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**Validation of the Comprehensive ICF Core Set for  
Multiple Sclerosis:  
The perspective of physicians**

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## Deutsche Zusammenfassung

**Hintergrund:** Das "Umfassende ICF Core Set für Multiple Sklerose" dient der klinischen Anwendung der Internationalen Klassifikation der Funktionsfähigkeit, Behinderung und Gesundheit (ICF) der Weltgesundheitsorganisation (WHO) mit dem Ziel, die typische Bandbreite der Funktionsfähigkeit bei Patienten mit Multipler Sklerose abzubilden.

**Ziel:** Das Ziel dieser Studie war die Validierung des "Umfassenden ICF Core Sets für Multiple Sklerose" aus der Perspektive der Ärzte.

**Methoden:** Mit Hilfe der Delphi-Methode wurden Ärzte mit Erfahrung in der Behandlung von Patienten mit Multipler Sklerose nach den Problemen, Ressourcen und Umweltfaktoren gefragt, die für die ärztliche Behandlung ihrer Patienten eine Rolle spielen. Die Expertenbefragung erfolgte in drei Runden per elektronischer Postzustellung (E-mail). Die Antworten der ersten Runde wurden nach definierten Übersetzungsregeln von zwei darin geschulten Doktoranden in die Sprache der ICF übersetzt. Der Grad der Übereinstimmung der gelinkten Antworten wurde anhand des statistischen Wertes Kappa berechnet. Die ICF-Kategorien der ersten Runde und die Ergebnisse der zweiten Runde wurden den Teilnehmern in einem zweiten und dritten Fragebogen zurückgemeldet.

**Ergebnisse:** Vierundachtzig Ärzte aus 36 Ländern nannten 1735 Probleme, Ressourcen und Umweltfaktoren, die in der Behandlung von MS Patienten eine Rolle spielen. 1452 davon konnten in 166 ICF-Kategorien übersetzt werden. Die restlichen Aussagen wurden den Personbezogenen Faktoren zugeordnet, bezeichneten eine spezielle Diagnose, waren nicht im ICF enthalten oder zu allgemein um sie in eine bestimmte ICF-Kategorie übersetzen zu können. Insgesamt wurden 89 ICF-Kategorien (64,5%) des „Umfassenden ICF Core Set für Multiple Sklerose“ von den Teilnehmern bestätigt, 49 Kategorien wurden nicht benannt. Acht zusätzliche ICF-Kategorien, die im bisherigen ICF Core Set für Multiple Sklerose nicht enthalten sind, wurden von mehr als 75 Prozent der teilnehmenden Ärzten als wichtig angesehen.

**Fazit:** Die Validität des "Umfassenden ICF Core Set für Multiple Sklerose" wurde aus der Perspektive der Ärzte im Wesentlichen bestätigt. Es wurden einige zusätzliche

ICF-Kategorien als wichtig erachtet, deren Aufnahme in das „Umfassende ICF Core Set für Multiple Sklerose“ in weiteren Studien diskutiert werden muss.

## Abstract

**Background:** The "Comprehensive ICF Core Set for Multiple Sclerosis" is an application of the International Classification of Functioning, Disability and Health (ICF) of the World Health Organisation (WHO) with the intention to represent the typical spectrum of functioning of patients with MS.

**Objective:** The objective of this study was to validate the "Comprehensive ICF Core Set for Multiple Sclerosis" from the perspective of physicians.

**Methods:** Using the Delphi technique physicians with experience in the treatment of patients with Multiple Sclerosis were requested to name MS patients` problems, resources and aspects of environment treated by physicians. The three-round survey was performed by electronic-mail (e-mail). Based on established linking rules the statements of the first Delphi round were linked to ICF categories by two trained doctoral students. The level of agreement was calculated by using the statistical value Kappa. The ICF categories of round one as well as the results of round two were reported back to the participants.

**Results:** Eighty-four physicians out of 36 countries named 1735 problems, resources and aspects of environment that are important in the treatment of patients with multiple sclerosis. There from 1452 could be linked to 166 ICF categories. The remaining statements were allotted to the component Personal Factors, indicated a definite diagnosis, were not classified in the ICF or were too general to define it clearly in the ICF. Totally, 89 categories (64.5 %) of the "Comprehensive ICF Core Set for Multiple Sclerosis" were confirmed by the participants, 49 categories were not named. Eight additional ICF categories which are currently not included in the "Comprehensive ICF Core Set for MS" were seen as important factors in the treatment of MS patients by more than 75 percent of the participating physicians.

**Conclusion:** The validity of the "Comprehensive ICF Core Set for Multiple Sclerosis" was largely affirmed by the participating physicians. However, several additional categories were named whose inclusion in the "Comprehensive ICF Core Set for Multiple Sclerosis" need to be investigated further.



# 1 Introduction

## 1.1 Multiple sclerosis

Multiple sclerosis (MS) is a chronic inflammatory, demyelinating disease of the central nervous system (CNS) that can result in problems of functioning and health. It is one of the most common neurological diseases of the white population in the northern hemisphere and Australia. Worldwide around 2.5 million people are affected by MS (American National MS society, 2007), whereas the prevalence rates feature regional differences, for example in Germany the prevalence rate is about 149 per 100000 habitants (Gleixner et al., 2007), while MS is rarely found in Black Africa. The prevalence of blacks in South Africa is about 0.22 per 100000 (Bhigjee et al., 2007). Generally, there are only few cases of MS near the equator, but the prevalence rate increases with the geographical equatorial distance (Kesselring, 2005). The age of onset of MS is between 20 and 40 years, but there are also cases where MS was diagnosed in childhood (Ferreira et al., 2008) or in advanced years (Azzimondi et al., 1994). Women are more frequently affected by MS than men, the female to male ratio is about 3:2 (Gleixner et al., 2007).

The aetiology of MS is not yet cleared finally but generally a combination of a multifactorial autoimmune process, genetic factors and additionally, environmental conditions seem to be involved in the genesis of this disease. There is a familiar increased risk to contract MS, for monozygotic twins it is 250 times higher than in the normal population, for siblings 30 times higher, whereas there is no higher risk for adopted or in law family members (Ebers et al., 1995; Ebers et al., 2000). A lot of different genes seem to play an important role for the risk to get MS as well as for the course of the disease, for example the human leukocyte antigen HLA-DR2 (Fazekas et al., 2001; Oksenberg et al., 2001; Barcellos et al., 2002). Also environmental conditions like climate related factors or virus infections are discussed to influence the genesis and course of MS (Gale et al., 1995; Ascherio et al., 2001; Nielsen et al., 2007).

MS is characterized by the chronic inflammation, the demyelination of the white as well as the grey matter of the CNS with multiple lesions, gliosis and the damage of axons. The mechanisms underlying these processes are multifactorial. Inflammation

cells, especially blood brain barrier penetrating t-lymphocytes (CD8+, and CD4+ T-cells, macrophages), the destruction of oligodendrocytes as well as metabolic dysfunctions within the axons seem to be very important for the pathogenesis (Geurts et al., 2003; Neumann et al., 2003). The MS typical plaques which arise by reason of inflammation, demyelination and gliosis are located preferentially periventricular (lateral ventricle, at the ground of the fourth ventricle), in the cerebellum, brain stem, optic nerve and spinal cord (particular in the pyramidal tract, funiculus posterior) (Delank, 2006; Gleixner et al., 2007). As a result of the inflammatory demyelination and the axonal loss the transfer of the nerve impulses is disturbed which leads to diverse neurological deficits (Brück et al., 2005).

The diagnosis of MS is a clinical one based on a detailed anamnesis, an extensive neurological examination and supplementary paraclinical tests like the Magnetic Resonance Imaging (MRI), the cerebrospinal fluid puncture and evoked potentials. According to the McDonald diagnostic criteria MS can be diagnosed if a dissemination of lesions in space and time can be demonstrated, either clinically on the basis of attacks or by using MRI (McDonald et al., 2001; Polman et al., 2005; Inglese et al., 2006).

Typical symptoms at the beginning of MS are sensory deficits, paresis and visual dysfunctions. Sensory deficits often appear as paraesthesias or as a reduced sensation of vibrations at the distal legs. A characteristic sign of a feasible MS is the Lhermitte-sign (Lhermitte et al., 1924). Flexing the neck results in an electrical shock felt along the vertebral column and into the legs. Another typical but rare symptom is the so called "Oppenheim-hand" which can lead to a total unusable hand due to a plaque in the funiculus posterior (Kesselring & Beer, 2005). Motor deficits characteristically arise as paraparesis, paralysis of one leg or hemiparesis. Another highly prevalent symptom in the MS population is spasticity which is significantly associated with a reduced level of functional independence (Barnes et al., 2003). Furthermore muscle reflexes can be increased or understated and reflex zones can be broadened. The most important sign of a destruction of the pyramidal tract is the positive Babinski reflex in MS patients, which normally is negative from the age of one. Ataxia, dysmetria, dysdiadochokinesia, kinetic tremor and dysarthria allude to an affection of the cerebellum. Visual deficits can impress as an optic neuritis as a result of plaques in the optic nerve with a decrease of the vision up to blindness, as

eye movement dysfunctions with ghost images, as deviation nystagmus or as internuclear ophthalmoplegia (Kesselring & Beer, 2005; Gleixner et al., 2007). During the course of the disease MS patients experience a lot of further problems like sexual, bladder and / or bowel dysfunctions which influence quality of life (Nortvedt et al., 2007). Bladder dysfunctions include for example incontinence, dysuria and urinary retention, bowel dysfunctions mainly manifest in obstipation and sexual dysfunctions affect for example the loss of erection in men and anorgasmia in women (Tepavcevic et al., 2008). Other common symptoms of MS patients are related to cognitive and affective dysfunctions like problems in memory, problem solving, attention control or information processing speed (Kesselring & Beer, 2005; Jonsson et al., 2006). With a prevalence rate of about 50 percent depression is also a widespread problem of MS patients (Sadovnick et al., 1996; Bamer et al., 2008). Strongly associated with depressive symptoms is disabling fatigue, which is seen as the worst or one of the worst symptoms by the majority of MS patients (Fisk et al., 1994; Chwastiak et al., 2005; Hadjimichael et al., 2008). Another characteristic and prevalent symptom is pain, more than 60 percent of MS patients are afflicted with chronic or acute pain syndromes (Stenager et al., 1991; Beiske et al., 2004). Because MS can affect almost every part of the CNS MS patients can feature an immense variability of symptoms which can change, increase or decrease in the course of the disease.

Based on the clinical course MS can be classified in different types (Lublin et al., 1996):

- **Relapsing-remitting (RR) MS** is characterised by disease relapses and the following complete or partial remission. During the relapses new symptoms can appear or old ones could reappear or become worse. There is no disease progression in the time between the relapses. About 85% of MS patients are diagnosed with RRMS.
- **Primary progressive (PP) MS** is defined as a continuous progression from the onset of the disease without remissions or intense relapses. Nevertheless there can be occasional plateaus or little improvements. It is a rare form of MS which affects approximately 10 percent of the patients.

