Public Health Impact of Hearing Impairment and Disability

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Key Words

Hearing disability • Epidemiology of hearing loss • Public health • Communicative rehabilitation • Hearing aids

Abstract

This presentation of the public health impact of hearing impairment highlights the important elements of interaction between the disability and community. **Objectives:** Retrospective study to identify the size of the problem of hearing loss, illustrating not only the magnitude but also the serious effect of the lack of reliable data concerning this matter. It highlights the challenges met within a mid-economy community regarding the handling of the impact of the disability. The Egyptian data is given as an example of the situation in a mid-economy community. **Study Design:** A brief introduction of some epidemiological factors of hearing impairment is presented including the size of the problem in Egypt. Data of the neonatal hearing screening program of the Audiology Unit, Ain Shams University, is presented. The impact of the disability is then discussed in relation to the age of onset and the degree and type of hearing loss. This is followed by the description of the nature and effect of the disability in the different age groups. A discussion of the various factors that may modify the capability of the community to deal with such disability follows. This includes various economic indices with their possible limitations on the part of the community. Such a briefing illustrates the challenges met in the rehabilitation of the deaf and the hearing-impaired in a developing mid-economy country. The broad lines of the management of the problem both at the prophylactic as well as the rehabilitative levels are discussed. A final remark on recommendations and possible future development in a developing country is presented.

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Introduction

Public health impact of disability is seen as the effect of that disability on the individual and the response of the community to handle it. Such disability imposes limitations on the performance of the individual in the community. The community has obligations to handle that challenge and to help provide supporting measures to the disabled individual.

Some Epidemiological Factors of Hearing Impairment Size of the Problem

Hearing loss represents a common birth defect and is difficult to detect, due to its 'invisible' nature. The incidence of children with hearing impairment in the literature is variable. It is reported to be between 0.65 and 6.0 per 1,000 live births [1, 2]. Hearing loss was found to represent a significant public health problem when compared to other commonly known childhood diseases even if it is minimal [3]. In Egypt, hereditary nonsyndromic hearing loss constitutes the highest percentage (27.7%) of causes of hearing loss among children, probably because of the traditional tendency of family intermarriage [4]. Three sources of figures are presented:

(1) In the Audiology Unit, Ain Shams University, a neonatal hearing screening program was first conducted in January 2002 for Neonatal Intensive Care Unit (NICU) graduates. The results of the period from January 2002 to January 2006 showed that 18.8% of cases did not pass the screening in the first session and needed reevaluation. Follow-up of these neonates showed that 4.8% had hearing loss [5]. The high prevalence of hearing loss in Egypt could be attributed to a high rate of consanguineous marriage resulting in hereditary hearing loss. Snoeckx et al. [6] found that 15% of Egyptian children with severe to profound hearing loss suffer from connexin 26 mutations.

(2) The Audiology Unit of Ain Shams University performed hearing screening in a remote underserved rural village in Upper Egypt. The study was carried out on 500 schoolchildren in August 2005 using pure-tone audiometry and immittance. The results showed that conductive hearing loss due to middle ear pathology was the most prevalent cause (16%). This is due to high prevalence of infections and poor sanitary conditions in these areas.

(3) The figures from the evaluation of patients referred to the Audiology Unit, Ain Shams University, during the year 2005 showed that 76% out of 4,562 adults and 71% out of 4,683 children had hearing loss. These high figures are expected since the referred patients were already suspected to have a hearing loss.

Effect of Hearing Loss on the Individual's Performance

The impact of hearing loss on the individual depends on several factors such as:

(1) *Age of Onset of Hearing Loss.* The critical period of language acquisition is defined as a certain period in life when an individual is programmed to optimally receive and utilize auditory stimuli. This period is from birth to 3 years of life. The effect of hearing loss on language acquisition and development is greater when it occurs in the prelingual or the perilingual period rather than in the postlingual period. Accordingly, hearing-impaired children suffer more than adults from hearing impairment, as verbal communication and scholastic achievement are severely affected by this disability.

