Abstract: Children with speech impairment form a significant part of many speech language pathology caseloads. Traditionally, assessment and intervention with these children has focused on the level of the impairment. However, the World Health Organization's International Classification of Functioning, Disability and Health (ICF) and ICF- version for Children and Youth provide a framework by which such children can be managed in an holistic manner, with due consideration given to the body structures and functions affected by their impairment, as well as the impact on children's activities and participation. The ICF acknowledges the individuality of each child with a speech impairment, through consideration of barriers and facilitators stemming from environmental and personal factors. In this article, assessment and intervention for speech impairment is described using each component of the ICF. A case study illustrating the use of the ICF with a child who has a speech impairment is provided.


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Application of the ICF and ICF-CY to children with speech impairment

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Abstract

Children with speech impairment form a significant part of many speech pathology caseloads. Traditionally, assessment and intervention with these children has focused on the level of the impairment. However, the International Classification of Functioning, Disability and Health (ICF) and ICF-Children and Youth (ICF-CY) provide a framework by which such children can be managed in an holistic manner, with due consideration given to the Body Structures and Functions affected by their impairment, as well as the impact on children’s Activities and Participation. The ICF acknowledges the individuality of each child with a speech impairment, through consideration of barriers and facilitators stemming from Environmental and Personal Factors. In this paper, assessment and intervention for speech impairment is described using the each component of the ICF. A case study illustrating the use of the ICF with a child who has a speech impairment is provided.

Key words: articulation, phonology, ICF, ICF-CY, World Health Organization, assessment, intervention, children

Learning objective:
To understand the application of the components of the ICF and ICF-CY to children with speech impairment (also called articulation/phonology/speech sound disorder).
Speech impairment is a sub-category of communication impairment and includes: speech sound impairment, articulation delay, phonological disorder, and childhood apraxia of speech. Children with speech impairment may only have a mild impairment (e.g., an interdental lisp) or they may have completely unintelligible speech. When assessing children to determine whether they have a speech impairment, speech-language pathologists (SLPs) typically consider the speech sounds the child can produce (phonetic ability), the accuracy of the speech sounds with respect to the language they are speaking (phonological ability), the child’s ability to combine sounds (phonotactic ability) and the child’s ability to produce appropriate intonation, stress, rhythm (prosodic ability). In addition, the child’s ability to hear and interpret speech sounds as well as their ability to store and retrieve phonetic, phonological and motor programming information is considered.\textsuperscript{1, 2} Children may have difficulty with some or all of these components to be identified as having a speech impairment. Intervention programs typically aim to increase intelligibility and reduce the occurrence of mismatches with the adult target. Intervention for children with speech impairment has been found to be effective via a range of levels of evidence including randomised controlled trial.\textsuperscript{3}

**Description of children with speech impairment using the ICF and ICF-CY**

The *International Classification of Functioning, Disability and Health* (ICF) as well as the derived version for children and youth (ICF-CY) to be released in 2007\textsuperscript{4} provide a number of components to ensure holistic understanding of people in context. Application of the ICF and ICF-CY to children with speech impairment requires consideration of every component: Body Functions, Body Structures, Activities and Participation, Environmental Factors, and Personal Factors.\textsuperscript{5, 6} Table 1 provides a summary of the components and domains that are most applicable to
children with speech impairment. However, it should be noted that communication affects all aspects of a child’s life, so codes other than those listed in Table 1 may also be applicable in some cases.

Insert Table 1 here

Speech impairment

Body Structures

SLPs initially consider children with suspected speech impairment at the level of Body Structures. For some children, an impairment in body structures is the origin of their speech difficulties; this may include structures of the ear (e.g., malformed cochlear), structures involved in voice or speech (e.g., cleft palate) or neurological structures (e.g., resulting in cerebral palsy). However, for 70-80% of children with speech impairment their body structures are typically intact and children are classified as having a speech disorder of unknown origin. More recently, these children have been characterized as having speech impairment of currently unknown origin due to expectations of scientific advances, particularly in the area of genetics research.