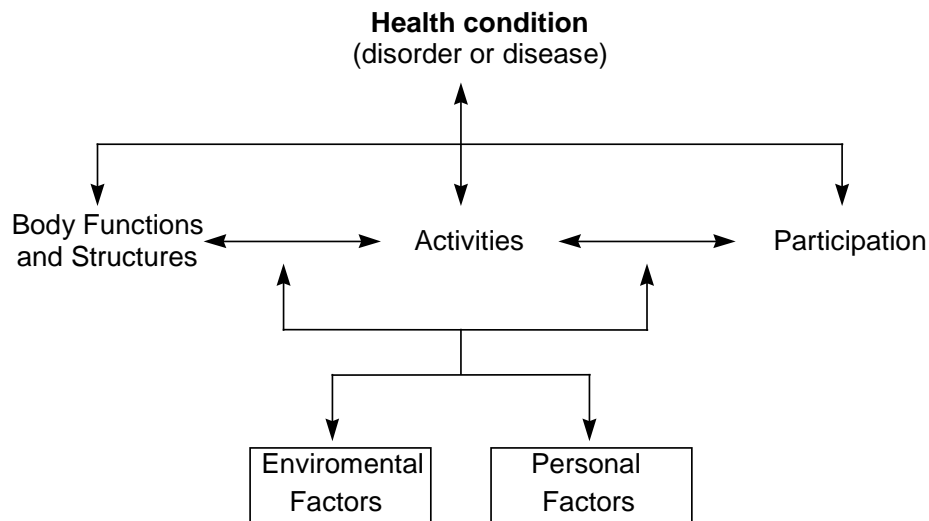
- **Secondary-progressive (SP) MS** is characterized by the progression of the disease between the relapses. This type of MS evolves from the RRMS after 10 to 20 years.
- **The progressive relapsing (PR) MS** shows a continuous progression from the onset of the disease with clear acute relapses with or without recovery. Between the relapses the disease proceeds.

The therapy of MS contains different components, the treatment of acute relapses, the prevention of relapses, the impairment impeding, the improvement of damaged parts of the CNS and of course the symptomatic treatment. According to the current treatment guidelines of the German Society of Neurology (Deutsche Gesellschaft für Neurologie (DGN), 2008) intravenous high-dosed methylprednisolone is used to treat acute relapses. To influence the course of the disease that means to reduce the frequency of relapses and stop the progression of disability the cytokines IFN $\beta$ -1b (Betaferon®) and IFN $\beta$ -1a (Avonex®, Rebif®) (Paty et al., 1993; Jacobs et al., 1995; Jacobs et al., 1996; PRISMS, 1998), the synthetic produced oligopeptide Glatirameracetate (Copaxone®) (Comi et al., 2001) and the humanised antibody Natalizumab (Tysabri®) (Polman et al., 2006) are approved. If these basis therapy possibilities fail it is also possible to treat RRMS with the reserve compound Azathioprin (e.g. Imurek®) (Goodin et al., 2002) and PR- or SPMS with Mitoxantrone (Ralenova®) (Hartung et al., 2002). Besides immunomodulating drugs the symptomatic therapy plays a decisive role within the multimodal therapy concept of MS. The symptomatic therapy includes not only the medication based treatment but also multidisciplinary rehabilitation procedures like physiotherapy, occupational therapy, speech therapy, psychological and social support as well as a comprehensive medical care including physicians of different disciplines (e.g. neurologists, urologists or ophthalmologists) and nursing staff (Deutsche Multiple Sklerose Gesellschaft (DMSG), 2004; Deutsche Gesellschaft für Neurologie (DGN), 2008). Essential intervention goals are the elimination or reduction of symptoms to improve the functional ability, to avoid impairment of daily activities as well as of participation of occupational and social life, to improve independence and quality of life of MS patients. Therefore, the therapy of MS patients poses a great challenge and demands a close collaboration of a multimodal team (Stevenson & Playford, 2007).

## **1.2 International Classification of Functioning, Disability and Health**

A comprehensive, efficient treatment for patients requires an interdisciplinary collaboration between the involved health professionals and other relevant instances. To assure the most efficient collaboration a common language for describing health and health-related states which can be used and understood by all parties is needed. The International Classification of Functioning, Disability and Health (ICF) provides such an unified and standard language (WHO, 2001). Since its approval in May 2001 by the fifty-fourth World Health Assembly (WHA), which is a member of the World Health Organization (WHO) family of International Classification, all member states of the WHO are urged to implement the ICF in clinical practice. The ICF establishes an universal and generally accepted language for the description of health conditions and health-related states and a globally agreed-upon framework for all health professionals as well as researchers, policy makers and the public (WHO, 2001).

The ICF is based on an integrative and functional model of health that provides a holistic, multidimensional and interdisciplinary understanding of health and health-related states. It is divided into two parts: *Functioning and Disability* and *Contextual Factors*. According to the ICF *Functioning and Disability* refer to the ICF components *Body Functions*, *Body Structures* and *Activities & Participation* in life situations. *Body Functions* are defined as physiological and psychological functions of the body system whereas *Body Structures* contain the anatomical structures of the body like organs, limbs and their components. The component *Activities & Participation* includes all domains which are associated with the aspects of functioning from individual and societal perspective. *Activity* means the execution of a task of action by an individual and *participation* the involvement in life situations. The components of the part *Functioning and Disability* can be used to describe problems of patients like impairments of *Body Functions* and *Body Structures*, limitations of *Activities* and restrictions of *Participation* as well as to describe non-problematic aspects of health and health-related states (WHO, 2001). In this context *Functioning* characterizes the positive aspects and *Disability* the negative aspects of the interaction between an individual with a health condition and its contextual factors (WHO, 2001). The part *Contextual Factors* includes the components *Environmental Factors* and *Personal Factors* (WHO, 2001) (figure1, 2).



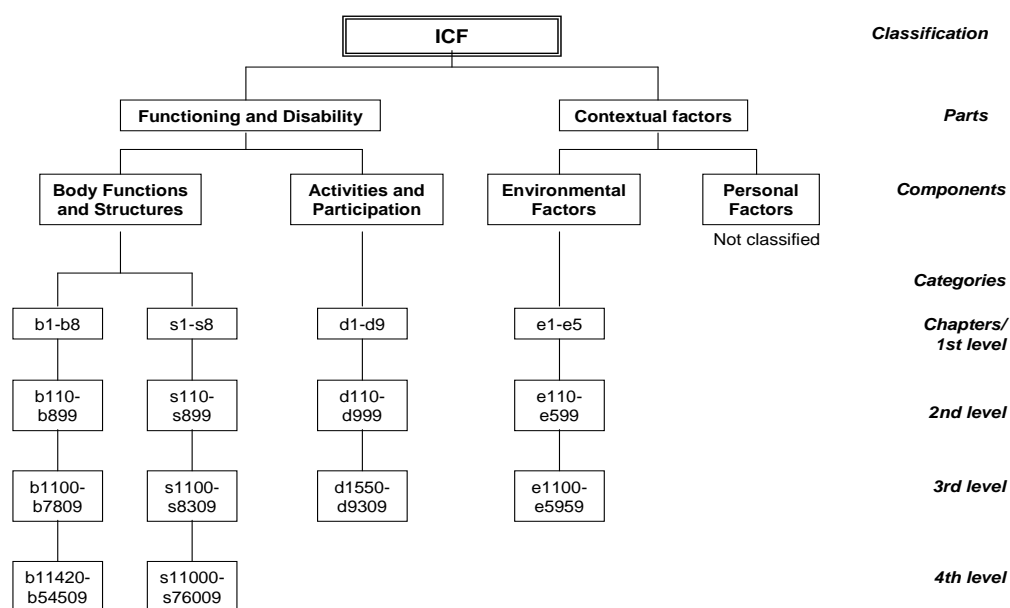
**Figure 1: Structure of the International Classification of Functioning, Disability and Health**

*Environmental Factors* can have an impact on all components of *Functioning and Disability* and include the physical, social and attitudinal environment of a person, which can be facilitating or hindering for the individual. *Personal Factors* that contain gender, race, age, lifestyle, habits, coping styles, social background etc. are not classified in the ICF so far.

The construction of the ICF is hierarchical. Within each component there is a list of so-called ICF categories which are the units of the classification (WHO, 2001). ICF categories are part of chapters which constitute the first level of precision. The categories are denoted by unique alphanumeric codes composed by a letter that refers to the components of the classification (b: *Body Functions*; s: *Body Structures*; d: *Activities & Participation*; e: *Environmental Factors*) and followed by a numeric code starting with the chapter number (one digit), followed by the second level (two digits) and the third and fourth level (one digit each) (figure 2). An example from the component *Body Functions* is presented below:

- |                      |                                 |
|----------------------|---------------------------------|
| component:           | b - Body function               |
| chapter (1st level): | b2 - Sensory functions and pain |
| second level:        | b280 - Sensation of pain        |
| third level:         | b2801 - Pain in body part       |
| fourth level:        | b28015 - Pain in lower limb     |

Within each component the categories are arranged in a stem / branch / leaf scheme. Consequently a higher-level (more detailed) category shares the lower level category of which it is member. Therefore, when using a higher level category it is possible to apply the lower-level category but not vice versa.



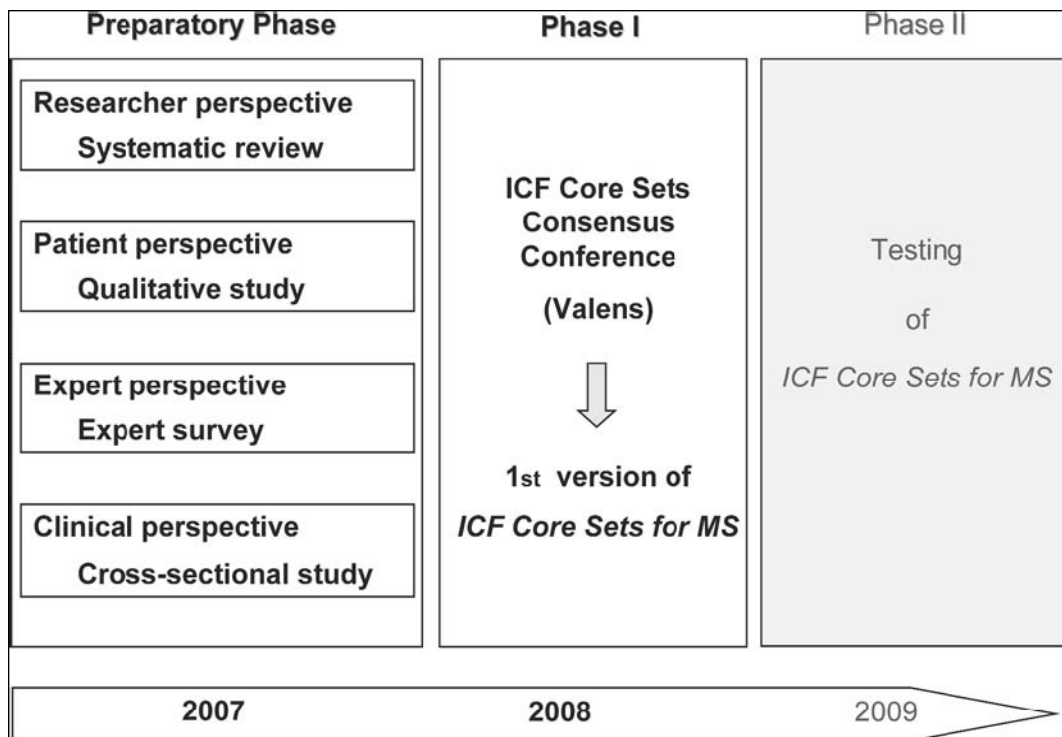
**Figure 2: Structure of the International Classification of Functioning, Disability and Health; hierarchical arrangement.**

Altogether, the ICF contains more than 1400 categories each allotted into the components named above except of the *Personal Factors* which are not yet classified. To facilitate the application of the ICF in clinical practice, the ICF Core Sets project was initiated in 2001 by the ICF Research Branch of the WHO Collaboration Center of the Family of International Classifications (DIMDI) at the Ludwig-Maximilians-Universität in Munich, Germany, together with the Classification, Terminology and Standards Team (CTS Team) at WHO and an increasing number of partner organizations (Stucki, 2004). The aim of this study is to select sets of ICF categories out of the whole classification that include the typical spectrum of problems in functioning in patients with a specific condition (Stucki, 2004; Cieza et al., 2004). These so called ICF Core Sets can serve as Comprehensive ICF Core

Sets which contain enough categories for multiprofessional, comprehensive assessments (Stucki, 2004; Cieza et al., 2004) or as Brief ICF Core Sets which are characterized by a minimal standard for the reporting of functioning and health for clinical studies and encounters. They should include as many categories as necessary for describing problems in functioning of patients with a specific condition adequately but as few as possible to remain practical. Up to now 17 ICF Core Sets for chronic conditions have been developed, for example ICF Core Sets for rheumatoid arthritis, stroke, depression, chronic widespread pain and low back pain (Cieza et al., 2004). The aim of the ICF Core Sets is to establish a fundament for the development of assessment instruments to appraise the severity of a disease, the course of the disease as well as the effectiveness of interventions. It provides a common language to facilitate communication between different health professionals as well as between health professionals, patients, their families and family caregivers. Furthermore it should be used in research to improve understanding of functioning, disability and health with the aim to minimize disability among people with a disease and to enhance quality of life (Stucki, 2004; Kesselring et al., 2008).

