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United Kingdom school-entry hearing screening: current practice

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ABSTRACT

Objective: To determine if the school-entry hearing screening (SEHS) programme continues to make a useful contribution to the identification of childhood hearing impairment in the light of the recent implementation of universal newborn hearing screening, and thereby to inform future policy development.

Design: Postal questionnaire survey to determine current implementation and effectiveness of SEHS

Setting: 244 school health services managed within primary care and acute trusts throughout the UK.

Participants: 229 SEHS service leads approached; 195 responded.

Main outcome measure: Details of implementation; positive predictive value of the screening test and its referral criteria.

Results: Implementation of the SEHS is variable, and there is no national approach to data collection, audit and quality assurance. Less than 10% of services had available robust data. The yield from screening ranges from 0.05% to 0.59% for permanent sensorineural hearing impairment and from 0.07% to 0.44% for permanent conductive hearing impairment. The positive predictive values from screen referral vary from 0.62% to 12.16% for permanent sensorineural hearing impairment and 1.24% to 17.56% for permanent conductive hearing impairment.

Conclusion: This comprehensive survey provides a previously unavailable national examination of the SEHS. The few available data on yield indicate that the SEHS may have a small but important role to play in identification of childhood hearing impairment, but the overwhelming conclusion is the urgent need for national guidelines on implementation of this screening programme to determine its value since the implementation nationally of universal newborn hearing screening.

In the UK, ~1300 children are born each year with moderate or greater hearing impairment in one or both ears (incidence at birth, 1.6 per 1000 live births).¹ There is a consensus that early detection of hearing impairment is desirable, leading to improved communication skills, educational attainment and quality of life, and, in the UK, there is a long established history of screening children for hearing impairment.²⁻⁴ Currently two such screening programmes operate nationally, the newborn hearing screen programme (NHSP) and the school-entry hearing screen (SEHS). The NHSP was introduced following a national review in 1997,² and has replaced the universal infant distraction test screening programme that was performed (usually by health visitors) at 8 months of age.² The NHSP is performed shortly after birth and achieved full implementation across England in March 2006; full UK implementation will be

achieved in the near future. The SEHS has been performed across the UK since the 1930s and has been the responsibility of the NHS since 1974.

The introduction of the NHSP has potential implications for the future role of the SEHS. The NHSP has a sensitivity for bilateral moderate or greater permanent congenital hearing impairment of >90%, which potentially reduces the pool of children to be identified at school entry.⁵ Doubts about the future role of the SEHS are compounded by long-standing concerns about its effectiveness. In 1987, a report of SEHS practice revealed a fragmented service, with little national uniformity and lacking even rudimentary audit data collection.⁶ In 2005, a similar study confirmed clinical impressions that considerable variation in all aspects of screen performance remained evident, but this study was limited by the failure to include any services with a non-medical lead, limiting the representativeness of the findings.⁷

Despite these issues, the SEHS may have public health value. It has the potential to identify significant numbers of children with mild, high-frequency, or late-onset/progressive impairments, not identified at birth and who may, without a further universal screen, otherwise be missed. It may also identify significant numbers of children with persistent middle ear disorders who are not otherwise known to services, although this is a complex area requiring more discussion than can be presented here. The current timing of the SEHS allows identification of children with hearing impairment who were not previously known to services, and subsequent intervention if necessary, at a time when good hearing is of particular importance educationally.

After full implementation of the NHSP, there is a pressing need to understand the practice and, more importantly, the yield of the SEHS in order to inform policy decisions about its future in the UK. However, a comprehensive understanding of national SEHS practice and effectiveness has always remained elusive, perhaps because the SEHS has evolved as a responsibility of local NHS services. Consequently, the health technology assessment programme (an arm of the NHS research and development initiative) commissioned research to understand current national SEHS implementation, assess the accuracy and effectiveness of alternative screening tests, and assess cost-effectiveness. The findings of the full study are published within a health technology assessment monograph.⁸ The findings on current implementation are presented here and discussed in the light of the introduction of universal newborn hearing screening and the policy decisions that should follow.