Body Functions

Following an investigation of Body Structures, the next consideration in identifying children with speech impairment is the Body Functions. Impairment at the level of Body Functions includes difficulties with the input, organization and production of speech at both the segmental level (vowels and consonants) and suprasegmental level (timing, intonation). Body Functions is the level of classification most widely used by SLPs. Results from a survey conducted by McLeod indicated that the majority of paediatric SLPs based their clinical decisions about a child’s speech on body functions, specifically the child’s level of intelligibility and inconsistency with normative data (such as age of acquisition of
speech sounds, phonemic repertoire etc.)\textsuperscript{1}. There were fewer comments relating to Participation and none relating to Body Structures. SLPs’ focus on Body Functions is consistent with the observation of Lollar and Simeonsson\textsuperscript{11} that “…improvement in function is often the litmus text that society uses to evaluate effectiveness of programs and treatments” (p. 323).

The major ICF domain of relevance to children with speech impairment is b3 Voice and Speech Functions, and specifically the category of b320 Articulation functions. Currently the ICF does not have subcategories of Articulation functions, nor does it contain a domain labelled Phonological functions. However, almost everything that SLPs do with this group of children relates to this large and encompassing category. Additional domains of relevance to speech impairment include difficulty with the domains of mental functions (e.g., perception (b156), language (b167), motivation (b1301), problem-solving (b1646)) and sensory functions (e.g., hearing (b230) including speech discrimination (b2304)). For example, problem-solving could include a child’s ability to self-evaluate the accuracy of and change their speech productions.\textsuperscript{12}

**Speech impairment and Activities/Participation**

A SLP is unable to determine the severity and impact of a child’s speech impairment without considering the component of Activities and Participation. Within this component, the main function that will be affected by speech impairment is d3 communication. It is probable that children with speech impairment may experience limitations with the activities of speaking (d330) and/or conversation (d350). However, the effects of speech impairment extend well beyond this.\textsuperscript{13} A speech

\textsuperscript{1}Intelligibility was classified under the ICF category of Activity in McLeod (2004); however, continued discussion with colleagues suggests that it is more appropriately classified under Body Function.
impairment may lead to limitations in a child’s ability to sound out words (d1 learning and applying knowledge), to handle stress and other psychological demands (d2 general tasks and demands), to engage in interpersonal interactions (d6 domestic life) and to engage in play (d8 major life areas).14

The ICF allows for comparison between performance and capacity.15 For children with speech impairment, there may be a mismatch between their ability to perform within their daily lives and their communicative capacity on standardized speech assessment tools. Some areas of difference for children with speech impairment include: single word versus connected speech;16, 17 imitated versus spontaneous speech;18 stimulable versus non-stimulable sounds;19 mono-syllabic versus polysyllabic words.20 Consideration of performance versus capacity is an important component within the capability focus model described by Kwiatkowski and Shriberg.21 The difference between performance and capacity is better understood with a dynamic assessment approach that has recently been applied to children with speech impairment22.

Speech impairment and Contextual factors

Environmental Factors.

During the assessment of a child with speech difficulties, a SLP will also consider Environmental Factors that may affect their abilities, management and future outcomes. The Environmental Factors within the ICF that most specifically relate to children with speech impairment include: support and relationships (e3); attitudes (e4); and services, systems and policies (e5); each will be discussed in turn.

Support and Relationships. A SLP will consider how a child with speech impairment interacts with and is supported by family and friends (e310, e320) in order to determine if the intervention needs to incorporate education, advice and support to
significant others such as siblings and parents. A SLP may also consider the level of support available to the child for completing therapy activities in order to determine whether intervention may occur in other environments (e.g., home). The SLP may also investigate the child’s need for support or assistance in order to function successfully in other environments (e.g., the kindergarten or school). Speech impairment is known to co-occur with other disorders, so a SLP may determine whether other professionals are involved in a child’s management, in order to provide a coordinated service.

Attitudes. It is important for the SLP to consider the attitudes of significant others when planning intervention. The SLP may wish to discover how family and friends feel about the child’s speech impairment and about the child’s need for intervention. Again, this may influence the amount of information and counselling provided, or suggest a need for the involvement of other health professionals (e.g., social workers). Within Western society there is stigma associated with even mild inability to pronounce speech sounds.