The ICF Core Sets for MS have been developed to establish useful standards for clinical practice and research (Kesselring et al., 2008). The development of the ICF Core Sets for MS comprises three phases: the so-called Preparatory Phase, Phase I and Phase II (Kesselring et al., 2008) (figure 3).





**Figure 3: Development of ICF Core Sets for MS: phases of the project**

Within the Preparatory Phase four so-called preparatory studies were conducted to address adequately different perspectives. A systematic literature review was performed (1) to identify parameters and outcomes reported in studies involving patients with MS and published within the years 2002 to 2006 and (2) to identify and quantify the concepts contained in those parameters and outcomes using the ICF as a reference. Within the qualitative study six focus groups with individuals afflicted with MS were performed at the Kempfenhausen Centre for Treatment of Multiple Sclerosis (Germany) to identify aspects of functioning and health, which are important to the individuals and to list those aspects using the ICF as a reference (Coenen et al., submitted). An internet based expert survey was performed to gather the opinion of an international pool of 173 experts of different health professions (physicians, nurses, physiotherapists, occupational therapists, (neuro-)psychologists, speech and language therapists and social workers) regarding the most relevant and typical areas to be considered in individuals with MS). A cross-sectional multicentre study with 205 patients was performed at centres in Switzerland and Germany (Valens Rehabilitation Centre, Switzerland; Rehabilitation Center Quellenhof Bad Wildbad, Germany; University Hospital Zurich, Switzerland; Swiss Multiple Sclerosis Society, Switzerland) to describe functioning and health of individuals with MS and to

identify the most common problems using the classification system of the ICF (Holper et al., 2009).

The results of these preparatory studies were presented at the ICF Core Set Consensus Conference for MS in May 2008 in Valens, where 21 experts in the field of MS (physicians, physiotherapists, social workers, psychologists, occupational therapists, speech and language therapists, nurses and a member of the MS Society of India) from 16 different countries (Argentina, Australia, Belgium, Canada, Estonia, Germany, India, New Zealand, Saudi Arabia, Slovenia, Spain, Sweden, Switzerland, Thailand, USA, UK) approved the first version of the ICF Core Sets for MS (Phase I). The Comprehensive ICF Core Set for MS includes 138 ICF categories covering the typical spectrum of problems in functioning of patients with MS. It includes 40 *Body Functions*, 7 *Body Structures*, 53 *Activities & Participations* and 38 *Environmental Factors* (Appendix 1). Based on the Comprehensive Core Set the candidate ICF categories of the Brief Core Set were defined (Appendix 2).

According to the phases of the project the worldwide validation of the ICF Core Sets for MS using a number of approaches to validate their content and feasibility is necessary (Phase II). The validation of the Brief ICF Core Set for MS will be performed by further studies using several statistical analysis. The aim of the validation of the Comprehensive ICF Core Set for MS is (1) to confirm the ICF categories of the first version of the Comprehensive ICF Core Set, (2) to identify included ICF categories which might be not relevant and (3) to discover additional ICF categories which are not yet contained in the Comprehensive ICF Core Set for MS. One aspect within the validation process is the validation from the user perspective for which the Comprehensive ICF Core Set has been developed in the first place. Since the preparatory studies and the consensus process did not explicitly address the interventions applied by health professionals it is necessary to evaluate whether their perspective is sufficiently represented in the Comprehensive ICF Core Set for MS. Therefore it should be explored whether the categories included in the Comprehensive ICF Core Set cover the patients' problems addressed by the specific interventions of health professionals. Moreover, the validation from the perspective of health professionals will contribute the worldwide acceptance and credibility of the Comprehensive ICF Core Set for MS. One group of health professionals involved in the interdisciplinary treatment and rehabilitation are physicians.

## **2 Objective**

The objective of this study was to validate the Comprehensive ICF Core Set for MS from the perspective of physicians. The specific aims were (1) to identify MS patients' problems, resources and aspects of environment treated by physicians and (2) to analyse whether these issues are represented by the current version of the Comprehensive ICF Core Set for MS.

## 3 Methods

### 3.1 Design

A three-round electronic survey was used based on the Delphi technique. The Delphi technique is a special kind of a written survey to structure a group communication process with the aim to gain consensus from a panel of individuals, who have knowledge of the topic being investigated. These informed persons are commonly titled "experts" (Linstone et al., 1975; Hasson et al., 2000; Bortz & Döring, 2006). The name of this method refers to the Greek oracle, which should have given outstanding wise advices (Bortz & Döring, 2006). The Delphi process is a multistage process consisting of a series of structured questionnaires whereas each questionnaire is built up on the results of the previous one (Hasson et al., 2000). Traditionally, the initial questionnaire is an open-ended questionnaire to collect qualitative comments of the participants (Hasson et al., 2000; Hsu et al., 2007). These answers were analysed and reported to the participants in the second questionnaire. The results of the second round are the basis for the third questionnaire again (Hasson et al., 2000; Hsu et al., 2007). The third questionnaire includes statistical information about the distribution of the group's response as well as the individual previous response, so each participant has the opportunity to revise or specify his/her answer (Jones & Hunter, 1995; Hasson et al., 2000; Hsu et al., 2007).

According to Häder (2000) there are special criteria which characterize the Delphi technique:

- application of a formalized questionnaire
- survey of experts
- anonymity of responses
- identification of a statistical result of the group
- information about the result is given to the participants
- repetition of the survey

Because of the anonymity of the participants' responses which distinguishes the Delphi technique from other consensus methods the dominance of single individuals

who might influence the whole group can be avoided. Furthermore, it is a cost efficient method because a large group of experts without geographical limitations can participate by using e-mail (Jones & Hunter, 1995; Häder, 2000). Today the Delphi technique is used in different areas, for example in the development of sciences and technique, telecommunication, in the field of education, tourism, general economic applications, politics and the health care sector (Häder, 2000).

### **3.2 Recruitment of participants**

The sample was selected using a purposive sampling approach. Purposive sampling is based on the assumptions that a researcher's knowledge about the population can be used to handpick the cases to be included in the sample (Polit & Hungler, 1997). At the beginning of this study national and international associations of physicians as well as universities, hospitals, rehabilitation centres and former cooperation partners of the ICF Research Branch in Munich were contacted by e-mail with the request to participate in this study or to name physicians who are experienced in the treatment of MS patients. In addition, literature search and personal recommendations were used to identify experts. To assure that the participants of the study are "qualified individuals" concerning MS treatment, the initial letter notes that participants should be "physicians experienced in the treatment of MS".

Within the first e-mail contact the physicians were invited to participate in the study "Validation of the Comprehensive ICF Core Set for MS from the perspective of physicians". A detailed description of the study, its background and goals were given and the task they have to perform as well as the timeline was explained (Appendix 3).

### 3.3 Material and data collection

The three-round Delphi exercise was accomplished by electronic-mail, started at the end of September 2008 and ended at the end of January 2009. In every round the participants had to return the filled in questionnaires within two weeks. Reminders were sent 3 days before deadline and 3, 8 and 14 days after deadline.

The Delphi process with the verbatim questions of the study "Validation of ICF Core Set for MS from the perspective of physicians" is demonstrated in figure 4.

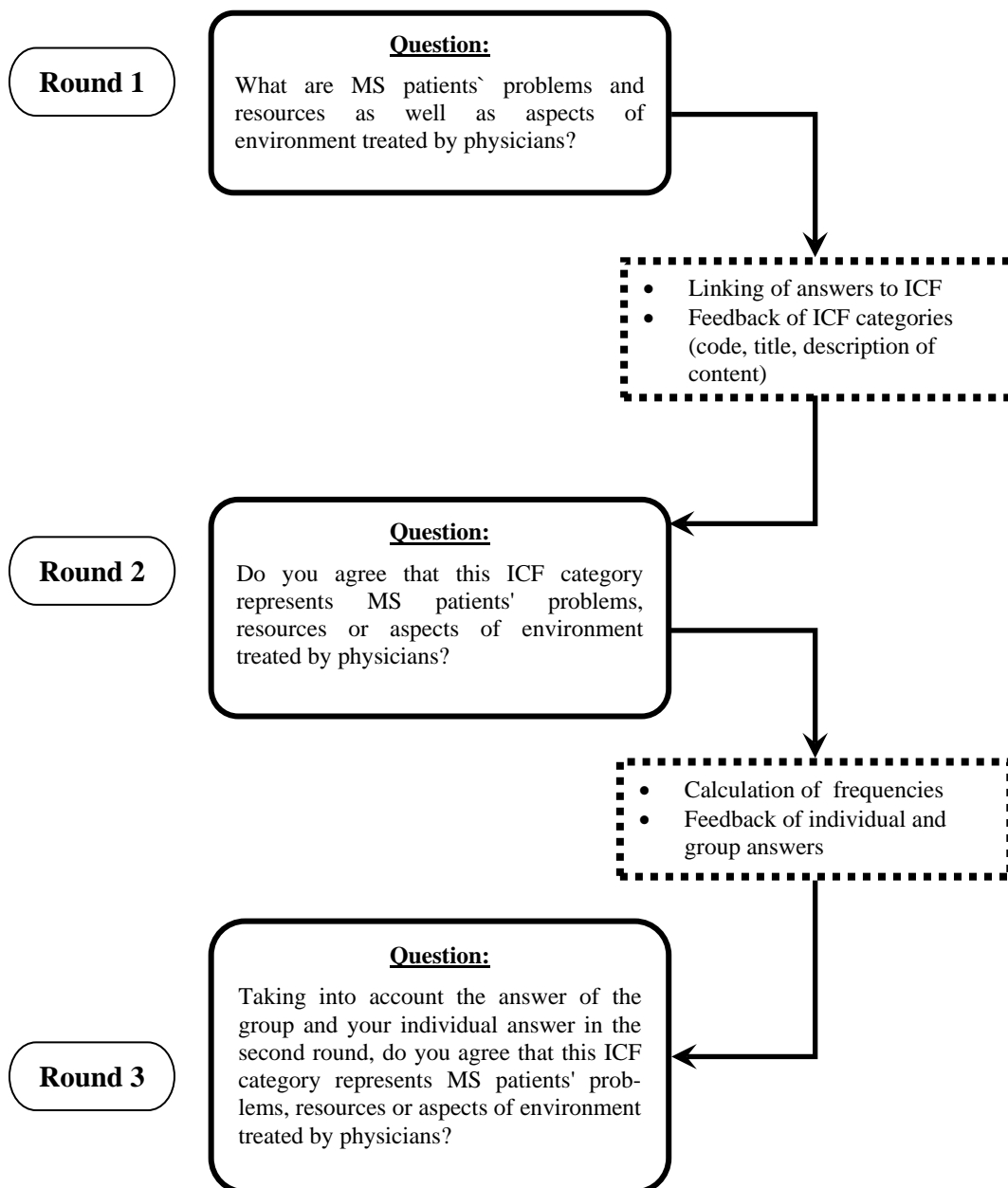


Figure 4: Description of the Delphi exercise

### 3.3.1 Delphi round 1

In the first Delphi round an open-ended questionnaire (figure 5) with the request to list all MS patients' problems and resources as well as aspects of environment treated by physicians and an information letter with introductions how to fill in the questionnaire was sent to the MS experts who agreed to participate.