Table 1 Children routinely entered into the school-entry hearing screen

	Services routinely screening:			Total number of responses
	All children	Some children	No children	
Children in state schools	170 (87.6)	13 (6.7)	11 (5.7)	194
Children in private schools	37 (20.4)	52 (28.7)	92 (50.8)	181
Children who are home educated	10 (5.7)	39 (22.4)	125 (71.8)	174
Children in special schools with known physical or sensory disability	85 (47.2)	44 (24.4)	51 (28.3)	180
Children in special schools with known mental disability (excluding those with hearing impairment)	79 (43.4)	46 (25.8)	53 (29.8)	178

Values in parentheses are percentages.

METHODS

Service lead identification

Service delivery of the SEHS varies across the UK in terms of the organisations responsible for coordinating the programme and employing staff who undertake it. In order to recruit all the SEHS services across the UK, we contacted all primary care trusts, school nursing departments and professional audiology societies, made presentations at appropriate national conferences, and contacted all other relevant NHS Trusts.

National survey

A postal questionnaire, administered in 2005, examined SEHS protocols in use across the UK, specifically focusing on which children are routinely screened, the conditions in which the screen is performed, the test methods used, the criteria for referral, the staff employed to perform the screen, the data management systems employed, and the coverage, referral rates and yield of the screen. In addition, we sought the views of the service leads regarding how useful they perceived the SEHS to be. Non-responders received a reminder letter and up to two follow-up telephone calls before non-response was assumed.

Data management

All identifiable information was removed before analysis. Data were double entered, and any outliers checked for accuracy.

Ethical approval

Ethical approval nationally was given by Central Manchester local research ethics committee in Manchester, UK. NHS research governance approval was given for all Trusts in which staff were approached.

RESULTS

Percentages are reported as a proportion of the number of services responding to the particular question rather than the total number of services identified.

Response rate

Questionnaires were posted to individual employees in 229 (94%) of the 244 services responsible for the SEHS in the UK. Difficulties in securing NHS research and development approval prevented the inclusion of 15 services: seven in England and eight in Northern Ireland. Consequently, only 20% (2/10) of identified services in Northern Ireland could be recruited. A total of 195 services (85%) responded across the UK.

Population

Twenty-four services (12.3%, 24/195) no longer run a universal SEHS; 13 run only a targeted screen and 11 implement no screen, citing resource limitations (five) and low yield (six) as the reason. The definition of a "universal screen" varied, as shown by the number of children routinely screened in different educational settings (table 1). Only 20% of services screen all children in private schools, and less than half screen all children in special schools.

Screen implementation

All respondents reported screening within school premises all or most of the time. The conditions under which the screen was performed are variable, and it was evident that suitable conditions could be difficult to identify. Most services (52.4%, 87/166) were able to screen in a quiet classroom most of the time, but 21.2% (31/146) stated that they were forced to screen in a noisy area some of the time, including instances of screening in cloakrooms, cupboards and, in one instance, the toilet.

Most services (97.1%, 170/175) use pure tone sweep audiometry as the first test, and 71.7%, (124/173) implement a two-test screen before referring a child to diagnostic services. The time between the two tests ranged from a few hours to more than 12 weeks, and the criteria for retesting/referral varied enormously, with combinations of levels and frequencies ranging from 30 dB HL at three frequencies to 20 dB HL at seven frequencies.

Table 2 Reported yield and positive predictive value of the school-entry hearing screening (children confirmed to have a hearing impairment as a percentage of the number screened and referred)

Diagnosis	Number of services providing data*	Yield† from total number of children screened (%)‡	Positive predictive value† from number of children referred (%)‡
Sensorineural hearing impairment	18 (3)	0.12 (0.05–0.59)	1.71 (0.62–12.16)
Permanent conductive hearing impairment	11 (6)	0.09 (0.07–0.44)	3.42 (1.24–17.56)

*Values in parentheses are the number reporting 0% children identified.

