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Referral criteria for school-based hearing screening in South Africa: Considerations for resource-limited contexts

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ABSTRACT

Background: School-based hearing screening is likely to be the first opportunity to identify childhood hearing loss in South Africa. Criteria for school-based hearing screening requires balancing the targeted degree of hearing loss while ensuring that referral rates are sufficiently low for a cost-effective and sustainable programme. The study aim was to investigate the effect of screening intensity (loudness) levels on the referral rate and to establish the effect of an immediate rescreen in reducing the referral rate.

Methods: A within-subject study was conducted in two phases. Phase 1: compared the referral rate in a counterbalanced sequence at screening levels of 20 dB HL, 25 dB HL and 30 dB HL across 1, 2 and 4 kHz for 135 children. Phase 2: determined the effect of an immediate rescreen on referral rate for 337 children screened at 25 dB HL. If a further referral was obtained on rescreen, diagnostic audiometry was subsequently conducted.

Results: Referral rate was reduced to 6.7% from 17% when using 25 dB HL as opposed to 20 dB HL as screening intensity. Referral rate was reduced to 4.4% when employing 30 dB HL as screening intensity. An immediate rescreen reduced the overall referral rate by more than one-third. Diagnostic audiometry confirmed that almost half (47%) of the referred children had a hearing loss.

Conclusion: A screening intensity of 25 dB HL and immediate rescreen reduces the referral rate significantly and will limit the burden of the screening programme on health care resources.

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Abbreviations: ESHL, Educationally Significant Hearing Loss; ASHA, American Speech-Language Hearing Association; AAA, American Academy of Audiology; JCIH, Joint Committee of Infant Hearing; NHS, Newborn Hearing Screening.

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1. Introduction

Hearing loss is the most common developmental disorder which is identifiable at birth, with an increase in prevalence throughout school-age due to the additions of late-onset, late identified and acquired hearing loss (Fortnum, 2003; Lopez, Mathers, Ezzati, Jamison, & Murray, 2006; Smith, Bale, & White, 2005; World Health Organization, 2013). Newborn hearing screening has made early identification of congenital and early-onset hearing loss possible to allow for optimal outcomes through early intervention (Cunningham & Cox, 2003; Muse et al., 2013). Beyond the newborn period, close to 20% of permanent, moderate or greater bilateral, mild bilateral and unilateral impairments remain to be identified around the time of school entry due to progressive or delayed-onset hearing loss (American Academy of Audiology (AAA), 2011; Bamford et al., 2007; Grote, 2000).

Nine or ten in every 1000 school-aged children (White, 2010) will potentially have a hearing loss and as a result these students will have difficulties in perceiving speech clearly in social and educational contexts which will contribute to difficulties with attention, learning and social functioning (Bess, Dodd-Murphy 1998; Davis, Elfenbein, Schum, & Bentler, 1986; McKay, Gravel, & Tharpe, 2008; World Health Organization, 2013). Minimal and unilateral permanent hearing losses may also result in poorer educational test performance, higher incidence of failed grades and greater dysfunction in areas such as behaviour, energy, stress, social support, self-esteem and socio-emotional aspects (Bess & Dodd-Murphy, 1998; McKay et al., 2008; Tharpe, 2008).

1.1. Definition of key concepts

School-based hearing screening is used to identify children with late-onset or progressive hearing impairments (Meyer, Swanepoel, Van Der Linda, & Le Roux, 2012; Theunissen & Swanepoel, 2008). School-based hearing screening is widely recommended (American Speech-Language-Hearing Association (ASHA), 1997; Skarzynski & Piotrowska, 2012) with clear guidelines in terms of implementation. The universal goal of hearing screening is to identify all children with a significant hearing loss in order to allow for further diagnosis and appropriate intervention (AAA, 2011; ASHA, 1997; Kam et al., 2013; Skarzynski & Piotrowska, 2012; Theunissen & Swanepoel, 2008).

School-based hearing screening is of particular importance in countries like South Africa where no legislation or health care mandate is in place to conduct hearing screening on newborns and infants for hearing loss (Meyer et al., 2012; Theunissen & Swanepoel, 2008). As a result, school-based screening may be the first point of access for detection of hearing loss. The recently launched Integrated School Health Policy (ISHP, 2012) for South Africa acknowledges the importance of hearing screening by including it as part of all the health phases with priority on the foundational phase (Grade R–3). The Integrated School Health Policy (2012) specifies that hearing screening is to be conducted by school health nurses with an audiometer using a screen criteria of 20 dB HL

intensity at 1, 2 and 4 kHz in accordance with current international guidelines (AAA, 2011; ASHA, 1997).

The pure tone audiometric sweep test has been considered the gold standard and is the most widely used and recommended screening method for school-based hearing screening (AAA, 2011; ASHA, 1997; Bamford et al., 2007). A pure tone signal is presented across different frequencies at a specific screening intensity level; responses to the signals typically include a hand raise or a conditioned response (e.g. dropping a block in a bucket). Although it is easy to administer, successful implementation is often hindered by a number of intrinsic and extrinsic factors. One of these intrinsic factors is to identify the target disorder. For school-based hearing screening the target disorder is often referred to as an educationally significant hearing loss (ESHL) (AAA, 2011; ASHA, 1997).

ESHL is considered a hearing loss that interferes with a learner's academic performance (WHO, 2014). This may include permanent sensorineural, conductive and mixed hearing losses, but may also include transient conductive losses. However, the severity of a hearing loss that constitutes ESHL is not always clearly defined. According to the World Health Organisation (2014) a disabling childhood hearing loss constitutes an average hearing threshold in the better ear across the frequencies 0.5, 1, 2, 4 kHz to be >30 dB HL. Despite some variability in the frequencies employed for screening, current recommendations generally agree that 1, 2 and 4 kHz should be screened bilaterally (AAA, 2011; ASHA, 1997; ISHP, 2012; Kam et al., 2013; Wu et al., 2014). However, there is less consistency with regards to the screening intensity level that should be used to appropriately identify children with ESHL.

Guidelines specify a screening level of 20 dB HL across 1, 2 or 4 kHz in order to identify an ESHL (American Academy of Audiology, 2011; American Speech-Language-Hearing Association, 1997; Integrated School Health Policy of South Africa, 2012). Despite these guidelines, screening programmes have used various criteria to identify ESHL. For example, Lü et al. (2011) defined a possible hearing loss as an average of >40 dB HL across frequencies (0.5–4 kHz) and Kam et al., (2013) use a screening level of >25 dB HL at 1, 2, and 4 kHz. Furthermore, in some developed and developing countries screening intensity levels of 25, 30 and even 40 dB HL have typically been employed (AAA, 2011; Al-Rowaily, AlFayez, AlJomiy, AlBadr, & Abolfotouh, 2012; Kam et al., 2013; Lo & McPherson, 2013; Wu et al., 2014). A higher screening intensity level is sometimes used due to the presence of adverse background noise levels that are present in the test environment (Counter, 1986; Kam et al., 2013; McPherson, Law, & Wong, 2010). The selected criterion for screening in turn has an effect on the referral rates, sensitivity and specificity of a screening programmes (Dodd-Murphy, Murphy, & Bess, 2014). Ultimately these factors also determine the cost-effectiveness and feasibility of hearing screening programmes.

An immediate rescreen is an additional factor to consider for the purposes of reducing the referral rate. Screening is seen as a subjective test which requires the child to respond, thus external factors may influence the way a child may initially respond. Some of these external factors include the

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