Psychosocial Development in a Danish Population of Children With Cochlear Implants and Deaf and Hard-of-Hearing Children

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Research has shown a prevalence of psychosocial difficulties ranging from about 20% to 50% among children with hearing loss. This study evaluates the prevalence of psychosocial difficulties in a Danish population in relation to different explanatory variables. Five scales and questionnaires measuring sign language, spoken language, hearing abilities, and psychosocial difficulties were given to 334 children with hearing loss. Results show that the prevalence of psychosocial difficulties was 3.7 times greater compared with a group of hearing children. In the group of children with additional disabilities, the prevalence was 3 times greater compared with children without additional disabilities. If sign language and/or oral language abilities are good, the children do not have a substantially higher level of psychosocial difficulties than do hearing children. This study documents the importance of communication—no matter the modality or degree of hearing loss—for the psychosocial well-being of hearing-impaired children.

Psychosocial difficulties involve both psychological and social aspects of a child’s life. There are several basic behavioral and emotional elements that characterize a child without psychosocial difficulties. These include among other things feeling good about oneself, feeling comfortable around other people, controlling tension and anxiety, and being able to meet goals. Psychosocial refers to the interrelation of behavioral and social factors. The concept is associated to general well-being and quality of life (Martikainen, Bartley, & Lahelma, 2002).

Hearing impairment among children affects psychosocial development, but there is no consensus about the rate of prevalence. Table 1 lists studies conducted within the past 15 years. Studies concerning children younger than 19 years of age were selected. The different studies find prevalence rates of psychosocial difficulties ranging from no more than normal to 77% among children with hearing loss. The majority of studies find a prevalence ranging from about 20% to 50%. There is also no overall consensus about factors affecting psychosocial difficulties among children with hearing loss. Keilmann, Limberger, and Mann (2007) find low level of psychosocial difficulties among children attending mainstream schools compared with special schools, and other studies (Hindley, Hill, McGuigan, & Kitson, 1994) find the level of psychosocial difficulties lower at deaf schools compared with hearing-impaired units. A higher prevalence of psychosocial difficulties among boys was found in some research (Polat, 2003; Sinkkonen, 1994) but not in others (van Eldik, Trefers, Veerman, & Verhulst, 2004). Polat (2003) did find an association between degree of hearing loss and psychosocial difficulties (deaf vs. hard of hearing), but Sinkkonen (1994) and Hintermair (2007) did not. Finally, van Eldik et al. (2004) found a higher prevalence of psychosocial difficulties among deaf children 12–18 years of age than among children 4–11 years of age, but Polat found that older children were better adjusted related to psychosocial well-being than younger children. Some other factors have been discussed: Several studies (van Eldik...
et al., 2004; van Gent, Goedhart, Hindley, & Treffers, 2007; Hindley et al., 1994; Hintermair, 2007; Polat, 2003; Sinkkonen, 1994) found additional disabilities (physiological and/or psychiatric disorders) associated with a higher prevalence of psychosocial difficulties. As in studies concerning hearing children, parental resources and stress (Hintermair, 2006), socioeconomic status, and ethnicity, among other things, had also been discussed in relation to psychosocial well-being of hearing-impaired children (Stacey, Fortnum, Barton, & Summerfield, 2006).

In the past decade, discussions have also focused on psychosocial well-being of deaf/hard-of-hearing children with cochlear implants (CI) as compared with deaf/hard-of-hearing children without CI (Bat-Chava, Martin, & Kosciw, 2005; Boyd, Knutson, & Dahlstrom, 2000; Huber, 2005; Khan, Edwards, & Langdon, 2005; Nicholas & Geers, 2003). As seen in Table 2, where studies conducted within the past 8 years concerning children younger than 19 years of age were selected, it appears that the overall psychosocial well-being of deaf/hard-of-hearing children with CI lies somewhere between that of deaf/hard-of-hearing children without CI and hearing children, but results and conclusions vary considerably. The same factors as mentioned previously have been discussed (Stacey et al., 2006), but few studies have been conducted and they often meet limitations regarding the number of participants, use of relevant control groups (deaf signing children and hearing children), and the number of relevant explanatory variables. Auditory speech performance has of course been of special interest in some studies. Huber found that health-related quality of life correlate with auditory speech performance, but Nicholas and Geers did not find this association.