†Excluding those services reporting 0% children identified.

‡Values are median (range).

Screen personnel

The SEHS remains largely the responsibility of the School Health Service. School health nurses are employed as screeners by 66.3% of services (118/178) and school health nurse assistants by 18.5% (33/178).

Coverage, referral rates, yield and positive predictive value

Only 9.5% of services (16/168) have performed an audit within the last 2 years. Seventy percent (112/161) reported using a data management system, but less than half of these (46.4%, 52/112), stated that they could easily retrieve data reports from this system. Therefore, very few services were able to give accurate data on screen coverage ($n = 55$) and/or referral rates ($n = 46$).

Coverage (of the target population), where reported, was relatively high, with 75% of services apparently achieving greater than 90% coverage. Reported referral rates ranged from 1.91% to 23.4%, with a median of 7.9%.

Eighteen services were able to indicate the yield of the screen, in terms of the number of children screened, and the positive predictive value, in terms of the number of children referred by the screen (table 2). No data were available on false-negative results—that is, children who were not referred but were subsequently identified with hearing impairment.

Respondents' views on the value and continued need for the SEHS

Fifty services (28.6%, 50/175) were planning to change their current practice in some way including considering discontinuation ($n = 12$) or moving to a targeted service ($n = 5$). Services rated the overall usefulness of the SEHS, as it is currently operated, on a scale from 1 (not at all useful) to 10 (very useful). A rating of 8 or higher was given by 69.7% of services (122/175), and only 6.8% (12/176) of services gave a rating of 4 or less. Positive aspects of the screen were that it was a useful way to identify children who had missed any previous screening or surveillance opportunities, including children coming to live in the UK, and also to exclude hearing impairment as a possible cause of a child's observed difficulties in school. Suggestions to improve the screen were for better standards/guidelines, improved test conditions, and better IT support, and data collection.

DISCUSSION

This study represents the most comprehensive analysis of SEHS performance since its inception. The 244 SEHS services identified is a much higher number than in the previous survey, and is likely to represent almost total coverage of SEHS service teams.⁷ There was a high rate of questionnaire return, and, except for Northern Ireland, the survey coverage was geographically even. However, no definitive list of services exists, and so it is possible that some services were missed. Also, caution should be applied when interpreting the low coverage of the screen in special schools. It is probable that children in special schools represent a distinct population with unique physical and educational needs and are thus better served by full audiological examination rather than sweep test screening. Furthermore, the UK government promotes integrated education, and so increasing numbers of children with disabilities are educated in mainstream schools.⁹

The aim of this study was to determine if the SEHS continues to make a useful contribution to the identification of childhood hearing impairment in the UK in the light of the recent implementation of universal newborn screening. It was not

What is already known on this topic

- ▶ Previous small studies of the value of the school entry hearing screen (SEHS) have indicated considerable variation in implementation and performance and have raised concerns about the continued provision.
- ▶ These concerns are compounded by the recent introduction of a hearing screen for all babies at birth.

What this study adds

This comprehensive analysis of SEHS performance concludes that the SEHS continues to have value, but evidence-based decisions on continued provision cannot be taken without the establishment of national guidelines on implementation and the collection of robust, comparable data.

possible to reach a definitive conclusion for three important reasons.