(2) *Degree of Hearing Loss.* Severe to profound hearing loss has a greater impact than mild to moderate hearing loss. It was found that children with congenital bilateral severe to profound hearing loss leave the education system at the age of 18 years with language abilities equivalent to 9-year-olds, while children who suffer from mild to moderate hearing loss leave the education system at the age of

18 years having achieved an average sixth grade reading level and an average language-age equivalent to 12-year-olds [7]. It was also found that school-age children even with mild degrees of hearing loss (unilateral, mild, high-frequency) are more likely to have scholastic difficulties and problems with social interaction and self-esteem [7].

(3) *Type of Hearing Loss.* The impact of moderate to profound sensorineural hearing loss is more severe than conductive hearing loss for the individual's life. It can lead to delayed language development in children, which has a negative effect on scholastic achievement later in life. On the other hand, mild sensorineural hearing loss has less drastic effects on language development. Conductive hearing loss, long considered of no negative effect on language development, may put the child in a disadvantageous position regarding scholastic achievement [8]. The child's self-produced noises, like breathing, chewing, and others, may significantly interfere with speech perception and discrimination.

Outcome of Hearing Loss

Children suffering from hearing loss usually present with delayed language development, scholastic underachievement, behavioral, psychological, intellectual and social problems. Hearing loss may also have a serious impact on the life of adults. The younger ones may experience self-doubt and concern about finding life partners. They usually complain of problems in work placement and vocational achievement. Older persons may be uncertain about their goals in life, and may consider early retirement. Both age groups of adults may experience fear, worry, anxiety and embarrassment [9].

On the other hand, the old and the old-old may suffer from difficulty in adaptation to life, social withdrawal and isolation problems. Hearing loss in the elderly population is usually associated with depression together with social isolation as there are severe communication problems. They may also have serious difficulty in speech discrimination due to phonemic regression together with central auditory dysfunction. This may add to the communicative problem [10].

Ability of the Community to Deal with the Impact of Disability on the Individual's Performance

Economic Aspects

The handling of public health problems in any community represents an economic burden that has to be confronted if the impact of such problems is to be ab-

Table 1. Macro-allocation for health (total health expenditure)

	Total health expenditure, million USD	Per capita share, USD	% of GDP
Egypt	921	18	2.6, mid-economy
France	105,467	1,869	8.9, high-economy

Comparison between the figures of Egypt and France regarding the allocated percentage of health services in relation to the GDP and the government balance sheet (1990) [11]. This table illustrates the disadvantaged position of a developing community to handle health challenges as compared to a high-economy country (France).

sorbed or reduced. Accordingly, the economic profile of the community has to be studied to find out in what way this aspect may modify the ability of the community to overcome the impact of the disability we are referring to in this work [11].

It is evident that a community with a low gross domestic product (GDP) faces financial challenges that limit its resources to handle the impact of the disability. Development and the combat of poverty are the hope for a better chance for low economy countries to give effective rehabilitation services.

General Economic Indices

In Egypt, which is an example of a middle economy community, the following indices reflect a challenge to the ability of the community to handle the impact of hearing impairment [figures for the years 1999–2000 from ref. 11]: *population growth rate: 2.0%; economy growth rate: 6.5%; *GDP per capita: USD 1,159; budget balance sheet deficit: less than 1%; *trade balance deficit: USD 11.5 billion; inflation rate: 3.2%; *unemployment rate: 7.9%; *adult literacy rate: 53% (indices marked with an asterisk are considered to be negative points in the economic aspects of a community).

Economic Allocations for Health Care and Rehabilitation

Closely related to the above-mentioned indices is the allocation provided by such an economy for the rehabilitative services in general. The following is a summary of the macro-, meso- and micro-allocations for rehabilitation in Egypt. An outline of the three levels of allocations of financial resources is given. The first is the macro-allocation of the total health expenditure. The meso-allocation is the allocation of all rehabilitative services. Fi-

Table 2. Macro-allocation for health (total health expenditure) [11]

	% of the government's balance sheet	Per capita expenditure, USD
Egypt	2.2	10
Kuwait	6.8	510
Sudan	4.8	3

Comparison between macro-allocation for health and the per capita expenditure in some countries in the Middle East (1996). Countries with higher GDP such as Kuwait are in a more favorable position to handle the challenges of rehabilitation.

nally, micro-allocation concerns the available resources for communicative rehabilitation.