Additionally, the questionnaire included questions about personal data of the participants. They should name their age, gender, the country they come from, their specialties / certifications, their current professional activity and the number of years of their professional experience as well as the years of their practical experience with patients with MS. They were asked to rate their experience in the treatment of patients with MS (1=low to 5=excellent).

Delphi Exercise Round 1		Health Profession: Physicians	
<b>What are MS patients' problems and resources as well as aspects of environment treated by physicians?</b>			
Please list your answers in the following lines.			
Please try to use <b>only one line</b> per <b>patient problem</b> , per <b>patient resource</b> or per <b>aspect of the environment</b> .			
<b>Some information about yourself:</b>			
	Age	<input type="text"/>	years
	Gender	<input type="text"/>	
	Country	<input type="text"/>	
	Specialties/Certifications	<input type="text"/>	
	Current professional activity in ...		
	acute clinic	<input type="text"/>	Please mark the field that best describes your professional activity
	inpatient rehabilitation center	<input type="text"/>	
	outpatient rehabilitation center	<input type="text"/>	
	university	<input type="text"/>	
	other ...	<input type="text"/>	
	Professional experience	<input type="text"/>	years
	Practical experience with patients with multiple sclerosis	<input type="text"/>	years
	How would you rate your expertise in the treatment of patients with MS ?	<input type="text"/>	Please chose a number between 1 (low) and 5 (excellent)

Figure 5: Questionnaire round 1

## Preparation of the data of the first Delphi round

The answers of the first Delphi round were linked to ICF categories based on established linking rules (Cieza et al., 2002; Cieza et al., 2005) by two trained doctoral students.

According to these linking rules each answer of the first round was linked to the most precise category of the ICF. If a statement applied to more than one category multiple ICF categories were linked. By using the abbreviation "pf" all statements related to *Personal Factors* could be classified. Answers that were not yet covered in the ICF assigned "nc". Statements which deal with a diagnosis or a health condition were allotted to "hc" (health condition). All "pf's", "hc's" and "nc's" were mentioned separately in the second questionnaire. If a statement was too general to classify it exactly in the ICF an "nd" (not definable) was assigned with the consequence that it did not appear in the second round. Table 1 shows an example of the linking procedure.

<b>Answer of participant</b>	<b>Linked ICF category linker A</b>	<b>Linked ICF category linker B</b>	<b>Agreed on ICF category</b>
<b>Spasticity</b>	b735	b735	b735
<b>Depression</b>	hc	hc	hc
<b>Sexual and sphincter disturbances</b>	b640, b620	b640, b525	b640, b525
<b>Carer burden</b>	e340	nc	e340

**Table 1: Example of the linking procedure**



To assure the quality of the linking process two procedures were established; namely multiple coding and peer review:

**(1) Multiple coding:** each doctoral student had linked the answers of eight participants (132 statements). Afterwards the results were compared, discussed and a consensus was reached. In the case of disagreement a third opinion of another trained health professional (psychologist) was obtained.

**(2) Peer review:** The answers of the first 33 questionnaires (585 statements) were linked independently by the two trained doctoral students without reaching a consensus.

### 3.3.2 Delphi round 2

In the second Delphi round the linked categories of the first round were reported back to the participants who responded the first questionnaire. The second questionnaire included the ICF code, the title and the description of all linked ICF categories as well as all responses which were categorized as pf, hc and nc, respectively (figure 6). The participants were asked whether they agree that this ICF category represents MS patients' problems, resources or aspects of environment treated by physicians.

#### Delphi Exercise Round 2 Physicians

Do you agree that this ICF category represents MS patients' problems, resources or aspects of the environment treated by physicians ?

ICF code	ICF category title	ICF category description	YES/NO
b1101	Continuity of consciousness	Mental functions that produce sustained wakefulness, alertness and awareness and, when disrupted, may produce fugue, trance or other similar states.	<input type="checkbox"/>
b1263	Psychic stability	Mental functions that produce a personal disposition that is even-tempered, calm and composed, as contrasted to being irritable, worried, erratic and moody.	<input type="checkbox"/>
b1265	Optimism	Mental function that produce a personal disposition that is cheerful, buoyant and hopeful, as contrasted to being downhearted, gloomy and despairing.	<input type="checkbox"/>
b130	Energy and drive functions	General mental functions of physiological and psychological mechanisms that cause the individual to move towards satisfying specific needs and general goals in a persistent manner.	<input type="checkbox"/>
b1308	Energy and drive functions, other specified	Fatigue	<input type="checkbox"/>

Figure 6: Questionnaire round 2

#### Preparation of the data of the second round

All answers of the second round were collected. The percentage of the agreement that an ICF category represents MS patients' problems, resources, aspects of environment, personal factors, health conditions or not classified categories was calculated. The results and the individual answers were listed in the third questionnaire (figure 7).

### 3.3.3 Delphi round 3

The third questionnaire included the ICF code, the title and the description of the ICF categories as in the second questionnaire and additionally a column with the identification numbers of all participants who agreed that this ICF category represents MS patients' problems, resources or aspects of environment treated by physicians and a column with the percentage of agreement (figure 7). The questionnaire of the third round was sent to the participants who responded the questionnaire of the second round. Taking into account the answer of the group and their individual answer of the second round the participants should review his / her answer of the second round and answer the same question as in round two again.

**Delphi Exercise Round 3**  
Physicians

Taking into account the answer of the group and your individual answer in the second round, do you agree that this ICF category represents MS patients' problems, resources or aspects of the environment **treated by physicians?**

ICF code	ICF category title	ICF category description	ID-number	% agreement	YES/NO
b1101	Continuity of consciousness	Mental functions that produce sustained wakefulness, alertness and awareness and, when disrupted, may produce fugue, trance or other similar states.	3,5,7,10,12,14,15,16,18,20,21,23,24,25,28,31,32,33,34,36,37,41,43,45,48,49,52,54,57,58,61,65,66,67,70,71,72,76,78,79,80,81,82,83,84,87,88,89,90,91,92,94,96,97,99	69,6	
b1263	Psychic stability	Mental functions that produce a personal disposition that is even-tempered, calm and composed, as contrasted to being irritable, worried, erratic and moody.	1,3,5,7,8,9,10,12,13,14,15,16,17,18,19,20,21,23,24,25,26,28,29,31,32,33,34,36,37,41,43,45,46,48,49,51,52,54,57,58,59,60,61,63,65,66,67,70,71,72,75,76,77,78,79,80,81,82,83,84,87,88,89,90,91,92,95,96,97,98,99	89,9	
b1265	Optimism	Mental function that produce a personal disposition that is cheerful, buoyant and hopeful, as contrasted to being downhearted, gloomy and despairing.	1,2,3,5,7,8,9,12,13,14,16,17,18,19,20,21,23,25,26,28,31,32,33,34,37,43,48,52,54,58,59,60,61,63,65,66,72,75,76,77,79,80,81,83,84,87,88,89,91,92,95,97,99	67,1	
b130	Energy and drive functions	General mental functions of physiological and psychological mechanisms that cause the individual to move towards satisfying specific needs and general goals in a persistent manner.	1,3,5,7,8,12,13,14,15,16,17,18,20,21,24,25,26,28,29,31,32,33,34,37,41,43,48,51,52,54,55,57,58,59,60,63,65,66,72,75,76,77,78,79,80,81,82,83,84,87,88,89,90,91,92,94,95,97,99	74,7	
b1308	Energy and drive functions, other Fatigue specified		1,2,3,5,8,9,10,12,13,14,15,16,17,18,19,20,21,23,24,25,26,28,29,31,32,33,34,36,37,40,41,42,43,45,46,47,48,49,51,52,54,55,57,58,59,60,61,63,65,66,67,70,71,72,75,76,77,78,79,80,81,82,83,84,86,87,88,89,90,91,92,94,95,96,97,98,99	98,7	

Figure 7: Questionnaire round 3

### Preparation of the data of the third round

The identified ICF categories were compared to the categories of the Comprehensive ICF Core Set for MS.

### **3.4 Data analysis**

Descriptive statistics were applied to characterize the sample and frequencies of responses using SPSS 17.0 for Windows. Based on the answers of the participants of the third round the level of agreement that the corresponding ICF category represents MS patients' problems, resources, aspects of environment, personal factors or health conditions treated by physicians was calculated. To check differences in age, professional and practical experience regarding the WHO regions nonparametric analysis (Kruskal-Wallis-test,  $p < 0.05$ , Appendix 4) were performed using SPSS. To describe the agreement between the two doctoral students who performed the peer review of the linking process Kappa statistics with 95% bootstrapped confidence intervals (95% CI) were used. Values of Kappa range from 0 to 1. A value of 1 indicates perfect agreement, a value of 0 indicates no agreement (Cohen, 1960; Vierkant, 2009). Kappa statistics were performed by using SAS 9.1.

## 4 Results

### 4.1 Participants

To get in contact with potential participants 211 MS and neurology associations and 326 individual experts of all WHO regions were contacted. The number of contacts as well as the respective number of physicians who agreed to participate in the Delphi exercise is shown in Table 2.

Way of contact	Contacts n	Physicians agreed to participate n	Physicians participated in the first round n
MS / neurology associations	211	16	15
Expert pool of collaborating partners	105	37	31
Internet search	141	12	8
Personal recommendations	80	34	30
<b>Total</b>	<b>537</b>	<b>99</b>	<b>84</b>

**Table 2: Results of the recruitment of participants**

A total of 99 physicians from 36 countries agreed to participate in the Delphi exercise, finally 84 MS experts (response rate 85 %) send back the filled in questionnaire of the first round. Table 3 shows the number of participants of the different rounds with respect to the WHO world regions.

WHO Region	Participants n		
	Round 1	Round 2	Round 3
European Region	54	52	50
South-East Asia Region	6	4	4
Western Pacific Region	6	5	5
Region of the Americas	10	10	10
African Region	3	3	3
Eastern Mediterranean Region	5	5	4
<b>Total</b>	<b>84</b>	<b>79</b>	<b>76</b>

**Table 3: Number of participants with respect to the WHO world regions**

In detail the participants of the first round came from the following countries:

- (1) Europe (64.3%):** Austria (2 physicians), Azerbaijan (1), Belarus (1), Belgium (3), Bosnia & Herzegovina (1), Croatia (1), Germany (9), Greece (1), Hungary (2), Italy (5), Lithuania (2), Netherlands (4), Poland (1), Romania (3), Slovenia (3), Spain (5), Sweden (2), Switzerland (2), Turkey (2), United Kingdom (4).
- (2) South-East Asia Region (7.1%):** India (4), Sri Lanka (1), Thailand (1).
- (3) Western Pacific Region (7.1%):** Australia (2), Malaysia (1), Mongolia (2), New Zealand (1).
- (4) American Region (11.9%):** Brazil (1), Canada (2), El Salvador (1), Mexico (1), United States of America (5).
- (5) Eastern Mediterranean Region (6.0%):** Morocco (2), United Arab Emirates (3).
- (6) African Region (3.6%):** South Africa (1), Ghana (2).