Services, Systems and Policies. Depending on a SLP’s work environment, the services, systems and policies of the health, education and training (including special education) may be a consideration. These have an impact on eligibility for service/support, prioritisation of services, waiting time, duration of service, type of service provision and cost of service. While in the USA and UK, services to children with speech impairment are mandated in law (e.g., Individuals with Disabilities Education Act, IDEA), in nations such as Australia some children with speech impairment receive limited services. McKinnon et al. described teachers’ identification of school students with speech impairment from 10,425 students in one Sydney Australian Catholic Diocese. The teachers indicated that over
half of the students with speech impairment required moderate to very high levels of support. In contrast, the teachers indicated that many of the students with speech impairment received no/minimal learning support, and 91.1% of these students did not have an individualised education plan (IEP), 84.8% received no/minor curriculum adaptation and almost one-quarter (24.1%) had no involvement with outside agencies (including speech-language pathology services).

**Personal factors.**

Attached to every “speech impairment” is a real child. His or her unique makeup must be considered within his/her cultural milieu in order to determine the most appropriate intervention goals. The ICF recognizes the “large social and cultural variance” (p 8) including: gender, age, other health conditions, coping style, social background, education, profession, past experience, and character style.

Currently, research into typically developing children has demonstrated a wide range of individual differences in the acquisition of speech sounds. For children with speech impairment, there are some case studies documenting the effect of personal factors on appropriate goal setting and intervention outcomes. For example, Kamhi describes the impact of personality/character style on the progress of phonological intervention with his daughter, Franne. Franne’s “stubbornness” and desire to communicate with her parents led to delineation between speech sound practice with her SLP and meaningful communication with her parents. He writes: “Franne’s reluctance to practice speech sounds was her way to let us know that we should focus on what she said when she spoke, rather than on how she said it” (p. 183). Consequently, SLPs consider personal factors when planning assessments and intervention.

**Risk factors.**
Although risk factors are not equivalent to personal factors on the ICF, some factors, such as gender, age and social background, have also been found to be associated with increased likelihood of speech impairment. For instance, the ratio of boys to girls with impaired speech has been documented as approximately 2:1.\textsuperscript{36} The average age of referral for children with speech impairment of unknown origin is 4;3 (years; months).\textsuperscript{37} There is strong evidence to suggest that positive family history of speech, language and or literacy difficulties are risk factors for speech impairment \textsuperscript{6, 36, 38, 39} and there is moderate evidence to suggest that low maternal education is a risk factor for speech impairment.\textsuperscript{6, 38} There is also some inconclusive evidence to indicate that children from low socioeconomic (SES) backgrounds are at greater risk for speech impairment.\textsuperscript{39} When a combination of these factors is considered, Campbell et al.\textsuperscript{7} indicated that a child was 7.71 times more likely to have a speech impairment if they were male, with a positive family history and low maternal education levels than a child without any of these factors.

Assessment and intervention tools available for children with speech impairment

A wide range of assessment and intervention tools are available to SLPs for assessing and targeting Body Functions and many fewer for the other ICF domains.

Body Structures

Some impairments in body structures and functions that influence speech production can be detected via oromusculature examination (OME).\textsuperscript{40, 41} For example, impaired body structures including tongue-tie and impaired body functions including difficulty on diadochokinesis tasks (rapid speech movement) would be apparent during an OME. SLPs often refer to other medical practitioners such as ear, nose and throat specialists, orthodontists, and craniofacial surgeons for assessment and
diagnosis of children with impaired body structures. For example, impairments of body structures and functions relating to hearing impairment (that can co-exist with speech impairment) can be detected via audiological examination, such as pure tone hearing tests and tympanometry. It follows that intervention for impairments of body structures such as cleft palate would also require the involvement of other medical specialists.

