

The World Health Organization Model of Functioning and Disability Applied to Audition

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The consequences of hearing loss are far greater than the damage to the structures in the auditory system. The World Health Organization (WHO) has developed the International Classification of Functioning and Disability as a system for classifying the consequences of all health conditions (WHO, 1999). The WHO model is described with particular attention to the aspects that relate to hearing impairment. The system is discussed as a means for describing the full consequences of hearing loss and as a method for evaluating the functioning of persons with hearing impairment.

Introduction

The concept of health care has expanded greatly during the 20th century. The objectives of health care have progressed from the diagnosis and treatment of diseases and disorders to the understanding of the consequences of diseases and disorders -- especially those that are chronic in nature. A more recent goal in health care has been to improve human functioning with the management of the consequences of the health condition as well as curing the disease. Disability is the term that has been used by professionals and investigators when the ability to function has been compromised or lost. As a result, both "functioning" and "disability" are terms that are used in the management and treatment of the consequences of health conditions.

In 1980, the World Health Organization (WHO) developed a classification system of disabling conditions entitled the "International Classification of Impairments, Disabilities and Handicaps" (ICIDH)(WHO, 1980). Revised versions of the ICIDH classification system were published in 1997 and then in 1999 with a modified title -- the "International Classification of Functioning and Disability" (ICIDH-2)(WHO, 1999). In the ICIDH-2, the concepts of functioning and disability have three dimensions: body functions and structures; activity at the person level; and participation at the social level (WHO, 1999). In the ICIDH-2, the consequences of a health condition are described in terms of functioning in all three dimensions plus the consideration of effects due to contextual factors. The ICIDH-2 is intended to be used to describe all forms of disability; however, due to the limited work on this endeavor to date, only a few forms of disability have been described thoroughly.

Hearing impairment has consequences that may affect the development of the intellectual, communicative and social skills of an individual. In the educational system, the responsibility for academic and social development is distributed among the members of a team and is expressed in the individual education plan (IEP). Though no one member of the team has sole responsibility for all aspects of a child's functioning and disability, the

better each team member understands the total consequences of the hearing impairment, the greater the child's chances for success. For example, the educational audiologist who typically has primary responsibility for hearing assessment and amplification also has the responsibility for presenting information regarding the impact that hearing impairment can have on the communication, learning and social/emotional development of the child (Johnson, Benson, & Seaton, 1997). The WHO model provides a format to describe the consequences of hearing impairment for a specific child in a very comprehensive and formal manner.

Although the ICIDH-2 is a classification system, it can also be used as a method of describing the dimensions of function within a disability. The first purpose of this paper is to describe the ICIDH-2 and to provide examples of its application to functioning and disability. The second purpose is to identify the dimensions and domains that pertain specifically to audition, and relate those to what is known about learning and living with a hearing impairment.

Family of WHO Classifications

The WHO has developed a family of disease and health-related classification systems. The structure of these systems is shown in Figure 1. At the core of these classification systems is the International Statistical Classification of Diseases and Related Health Problems (ICD). The ICD is a system used for the classification of the diagnoses of diseases and disorders. Some of the classification lists have been expanded to provide increased clinical detail. The specialty-based adaptations shown in Figure 1 are expansions of the ICD system that were needed for seven disciplines. Figure 1 also specifies information systems designed to support primary health care which are not formal classification systems. The International Nomenclature of Diseases (IND) shown in Figure 1 was developed to provide a single recommended name for each morbid entity for use in conjunction with the ICD.