The demographic and professional data of the 84 physicians who completed the first round is shown in Table 4.

WHO Region	Gender % Female	Age Median (Range)	Professional experience in years, Median (Range)	Experience in treatment of patients with MS in years, Median (Range)	Self-Rating of Expertise regarding MS*, Median (Range)
European Region	44.4	44.0 (24-71)	18.0 (3-40)	13.0 (3-40)	4.0 (3-5)
South-East Asia Region	33.3	47.0 (37-53)	18.5 (10-25)	11.5 (7-22)	4.0 (3-4)
Western Pacific Region	66.7	44.0 (31-67)	13.0 (5-43)	7.5 (3-30)	4.0 (4-5)
Region of the Americas	30.0	52.0 (46-72)	24.5 (15-46)	16.5 (12-36)	5.0 (4-5)
African Region	33.3	37.0 (32-57)	10.0 (5-28)	8.0 (2-18)	3.0 (3-4)
Eastern Mediterranean Region	80.0	45.0 (39-53)	20.0 (11-28)	10.0 (8-20)	4.0 (4-5)
<b>Total</b>	45.2	46.0 (24-72)	18.0 (3-46)	13.0 (2-40)	4.0 (3-5)

**Table 4: Demographic and professional data of the participants, \*1=low, 5=excellent**

The nonparametric analysis with the Kruskal-Wallis Test ( $p < 0.05$ ) showed that there were no significant differences regarding age, professional and practical experience between the participants of the six WHO world regions (Appendix 4).

Most participants were specialists in neurology but also physicians who are specialized in physical and rehabilitation medicine, in urology, psychiatry and neuroimmunology took part in this study.

The current professional activity of the participating MS experts ranges from acute clinics to rehabilitation centres and universities. Table 5 shows the current professional activities of the participants, whereas multiple answers were permitted.

WHO Region	Acute clinic n	University / university hospital n	Inpatient rehabilitation centre n	Outpatient rehabilitation centre n	others n
European Region	27	19	16	7	5
South-East Asia Region	3	5	1	1	0
Western Pacific Region	3	1	1	0	2
Region of the Americas	2	6	1	1	1
African Region	2	1	0	0	2
Eastern Mediterranean Region	2	2	2	1	2
<b>Total</b>	39	34	21	10	12

**Table 5: Current professional activity of the participants of round 1**

The second questionnaire was sent to all participants of the first round and was answered by 79 out of 84 physicians (94%) and 76 out of 79 physicians (96.2%) participated in round 3. Comparing the number of the experts who agreed to participate and the number of the participants of the third round a response rate of 76.7 percent (76 out of 99) was achieved.



## **4.2 Results of the linking procedure**

In the first round 1735 statements out of 1443 answers of the participants were retrieved. One thousand four hundred fifty-two of them could be linked to a specific ICF category, 15 statements assigned pf, 64 were allotted to hc, 44 were not classified in the ICF and assigned nc and 160 statements were assigned nd.

Totally, 166 different ICF categories (77 *Body Functions*, 53 *Activities & Participation*, 34 *Environmental Factors*, 2 *Body Structures*) were linked to the statements of the participants and reported in the second questionnaire. Of the ICF component *Body Functions* 36 categories were linked on the second level, 34 on the third level and 7 on the fourth level of the classification. Twenty-nine second level and 24 third level categories of the component *Activities & Participation*, 20 second level and 14 third level categories of the component *Environmental Factors* and one second level and one third level category of the component *Body Structures* were linked. The statements which were related to *Personal Factors* could be summarised to 6 pf's, 64 answers that characterized a health condition were abstracted to 10 hc's and 44 statements which were not classified in the ICF were combined in 8 nc's.

The Kappa statistics for the linking process was 0.82 with a 95 percent bootstrapped confidence interval from 0.79 to 0.86.

### 4.3 Results of the Delphi exercise

Totally, 89 ICF categories of the Comprehensive ICF Core Set for MS were confirmed by the participating physicians either at the same or at a different level of classification, the remaining 49 ICF categories of the Comprehensive ICF Core Set were not confirmed. Furthermore 8 categories were named by more than 75 percent of the participants which are not yet included in the Comprehensive ICF Core Set for MS. A summary of the frequencies of the confirmed and additional ICF categories that were identified in the Delphi exercise for the Validation of the Comprehensive ICF Core Set for MS is shown in table 6.

	Body Functions	Body Structures	Activities & Participation	Environmental Factors	Total
<b>Number of categories identified</b>	77	2	53	34	166
<b>n (%) of confirmed categories of the ICF Core Set at the same level of classification</b>	25 (32.5%)	1 (50.0%)	27 (50.9%)	23 (67.6%)	76 (46.4%)
<b>n (%) of confirmed categories of the ICF Core Set at a different level of classification</b>	35 (45.5%)	1 (50.0%)	24 (45.3%)	9 (26.5%)	69 (41.6%)
<b>n (%) of additional categories not included in Core Set with agreement &lt;75%</b>	9 (11.7%)	0	2 (3.8%)	2 (5.9%)	13 (7.8%)
<b>n (%) of additional categories not included in Core Set with agreement ≥75%</b>	8 (10.4%)	0	0	0	8 (4.8%)
<b>n (%) of not confirmed categories of the ICF Core Set</b>	7 (17.5%)	5 (71.4%)	22 (41.5%)	15 (39.5%)	49 (35.5%)

**Table 6: Representation of ICF categories identified in the Delphi exercise for MS: summary of results**

### 4.3.1 Body Functions

Table 7 shows the results of the component *Body Functions* of the Delphi exercise in comparison to the Comprehensive ICF Core Set for MS.

**Confirmed categories:** Twenty-five categories of the Comprehensive ICF Core Set for MS were confirmed by the participants of the Delphi exercise at the same level of classification. With an agreement between 62.2 percent and 98.7 percent (mean 88.8%) the participants held that these categories represent MS patients' problems treated by physicians (21 second level categories, 4 third level categories).

Thirty-five of the identified ICF categories were included in the ICF Core Set but at a different level of classification (6 fourth level categories, 26 third level categories, 3 second level categories). The participants named for example the ICF categories *b6202-Urinary continence*, *b6200-Urination* and *b6201-Frequency of urination*, which confirm the corresponding second level category *b620-Urination functions* of the Comprehensive ICF Core Set for MS.

**Additional categories:** Seventeen linked ICF categories were not included in the Comprehensive ICF Core Set for MS, not even on a different level of classification; eight of them reached an agreement of more than 75 percent. These additional categories are *b215-Function of structures adjoining the eye*, *b240-Sensations associated with hearing and vestibular function*, *b435-Immunological system functions*, *b840-Sensation related to the skin*, *b1600-Pace of thought*, *b2401-Dizziness*, *b6700-Discomfort associated with sexual intercourse* and *b43501-Non-specific immune response*.

**Not confirmed categories:** The Comprehensive ICF Core Set for MS includes seven ICF categories which were not confirmed by the participants of the validation phase even not at a different level of classification. These categories are *b114-Orientation functions*, *b156-Perceptual functions*, *b235-Vestibular functions*, *b260-Proprioceptive functions*, *b310-Voice function*, *b5104-Salivation* and *b750-Motor reflex functions*.

ICF Code			ICF Category Title	Round 3 n=76
2nd level	3rd level	4th level		% agreement
	<i>b1101</i>		Continuity of consciousness	71.2
<b>b114</b>			Orientation functions	
<b>b126</b>			Temperament and personality functions	
	b1263		Psychic stability	94.6
	b1265		Optimism	70.3
b130			Energy and drive functions	82.2
	<b>b1300</b>		Energy level	
	<b>b1301</b>		Motivation	
	<b>b1308</b>		Energy and drive functions, other specified (fatigue)	98.6
<b>b134</b>			Sleep functions	79.7
<b>b140</b>			Attention functions	79.5
<b>b144</b>			Memory functions	87.8
	b1440		Short-term memory	74.3
<b>b152</b>			Emotional functions	90.5
	b1522		Range of emotion	78.7
<b>b156</b>			Perceptual functions	
	<u><i>b1600</i></u>		Pace of thought	83.8
<b>b164</b>			Higher-level cognitive functions	88.0
	b1641		Organization and planning	85.3
<b>b210</b>			Seeing functions	90.7
	<u><i>b215</i></u>		Functions of structures adjoining the eye	81.3
	<i>b230</i>		Hearing functions	62.7
<b>b235</b>			Vestibular functions	
	<u><i>b240</i></u>		Sensations associated with hearing and vestibular function	98.6
	<u><i>b2401</i></u>		Dizziness	98.7
<i>b250</i>			Taste function	42.7
<i>b255</i>			Smell function	32.0
<b>b260</b>			Proprioceptive function	
<b>b265</b>			Touch function	89.3
<b>b270</b>			Sensory functions related to temperature and other stimuli	93.3
	b2700		Sensitivity to temperature	93.3
	b2702		Sensitivity to pressure	83.8

ICF Code			ICF Category Title	Round 3 n=76
2nd level	3rd level	4th level		% agreement
<b>b280</b>			Sensation of pain	98.7
	b2800		Generalized pain	97.3
		b28010	Pain in head and neck	93.3
		b28012	Pain in stomach or abdomen	58.7
		b28013	Pain in back	90.5
		b28014	Pain in upper limb	96.0
		b28015	Pain in lower limb	97.3
		b28016	Pain in joints	86.7
<b>b310</b>			Voice function	
<b>b320</b>			Articulation functions	85.3
<b>b330</b>			Fluency and rhythm of speech functions	82.2
<u>b435</u>			Immunological system functions	86.7
		<u>b43501</u>	Non-specific immune response	76.0
<i>b440</i>			Respiration functions	62.7
<b>b445</b>			Respiratory muscle functions	69.3
<b>b455</b>			Exercise tolerance functions	
	b4552		Fatiguability	98.7
	<i>b5101</i>		Biting	41.3
	<i>b5102</i>		Chewing	40.5
	<b>b5104</b>		Salivation	
	<b>b5105</b>		Swallowing	90.7
<b>b525</b>			Defecation functions	97.3
	b5252		Frequency of defecation	94.6
	b5253		Faecal continence	98.7
b550			Thermoregulatory functions	58.7
	<b>b5500</b>		Body temperature	62.2
	<b>b5508</b>		Thermoregulatory functions, other specified (Sensitivity to heat)	
	<b>b5508</b>		Thermoregulatory functions, other specified (Sensitivity to cold)	
<b>b620</b>			Urination functions	96.0
	b6200		Urination	95.9
	b6201		Frequency of urination	97.3
	b6202		Urinary continence	100.0
<b>b640</b>			Sexual functions	95.9