**Body Functions**

The majority of assessment and intervention tools designed for children with speech impairment can be categorised using the Body Functions domain: Articulation functions (b320). Traditional measures of the speech function of these children include the many available articulation/phonology tests such as the *Bankson Bernthal Test of Phonology*,42 *Diagnostic Evaluation of Articulation and Phonology (DEAP)*,43 *Computerized Articulation and Phonology Evaluation System (CAPES)*44 and the *Profiling Elements of Prosodic Systems – Children (PEPS-C)*.45 The range of speech analyses includes phonological analyses (e.g., *Profile of Phonology (PROPH+)*);46 nonlinear analyses47 and psycholinguistic analyses.2 Additionally objective measures, including acoustic (e.g., spectrographic) and physiological (e.g., electropalatographic48) tools enable more accurate description of speech.49 Children with speech impairment frequently receive assessment reports concluding with impairment-based goals such as to increase the percent of consonants correct (PCC), to decrease the occurrence of various phonological processes, or to produce a list of phonemes expected but not produced correctly by the child. These goals may be targeted through one of a number of intervention approaches including *Core Vocabulary*,50 *Metaphon*,51 *Parents and Children Together (PACT)*,52 and *PROMPT*.53
All of these approaches and goals can be categorised under Articulation functions (b320) of the ICF.

**Activities and Participation**

There are few examples of ways in which SLPs assess the component of Activities and Participation among children with speech impairment. Examples include the *Therapy Outcomes Measure* and the *AusTOMS* that include a specific subsection on children’s speech.

Due to the paucity of tools for SLPs to explore the Activities and Participation of children with speech impairment, the *Speech Participation and Activity in Children* (SPAA-C) was developed. Questions about the daily lives of children and impact of having a speech impairment were included in a semi-structured interview format to be used with any or all of the following: the child with a speech impairment, their siblings, parents, friends, teachers and significant others such as grandparents, sports coach, or neighbours. One component of the SPAA-C is the inclusion of a Likert scale where children indicate how they feel about different scenarios relating to speaking. The 10-question Likert scale has been trialled with 95 preschool children who did not have a communication impairment and was found to be appropriate for use with young children. The SPAA-C has been extended to include drawings of the interviewed children to further illustrate who they are and the impact of speech impairment on their worlds. Research using the SPAA-C has documented the impact of speech impairment on the lives and families of children with speech impairment, and specifically siblings of children with speech impairment. The SPAA-C can be used to gain information to cooperatively plan assessment, goal setting, and intervention so that changes can directly impact the child’s whole life.
Further, SLPs can consider *interpersonal interactions and relationships* (d7) in their intervention planning for children with speech impairment. Pertinent social assessment practices may consist of a discussion with the child, his/her parents, siblings, friends, grandparents and other significant people to ascertain social goals and barriers, interests and hopes. Currently, there is a lack of discussion that targets this component of the ICF for children with speech impairment.

**Case Example**

Joe was a young boy, aged 4;0 who experienced speech difficulties and was referred by his mother to the outpatient clinic at a regional hospital. The following discussion regarding Joe’s presentation and management illustrates the manner in which the ICF can be used with children who have a speech impairment. An additional case study using the ICF and ICF-CY is available in McLeod and describes Jarrod, a seven-year-old boy who has severely unintelligible speech.

**Referral process**

The speech pathology department at the hospital had a policy whereby children could be referred by parents, general practitioners, maternal and child health nurses and other health professionals. All new referrals were discussed at a central intake meeting held with other service providers and distributed according to the child’s needs. As a consequence, Joe was placed on a waiting list at the hospital to be contacted by SLPs when time became available. It was the hospital’s policy that parents/guardians would be contacted within 8 weeks. Joe’s referral to speech pathology involved components of the ICF. Environmental Factors, such as support and relationships (e3) and attitudes (e4), influenced his mother’s initial decision to refer, and services, systems and policies (health) (e580) influenced subsequent management.
Assessment

When Joe attended the initial assessment, he was accompanied by his mother. The assessment involved completion of a case history, administering of standardised assessments and informal play/observation. The case history provided information relating to many aspects of the ICF. His mother was able to provide detail about Personal Factors, including social background and character style, Body Functions, including global mental functions (b110-b139) (e.g., persistence (b1234), optimism (b1265), motivation (b1301), confidence (b1266))², specific mental functions (b140-b189) (e.g., attention (b140), reception and production of language (b1670, b1671)), sensory functions (b2) (e.g., hearing (b230)), voice and speech functions (b3) (e.g., articulation (b320)), and functions relating to the digestive, metabolic and endocrine systems (b5) (e.g., biting (b5101), chewing (b5102) and swallowing (b5105)). For instance, she reported that Joe was a bright and happy child who could be shy around strangers. He had attained most developmental milestones at appropriate ages, except for his production of speech sounds. She reported no concerns with Joe’s attention, production and understanding of language, and revealed that his hearing had been previously assessed and found to be within normal limits.

