties of the strengths and difficulties questionnaire, *J. Am. Acad. Child Adolesc. Psychiatry* 40 (11) (2001) 1337–1345, <https://doi.org/10.1097/00004583-200111000-00015>.
- [6] J. Niclasen, J. Dammeyer, Psychometric properties of the strengths and difficulties questionnaire and mental health problems among children with hearing loss, *J. Deaf Stud. Deaf Educ.* 21 (2) (2016) 129–140, <https://doi.org/10.1093/deafed/env067>.
- [7] L. Anmyr, K. Larsson, M. Olsson, A. Freijrd, Strengths and difficulties in children with cochlear implants—comparing self-reports with reports from parents and teachers, *Int. J. Pediatr. Otorhinolaryngol.* 76 (8) (2012) 1107–1112, <https://doi.org/10.1016/j.ijporl.2012.04.009>.
- [8] A.P. Netten, C. Rieffe, S.C. Theunissen, et al., Early identification: language skills and social functioning in deaf and hard of hearing preschool children, *Int. J. Pediatr. Otorhinolaryngol.* 79 (12) (2015) 2221–2226, <https://doi.org/10.1016/j.ijporl.2015.10.008>.
- [9] L. Mejstad, K. Heiling, C.G. Svedin, Mental health and self-image among deaf and hard of hearing children, *Am. Ann. Deaf* 153 (5) (2009) 504–515, <https://doi.org/10.1353/aad.0.0069>.
- [10] R. Michael, J. Attias, E. Raveh, Cochlear implantation and social-emotional functioning of children with hearing loss, *J. Deaf Stud. Deaf Educ.* 24 (1) (2019) 25–31, <https://doi.org/10.1093/deafed/eny034>.
- [11] J. Stevenson, D. McCann, P. Watkin, S. Worsfold, C. Kennedy, T. Hearing Outcomes Study, The relationship between language development and behaviour problems in children with hearing loss, *JCPP (J. Child Psychol. Psychiatry)* 51 (1) (2010) 77–83, <https://doi.org/10.1111/j.1469-7610.2009.02124.x>.
- [12] N.J. Laugen, K.H. Jacobsen, C. Rieffe, L. Wichstrom, Predictors of psychosocial outcomes in hard-of-hearing preschool children, *J. Deaf Stud. Deaf Educ.* 21 (3) (2016) 259–267, <https://doi.org/10.1093/deafed/enw005>.
- [13] M. Huber, T. Burger, A. Illg, et al., Mental health problems in adolescents with cochlear implants: peer problems persist after controlling for additional handicaps, *Front. Psychol.* 6 (2015) 953, <https://doi.org/10.3389/fpsyg.2015.00953>.
- [14] J. Fellinger, D. Holzinger, H. Sattel, M. Laucht, Mental health and quality of life in deaf pupils, *Eur. Child Adolesc. Psychiatr.* 17 (7) (2008) 414–423, <https://doi.org/10.1007/s00787-008-0683-y>.
- [15] M. Hintermair, Prevalence of socioemotional problems in deaf and hard of hearing children in Germany, *Am. Ann. Deaf* 152 (3) (2007) 320–330, <https://doi.org/10.1353/aad.2007.0028>.
- [16] C.L. Wong, T.Y.C. Ching, L. Cupples, et al., Psychosocial development in 5-year-old children with hearing loss using hearing aids or cochlear implants, *Trends Hearing* 21 (2017), <https://doi.org/10.1177/2331216517710373>, 2331216517710373.
- [17] C.M. Aanonsen, K. Heiling, T.S. Novik, T. Jozefiak, Quality of Life, family function and mental health of deaf and hard-of-hearing adolescents in mental health services in Norway, *Int. J. Mental Health Deafness* 4 (1) (2018) 3–13.
- [18] C.M. Aanonsen, T. Jozefiak, K. Heiling, T. Rimehaug, Validation of the strengths and difficulties self-report in Norwegian sign language, *J. Deaf Stud. Deaf Educ.* 25 (1) (2020) 91–104, <https://doi.org/10.1093/deafed/enz026>.
- [19] J. Stevenson, H. Pimperton, J. Kreppner, S. Worsfold, E. Terleksi, C. Kennedy, Emotional and behaviour difficulties in teenagers with permanent childhood hearing loss, *Int. J. Pediatr. Otorhinolaryngol.* 101 (2017) 186–195, <https://doi.org/10.1016/j.ijporl.2017.07.031>.