Firstly, there remains wide variation in the implementation of the SEHS throughout the UK, substantiating previous research.^{6,7} This is undoubtedly a consequence of the lack of a national protocol for SEHS. It is notable that 12% of services do not operate a universal SEHS and that resource limitations were often cited as the reason for this. For most of the UK, the SEHS is a part of the School Health Service, which is a service in transition and often cited as under-resourced.¹⁰

Secondly, there is an almost universal failure to use effective data management. Thus there is little robust audit at local, and therefore national, level. The data obtained by this survey suggest that the SEHS as it is currently operated has yields that may be important, but, without further robust data on prevalence of previously unknown hearing impairment at school entry and on yields at local and national level, we cannot be certain. Any interpretation of these data must be made with caution, as they are based on only a small number of services, which, as they were able to provide data, may also be providing a better quality service than the norm and may not therefore be representative. Variation in yield may also be due to disparities in screen protocol; a screen failure criterion of 20 dB will necessarily refer more children than a criterion of 30–35 dB.

Thirdly, even if these first two issues had been addressed, many of the children currently screened by the SEHS will not yet have been through the NHSP, as the newborn screen was only fully implemented in 2006 in England, and later in some other parts of the UK. Thus the effect of a high-sensitivity screen at birth on the yield of the SEHS cannot yet be judged, but importantly will be able to be effectively addressed only if policies on the first two issues above (a national protocol and efficient data monitoring) are developed.

Despite the considerable difficulties experienced in performing the SEHS and the lack of robust audit, there were clear indications from comments offered that most of the service leads regard the screen as useful and would prefer it to continue. A significant number of respondents stated that they would welcome national guidance regarding the screen, and, if the SEHS is to continue, this is the crucial next step.

It is not possible at the moment to judge the performance of current SEHS practice and thereby to determine which methods, if any, are the most effective. There is no evidence

for the service to either continue or discontinue, and, until such evidence is available, policy decisions cannot properly be made. The implications of this are that services in the UK currently operating an SEHS should continue to do so, pending later evidence-based decisions. The imperative is to acquire the evidence base through three strands of enquiry. Firstly, a high priority is for the establishment of a single national protocol for the SEHS to make future studies of screen performance directly comparable. Uniformity of practice would be greatly aided by the acknowledgement of ownership of the screen within a professional group or service. Secondly, it is vital that data collection systems be established, within existing systems if possible, at both local and national levels in order that robust data on screen accuracy and effectiveness can be analysed. Finally, trials are needed to compare the effectiveness of alternative approaches with the identification of permanent hearing impairment in this age group. Only after the formation of this tripartite evidence base should any decisions regarding the future of the SEHS be made.

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design, the collection, analysis, and interpretation of data, the writing of the report, nor the decision to submit the article for publication. The authors' work was independent of the funders (the funding source had no involvement).

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Archivist

Results of lung transplantation for cystic fibrosis in the USA, 1992–2002

In the USA about 12% of all deaths of people with cystic fibrosis (CF) are due to complications of lung transplantation. There is uncertainty, however, about the overall effects of lung transplantation on survival. Now a study (Theodore G Liou and colleagues. *New England Journal of Medicine* 2007;**357**:2143–52; see also editorial, *ibid*: 2186–8) has suggested that lung transplantation in the USA between 1992 and 2002 was more likely to shorten rather than lengthen the lives of patients with CF.

Data from the US Cystic Fibrosis Foundation Patient Registry and from the Organ Procurement and Transplantation Network showed that 248 of the 514 children with CF on the waiting list for lung transplantation actually underwent the operation. Four factors in addition to transplantation affected survival. Infection with *Burkholderia cepacia* was associated with decreased survival. Diabetes decreased survival while on the waiting list but not after transplantation, whereas older age was associated with decreased survival after transplantation but not while on the waiting list. Infection with *Staphylococcus aureus* was associated with increased survival while on the waiting list but decreased survival after transplantation. Using three of these factors (age, diabetes and *S aureus* infection) as covariates, the likely effect of transplantation on survival was estimated for each patient. For only five of the 514 patients was the estimate significantly indicative of likely benefit. There were significant estimates of likely harm for 315 patients. Non-significant estimates were of harm for 118 patients and benefit for 76.

Among these patients less than 1% were likely to have been benefited from lung transplantation. The authors of this paper call for a randomised controlled trial to clarify the effects of transplantation on survival and quality of life.