His mother was also able to provide information about Activities and Participation such as learning and applying knowledge (d1) (e.g., acquiring language, maintaining attention), general tasks and demands (d2) (e.g., carrying out daily routine, handling stress), communication (d3) (e.g., comprehending spoken messages, speaking, conversing), self care (d5) (e.g., eating, drinking), and interpersonal interactions and relationships (d7) (e.g., forming relationships, interacting according to social rules, relating with strangers, parent-child relationships and sibling

² These codes are to mean pathologic state and not just as a personality variation.
relationships). For instance, Joe’s mother revealed that he was able to perform many activities of daily living without assistance (e.g., dressing, feeding), that he had made friends at kindergarten and played with his sister happily at home. However, she revealed that Joe had difficulty interacting with unfamiliar people at times due to his unintelligible speech. According to his mother, when Joe was not understood, he would not persevere with the interaction, but instead “clam up.” Over time, she had noticed Joe had become more reluctant to attempt conversations with strangers. This information provided the SLP with an idea of the impact that Joe’s speech impairment had on his ability to participate in life activities, according to a significant other person in his life.

Joe’s mother was also able to outline the environmental and personal factors that could affect his management. For instance, she revealed that Joe lived at home with his parents and older sister. She also revealed a family history of speech and language difficulties, a Personal Factor that could predispose Joe to having a speech impairment. Joe’s mother was not concerned about his language skills, but reported concerns about his ability to produce speech sounds and be understood by others, especially strangers/unfamiliar listeners.

Following the case history, Joe’s speech and language skills were evaluated. An informal oromusculature examination (OME) was conducted to investigate Body Structures involved in voice and speech (s3). Joe’s voice and speech functions and communication activities were formally assessed using the *Diagnostic Evaluation of Articulation and Phonology* (DEAP) and the *Clinical Evaluation of Language Fundamentals – Preschool* (CELF-P), while other body functions and activities and participation were informally evaluated.
As a result of the OME, it was probable that Joe had a speech impairment of unknown origin. He did not have any impaired body structures that contributed to his speech difficulty and his hearing had been assessed and found to be within normal limits. Results from the formal assessments revealed Joe’s ability to receive/comprehend communication (d310) was unimpaired. However, his ability to produce communication was moderately impaired (d330) due to his difficulty producing a range of speech sounds (b320).

Observation during the session supported his mother’s report that Joe was a shy child (b126) who was initially reluctant to engage with strangers (d730). However, he appeared to have a good relationship with his mother (d760). Joe’s ability to form relationships with unfamiliar people developed as his confidence increased. He presented as a happy child who was able to focus and maintain attention for an extended period of time (b140), when motivated by reinforcement. These observations revealed the involvement of other Body Functions and Personal Factors and their interactions with Activities and Participation. They also informed intervention strategies.

**Intervention**

As Joe was found to have unimpaired body structures involved in voice and speech (s3), intervention was planned to target the components of Body Functions and Activities and Participation. Therapy was based on the Parents and Children Together (PACT) approach and incorporated parent education, metalinguistic training and phonetic production training, with reinforcing activities to help focus attention and increase motivation.

This intervention was conducted with consideration of Joe’s personal and environmental context. Joe lived with his parents and his mother accompanied him to
therapy. However, both parents were employed and so intervention had to consider the availability of his support network. As a result clinic sessions were held fortnightly, rather than weekly. It also meant that home activities were not always completed. However, Joe attended kindergarten and so his environmental facilitators extended to the staff who worked there. They were eager to assist Joe’s development and so were informed of therapy goals and activities, and attempted to incorporate these into small group sessions in the kindergarten environment.