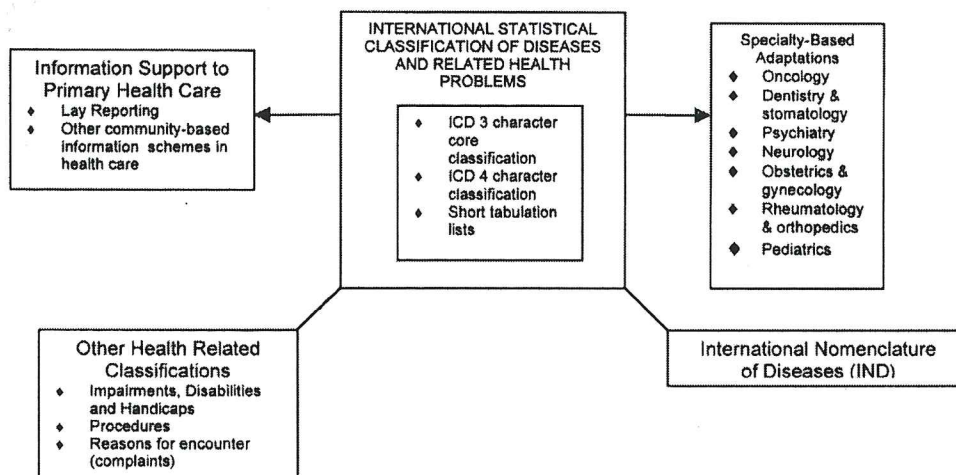


Figure 1. Family of disease and health-related classifications (WHO, 1993).

The second main type of classification system in the WHO family are the non-diagnostic classification systems listed as Other Health Related Classifications in Figure 1. This group covers aspects of health problems that are outside the realm of formal diagnoses including the ICIDH, which is the classification of the consequences of health conditions. Another system which is a part of this classification group is the International Classification of Procedures in Medicine (WHO, 1978), which classifies procedures for medical diagnosis, prevention, therapy, radiology, drugs, and surgical and laboratory procedures.

International Statistical Classification of Diseases and Related Health Problems (ICD)

Initially, the ICD was established to classify causes of death. The first classification of the causes of death was published in 1893 (WHO, 1993). Later, this system was expanded to include the diagnosis of diseases. In the course of 100 years, this classification system has been revised ten times. The ICD-10 is intended to be used for the classification of diseases and disorders as well as for epidemiological purposes such as the tabulation, analysis, and interpretation of mortality and morbidity data. The ICD is the parent classification system in the WHO family and it has served as a model for the other classification systems in the family. In the ICD-10, diseases are grouped in the following categories: epidemic diseases, constitutional or general diseases, local diseases arranged by site, developmental diseases, and injuries. These categories are mutually exclusive and cover the entire range of morbid conditions. Every disease or morbid condition has a well-defined place in the list of categories. Disease entities of particular public health importance or which occur frequently have their own categories.

International Classification of Functioning and Disability (ICIDH-2)

Although the classification of diseases can be traced back as far as the late 1800's, the classification of the consequences of

diseases by the World Health Organization was not begun until the early 1970's and was not published until 1980 (WHO, 1980). In addition to the WHO efforts, independent investigators have developed systems for describing the consequences of disease (Granger, 1984; Nagi, 1965, 1991; Pope & Tarlov, 1991; Wilson & Cleary, 1995). The differences between these descriptive systems typically occur in the use of terminology and the categorization of disability related to disease consequences. The World Health Organization classification system was selected as the subject of this paper because it is the most widely used. The WHO Collaborating Centre (WCC) for the ICIDH in the Netherlands has identified over 1,000 publications referring to the WHO classification system since its introduction in trial form in 1976 (Yaruss, 1998).

In the first version of the ICIDH (WHO, 1980), the consequences of a health condition were described using the dimensions of "impairment", "disability" and "handicap". In the ICIDH-2 (WHO, 1999), the terminology was modified to reflect changes in the conception of functioning and disability. The terms "disability" and "handicap" in the ICIDH were considered to have socially negative connotations (Frattali, 1998) that only focused on the loss of function as opposed to the abilities of the person. In the ICIDH-2, the terms "activity" and "participation" have replaced the terms "disability" and "handicap" respectively. These new terms are considered to have neutral social connotations and thus allow for both positive and negative factors to be addressed (WHO, 1999). The WHO is continuing to evaluate these new concepts to determine if they will gain widespread acceptance or if they will need further modification (WHO, 1999).