Controversies between a medical/audiological versus a cultural/ecological perspective on deafness (Blume, 1999; Hindley et al., 1994; Polat, 2003) are

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Studies evaluating psychosocial difficulties among deaf and hard-of-hearing children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study</td>
<td>Participants</td>
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<tr>
<td>Hindley et al. (1994)</td>
<td>93 children at deaf school and hearing impaired units (England)</td>
</tr>
<tr>
<td>Sinkkonen (1994)</td>
<td>414 children with hearing loss at deaf schools/special schools (Finland)</td>
</tr>
<tr>
<td>Vostanis, Hayes, Du Feu, and Warren (1997)</td>
<td>84 children at schools for the deaf (England)</td>
</tr>
<tr>
<td>Polat (2003)</td>
<td>1,097 deaf students (Turkey)</td>
</tr>
<tr>
<td>van Eldik et al. (2004)</td>
<td>238 deaf children (Holland)</td>
</tr>
<tr>
<td>Maes and Grietens (2004)</td>
<td>94 children with visual and auditory disabilities at regular schools (Belgium)</td>
</tr>
<tr>
<td>Keilmann et al. (2007)</td>
<td>53 children at mainstream schools and 78 children at special schools for the deaf (Germany)</td>
</tr>
<tr>
<td>Hintermair (2007)</td>
<td>213 deaf/hard-of-hearing children at schools for the deaf (Germany)</td>
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part of the discussions about the psychological development of deaf/hard-of-hearing children with and without CI. In Denmark (and in Scandinavia, in general), there has, for several years, been a high standard of service and education for deaf children and their families, focusing on a bicultural (deaf and hearing) and bilingual (signed and oral) perspective (Heiling, 1995). A bicultural and bilingual perspective has been found to be positive for deaf children’s psychosocial and cognitive development because it gives the children a greater ability for natural communication from early in life and an ability to develop a self-image and self-esteem as a deaf person (Heiling, 1995; Hindley, 2000; Preisler, 1999). Studies do find that sign language abilities correlate with psychosocial well-being (Polat, 2003; Sinkkonen, 1994). Adequate communication seems to be important for deaf children’s development. Parental hearing status has also been discussed as an important issue within this perspective (Mayberry, 2003). Polat found that deaf children of deaf parents did have a better psychosocial adjustment than deaf children of hearing parents.

Overall, discussions are ongoing as to whether or not it is deafness per se, or some environmental factors that influence psychosocial well-being among children with hearing loss (Polat, 2003). It is still unclear if CI and a high level of auditory performance and speech intelligibility are a better protection against psychosocial difficulties than are deaf culture and good sign language abilities. The aim of this study was to evaluate the prevalence of psychosocial difficulties in a large group of deaf/hard-of-hearing children with and without CI in Denmark and to evaluate a number of explanatory factors.

### Method

#### Sample

Three hundred thirty-four children from six different schools all over Denmark were included: 114, 82, and 34 children from the three Danish schools for the deaf, and 12, 44, and 48 children from three different “center schools” having “hearing classes” parallel to hearing children. Seven schools were invited to participate, but one center school declined due to time constraints. All are public schools for deaf and hard-of-hearing children in Denmark. All use sign language, oral Danish, or some kind of a combination (total communication) adjusted to the child. With a prevalence ratio of moderate to profound hearing loss at 1.1:1000 (van

### Table 2: Studies evaluating psychosocial difficulties among deaf/hard-of-hearing children with cochlear implants (CI)