The continuation of intervention beyond the clinic was possible due to the supportive attitude of Joe’s family (e410) and kindergarten (e430). Service plan meetings were held in order to keep everyone informed of Joe’s needs and progress. A communication book was also devised to assist this. However, the book achieved a double-purpose in that it provided Joe’s mother with a means of informing kindergarten staff about events in his life that he may wish to talk about. By providing staff with this background information, she was increasing Joe’s likelihood of successful communication when conversing with the staff (d330). In therapy sessions, production of core vocabulary containing the targeted sounds was a goal to also improve Joe’s ability to converse. Other strategies could have been implemented to assist Joe participate in activities at kindergarten, such as developing peer relationships (d750) and starting/sustaining a conversation (d350). These strategies could have included education of peers to request repetition when Joe was not understood (e325), and education of staff to look at Joe and utilise available contextual cues to assist their understanding (e360).

The discharge policy at the hospital stipulated that children could continue to receive intervention until they were functioning within normal limits or reached school-age. As a result, Joe was able to continue receiving regular intervention for 18
months. However, when Joe was due to commence school, he was ineligible for ongoing services (cf. McKinnon et al.\textsuperscript{27}). Despite the fact that he continued to have difficulty producing polysyllabic words and the strong link between speech impairment and reading/spelling difficulty (b\textsuperscript{140-189}) local governmental policies dictated that his speech impairment was not severe enough to warrant further intervention. The impact that such policies have on the lives of children with speech impairment is currently under investigation.\textsuperscript{61}

**Summary**

The components of the ICF and the interrelationship between each component are relevant for children with speech impairment. SLPs traditionally focus on Body Functions; however, additional consideration of Activities and Participation, Environmental and Personal Factors is also important. In most cases, problems with Body Structures are ruled out as a causative factor. The ICF is beneficial for holistically considering these children in their milieu.

**Acknowledgment**

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Table 1. The components and domains within the ICF most relevant to children with speech impairment

<table>
<thead>
<tr>
<th>ICF and ICF-CY parts</th>
<th>ICF and ICF-CY components</th>
<th>ICF domains relevant to speech impairment</th>
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<tbody>
<tr>
<td>I. Functioning and disability</td>
<td>Body Functions</td>
<td>b110-b139. Global mental functions (including temperament and personality functions)</td>
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<td></td>
<td></td>
<td>b140-b189. Specific mental functions (including perceptual functions, and mental functions of language)</td>
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<td></td>
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<td>b320-b249. Hearing and vestibular functions</td>
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<td></td>
<td></td>
<td>b3. Voice and speech functions (including voice functions, articulation functions, and fluency and rhythm of speech)</td>
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<td>Body Structures</td>
<td>s1. Structures of the nervous system (including structure of brain)</td>
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<td>s2. Structure of the eye, ear and related structures (including structure of the external, middle, and inner ear)</td>
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<td></td>
<td></td>
<td>s3. Structures involved in voice and speech (including structure of the nose, mouth, pharynx, and larynx)</td>
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<td>s430. Structures of respiratory system</td>
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<td></td>
<td>Activities and Participation</td>
<td>d1. Learning and applying knowledge (including listening, learning to read, thinking)</td>
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<td></td>
<td></td>
<td>d3. Communication (including communicating – receiving, communicating – producing, conversation and use of communication devices and techniques)</td>
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<td>d6. Domestic life (including assisting others in communication)</td>
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<td></td>
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<td>d7. Interpersonal interactions and relationships (including family relationships)</td>
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<td>d8. Major life areas (including education)</td>
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<td></td>
<td></td>
<td>d9. Community, social and civic life</td>
</tr>
<tr>
<td>II. Contextual factors</td>
<td>Environmental factors</td>
<td>e1. Products and technology</td>
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<tr>
<td></td>
<td></td>
<td>e3. Support and relationships (including immediate and extended family, friends, health professionals)</td>
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<td></td>
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<td>e4. Attitudes (including societal attitudes, social norms, practices and ideologies)</td>
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<td></td>
<td></td>
<td>e5. Services, systems and policies (including communication, health and, education)</td>
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<tr>
<td></td>
<td>Personal factors</td>
<td>Attributes of the person, and the internal influences on functioning and disability</td>
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</tbody>
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