The ICIDH-2 is a 214-page description of functioning and disability. The complete manual for the ICIDH-2 can be located online at <<http://www.who.int/icidh>>. Its organization provides a structure in which the many consequences associated with diseases, disorders or injuries can be specified qualitatively and quantitatively. The ICIDH-2 provides a framework for examining functioning at the level of the body as a consequence of a

health condition, functioning at the level of the person's individual activities, and functioning of the individual in society (WHO, 1999).

In the ICDH-2, the three major divisions of disability and functioning are called dimensions: body functions and structures refers to functioning at the body level, activities refers to functioning at the person level and participation refers to functioning at the society level. In addition to these dimensions are contextual factors that can influence behavioral outcomes. Figure 2 gives an overview of the aspects of the dimensions of the ICDH-2 (WHO, 1999). Each column in Figure 2 is a dimension of functioning and disability; each row contains a description of aspects in which these dimensions can be considered.

Aspects	Dimensions			
	Body Functions & Structures	Activities	Participation	Contextual Factors
Level of Functioning	body (body parts)	individual (person as a whole)	society (life situations)	environmental factors (extended influence on functioning) + personal factors (internal influence on functioning)
Characteristics	body function body structure	performance of individual's activities	involvement in life situation	feature of the physical, social and attitudinal world + Attributes of the person
Positive Aspects (Functioning)	functional and structural integrity	activity	participation	facilitators
Negative Aspects (Disability)	impairment	activity limitation	participation restriction	barriers/hindrances
Qualifiers: First Qualifier	Uniform Qualifier: Extent or Magnitude			
Second Qualifier	Localization	Assistance	Subjective Satisfaction (under development)	(under development)

Figure 2. Aspects of the dimensions of the ICDH-2 (WHO, 1999).

The ICDH-2 classification system has a hierarchical structure of terminology for the consequences of health conditions. The subgroups of the primary categories of function and disabilities (i.e., dimensions) are *domains, facets, and items* (WHO, 1999). In the present paper, the majority of the discussion is focused at the levels of dimensions and domains because much of the work on the facets and items as they relate to audition has yet to be done.

Figure 3 shows the relationships among the three dimensions of functioning and disability, the health condition, and contextual factors. The factors associated with each dimension are dynamic.

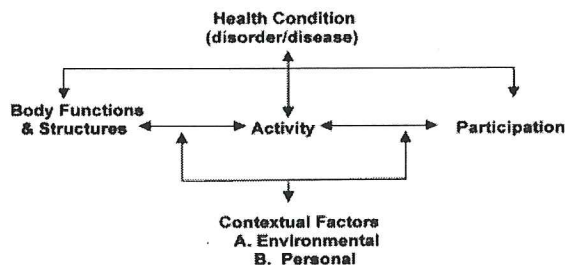


Figure 3. Current understanding of interactions within the ICDH-2 dimensions (WHO, 1999).

They may fluctuate or proceed in a specific direction. The factors are considered to be interactive because any factor has the possibility of influencing any other factor within or across dimensions. In addition, contextual factors may interact with factors in any or all of the dimensions. For example, an impairment of body function or structure may limit a person's activity and also the ability to participate. However, it is also possible that an impairment of body function or structure may result in a restriction of participation without limiting a person's activity. An individual may also experience a degree of influence in a reverse direction such as a limitation in activity resulting in an increase in the impairment (e.g., inactivity of muscles can cause atrophy).