- [20] L. Roland, C. Fischer, K. Tran, T. Rachakonda, D. Kallogjeri, J.E. Lieu, Quality of life in children with hearing impairment: systematic review and meta-analysis, *Otolaryngol. Head Neck Surg.* 155 (2) (2016) 208–219, <https://doi.org/10.1177/0194599816640485>.
- [21] R. Niemensivu, R.P. Roine, H. Sintonen, E. Kentala, Health-related quality of life in hearing-impaired adolescents and children, *Acta Otolaryngol.* 138 (7) (2018) 652–658, <https://doi.org/10.1080/00016489.2018.1438661>.
- [22] A.P. Yigider, S. Yilmaz, H. Ulusoy, T. Kara, L. Kufeciler, K.H. Kaya, Emotional and behavioral problems in children and adolescents with hearing loss and their effects on quality of life, *Int. J. Pediatr. Otorhinolaryngol.* 137 (2020) 110245, <https://doi.org/10.1016/j.ijporl.2020.110245>.
- [23] C.L. Haukedal, J. von Koss Torkildsen, B. Lyxell, O.B. Wie, Parents' perception of health-related quality of life in children with cochlear implants: the impact of language skills and hearing, *J. Speech Lang. Hear. Res.* 61 (8) (2018) 2084–2098, [https://doi.org/10.1044/2018\\_JSLHR-H-17-0278](https://doi.org/10.1044/2018_JSLHR-H-17-0278).
- [24] C.L. Haukedal, B. Lyxell, O.B. Wie, Health-related quality of life with cochlear implants: the children's perspective, *Ear Hear.* 41 (2) (2020) 330–343, <https://doi.org/10.1097/AUD.0000000000000761>.
- [25] T.F.K. van der Straaten, C. Rieffe, W. Soede, et al., Quality of life of children with hearing loss in special and mainstream education: a longitudinal study, *Int. J. Pediatr. Otorhinolaryngol.* 128 (2020) 109701, <https://doi.org/10.1016/j.ijporl.2019.109701>.
- [26] M. Hintermair, Health-related quality of life and classroom participation of deaf and hard-of-hearing students in general schools, *J. Deaf Stud. Deaf Educ.* 16 (2) (2011) 254–271, <https://doi.org/10.1093/deafed/enq045>.
- [27] A. Hendekci, S. Bilgin, Evaluation of the relationship between emotional and behavioral problems and quality of life of adolescents in school, *J. Child Health Care* (2019), <https://doi.org/10.1177/1367493519892130>, 0.
- [28] L. Rajmil, J.A. Palacio-Vieira, M. Herdman, et al., Effect on Health-Related Quality of Life of Changes in Mental Health in Children and Adolescents, *Health and Quality of Life Outcomes*, vol. 7, 2009, <https://doi.org/10.1186/1477-7525-7-103>, 1 103.
- [29] F. Mattejat, H. Remschmidt, ILK - Das Inventar zur Erfassung der Lebensqualität bei Kindern und Jugendlichen (ILK) - (The inventory of life quality in children and adolescents ILC), Hans Huber Verlag, Bern, 2006.
- [30] J.E. Lieu, Unilateral hearing loss in children: speech-language and school performance, *B-ENT Suppl* 21 (2013) 107–115.
- [31] L.L. Stone, R. Otten, R.C. Engels, A.A. Vermulst, J.M. Janssens, Psychometric properties of the parent and teacher versions of the Strengths and Difficulties Questionnaire for 4- to 12-year-olds: a review, *Clin. Child Fam. Psychol. Rev.* 13 (3) (2010) 254–274, <https://doi.org/10.1007/s10567-010-0071-2>.
- [32] J. Niclasen, T.W. Teasdale, A.M. Andersen, A.M. Skovgaard, H. Elberling, C. Obel, Psychometric properties of the Danish Strength and Difficulties Questionnaire: the SDQ assessed for more than 70,000 raters in four different cohorts, *PLoS One* 7 (2) (2012), e32025, <https://doi.org/10.1371/journal.pone.0032025>.
- [33] J. Niclasen, A.M. Skovgaard, A.M. Andersen, M.J. Somhøvd, C. Obel, A confirmatory approach to examining the factor structure of the Strengths and Difficulties Questionnaire (SDQ): a large scale cohort study, *J. Abnorm. Child Psychol.* 41 (3) (2013) 355–365, <https://doi.org/10.1007/s10802-012-9683-y>.