ICF Code			ICF Category Title	Round 3 n=76
2nd level	3rd level	4th level		% agreement
	b6400		Functions of sexual arousal phase	82.4
	b6403		Functions of sexual resolution phase	60.3
<i>b660</i>			Procreation functions	68.9
	<u>b6700</u>		Discomfort associated with sexual intercourse	94.7
<b>b710</b>			Mobility of joint functions	82.7
<b>b730</b>			Muscle power functions	89.3
	b7303		Power of muscles in lower half of the body	88.0
	b7305		Power of muscles of the trunk	80.0
<b>b735</b>			Muscle tone functions	96.0
	b7350		Tone of isolated muscles and muscle groups	93.2
	b7353		Tone of muscles of lower half of body	93.3
	b7354		Tone of muscles of all limbs	93.2
	b7355		Tone of muscles of trunk	94.4
	b7356		Tone of all muscles of the body	93.1
<b>b740</b>			Muscle endurance functions	82.7
	b7401		Endurance of muscle groups	77.0
<b>b750</b>			Motor reflex functions	
<b>b760</b>			Control of voluntary movement functions	95.9
<i>b765</i>			Involuntary movement functions	93.2
	<b>b7650</b>		Involuntary contractions of muscles	
	<b>b7651</b>		Tremor	97.3
<b>b770</b>			Gait pattern functions	94.6
<b>b780</b>			Sensation related to muscles and movement functions	
	b7800		Sensation of muscle stiffness	98.6
	b7801		Sensation of muscle spasm	100.0
<i>b810</i>			Protective functions of the skin	62.4
<u>b840</u>			Sensation related to the skin	97.3

**Table 7: ICF component Body Functions: ICF categories included in the Comprehensive ICF Core Set for MS (bold font), ICF categories linked to participants' responses and included in the Comprehensive ICF Core Set at a different level of classification (normal font), additional categories not included in the Comprehensive ICF Core Set with an agreement < 75% (cursive font) and with an agreement >75% (cursive, underlined) and ICF categories included in the ICF Core Set but not confirmed by the participants (bold, cursive font). Percentage of participants who considered the respective ICF category as relevant in the third round.**

### 4.3.2 Body Structures

Table 8 shows the results of the component *Body Structures* of the Delphi exercise in comparison to the Comprehensive ICF Core Set for MS.

**Confirmed categories:** Two of the ICF categories of the Comprehensive ICF Core Set for MS were confirmed by the MS experts of the Delphi exercise. The second level category *s810-Structure of areas of the skin* is included on the same level in the Comprehensive ICF Core Set for MS. The second confirmed category is *s1106-Structure of cranial nerves* which represents the second level category *s110* of the Comprehensive ICF Core Set.

**Additional categories:** The participants named no additional ICF category of the component *Body Structures*.

**Not confirmed categories:** Five ICF categories of the Comprehensive ICF Core Set were not confirmed by the participants.

ICF Code		ICF Category Title	Round 3 n=76
2nd level	3rd level		% agreement
<b>s110</b>		Structure of brain	
	s1106	Structure of cranial nerves	69.9
<b>s120</b>		Spinal cord and related structures	
<b>s610</b>		Structure of urinary system	
<b>s730</b>		Structure of upper extremity	
<b>s750</b>		Structure of lower extremity	
<b>s760</b>		Structure of trunk	
<b>s810</b>		Structure of areas of skin	63.0

**Table 8: ICF component *Body Structures*: ICF categories included in the Comprehensive ICF Core Set for MS (bold font), ICF categories linked to participants' responses and included in the Comprehensive ICF Core Set at a different level of classification (normal font) and ICF categories included in the ICF Core Set but not confirmed by the participants (bold, cursive font). Percentage of participants who considered the respective ICF category as relevant in the third round.**

### 4.3.3 Activities & Participation

Table 9 shows the results of the component *Activities and Participation* of the Delphi exercise in comparison to the Comprehensive ICF Core Set for MS.

**Confirmed categories:** Twenty-seven ICF categories of the Comprehensive ICF Core Set for MS were confirmed by the participants at the same level of classification (50.9%). Twenty-four of the identified categories (45.3%) are included in the Comprehensive ICF Core Set but at a different level of classification. For example the third level category *d4154-Maintaining a standing position* confirms the second level category *d451-Maintaining a body position* of the Comprehensive ICF Core Set for MS.

**Additional categories:** Two ICF categories were linked which are not included in the Comprehensive ICF Core Set for MS. These are *d335-Producing nonverbal messages* and *d855-Non-remunerative employment*.

**Not confirmed categories:** Twenty-two ICF categories of the chapter *Activities & Participation* which are included in the Comprehensive ICF Core Set for MS were not confirmed in this study. These categories derived from all chapters of the component *Activities and Participation*.

ICF Code		ICF Category Title	Round 3 n=76
2nd level	3rd level		% agreement
<b>d110</b>		Watching	56.8
<b>d155</b>		Acquiring skills	
<b>d160</b>		Focusing attention	
<b>d163</b>		Thinking	
<b>d166</b>		Reading	62.2
<b>d170</b>		Writing	
<b>d175</b>		Solving problems	
<b>d177</b>		Making decisions	
<b>d210</b>		Undertaking a single task	
<b>d220</b>		Undertaking multiple tasks	
<b>d230</b>		Carrying out daily routine	83.8
	d2303	Managing one's own activity level	78.4
<b>d240</b>		Handling stress and other psychological demands	



ICF Code		ICF Category Title	Round 3 n=76
2nd level	3rd level		% agreement
	d2401	Handling stress	83.8
<b>d330</b>		Speaking	71.6
<i>d335</i>		Producing nonverbal messages	56.8
<b>d350</b>		Conversation	
<b>d360</b>		Using communication devices and techniques	
<b>d410</b>		Changing basic body position	82.2
	d4103	Sitting	83.6
	d4104	Standing	85.1
<b>d415</b>		Maintaining a body position	
	d4154	Maintaining a standing position	94.5
<b>d420</b>		Transferring oneself	85.1
<b>d430</b>		Lifting and carrying objects	
<b>d440</b>		Fine hand use	83.8
<b>d445</b>		Hand and arm use	83.8
<b>d450</b>		Walking	90.5
	d4500	Walking short distances	89.2
	d4501	Walking long distances	82.4
<b>d455</b>		Moving around	
	d4551	Climbing	79.5
	d4552	Running	74.3
<b>d460</b>		Moving around in different locations	79.7
	d4600	Moving around within the home	86.7
	d4601	Moving around within buildings other than home	77.3
	d4602	Moving around outside the home and other buildings	78.7
<b>d465</b>		Moving around using equipment	80.0
<b>d470</b>		Using transportation	77.3
<b>d475</b>		Driving	82.7
	d4751	Driving motorized vehicles	84.9
<b>d510</b>		Washing oneself	86.7
	d5101	Washing whole body	85.3
<b>d520</b>		Caring for body parts	
<b>d530</b>		Toileting	82.4
	d5301	Regulating defecation	81.3
<b>d540</b>		Dressing	84.0
<b>d550</b>		Eating	84.0
<b>d560</b>		Drinking	82.7

ICF Code		ICF Category Title	Round 3 n=76
2nd level	3rd level		% agreement
<b>d570</b>		Looking after one's health	86.7
	d5701	Managing diet and fitness	82.7
	d5702	Maintaining one's health	89.3
<b>d620</b>		Acquisition of goods and services	
	d6200	Shopping	53.3
<b>d630</b>		Preparing meals	61.3
<b>d640</b>		Doing housework	62.7
	d6402	Cleaning living area	60.8
<b>d650</b>		Caring for household objects	
<b>d660</b>		Assisting others	
<b>d710</b>		Basic interpersonal interactions	
<b>d720</b>		Complex interpersonal interactions	
<b>d750</b>		Informal social relationships	
<b>d760</b>		Family relationships	75.7
<b>d770</b>		Intimate relationships	74.7
	d7702	Sexual relationships	74.7
<b>d825</b>		Vocational training	
<b>d830</b>		Higher education	
<b>d845</b>		Acquiring, keeping and terminating a job	76.0
	d8451	Maintaining a job	74.7
<b>d850</b>		Remunerative employment	62.7
<i>d855</i>		Non-remunerative employment	56.0
<b>d860</b>		Basic economic transactions	
<b>d870</b>		Economic self-sufficiency	
<b>d910</b>		Community life	
<b>d920</b>		Recreation and leisure	64.0
	d9201	Sports	53.3
	d9204	Hobbies	47.3
<b>d930</b>		Religion and spirituality	22.7
	d9300	Organized religion	17.3

**Table 9: : ICF component Activities and Participation: ICF categories included in the Comprehensive ICF Core Set for MS (bold font), ICF categories linked to participants' responses and included in the Comprehensive ICF Core Set at a different level of classification (normal font), additional categories not included in the Comprehensive ICF Core Set with an agreement < 75% (cursive font) and with an agreement >75% (cursive, underlined) and ICF categories included in the ICF Core Set but not confirmed by the participants (bold, cursive font). Percentage of participants who considered the respective ICF category as relevant in the third round.**

#### 4.3.4 Environmental Factors

Table 10 shows the results of the component *Environmental Factors* of the Delphi exercise in comparison to the Comprehensive ICF Core Set for MS.

**Confirmed categories:** Twenty-three ICF categories of the Comprehensive ICF Core Set for MS were confirmed by the participants of the Delphi exercise at the same level of classification (70.6%). Nine categories which were named by the participants are included in the Comprehensive ICF Core Set for MS at a lower level of classification (26.5%), for example *e1150-General products and technology for personal use in daily living* and *e1151-Assistive products and technology for personal use in daily living* confirm the second level category *e115-Products and technology for personal use in daily living* of the ICF Core Set for MS.

**Additional categories:** The linked ICF categories *e2600-Indoor air quality* and *e510-Services, systems and policies for the production of consumer goods* are the only two categories that are not included in the Comprehensive ICF Core Set for MS but the agreement that these categories represent MS patient’s aspects of environment treated by physicians was lower than 75 percent.

**Not confirmed categories:** Further 15 ICF categories are included in the Comprehensive ICF Core Set for MS which were not confirmed by the participants of the Delphi exercise. These categories derived from all chapters of the component *Environmental Factors*.

ICF Code		ICF Category Title	Round 3 n=76
2nd level	3rd level		% agreement
	<b>e1101</b>	Drugs	90.7
	<b>e1108</b>	Products or substances for personal consumption, other specified	84.0
<b>e115</b>		Products and technology for personal use in daily living	78.7
	e1150	General products and technology for personal use in daily living	53.3
	e1151	Assistive products and technology for personal use in daily living	89.3
<b>e120</b>		Products and technology for personal indoor and outdoor mobility and transportation	89.2
	e1201	Assistive products and technology for personal indoor and outdoor mobility and transportation	90.7

ICF Code		ICF Category Title	Round 3 n=76
2nd level	3rd level		% agreement
<b>e125</b>		Products and technology for communication	
<b>e135</b>		Products and technology for employment	68.0
<b>e150</b>		Design, construction and building products and technology of buildings for public use	37.3
<b>e155</b>		Design, construction and building products and technology of buildings for private use	36.0
<b>e165</b>		Assets	24.0
	<b>e2250</b>	Temperature	42.7
	<b>e2251</b>	Humidity	22.7
	<b>e2253</b>	Precipitation	
	<i>e2600</i>	Indoor air quality	21.3
<b>e310</b>		Immediate family	58.7
<b>e315</b>		Extended family	37.3
<b>e320</b>		friends	
<b>e325</b>		Acquaintances, peers, colleagues, neighbours and community members	44.0
<b>e330</b>		People in positions of authority	
<b>e340</b>		Personal care providers and personal assistants	90.7
<b>e355</b>		Health professionals	94.7
<b>e360</b>		Other professionals	66.7
<b>e410</b>		Individual attitudes of immediate family members	
<b>e415</b>		Individual attitudes of extended family members	
<b>e420</b>		Individual attitudes of friends	
<b>e425</b>		Individual attitudes of acquaintances, peers, colleagues, neighbours and community members	
<b>e430</b>		Individual attitudes of people in positions of authority	
<b>e440</b>		Individual attitudes of personal care providers and personal assistants	
<b>e450</b>		Individual attitudes of health professionals	
<b>e460</b>		Societal attitudes	
<i>e510</i>		Services, systems and policies for the production of consumer goods	41.1
<b>e515</b>		Architecture and construction services, systems and policies	
<b>e525</b>		Housing services, systems and policies	44.6
<b>e540</b>		Transportation services, systems and policies	51.4
	<i>e5400</i>	Transportation services	53.3
<b>e550</b>		Legal services, systems and policies	
<b>e555</b>		Associations and organizational services, systems and policies	58.1