ICDH-2 Dimensions of Functioning and Disability

Body function and structure. "Body functions" are the physiological or psychological functions of the body systems. "Body structures" are the anatomical parts of the body such as organs, limbs and their components (WHO, 1999, p. 16). Impairments are problems in body function or structure, such as a significant deviation or loss. Impairment in body function and/or structure is not the same as the underlying pathology; rather, it is the manifestation of pathology or pathologies. Impairment of body function refers to a loss of function such as hearing impairment for which the corresponding impairment of structure might be cochlear damage. Structural impairments can involve defects, anomalies, or loss of limb or other structures of the body. Impairments of body function or structure are specified using one or more of the following criteria: loss or lack, reduction, addition or excess, or deviation. Impairment may be permanent or temporary, intermittent or continuous, or progressive or regressive. It is also possible for an impairment to cause other impairments.

Activities. The term "activity" is defined as "the performance of a task or action by an individual" (WHO, 1999, p. 18). The elements in this dimension are used to describe activities that are associated with a person's everyday life. These activities range from simple to complex. Impairment of body function or structure is typically determined in isolation or in a test environment. However, activity is the assessment of the impairment in a natural context. For example, impairment of hearing sensitivity measured in an audiological examination would be considered to be in the body function dimension. But the activity of listening -- the ability to successfully use the impaired hearing -- is considered under the activity dimension and is an indication of the

person's performance in his/her everyday environment. The degree of impairment cannot necessarily be used to predict the degree of activity limitation that might occur.

Participation. "Participation" is defined as "an individual's involvement in life situations in relation to health conditions, body functions and structures, activities, and contextual factors" (WHO, 1999, p. 19). The restriction of participation may be in the nature of the participation, the duration, or the quality. This dimension applies to the consequences of a health condition at the societal level. A limitation of activity affects only the individual's activities. By contrast, a restriction of participation affects the extent of an individual's involvement in some area of human life as compared to the involvement of an individual without a disability. For example, a person with hearing impairment may experience a limitation in the activity of using the telephone. As a result of a limitation in the ability to use the telephone, the person may be unable to obtain employment, which is a restriction in participation. Overall, participation refers to the whole experience of a person with a health condition in the social contexts in which one lives.

Contextual factors. Contextual factors can either be environmental or personal. Examples of environmental factors might be architectural characteristics, such as excess room reverberation, or societal attitudes toward individuals with hearing impairment. Environmental factors are listed formally in the ICIDH-2 classification. Personal factors such as age, gender and lifestyle are not included in the current classification system. However, the concept of personal factors can be taken into consideration by an individual user of the classification system, and there is the possibility of the creation of such a listing in the future.

ICIDH-2 Code. In the coding system for the ICIDH-2, base codes are composed of a letter followed by three to five numbers. The letter portion of the code is used to indicate the dimension:
 b - body functions
 s - body structures
 a - activities
 p - participation
 e - list of environmental factors

The digits at the beginning of the numerical sequence indicate the general ICIDH-2 categories whereas the digits at the end of the sequence indicate the more specific categories within the ICIDH-2. A period (.) at the end of this alphanumeric code can be followed by additional numerical qualifiers. In the activities dimension of the ICIDH-2, qualifiers can be used to denote severity and/or assistance needed. For example, the code "a1101.31" indicates difficulty in the activity of listening, which is severe and requires the use of a technical aid.

a denotes activity dimension
1101 listening activity
.3 qualifier indicating severe limitation
.31 qualifier indicating use of technical aid

In the case of participation, a qualifier is used to indicate the extent of participation. For example, if a person with epilepsy experiences complete restriction of participation in mobility with

private transportation because the law expressly prohibits operating a motor vehicle, then this person will have to depend on getting transportation from family members who have private transportation. The full code to indicate this restriction of participation would be p2400.4.

p participation dimension
2400 participation in mobility with private transportation
.4 complete restriction

Examples of Functioning and Disability Described Using ICIDH-2

Current literature contains applications of the ICIDH (WHO, 1980) in such fields as mental health (Ustun, Cooper, van Duuren Kristen, Kennedy, Hendershot, & Sartorius, 1995), physical medicine (Heerkens, Van Ravensberg, & Brandsma, 1995), rehabilitative medicine (Van Bennekom, Jelles, & Lankhorst, 1995), geriatric medicine (Grimby et al., 1993), pediatric neurology (Diderichsen et al., 1990), speech-language pathology (Raaijmakers, Dedder, Degonckere, & van der Zee, 1995; Yaruss, 1998) and otolaryngology (Cohen, 1995). In the following sections, examples are given for the use of the ICIDH-2 from the field of education and from the field of speech-language pathology.