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Prevalence of psychosocial difficulties</th>
<th>Method</th>
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<tbody>
<tr>
<td>Bat-Chava and Deignan (2001)</td>
<td>25 children with CI (United States)</td>
<td>CI improved the children’s relationship to hearing peers, but they still faced communication obstacles</td>
<td>Checklist completed by parents</td>
</tr>
<tr>
<td>Nicholas and Geers (2003)</td>
<td>181 children with CI (United States)</td>
<td>Children with CI were competent and well adjusted in most aspects of daily life</td>
<td>Self-report of children plus rating scale and questionnaires filled out by parents</td>
</tr>
<tr>
<td>Khan et al. (2005)</td>
<td>25 children with CI, 13 hearing impaired, and 18 hearing children (England)</td>
<td>No differences between the groups</td>
<td>Checklist completed by parents</td>
</tr>
<tr>
<td>Bat-Chava et al. (2005)</td>
<td>29 children with CI and 12 with hearing aids (United States)</td>
<td>Children with CI who were more delayed than children with hearing aids at the outset made significant progress over time</td>
<td>Interview of parents using questionnaire</td>
</tr>
<tr>
<td>Huber (2005)</td>
<td>65 children with CI (Austria)</td>
<td>8–12 years: below the standard of hearing children; 13–16 years: within the norm of hearing children</td>
<td>Questionnaire filled out by parents and children</td>
</tr>
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</table>
Naarden, Decoufle, & Caldwell, 1999), the 334 children comprised about 50% of all children in Denmark with moderate to profound hearing loss. Some of the children with moderate hearing loss and children with CI were enrolled in mainstream schools and were not included in this sample.

The 334 children included in this study were all children at the six schools, except for 9 of the children (3%). In two cases, the parents did not permit participation, and in seven other cases, the parents did not respond or the teacher did not send back the questionnaires.

All 334 children were between 6 and 19 years old (\(M = 12.8, SD = 2.8\)), of which 183 were boys (55.2%) and 151 were girls (45.2%). The children were divided into three separate groups: deaf, hard of hearing, and children with CI. One hundred nineteen were deaf (36.4%), 116 were hard of hearing (35.5%), and 92 had CI (28.1%). Seven cases gave no information concerning this. An unaided average hearing level of approximately 80 dB was used to divide between deaf and hard-of-hearing children. Mean age of the deaf children was 14.1 years (\(SD = 2.3\)), the hard of hearing children 12.9 years (\(SD = 2.9\)), and the cochlear-implanted children 11.0 years (\(SD = 2.4\)). Mean age of cochlear implantation was 6.1 (\(SD = 3.2\)), and average number of years following implantation (age of hearing) was 4.8 (\(SD = 3.4\)).

**Measure**

The study contained four single-item scales and one questionnaire: a speech intelligibility scale, an auditory performance scale, a sign language production scale, a sign language understanding scale, and a psychosocial well-being questionnaire. All scales and the questionnaire were completed by the teachers at the schools.

**Speech and hearing.** Categories of Auditory Performance (CAP; Archbold, Lutman, & Marshall, 1995) and Speech Intelligibility Rating (SIR; Allen, Nikolopoulos, Dyrar, & O’Donoghue, 2001) were applied for assessment of the level of auditory performance and speech intelligibility. CAP and SIR are frequently used in research. CAP is a single-item scale with a range of 0–7. Level 0 is “no awareness of environmental sounds” and Level 7 “uses a telephone with a known speaker.” SIR is also a single-item scale with a range of 1–5. Level 1 is “connected speech is unintelligible…” and 5 “connected speech is intelligible to all listeners….” Interrater reliability was evaluated for the CAP and SIR. Two different teachers completed the CAP and SIR independently for 47 children, and ordinal (quadratic) kappa reached .785 for CAP and .848 for SIR. The sum of CAP and SIR, the “oral score”, was calculated for each child.

**Sign language.** Two single-item ratings of sign language production scale (SPS) and sign language understanding scale (SUS) were included in the study. Due to the impossibility of finding any short screenings of Danish sign language for research, the SPS and SUS were designed for this project. SPS is a single-item scale with a range of 1–5. Level 1 is “the child does not produce signs” and Level 5 “the child has a fluent and almost conventional correct sign language.” SUS is a single-item scale with a range of 0–7. Level 0 is “does not comprehend or attend to signs” and Level 7 “is able to take part in longstanding and complex conversation in sign language.” The range of the SUS and SPS corresponds to that of the CAP and SIR scales. Interrater reliability was evaluated. Two different teachers completed the SUS and SPS independently for 74 children, and ordinal (quadratic) kappa reached .944 for SUS and .921 for SPS. Validity was evaluated for the SUS by comparing ratings of 12 children with the score of the Danish translation (Seiler & Larsen, 2005) of the Assessing British Sign Language Development: Receptive Skills Test (Herman, Holmes, & Woll, 1999). Correlation between the SUS and the sign language receptive skill test reached statistical significance (Spearman rank correlation coefficient = .905, \(p < .000\)). No corresponding test was available for sign language production. The sum of SPS and SUS scores, the “sign language score”, was calculated for each child.

