Organization of the hearing screening examinations in Polish schools in rural areas and small towns

Skarzynski H., Kochanek K., Senderski A., Skarzynski P.H., Ludwikowski M., Kopaczewski M., Bruski L.

International Center of Hearing and Speech of the Institute of Physiology and Pathology of Hearing, Warsaw/Kajetany, Poland

It is widely known that early detection of hearing disorders and application of the appropriate therapy assure the achievement of satisfactory result and result in a lower cost of treatment compared with delayed therapy.

In an ideal healthcare system, hearing screening should be conducted independently of age, in order to obtain diagnosis and start therapy at the earliest possible time. In Poland the program of newborn hearing screening has been successfully implemented for 6 years, with social acceptance and the acceptance of such programs by the medical profession .

It is an established fact that the incidence of hearing problems increases with age. Epidemiological research and screening examinations conducted for the last ten years by the Institute of Physiology and Pathology of Hearing, in the collaboration with different governmental institutions and NGOs, show that on average one person in three experiences some problems related with hearing, including one child of school age in six.

Between March and June 2008, the Institute of Physiology and Pathology of Hearing, in collaboration with the Agricultural Social Insurance Fund and the Association of the Deaf and Hearing Impaired 'Homo-Homini' implemented a screening program for children aged 7-12 from rural areas and small towns (below 5,000 inhabitants) in the eastern regions of Poland. The program was intended to include the entire population of 7-year-olds and about 10-15% of children between 8 and 12 years of age. The precondition of the child's participation in the program was the consent of parents or care-takers.

The chief goals of the program were following:

- Detection of hearing disorders of conductive and sensorineural origin
- Raising awareness of families and teachers regarding the potential of early detection and therapy in cases of hearing loss.

The program was intended also to provide information about the epidemiology of hearing disorders in the populations studied (including assessment of the incidence of central hearing disorders and tinnitus).

Fig. 1. Regions where the screening program was implemented

Table 1 presents the main parameters of the program.

Table 1. Selected parameters of the program.

Number of 7-12-year-old children encompassed by the program	92, 876
Percentage of 7-year olds included	84,3%
Percentage of 8-12-year-old children included	15,7%
Number of schools included	5045
Percentage of the total number of schools in relevant regions	88,4%
Percentage of parents who consented to participate in screening	94,8%

A considerable difficulty in carrying out the program was the wide dispersal of schools in regions involved. In the rural regions the majority (70.7%) comprised small schools, in which the number of children involved in the program did not exceed twenty.

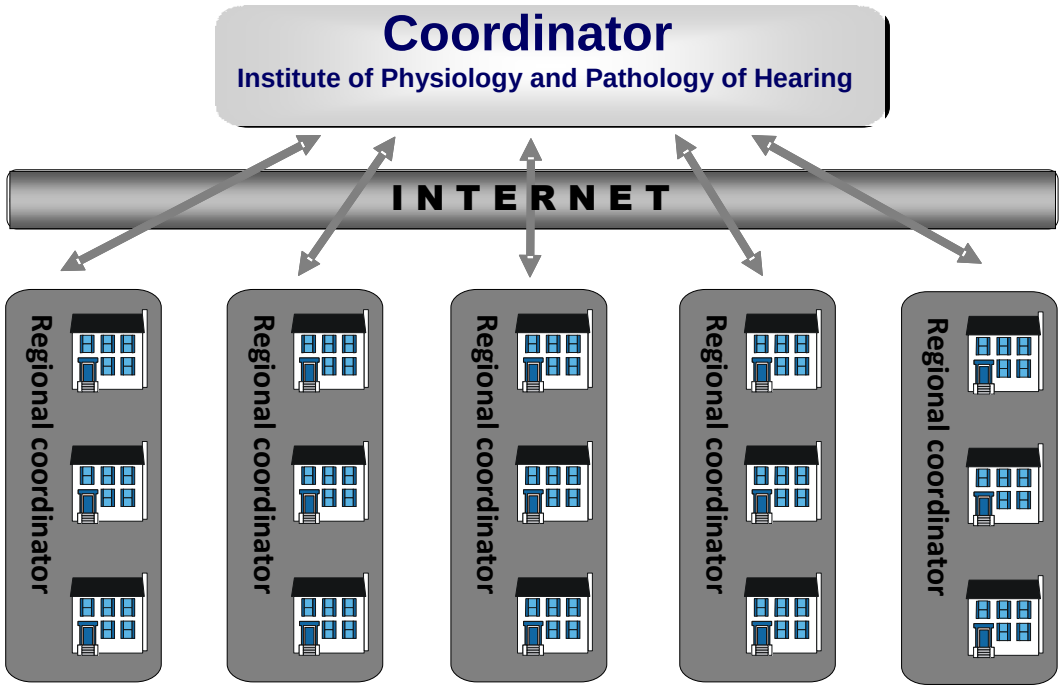

Fig. 2. Project management scheme

The program was managed by the coordinator (the Institute of Physiology and Pathology of Hearing), whose main task was to plan examinations in all regions, appoint regional coordinators, train the researchers, supervise the implementation of the program and analyze the results. He was also responsible for the diffusion of information about the program in the society. Regional coordinators were responsible for recruiting the researchers, scheduling and supervising the examinations.

The total number of researchers employed in the program was 131 and most of them were engaged for longer than one month. The researchers were, among others, students, audiology technicians, unemployed persons and employees of the psychology-education services. All were trained in the methodology of screening examinations and in proper use of the equipment. During the implementation of the program the researchers travelled in total over 250,000 km and the duration of examinations was more than 14,000 hours.

Information materials about the program, together with the booklet about the prophylaxis and the examination consent forms were delivered to schools through local administration units – gminas (communities). The teachers distributed the materials among parents during regular meetings.