For example, a child with attention deficit disorder will have poor attention that may be evident in an inability to sustain attention (b1400) and in the continuity of consciousness (b1101). It is possible that such a child may experience difficulties in activities that require the following of directions in school (a8450) and in paying attention to the teacher (a1150). He or she may experience difficulties with other children at school or play because of difficulties taking turns (a7400). The child's behavior may be sufficiently disruptive that it may limit participation in education at school (p630) and in play, sports and games (p9200/p9201) because of the child's exclusion by peers. The full consequences of the child's disability may be expressed as shown in the listing below:

Impairments in body function or structure	Activity Limitations	Participation Limitations
*Poor attention	*Following directions	*Participation in education
*Problems with concentration	*Paying attention	*Participation in play, sports and games
*Continuity of consciousness	*Waiting for turns	

In speech-language pathology, the ICIDH-2 model has been used to describe the consequences of a stroke (Frattali, 1998). An individual who suffers a stroke due to cerebral vascular disease subsequently may have language impairments due to aphasia (b1750, b1751 and b1752). This may lead to a limitation in communication activities: using the telephone (a2550), communicating spoken messages (a230), or reading the newspaper (a225). These activity limitations may lead to restriction in

participation by creating social isolation (p430), interrupting participation in community activities (p910) or causing the person to be unable to work (p730).

Application of the ICIDH-2 to Audition

In the ICIDH, the term "disability" is used to indicate any restriction or lack of ability to perform an activity in the same manner as is considered to be normal for a human being. Other organizations have addressed functioning and disability as they relate to the consequences of hearing and speech disorders. The American Academy of Otolaryngology (1979) described guidelines for evaluating hearing handicap. The American Speech-Language-Hearing Association (1981) established definitions for hearing impairment, hearing disability and hearing handicap. In both cases, disability was defined as a percentage of hearing loss based on thresholds of audibility for the purpose of computing monetary compensation. In these cases, the term "disability" has been defined narrowly.

A number of investigators have used the concepts developed in the ICIDH to define and describe the consequences of hearing impairment (Davis, 1983; Erdman, 1993; Swan & Gatehouse, 1990; Thomas, 1984, 1988). Stephens and Hetu (1991) at-

tempted to clarify the terminology primarily applied to impairment for adults with acquired hearing loss. Thus far, investigators in the field of hearing impairment have only recently begun to address the fundamental concepts in the ICIDH and now the ICIDH-2, and have used only parts of the model to begin to develop a comprehensive description of the consequences of hearing impairment.

A demonstration of the full use of the ICIDH-2 to provide a comprehensive description of the consequences of hearing impairment for different types of hearing losses and also for particular individuals will follow. This will be done by considering all of the dimensions and the domains in the ICIDH-2 that apply to audition. The next two levels in the model, facets and items, will be covered only selectively -- in part because they are so numerous and in part because they add refinement and specification of degree of involvement to main concepts listed in the domains.

Figure 4 is a complete listing of all of the dimensions and domains in the ICIDH-2 for all forms of disability regardless of the disease or disorder. Each chapter is a separate domain. The chapters marked with a check (✓) are those that apply to the function and disability associated with hearing impairment. In