**Psychosocial difficulties.** The Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) was included. SDQ is a short and easy behavioral screening questionnaire that asks about children’s and teenagers’ psychosocial well-being. SDQ has been translated into Danish (Obel, Dalsgaard, Stax, & Bilenberg, 2003). The version for teachers and parents...
was used. The SDQ contains items like “has at least one good friend,” “often loses temper,” and “often lies or cheats,” and the teacher or the parent is able to answer: “not true,” “somewhat true,” or “certainly true.” The SDQ goes from 4 to 16 years. Children older than 16 (n = 22) were excluded from the analysis. The SDQ gives an overall score from 0 to 40, where 0 indicates no problems and 40 indicates a significant number of problems. In a hearing Swedish population of 900 children, Smedje, Broman, Hetta, and von Knorring (1999) decided on a cut-off score of 14 (90th percentile) on the SDQ for both boys and girls. The cut-off score of 14 will be used in this study. SDQ was also rated independently by two teachers of 20 children to evaluate interrater reliability. Kappa value for rating the child normal (≤14) or not normal (>14) was 0.783. Hintermair (2007) used the SDQ completed by mothers and fathers in a study of deaf/hard-of-hearing children and found by evaluating the factor structure that SDQ was a reliable and valid questionnaire to use in samples of deaf/hard-of-hearing children. Also, Cornes (2007) evaluated the psychometric properties of the SDQ and found it a reliable and valid questionnaire to use among deaf and hard-of-hearing children.

Information on different variables was obtained by the teachers: gender, age, and cause of hearing loss (etiology). Etiology was excluded from the analysis because of incomplete information. Ethnicity was recoded to Danish or not Danish (78% [n = 261] were Danish). Family status was coded to residing with both parents or not, education level of parents to the sum of parents’ education in years, and parental hearing loss into having at least one parent with hearing loss or not (9.3% [n = 31] of the children did have at least one parent with hearing loss). Finally, information on additional disabilities (mental retardation, autism, visual impairment, physical impairment, etc.) was obtained. Seventy-eight children (23.7%) had additional disabilities and it was a heterogeneous group: 14 had severe visual impairment, 9 had severe physical impairment, 31 were mentally retarded, 13 had an autism spectrum disorder, 14 had severe neurological disorders associated to attention, and 9 had “other” kinds of diagnosed severe developmental disabilities. Ten children had more than one additional disability. Additional disabilities were coded into no additional disabilities or one or more moderate to severe physical and/or visual impairment and/or diagnosed severe developmental disorders (autism, mental retardation, etc.).

In seven cases, the given information was incomplete about at least one variable. Two different teachers independently gave information about the explanatory variables for 20 children. Kappa values reached between .69 and 1.00, which was acceptable (Shrout, 1998).

Procedure

The teachers at the schools completed all screenings and data gathering about each child. All participating teachers knew the children and their families fairly well, and were well educated about the development and education of hearing-impaired children. Data were collected from May 2006 to May 2007. The questionnaires were mailed to the school secretary, who distributed and collected them. The teachers were informed about the study both in a letter and at a meeting at the schools. All parents were informed by mail and asked to allow their child to participate.

The relationships between SDQ score and explanatory variables including all relevant interaction terms were analyzed using logistic regression. The SDQ score was dichotomized into normal (≤14) and not normal (>14). The logistic regression model was found using forward selection (conditional). Odds ratios and descriptive statistics (percent and number of children above cut-off score on the SDQ) were used to illustrate some of the results. The statistical procedures were made in SPSS 15.0.

The following explanatory variables were included in the analysis: age, gender, school type (school for the deaf or center school), ethnicity, family status, education level of parents, parental hearing loss, additional disabilities, child’s hearing status (deaf, hard of hearing, or CI), and finally, as described, oral score (sum score of CAP and SIR) and sign language score (sum score of SPS and SUS).