ICF Code		ICF Category Title	Round 3 n=76
2nd level	3rd level		% agreement
	e5550	Associations and organizational services	58.1
<b>e570</b>		Social security services, systems and policies	74.7
	e5700	Social security services	78.7
<b>e575</b>		General social support services, systems and policies	64.0
	e5750	General social support services	66.7
<b>e580</b>		Health services, systems and policies	94.7
	e5800	Health services	96.0
<b>e585</b>		Education and training services, systems and policies	
<b>e590</b>		Labour and employment services, systems and policies	54.7
	e5950	Political services	30.7

**Table 10: ICF component Environmental Factors: ICF categories included in the Comprehensive ICF Core Set for MS (bold font), ICF categories linked to participants' responses and included in the Comprehensive ICF Core Set at a different level of classification (normal font), additional categories not included in the Comprehensive ICF Core Set with an agreement < 75% (cursive font) and with an agreement >75% (cursive, underlined) and ICF categories included in the ICF Core Set but not confirmed by the participants (bold, cursive font). Percentage of participants who considered the respective ICF category as relevant in the third round.**

### 4.3.5 Personal Factors

Table 11 shows the results of the component *Personal Factors* of the Delphi exercise. At least 90 percent of the physicians considered each of the six *Personal Factors* as relevant.

Answer	Round 3 n=76
	% agreement
Coping	91.9
Dependency from others / devices	91.9
Loss of control	90.7
Self-esteem	91.8
Uncertainty about future	92.0
Unrealistic therapeutic expectations	96.0

**Table 11: Responses that were linked to the ICF component Personal Factors. Percentage of participants who considered the respective response as relevant**

### 4.3.6 Health Conditions

Table 12 shows the health conditions which were named in the Delphi exercise.

Answer	Round 3 n=76
	% agreement
Depression	100.0
Dementia	97.3
Trigeminal neuralgia	100.0
Epilepsy	97.3
Oscillopsia	97.3
Aspiration pneumonia	98.6
Ileus and subileus	90.7
Restless legs	94.5
Psychotic disorders	94.6
Osteoporosis	95.9

*Table 12: Responses that characterize a health condition. Percentage of participants who considered the respective response as relevant in the third round.*

### 4.3.7 Not Classified

Table 13 shows the main statements which are not classified in the ICF.

Answer	Round 3 n=76
	% agreement
Diagnostic and follow-up procedures (diagnosis, MS relapses, prognosis, disease course)	100.0
Use of adaptive devices	97.3
Change of roles /role models	78.7
Falls	98.7
Information about MS	98.7
Pregnancy planning	97.3
Professional future	96.0
Travelling with medications	94.6

*Table 13: Responses that could not be linked to a specific ICF category since the linking unit is not covered by the ICF. Percentage of participants who considered the respective response as relevant in the third round.*



## 5 Discussion

### 5.1 Discussion of the results

The results of this study largely affirm the validity of the Comprehensive ICF Core Set for MS from the perspective of physicians. Sixty five percent of the ICF categories of the current version of the Comprehensive ICF Core Set were confirmed by the participants. Almost each of the linked categories of the ICF components *Body Structures, Activities and Participation* and *Environmental Factors* is included in the Comprehensive ICF Core Set for MS either at the same or at a different level of classification. Seventeen linked categories of the component *Body Functions* are not included in the Comprehensive ICF Core Set for MS, whereas only eight of these categories reached an agreement of at least 75 percent. Furthermore several *Personal Factors* as well as other aspects that are not covered by the ICF classification but treated by physicians were identified.

#### 5.1.1 Body Functions

The Comprehensive ICF Core Set for MS includes 40 ICF categories of the component *Body Functions*, the majority of them were confirmed by the participants of the Delphi exercise either at the same or at a different level of classification. For example, the category *b1308-Energy and drive functions, other specified (fatigue)* was confirmed by 98.6 percent of the participants. However, the corresponding categories *b1300-Energy level* and *b1301-Motivation* were not named by the physicians. These categories represent the second level category *b130-Energy and drive functions* which is not included in the Comprehensive ICF Core Set but was additionally mentioned by the participating physicians. "Fatigue" is described as one of the main problems of MS patients with prevalence rates of more than 50 percent, the majority of MS patients even describes it as the worst or one of the worst symptom with a significant effect on the mental health and general health status (Fisk et al., 1994; Hadjimichael et al., 2008). Hence it should be reconsidered whether it is reasonable to include all three categories *b1300*, *b1301* and *b1308* in the Comprehensive ICF Core Set for MS or only the category *b1308-Fatigue*.

The category *b780-Sensation related to muscles and movement functions* was not confirmed on the second level but on the more detailed third level of the classification. Almost all participants agreed that the categories *b7800-Sensation of muscle stiffness* and *b7801-Sensation of muscle spasm* represent relevant problems of MS patients' treated by physicians. So the importance of these ICF categories was supported from the clinical perspective. Forty-seven percent of the MS patients of the study of Barnes et al. (2003) and 84 percent of the interviewed patients in the study of Rizzo et al. (2004) reported clinical significant spasticity. Instead of the second level category *b780-Sensation related to muscles and movement functions* the inclusion of the more detailed categories *b7800* and *b7801* seems to be appropriate and should be discussed during the revision process.

Additionally, the participants named 17 ICF categories which are not yet contained in the Comprehensive ICF Core Set for MS; eight thereof had an agreement of more than 75 percent. Before discussing these categories in detail one has to mention that some of these categories are related to side effects of medication used to treat MS. The question whether ICF categories concerning side effects of medication should be included in the Comprehensive ICF Core Set for MS has to be considered carefully. With the advent of new medications, new side effects may appear. On the one hand, one has to keep in mind that the ICF Core Set describes functioning and disability of MS patients independent of the treatment. On the other hand, the intake of medication and the suffering of side effects belong to the reality of patients with MS. Perhaps one solution to this dilemma could be the development of treatment-specific ICF Core Sets.

From the majority of the participants the categories *b240-Sensations associated with hearing and vestibular function* and *b2401-Dizziness* were seen as relevant problems of MS patients treated by physicians. The study of Beer and Kesselring as well as the study of Sundström demonstrated that eight percent of the MS patients are afflicted with vertigo as a defined onset attack symptom (Beer & Kesselring, 1988; Sundström et al., 2004). Frohmann and colleagues examined 1153 MS patients, 6.8 percent of them had experienced an episode of true vertigo at some time during their illness. Benign paroxysmal positioning vertigo (BPPV) was the most common cause of vertigo in this study followed by a new demyelinating plaque within the brainstem (Frohmann et al., 2000; Frohmann et al., 2003). When vertigo occurs on the basis of

inflammatory demyelination, the medial vestibular nucleus (MVN) and the root entry zone of cranial nerve VIII represent the most common neuroanatomical localizations (Francis et al., 1992; Gass et al., 1998; Thömke et al., 1999). On the assumption that an acute inflammatory demyelinating exacerbation constitutes the vertigo a treatment with corticosteroids and vestibular suppressants (e.g. diazepam, clonazepam) might be indicated. When the diagnosis of BPPV is established, particle repositioning manoeuvres are the treatment of choice and will lead to complete resolution of vertigo in most patients (Frohmann et al., 2003). Furthermore it should be considered that a number of drugs for the symptomatic treatment of MS patients can cause vertigo as adverse effect, e.g. Gabapentin for the treatment of spasticity, Modafenil for the treatment of fatigue or Sildenafil for the treatment of sexual dysfunctions (Deutsche Multiple Sklerose Gesellschaft (DMSG), 2004). So it is up to the physician to detect the cause of the vertigo and choose the adequate treatment for the patient. That's why the inclusion of at least the second level category *b240-sensations associated with hearing and vestibular function* into the Comprehensive ICF Core Set for MS in addition to the already existing category *b230-Vestibular functions* should be discussed.

The category *b840-Sensation related to the skin* is another issue which was identified to be relevant in the treatment of MS patients by almost all participants and which is not included in the Comprehensive ICF Core Set for MS. The epidemiologic study of Beer and Kesselring already demonstrated that 41.3 percent of the MS patients are afflicted with paraesthesias at the onset of the disease (Beer & Kesselring, 1988). Also 40 percent of the MS patients analysed by Sander and Arts mentioned paraesthesia as a symptom (Sander & Arts, 1986). Paraesthesias can also appear as paroxysmal symptoms which last only some hours and end spontaneously as shown in the case report of Khan and Olek (1995). Paraesthesias are often associated with pain (Beiske et al., 2004) which is described as burning, itching, electric and formication (feeling as if ants were crawling across your skin) (Rae-Grant et al., 1999). In the study of Beiske and colleagues about 40 percent of the patients reported that these symptoms had important influence on daily activities, hence it is important to treat these sensations (Beiske et al., 2004). The current guidelines of the symptomatic treatment of MS that were approved by the German Multiple Sclerosis Society (DMSG) in 2004 recommend Amitriptyline, Carbamazepine, Gabapentin,

Lamotrigine or Morphine as possible medication of paraesthesias or dysaesthesias (DMSG, 2004). Another point that should be considered is the developing of paraesthesias or polyneuropathies as side effects of drugs that are used for the symptomatic treatment of MS, for example Aminopyridin for the treatment of fatigue or Isoniazid which is used to improve tremor (DMSG, 2004). It becomes apparent that physicians are often faced with problems which are mentioned in the ICF category *b840-Sensation related to skin*, so an inclusion of this category in the Comprehensive ICF Core Set for MS to complement the existing category *s810-Structure of areas of skin* should be considered.

Another ICF category considered to be relevant in the treatment of MS by the participating physicians is *b6700-Discomfort associated with sexual intercourse*. Neither this category nor the corresponding second level category *b670-Sensation associated with genital and reproductive functions* are contained in the Comprehensive ICF Core Set for MS. Sexual dysfunctions in general can arise at any time during the course of MS with a prevalence rate of about 50 to 90 percent (Zorzon et al., 1999). Schapiro (1998) maintains that more than 70 percent of all women with MS and 90 percent of all men with MS reported some change in their sexual life after the onset of the disease. To date, research on the sexuality of individuals with MS has focused primarily on factors that influence the physical aspects of sexuality, such as performance and arousal (Gagliardi, 2003). Women are mostly affected by impaired genital sensations, anorgasmia or hyporgasmia, reduced libido as well as decreased vaginal lubrication. Men often suffer from total or incomplete loss of erection, impotence or erectile dysfunction, ejaculatory and orgasmic dysfunctions and reduced libido (Zorzon et al., 1999). The study of Zivadinov and colleagues demonstrated that symptoms of sexual dysfunctions are associated with sphincter dysfunctions, bladder dysfunctions, fatigue, depression, anxiety and cognitive impairment (Zivadinov et al., 1999). In addition to these physical impairments emotional and psychological aspects like self-esteem, body image, relationships with others and self-identification are intertwined with sexuality (Richardson & Lazur, 1995) as well as demographic factors like present age and age at onset of symptoms, low educational level, unemployment and marriage (Zivadinov et al., 1999). It becomes obvious that a lot of different aspects influence sexuality of MS patients with great implications on the quality of life of these individuals.