Body Functions Dimension	Body Structures Dimension	Activities Dimension	Participation Dimension	Environmental Factors Dimension
✓Chapter 1 Mental Function	Chapter 1 Structure of the Nervous System	✓Chapter 1 Activities of Learning and Applying Knowledge	✓Chapter 1 Participation in Personal Maintenance	✓Chapter 1 Products and Technology
✓Chapter 2 Sensory Functions	✓Chapter 2 The Eye, Ear and Related Structures	✓Chapter 2 Communication Activities	✓Chapter 2 Participation in Mobility	✓Chapter 2 Natural Environment and Human Made Changes to Environment
✓Chapter 3 Voice and Speech Functions	Chapter 3 Structures Involved in Voice and Speech	Chapter 3 Movement Activities	✓Chapter 3 Participation in Exchange of Information	✓Chapter 3 Support and Relationships
Chapter 4 Functions of the Cardiovascular, Hematological, Immunological and Respiratory Systems	Chapter 4 Structure of the Cardiovascular, Immunological and Respiratory Systems	✓Chapter 4 Activities of Moving Around	✓Chapter 4 Participation in Social Relationships	✓Chapter 4 Attitudes, Values and Beliefs
Chapter 5 Functions of the Digestive, Metabolic, Endocrine Systems	Chapter 5 Structures Related to the Digestive, Metabolism and Endocrine Systems	Chapter 5 Self Care Activities	✓Chapter 5 Participation in Home Life and Assistance to Others	✓Chapter 5 Services
Chapter 6 Genitourinary and Reproductive Functions	Chapter 6 Structure Related to Genitourinary System	✓Chapter 6 Domestic Activities	✓Chapter 6 Participation in Education	✓Chapter 6 Systems and Policies
Chapter 7 Neuromusculoskeletal and Movement Related Functions	Chapter 7 Structure Related to Movement	✓Chapter 7 Interpersonal Activities	✓Chapter 7 Participation in Work and Employment	
Chapter 8 Functions of the Skin and Related Structures	Chapter 8 Skin and Related Structures	✓Chapter 8 Performing Tasks and Major Life Activities	✓Chapter 8 Participation in Economic Life	
			✓Chapter 9 Participation in Community, Social and Civic Life	

Figure 4. Complete listing of the ICIDH-2 dimensions and their domains (WHO, 1999) A check (✓) indicates those domains that may apply to functioning and disability as a result of hearing impairment.

the first two dimensions (body function and structure), only four chapters (domains) are marked. However, in considering the three remaining dimensions -- activities, participation and contextual factors -- 21 out of 23 chapters are marked with checks. This indicates that the four hearing related impairments of body function and structure may result in extensive consequences in the dimensions for activities and participation and may be significantly influenced by environmental factors.

The levels in the model beyond the dimensions and domains shown in Figure 4 are facets and then items. The following are examples of the information that might be represented at these levels of the model. In the body function dimension under the domain of "sensory functions" (Chapter 2), there is the facet entitled "hearing functions." It includes the functions of hearing, localizing sound, and auditory discrimination. Beyond this level, there are seven items used for the specification of functions in the facet: hearing sounds, auditory discrimination, localization of a sound source, lateralization of sound, speech discrimination, other specific hearing functions, and unspecified hearing functions. In the activities dimension, the domain of "communication activities" (Chapter 2) includes the use of communication devices (facet). This facet contains items regarding the use of communication devices/techniques, the telephone, other telecommunication devices, and a typewriter/computer. The reason for the inclusion of the domain "activities of moving around" (Chapter 4) is less obvious than for Chapter 2. "Activities of moving around" include the following items which may be affected by hearing impairment: understanding traffic rules, buying tickets for transportation, and evaluating a traffic situation. In the dimension of participation, one domain is the "participation in the exchange of information" (Chapter 3). This domain includes the participation in spoken and non-spoken exchange of information (facet). The items in this facet are spoken exchange of information, exchange of information by means of formal signing and other forms of non-spoken exchange of information.