Results

Smedje et al. (1999) decided on a cut-off score of 14 (90th percentile) on the SDQ for both boys and girls
in a hearing Swedish population. In the sample presented here, 37% \((n = 115)\) reached a score of more than 14 on the SDQ. There were 3.7 times as many psychosocial difficulties as compared with the Swedish population of hearing children.

In Table 3, the logistic regression model of variables affecting the SDQ score is presented.

Additional disabilities did have a significant relationship to psychosocial difficulties \((p < .001)\). Odds ratio was 3.2, indicating that children with additional disabilities did have psychosocial difficulties three times more often compared with children without additional disabilities.

Low sign language and oral abilities were significantly related to psychosocial difficulties \((p = .015\) and \(.009\), respectively). Odds ratio for scoring one point higher on SPS or SUS was 0.85, indicating a decreased risk of 15% for having psychosocial difficulties. For one higher point scored on CAP or SIR, odds ratio was 0.92, indicating a decreased risk of 8%. The impact of sign language and oral abilities can be illustrated: If scores on both SPS and SUS were at maximum \((7 \text{ and } 5, \text{ respectively})\), then only 16.7% \((n = 17)\) reached a score above 14 on the SDQ. If the scores on the CAP and SIR were at their highest \((7 \text{ and } 5, \text{ respectively})\), then only 14.6% \((n = 6)\) reached a score above 14 on the SDQ. In the logistic regression model, interactions terms between additional disabilities and sign language abilities, additional disabilities and oral abilities, gender and sign language abilities, and gender and oral abilities were not significantly associated to SDQ score. The relationship between language abilities (signed or oral) and SDQ score was not influenced by gender or additional disabilities.

An approximate significant higher risk for psychosocial difficulties was found among boys compared with girls \((p = .06)\). An odds ratio of 0.48 did indicate that boys face psychosocial difficulties two times more often than girls.

Child’s age, parents’ education, child’s hearing status (deaf, hard of hearing, or CI), ethnicity (Danish or not), type of school (deaf or center school), family status, and whether or not the children did have at least one parent with hearing impairment were all not significantly related to SDQ score.

Discussion

Some studies focus on the significance of communication as an important issue in the psychological development of children with hearing loss (Bond, 2000; Hindley, 2000, 2005; Meadow, 1968/2005). This study supports this view—no matter the modality. If sign language ability or oral Danish was good (defined by maximum score on SPS and SUS or CAP plus SIR), there was an approximately normal prevalence of psychosocial difficulties among children with hearing loss. The overall prevalence of 3.7 times as many children with psychosocial difficulties is in accordance with other studies conducted in different countries (van Eldik et al., 2004; van Gent et al., 2007; Hindley et al., 1994; Hinternair, 2007; Sinkkonen, 1994).

In this study, psychosocial well-being was not related to hearing loss among parents. This is in contradiction to the study by Polat (2003), which found better psychosocial well-being among deaf children of deaf parents than among deaf children of hearing parents. Parental hearing loss seems not to make any difference concerning psychosocial difficulties in the group of hearing-impaired children. In this study, it was the language ability, and not if the child was living in a bicultural and bilingual family, that seems to be important.
There were a large number of children with additional disabilities who have psychosocial difficulties. The much higher prevalence rate within the group of children having additional disabilities, as opposed to children whose hearing loss was the only disability, is in accordance with other studies (van Eldik et al., 2004; van Gent et al., 2007; Hindley et al., 1994; Hintermair, 2007; Polat, 2003; Sinkkonen, 1994). One major explanation is that some pre- and postnatal viral infections (rubella, cytomegalovirus, meningitis) and some of the syndromal causes of deafness (CHARGE and Goldenhar, among others) both directly and indirectly increase the risk for mental health problems (Bond, 2000; Hindley, 2005). It is well known that children with multiple disabilities, also without hearing loss, are at a higher risk for psychosocial difficulties (Bond, 2000; Rutter, Graham, & Yule, 1970). In this study, additional disabilities affected both signed and oral language abilities. Hearing impairment and additional disabilities (cognitive, physical, or visual) in combination increase those difficulties hearing-impaired children face in developing useful signed or oral communication. Communication becomes a very important area of concern for these children.

Compared with a population of hearing children, there were a lot of children in this study with mental retardation and autism. This is in accordance with other findings (Bond, 2000; Hindley, 2005).