(1) *The Macro-Allocation System for Health Services in Egypt.* The percentage of macro-allocation for health was going down since 1960, yet it started to go up in 1995. It is still, however, considered insufficient regarding Egypt's health requirements. It is considered very meager compared to the health sector share in developed countries (tables 1, 2).

(2) *Meso-Allocation System for All Rehabilitative Services in Egypt.* At this level of allocation the sources are divided between the multiple outlets of rehabilitation services. These include health, education and welfare sectors. The share of each sector in this field of rehabilitation is given below. Meso-allocations for the various sectors of rehabilitative services: health – Egyptian pounds (EGP) 7,469,000 (USD 1,299,000) for clinics of Phoniatrics and Audiology; education – EGP 3,707,000 (USD 647,000) for special education classes; welfare – EGP 7,200,000 (USD 1,252,000) for NGO centers of rehabilitation and education; total – EGP 18,376,000 (USD 3,198,000).

(3) *Micro-Allocation System for the Care of Communicative Disorders in Egypt.* In 1999 there were only 19 governmental hospitals together with 20 private clinics and hospitals providing phoniatric/audiological services in the whole country. In addition, the availability of human resources providing health services in this field is also limited. Example of micro-allocation for communicative disorders: expenditure of 3 major centers in Cairo: EGP 581,129 (USD 101,000) in 2000. Cost of examination per patient [11]: actual, EGP 68 (USD 11.9); subsidy, EGP 23 (USD 4; patient payment, EGP 45 (USD 7.8).

Legislative Aspects

The legislative aspects related to hearing conservation and other preventive regulations are rather limited. Apart from a few laws controlling noise pollution and its regulation in industry, there is practically no comprehensive community-imposed legal agenda on hearing, its conservation, or the rights of the hearing-impaired person for protection, diagnosis or rehabilitation.

Professional Aspects

The lack of a sufficient number of well-trained and qualified personnel in the field of audiology or phoniatics represents an important limiting factor in spreading comprehensive services to cover the whole country. Future plans should include a clear agenda of the expansion of the training programs in those fields to cover all services in a nation of approximately 75 million. The estimated number of needed professionals in phoniatics is 700, the available figure at the present time is 75.

Awareness of the Problem

There is a general lack of public insight into the problem. Usually, the feeling towards the hearing-impaired is more misunderstanding than sympathy. Outside the University Clinics of Audiology and Phoniatics there are few sporadic programs for the care of the hearing-impaired. Few NGOs are making an effort to deliver services to these clients. There is still a lack of a national program or campaign that focuses on the needs and rights of the hearing-impaired. The lack of awareness is fueled by the lack of reliable figures on the size and distribution of the problem. Such figures, when available, might convince the community at large to direct its efforts to the reduction of the impact of the disability of hearing impairment and deafness.

Management and Reduction of the Effects of the Impact of the Disability

Prophylactic Aspects

In Children

(1) *Prevention of the Prevalent Causative Factors.* At present the following services are available free of charge: (a) adequate antenatal care through Health Centers distributed throughout the country; this aims at improved care during labor to avoid the occurrence of anoxia or birth trauma; (b) vaccination of children during the first 2 years of life against measles, mumps and other infectious diseases such as meningitis.

Yet, the following must be fulfilled in the future for adequate prevention: (a) improvement of the general hygienic conditions to avoid systemic infections (meningitis, typhoid) and local causes of ear infections; (b) genetic counseling of future parents to reduce the occurrence of hereditary hearing loss; (c) vaccination against rubella and cytomegalovirus may prevent infection during pregnancy with avoidance of the resulting serious hearing loss of the future baby, and (d) prevention of the intake of ototoxic drugs. All these measures may reduce the risk of hearing impairment in that critical period for the child.

(2) *Programs of Early Detection.* A neonatal hearing screening program was applied in the NICU graduates in Ain Shams University Hospitals since January 2002. The program aims at the early detection and management of hearing loss. A universal hearing screening covering the whole country is, however, still under trial. The general factors of lack of trained personnel, unavailable funds and absence of reliable figures are the obstacles this goal is facing.

In Adults and the Old

The reduction of the occurrence of hearing impairment may be achieved by prevention of the predisposing factors: (1) prevention the noise-induced hearing loss by application of noise control programs; (2) prevention of the intake of ototoxic drugs, and (3) control of systemic diseases such as hypertension and diabetes. These programs are aimed at, but not yet possible to apply, on a nationwide scale.