- [34] H. Kornør, S. Heyerdahl, Psychometric properties of the Norwegian version of Strengths and Difficulties Questionnaire, parent report (SDQ-P), *PsykTestBarn* 1 (2017) 1, <https://doi.org/10.21337/0048>.
- [35] M. Hysing, B. Sivertsen, K.M. Stormark, I. Elgen, A.J. Lundervold, Sleep in children with chronic illness, and the relation to emotional and behavioral problems—a population-based study, *J. Pediatr. Psychol.* 34 (6) (2009) 665–670, <https://doi.org/10.1093/jpepsy/jsn095>.
- [36] B. Van Roy, B. Groholt, S. Heyerdahl, J. Clench-Aas, Self-reported strengths and difficulties in a large Norwegian population 10–19 years: age and gender specific results of the extended SDQ-questionnaire, *Eur. Child Adolesc. Psychiatr.* 15 (4) (2006) 189–198, <https://doi.org/10.1007/s00787-005-0521-4>.
- [37] T. Jozefiak, Inventory of Life Quality in Children and Adolescents, Manual (Norwegian version), Hogrefe Psykologiförlaget AB, Stockholm, 2012.
- [38] H. Kristensen, P. Hove, Psychometric properties of the Norwegian version of inventory of life quality in children and adolescents (ILC) (article in Norwegian), *PsykTestBarn* 1 (5) (2013) 1–9, <https://doi.org/10.21337/0022>.
- [39] T. Jozefiak, B. Larsson, L. Wichstrom, Changes in quality of life among Norwegian school children: a six-month follow-up study, *Health Qual. Life Outcome* 7 (2009) 7, <https://doi.org/10.1186/1477-7525-7-7>.
- [40] J. Cohen, *Statistical Power Analysis for the Behavioral Sciences*, Laurence Erlbaum, Hillsdale, N. J., 1988.
- [41] J. Niclasen, C. Obel, C. Guldager, S. Pleinert, J. Dammeyer, Associations between childhood hearing loss and behavioural and academic difficulties: a Danish cohort study, *Int. J. Pediatr. Otorhinolaryngol.* 90 (2016) 91–98, <https://doi.org/10.1016/j.ijporl.2016.09.002>.
- [42] E. Heiervang, A. Goodman, R. Goodman, The Nordic advantage in child mental health: separating health differences from reporting style in a cross-cultural

- comparison of psychopathology, *JCPP (J. Child Psychol. Psychiatry)* 49 (6) (2008) 678–685, <https://doi.org/10.1111/j.1469-7610.2008.01882.x>.
- [43] U. Ravens-Sieberer, N. Wille, M. Erhart, et al., Prevalence of mental health problems among children and adolescents in Germany: results of the BELLA study within the National Health Interview and Examination Survey, *Eur. Child Adolesc. Psychiatr.* 17 (Suppl 1) (2008) 22–33, <https://doi.org/10.1007/s00787-008-1003-2>.
- [44] A. Langhammer, S. Krokstad, P. Romundstad, J. Heggland, J. Holmen, The HUNT study: participation is associated with survival and depends on socioeconomic status, diseases and symptoms, *BMC Med. Res. Methodol.* 12 (2012) 143, <https://doi.org/10.1186/1471-2288-12-143>.
- [45] R.M. Nilsen, S.E. Vollset, H.K. Gjessing, et al., Self-selection and bias in a large prospective pregnancy cohort in Norway, *Paediatr. Perinat. Epidemiol.* 23 (6) (2009) 597–608, <https://doi.org/10.1111/j.1365-3016.2009.01062.x>.
- [46] K. Van Naarden, P. Decouflé, K. Caldwell, Prevalence and characteristics of children with serious hearing impairment in metropolitan Atlanta, 1991-1993, *Pediatrics* 103 (3) (1999) 570–575, <https://doi.org/10.1542/peds.103.3.570>.
- [47] C. Stubner, T. Flynn, C. Gillberg, E. Fernell, C. Miniscalco, Schoolchildren with unilateral or mild to moderate bilateral sensorineural hearing loss should be screened for neurodevelopmental problems, *Acta Paediatr.* 109 (7) (2020) 1430–1438, <https://doi.org/10.1111/apa.15088>.
- [48] S. Häkli, M. Luotonen, R. Bloigu, K. Majamaa, M. Sorri, Childhood hearing impairment in northern Finland, etiology and additional disabilities, *Int. J. Pediatr. Otorhinolaryngol.* 78 (11) (2014) 1852–1856, <https://doi.org/10.1016/j.ijporl.2014.08.007>.