For the dissemination of information about the program an internet site was created providing running information about the program and all materials relevant to the program's implementation, such as methodology, information brochures, questionnaires, forms. The information was also disseminated through the mass media, using press conferences, radio and TV programs and press articles.

The goodwill of schools towards the program was ensured by cooperation with the regional school boards and local authorities.

Fig. 3. Unit for screening examination.

The screening examinations were performed using the 'Audiometr S' unit developed through the cooperation of the Institute of Physiology and Pathology of Hearing and the Institute of Innovations in Mining Industry EMAG in Katowice. The unit consists of the PDA microcomputer, headset and the patient's button. The unit can be programmed with different types of hearing test depending on what is necessary. During the screening program the following tests were used: air conduction hearing threshold audiometry for frequencies 250-8000 Hz and the test of central processing of auditory information (DDT - dichotic digital test). In the audiometry the criterion of the norm was a hearing threshold not exceeding 20 dB HL for frequencies of 250-8000 Hz. The unit was additionally equipped with an audiological questionnaire and background noise monitoring function. Screening examinations were conducted during lessons, in quiet rooms provided by the school's headmaster. Results of all tests were collected in the unit's database and uploaded to the central database of the program through the internet.

In carrying out the program the newest technologies of data collection and transmission were used, assuring the highest quality of data security. Within a few minutes of the examination, results were displayed on the coordinator's screen (Fig.4), and the coordinator decided if the examination was correctly conducted and, if necessary, referred the child for further diagnostic tests.

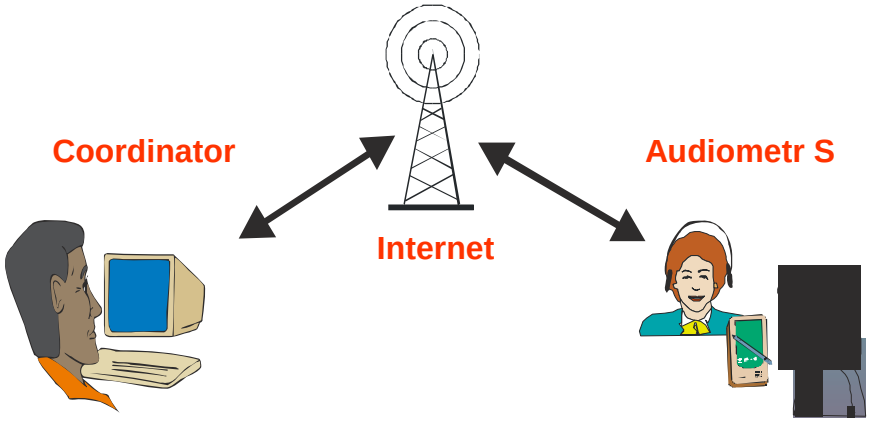

Fig. 4.Program data transfer chart

The GPRS data transmission technology was used to assure the smooth transfer of data between the screening unit and central database. Communication with the server used the GPRS protocol. The unit was equipped with a software module functioning as the FTP client, which enabled the direct transmission of data to the server.

The audiologist on duty used an application enabling them towork with the results of the examinations: downloading data from the server, reviewing them and qualifying the results. The audiologist, using the results, selected children in need of further audiological attention. The physician from the coordinator's team, after verification of the results, could contact the researcher using the GSM network, for example to order repeat examinations.

Table 2. Overall results of the program

Percentage of 7-year olds whose results indicated conductive or sensorineural hearing dysfunction	13.7 %
Percentage of 7-year olds whose results indicated central hearing dysfunction	15.1 %
Percentage of 7-year olds whose results indicated conductive, sensorineural or central hearing dysfunction	19.4 %
Percentage of children 8-12 year olds with conductive or sensorineural hearing dysfunction	15.1 %
Percentage of incorrect results of audiometry in one ear	65.0 %
Percentage of parents of children with hearing dysfunction who did not notice that their children had problems with hearing	59.5%

Table 3. Some of the questionnaire results

Percentage of children who in the questionnaire reported temporary or constant tinnitus	33 %
Percentage of children with hearing dysfunction who reported temporary or constant tinnitus	17,1 %
Percentage of children with hearing loss who are easily distracted, often ask for information to be repeated	66,3%
Percentage of children with delayed speech development	12,3%

Summary

The screening examinations of the population, conducted for three months on quantitatively significant material (92,876 children), demonstrated that the initial assumptions were correct, the implemented organization model was effective and that the portable units used in the program were suitable for hearing examinations.

The results of the examinations performed during the program confirmed a high incidence of hearing dysfunction among school children, in line with the results obtained by other authors (Bess, Dodd-Murphy et al. 1998; Niskar, Kieszak et al. 1998; Niskar, Kieszak et al. 2001). It seems alarming that there was a high percentage of children reporting temporary of constant presence of tinnitus.

Noteworthy was the high proportion of parents who consented for their children to participate in screening examinations. This demonstrated a high level of social awareness regarding the need for early detection of hearing dysfunction in school children. It also confirms the benefits of organizing hearing screening examinations in schools.

Bibliography

Bess, F. H., J. Dodd-Murphy, et al. (1998). "Children with minimal sensorineural hearing loss: prevalence, educational performance, and functional status." Ear Hear **19**(5): 339-354.

Niskar, A. S., S. M. Kieszak, et al. (1998). "Prevalence of hearing loss among children 6 to 19 years of age: the Third National Health and Nutrition Examination Survey." Jama **279**(14): 1071-1075.

Niskar, A. S., S. M. Kieszak, et al. (2001). "Estimated prevalence of noise-induced hearing threshold shifts among children 6 to 19 years of age: the Third National Health and Nutrition Examination Survey, 1988-1994, United States." Pediatrics **108**(1): 40-43.