Rehabilitative Aspects

General Program for Infants and Children

Such a program is most effective when it is based on the principle of early detection. Any identification/suspicion of a potential hearing loss should be followed by confirmation of the diagnosis, of the type and degree of the loss in preparation of prescribing the appropriate sound amplification system as early as possible in life.

Family counseling and guidance should be introduced energetically and properly and as much as needed. Proper preschool placement of the children in a rehabilitation program administered by specialized professionals is necessary, preferably in the framework of a program of integration of the hearing-impaired in the normally hearing population. The aforementioned elements of such a very early stage in the management and rehabilitation of hearing loss is the guarantee for success of the following stages of the program. This includes education in the pri-

mary school and the future education/vocation of the child till proper work placement and follow-up are achieved. Such a comprehensive program remains a recommendation rather than reality in a mid-economy country such as Egypt.

Educational and Social Considerations for Adults and Old-Old/Old Subjects

The educational/vocational needs of the growing hearing-impaired child have to be taken seriously to adapt to the child's abilities and mobilize all of his/her skills to perform optimally in any future line of work. Similarly, if the hearing loss is detected or has occurred at a later stage, re-placement in education and work might be necessary.

The social worker is called to aid on many occasions during the rehabilitation plan, especially for the adult and old-old/old subject to help them adapt to the challenges of the new situation and the limitations that face them. The social worker is supposed to help those persons to overcome, absorb and adapt to the impact of the disability of hearing impairment. Such a program is facing, at present, serious challenges represented by lack of qualified personnel, meager availability of hearing aids (HAs), and absence of sufficient funds.

Sound Amplification Systems

With few exceptions, appropriate sound amplification for both ears is mandatory once a hearing loss is diagnosed at any age. Technological development has provided the audiologist with a variety of types of digital HAs that would fit almost any type or degree of hearing loss. More sophisticated types of sound amplification systems are reserved for special indications such as in the case of cochlear implants and implantable HAs.

Despite the financial challenges, a cochlear implant program was started in 1994 in the Department of ORL, Ain Shams University, with its Units of Audiology and Phoniatrics. Nearly 200 implants have been fitted since the start of the program.

The following is an estimation of the number of HAs and their sources of distribution (figures are based on indirect evidence of the number of prescribed HAs). The general problem of lack of precise figures in the field involves the question of the number of HAs dispensed per year. Such a crucial question can still not be answered due to the general lack of reliable data.

(1) Health Insurance: dispenses about 12,000 HAs/year; (2) Ain Shams University Audiology Unit: dispenses about 1,568 HAs/year; (3) Cairo University Audiology

Unit: dispenses about 1,550 HAs/year; in addition, (4) patients can purchase their HAs from the commercial market directly.

Future Development

It is recommended:

(1) To procure solid honest data about the problem, regarding its size, distribution and the available sources for its management. To achieve this goal a number of well-planned and scientifically executed field surveys have to be carried out. The statistical outcome should represent the starting point for any serious future planning or even campaigning in the field of hearing impairment. Impressions and misrepresentative figures will not be able to convince any legislative or professional body, not even the public and the families of the disabled.

(2) To spread information and to heighten awareness about the problem among the public, the professionals and the administration. With the solid reliable data at hand, any well-studied plan of public education and motivation of the authorities will have a maximal chance of success. Otherwise, the most devoted and sincere efforts in the field of heightening awareness of the needs of the hearing-disabled in question may be defeated.

(3) To unify the sources of services combating hearing loss and the resulting disability. The care of the hearing-impaired appeared to be delivered by multiple sources, namely, health, education and welfare. It is mandatory to coordinate the efforts and the finances of those sources to guarantee optimal success for any future plans for the care, prevention, and rehabilitation of the hearing-impaired and to reduce the impact of the resulting disability.

(4) To establish and develop model systems of identification and rehabilitation of the hearing-impaired for future generalization even for remote and underserved areas. These systems, that might be executed in specialized centers, will represent a model for national development. These locally developed model systems have the best chances of success and generalization because they apply and consider the entire cultural, social, economic as well as professional aspects in the community they were developed in.

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