A higher prevalence of psychosocial difficulties among boys was also found in some existing research (Polat, 2003; Sinkkonen, 1994) but not in others (van Eldik et al., 2004). Polat argues that deaf girls’ superiority in verbal ability can make the difference. The general delay in language development among boys as compared with girls leads to, in the case of hearing impairment, an increased risk for psychosocial difficulties. But this study cannot confirm Polat’s view: The relationship between language abilities (signed or oral) and SDQ score was not influenced by gender.

There were no difference in psychosocial well-being between children with CI and deaf and hard-of-hearing children. This finding was in accordance with some studies (Khan et al., 2005), but in contrast to others, which found that deaf/hard-of-hearing children with CI enjoy greater psychosocial well-being than do deaf children (Bat-Chava et al., 2005). None of these studies controlled for the influence of additional disabilities or sign language abilities, which this study accentuates as important. Comparing deaf/hard-of-hearing children and children with CI and additional disabilities can be an issue of concern. In some cases, additional disabilities have been a contraindication for cochlear implantation (Bertram, 2004), which reduces the number of children with CI and additional disabilities.

Limitations of the Study

The cochlear-implanted children in this study are not representative of all children with CI in Denmark. A percentage of the deaf/hard-of-hearing children with CI attend mainstream schools and were not included in this study. The psychosocial well-being of deaf/hard-of-hearing children with CI in mainstream schools may differ from that which was found in the results of this study. In light of these results, it may be reasonably assumed that the difference would depend on the communication abilities of the children and the possibility of communication support in the school setting.

Other variables distinguishing this population of deaf/hard-of-hearing children with CI from other populations are as follows: age of implant surgery, which is high in this group of children ($M = 6.1$ years, $SD = 3.2$), and age of hearing (years of CI use), which is low ($M = 4.8$ years, $SD = 3.4$). Early cochlear implantation, before 5 years of age, will result in an average improved oral communication (Stacey et al., 2006). This study cannot be generalized to cochlear-implanted children in general.

Psychosocial difficulties were evaluated in this study using short screenings completed by the child’s teacher. Boyd et al. (2000) found that questionnaires in which parents report on the psychosocial well-being of their cochlear-implanted children are not preferable because they rate social functioning too high. Stacey et al. (2006) also found that parents of children with hearing loss reported more favorable judgments than did their teachers or simply avoided reporting very poor outcomes. Contrary to parents’ reports, teachers’ knowledge of the children can be limited, especially regarding information about the family.
Some of the differences in results and conclusions among studies about cochlear-implanted children seem to depend on the methods employed. Questionnaires answered by parents show fairly normal psychosocial well-being (Chmiel, Sutton, & Jenkins, 2000; Huber, 2005), but ratings from a videotaped peer task (Boyd et al., 2000) as well as from observations in natural settings (Preisler, Ahlstrom, & Tvingstedt, 1997) uncovered problems related to communication in social interaction with other children. Further research, especially longitudinal studies and studies using structured and unstructured video observations in natural settings (Preisler, Tvingstedt, & Ahlstrom, 2005; Preisler et al., 1997), must be done in order to elaborate upon the relationship between hearing impairment, communication, and psychosocial difficulties for deaf, hard-of-hearing, and cochlear-implanted people of all ages.

Conclusions

The level of sign language performance among the children in general was high. There were 3.7 times as many children presenting psychosocial problems as compared with a group of hearing children. Communication, oral or signed, is an important issue of concern in relation to children with hearing loss and psychosocial difficulties. This seems to be true for all groups of children, no matter the degree of hearing loss, whether they are deaf, hard of hearing, or cochlear implanted. If communication is good (defined by maximum score on SPS and SUS), the risk of psychosocial difficulties decreases substantially.

The degree of psychosocial difficulties is higher among children with additional disabilities and among boys. This study does not include children attending mainstream schools, which creates limitations for the possibilities of generalization.

References


Cornes, A. J. (2007). Development of computer-administered sign language (Auslan) versions of commonly used child mental health instruments and examination of their reliability, validity and acceptability by Australian deaf adolescents. Sydney, Australia: Department of Psychological Medicine, University of Sydney.


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