Table 1 is an example of how the ICIDH-2 model might be applied to an individual -- in this case a hypothetical 3rd grade child with a moderate, bilateral sensorineural hearing loss who wears binaural amplification. She has been identified as having speech and language impairments. Due to her hearing, speech and language impairments, she is experiencing limitation in activities such as hearing in background noise, acquiring skills, analyzing problems, reading, writing, and asking questions. The interaction between these impairments and activity limitations has resulted in a restriction of participation. Specifically, this child is experiencing a restriction of participation in the exchange of information and in social relationships. The consequences of this child's hearing impairment are specified using thirteen codes. These codes provide a basis for identifying areas of concern as well as areas that may require intervention.

The ICIDH-2 can also be used to specify the consequences of hearing impairment as measured by the tests and procedures currently used in audiology and aural (re)habilitation. For example, basic comprehensive audiometry is used to describe consequences in the dimension of impairment. The assessments for speech, language, and learning difficulties are also classified

Dimension:	Impairment of Function
Domain:	Specific Mental Functions
Facet:	Specific mental functions of language
Item:	Reception of language (b1750)
Item:	Expression of language (b1751)
Domain:	Voice and Speech Functions
Facet:	Articulation functions (b320)
Domain:	Sensory Functions
Facet:	Hearing functions
Item:	Moderate decrease in hearing (b2300.2)
Dimension:	Activities
Domain:	Activities of Learning and Applying Knowledge
Facet:	Purposeful sensory activity
Item:	Listening activity (a1101)
Facet:	Activities of acquiring skills
Item:	Following through acquisition of a skill (a1352)
Facet:	Problem-solving
Item:	Analyzing problems (a1451)
Facet:	Activities of learning to read (a120)
Facet:	Activities of learning to write (a125)
Domain:	Communication Activities
Facet:	Activities of producing spoken messages
Item:	Producing spoken messages with literal meaning (a2300)
Dimension:	Participation
Domain:	Participation in exchange of information
Facet:	Participation in spoken exchange of information (p310)
Facet:	Participation in written exchange of information (p320)
Domain:	Participation in social relationships
Facet:	Participation in informal social relationships
Item:	Participation in relationships with peers (p4304)

Table 1. ICIDH-2: Consequences of hearing impairment for a 3rd grade student.

in the dimension of impairment. The Screening Instrument for Targeting Educational Risk (SIFTER) (Anderson, 1989) is used to screen classroom behaviors. Distractibility, attention span, and following oral directions are some of the behaviors that are considered. The results obtained with this instrument reflect the consequences of hearing impairment in the dimension of activities. Self-assessment instruments used to measure the handicapping effects of hearing impairment (Schow & Nerbonne, 1982; Ventry & Weinstein, 1982) contain questions that measure the consequences of hearing impairment in two dimensions: activities and participation. For example, questions relating to the effect of hearing loss on verbal forms of communication describe activities while questions relating to the effect of hearing loss on psychosocial, vocational and educational issues describe participation (Alpiner & Garstecki, 1996).

Further Applications

The ICIDH-2 model allows those working in the fields of audiology and aural (re)habilitation to describe the consequences of hearing impairment in great detail. Professionals are encouraged to work with the model as a clinical tool and to adapt it to meaningfully describe the consequences of hearing impairment. This may require adding concepts as well as deleting those that do not apply to audition. With further investigation, it may be found that certain consequences depend on other consequences and that it may be of value to rank-order consequences. After the model has been adapted for application to hearing impairment, it may be possible to use it to identify patterns of auditory disability as well as to describe the functioning of particular individuals. Insights gained by using the model may provide a stimulus for the development of new measures for the consequences of hearing impairment, standards for age-appropriate function, and measures to evaluate treatment outcomes.

At this time, the American Speech-Language-Hearing Association is involved in extensive studies for the development of outcome measures in at least two areas: functional communication and treatment efficacy (personal communication, Margo Stein, June, 1999). In the areas of aural habilitation and rehabilitation, development of outcome measures using the ICIDH-2 structure may be helpful in the establishment of justification of funding for services. In this sense, the ICIDH-2 may provide a framework for creating an awareness of the complete needs of individuals with hearing impairment.

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