However, the majority of sexual problems reported in literature are covered by the existing ICF Core Set category *b640-sexual dysfunction*, so the need for the inclusion of the category *b6700-Discomfort associated with sexual intercourse* is not proved sufficiently and should be discussed regarding the results of other validation studies. Nevertheless it is appropriate for physicians to address sexual function within the context of routine health assessment although they might feel uncomfortable or inadequately trained to discuss sexual issues with their patients (Schmidt et al., 2005; Vermillion et al., 1997).

Furthermore the ICF categories *b435-Immunological system functions* and *b43501-Non-specific immune responses* were seen as relevant problems of MS patients' treated by physicians by the participants but are not included in the Comprehensive ICF Core Set for MS. These categories represent an important aspect especially from the perspective of physicians because several drugs of the basic therapy of MS affect immunosuppressive or immunomodulating. The consequence of the treatment with immunosuppressive drugs is the reduction of autoaggressive immunocompetent cells as well as the reduction of normal or counter-regulatory immunocompetent cells. This could breed to an increased liability to infections. However, in clinical practice this is rarely a problem (Kesselring, 2005). In 1985 Sibley and colleagues already recognized that patients with MS are less susceptible for infections than healthy individuals, but MS exacerbations were related to infections (Sibley et al., 1985). This was proved by numerous studies. Rapp and colleagues found that 35 percent of MS patients experienced a relapse also had a bacterial infection (Rapp et al., 1995). Correale and colleagues reported that there was a significant association between systemic infections and risk of MS relapses, increased MRI activity, and T cells activation (Correale et al., 2006). Besides, many MS patients suffer from urinary tract dysfunctions that can lead to urinary tract infections. Metz and colleagues present three case studies from an MS clinic where recurrent urinary tract infections were associated with acute exacerbation and neurological progression refractory to intravenous steroid treatment (Metz et al., 1998). This demonstrates that immunological system functions play an important role in the daily life of MS patients either because of the influence of drugs or because of the risk of relapses related to infections. Therefore it should be discussed whether these ICF categories or at least

the second level category *b435-Immunological system functions* should be included in the Comprehensive ICF Core Set for MS.

The category *b1600-Pace of thought* was also identified to be relevant in the treatment of MS patients. Currently, neither this ICF category nor the corresponding second level category *b160-Thought function* is included in the Comprehensive ICF Core Set for MS. Neuropsychological studies demonstrate that many MS patients show cognitive impairment with prominent involvement of memory, sustained attention and information processing speed (Bobholz & Rao, 2003; Amato et al., 2006). In literature the prevalence rates of cognitive impairments in MS patients diversify between 43 and 65 percent (Medaer et al., 1984; Rao et al., 1984; Rao et al., 1991; McIntosh-Michaelis et al., 1991; Faiss et al., 2007). Further studies demonstrate that cognitive deficits correlate with brain lesion and brain atrophy (Rao et al., 1989; Rovaris et al., 1998), whereas the localization defines the cognitive impairment (Swirsky-Saretti et al., 1992; Rovaris et al., 2000). Furthermore cognitive dysfunction can have long-term effects on patients and their families (Kesselring & Beer, 2005). The study of Amato and colleagues demonstrated that MS patients suffer from cognitive impairment had to modify or discontinue their work activity, had limitations in social interactions and required assistance in their personal lives (Amato et al., 2001). Also an association of impaired cognition with anxiety, fatigue and depression could be proved (Arnett et al., 2001; Faiss et al., 2007; Simionit et al., 2007) whereas no coherence between cognitive dysfunction and physical disability was found (Rao et al., 1991; Amato et al., 2006; Faiss et al., 2007). Cognitive impairment as well as the related depressive and anxiety symptoms result in a decreased quality of life (Cutajar et al., 2000; Benito-Leon et al., 2002). So it is necessary for the physician to recognise cognitive deficits as early as possible and to start the treatment to minimise these effects on the patients' life. Currently non-pharmacological measures like cognitive rehabilitation, occupational therapy and psychotherapy are focused on because only few effective pharmacological agents are approved as symptomatic therapy (Deutsche Multiple Sklerose Gesellschaft, 2004; Krupp et al., 2004; Kesselring & Beer, 2005). Several cognitive impairments like memory and learning deficits, attention deficits and executive dysfunctions are already represented in the Comprehensive ICF Core Set for MS by the ICF categories *b140-Attention function*, *b144-Memory functions* and *b164-Higher level*

*cognitive functions*. Another relevant cognitive dysfunction that can be affected in MS patients but is not yet included in the Comprehensive ICF Core Set for MS is the information processing speed (Rao et al., 1989; Faiss et al., 2007). This affection could be covered by the suggested ICF category *b1600-Pace of thought*, so an inclusion of this category should be initiated to complete the mental functions' ICF categories named above.

The majority of the participants held that the ICF category *b215-Function of structures adjoining the eye* describes relevant problems of MS patients treated by physicians. One symptom which belongs to this category is nystagmus. Charcot already included this symptom in his classical symptom triad that comprises nystagmus, intention tremor and scanning or staccato speech. Nystagmus is found in more than the half of the MS patients, whereas various types can be distinguished (Kesselring, 2005). The most common type is the horizontal optokinetic nystagmus; 57 percent of the examined MS patients in the study of Johnsen and colleagues featured this symptom (Johnsen et al., 1976). However, this kind of nystagmus should not be overestimated because it also can be found as a consequence of tiredness or missing cooperation (Kesselring, 2005). The acquired pendular nystagmus was diagnosed in four percent of the MS patients analysed by Aschoff and colleagues (1974). This study also demonstrated that patients with pendular nystagmus always suffered from severe cerebellar symptoms such as trunk ataxia, head tremor, intention tremor, or the cerebellar type of speech disturbance. Therefore, the cerebellar nuclei are obviously the structures the lesions of which may cause pendular nystagmus (Aschoff et al., 1974). Further types of nystagmus which can be found in patients with MS are spontaneous nystagmus, positional nystagmus (Johnsen et al., 1976), Downbeat nystagmus (Massucci & Kurtzke, 1988) or see-saw nystagmus (Sandramouli et al., 2005; Samkoff et al., 1994). To recognize nystagmus is more relevant for diagnosis than for therapy because a pharmacological treatment of nystagmus is difficult (Bandini et al., 2001). However, additional surgical approaches could improve the nystagmus (Jain et al., 2002). Since nystagmus is a classical, characteristic symptom of MS the inclusion of the ICF category *b215-Function of structures adjoining the eye* into the Comprehensive ICF Core Set for MS should be considered, although the treatment is complicated.

Seven ICF categories of the Comprehensive ICF Core Set for MS were not confirmed by the participating physicians. These are *b114-Orientation functions*, *b156-Perceptual functions*, *b235-Vestibular functions*, *b260-Proprioceptive functions*, *b310-Voice function*, *b5104-Salivation* and *b750-Motor reflex functions*. Perhaps these are usually treated by other health professionals but not by physicians. The categories *b310-Voice function* and *b5104-Salivation* describe typical work areas of speech therapists. The therapeutic aim of speech therapists is to correct voice dysfunctions, speech disorders, language disorders and dysphagia (Brauer & Tesak, 2003). Voice and speech dysfunctions as well as dysphagia are common problems of MS patients (de Pauw et al., 2002; Calcagno et al., 2002; Hartelius & Svensson, 1994). Therefore, it is important that these ICF categories are included in the Comprehensive ICF Core Set for MS although the participating physicians did not confirm these categories. The categories *b750-Motor reflex functions*, *b235-Vestibular functions*, *b156-Perceptual functions* and *b260-Proprioceptive functions* represent work areas of physiotherapists and occupational therapists. The primary aims of physiotherapists are to restore and maintain function, activity and independence (MS Trust, 2006). They improve or maintain muscle activity, balance, mobility, posture and joint range (Stevenson & Playford, 2007) which are characteristic problems of MS patients. Occupational therapists enable people to achieve health, well-being, independence and life satisfaction through participation in occupation (MS Trust, 2006) by learning or re-learning ways in which activities can be performed, by adapting the activity or by modifying the environment (Stevenson & Playford, 2007).

Since the treatment and rehabilitation of MS patients requires a multidisciplinary team it is necessary to include treatment goals of all engaged health professionals into the Comprehensive ICF Core Set for MS. So the results of further validation studies including different health professions must be compared to decide which of the categories of the Comprehensive ICF Core Set for MS describe the profile of MS patients comprehensively and therefore should be confirmed or not confirmed.



### **5.1.2 Body Structures**

Two ICF categories of the component *Body Structures* of the Comprehensive ICF Core Set for MS were confirmed by the participants. These are *s810-Structure of areas of the skin* and *s1106-Structure of cranial nerves*. The Comprehensive ICF Core Set for MS includes five further ICF categories which were not confirmed by the participants. That shows that the physicians participating in the Delphi exercise held that body structures are not the major problem they try to treat, perhaps because they can not influence for example the structure of the brain. Mainly they care about the implications because of changes for example in the structure of cranial nerves by treating the respective *Body Functions*, either with drugs, physical therapy or psychological counselling (Kesselring, 2005). Therefore the results of the other validation studies must be regarded and analysed to decide which *Body Structures'* categories should be contained in the Comprehensive ICF Core Set for MS.

### **5.1.3 Activities & Participation**

More than half of the ICF categories of the component *Activities and Participation* of the Comprehensive ICF Core Set for MS were confirmed by the participants of the Delphi exercise either at the same or at a different level of classification, especially various ICF categories of the chapters *d2-General tasks and demands*, *d4-Mobility*, *d5-Self-care*, *d7-Interpersonal interactions and relationships* and *d8-Major life areas*.

Furthermore, there are several categories which are included in the Comprehensive ICF Core Set for MS which were not confirmed by the participating physicians. This might be traced back to the fact that these ICF categories describe typical work areas of other health professionals than physicians. For example the categories *d520-Caring for body parts* and *d650-Caring for household objects* represent activities characteristically treated by occupational therapists (MS Trust, 2006). Since the care of MS patients requires a multi- and interdisciplinary team the results of the validation studies with other health professionals must be regarded to decide whether these ICF categories represent relevant problems of MS patients and therefore must be contained in the Comprehensive ICF Core Set for MS.

#### **5.1.4 Environmental Factors**

The majority of the ICF categories of the component *Environmental Factors* was confirmed by the participants for example the categories *e110-Drugs, e120-Products and technology for personal indoor and outdoor mobility and transportation, e340-Support from personal care providers and personal assistants, e355-Support from health professionals* or *e580-Health services, systems and policies*.

Once again, the ICF categories that were not confirmed by the physicians might represent work areas of other health professionals like occupational therapists, physiotherapists or social workers.

Peculiar is that not even one of the ICF categories of the chapter *e4-Attitudes* were confirmed by the participating physicians while at least one category of the other chapters of the *Environmental Factors* was named. Also the study of Khan and Pallant identified seven ICF categories of the chapter *e4-Attitudes* to be relevant in the treatment of MS patients (Khan & Pallant, 2007). One reason could be that physicians simply do not have enough time in their daily clinical routine to affect the attitudes of family members, friends or colleagues towards the disease and the patient. One way to influence attitudes and reduce prejudices might be an improved flow of information and education about the disease and its consequences. Another reason for not appearing of *e4*-categories might be a linking mistake influenced by the individual position of the linkers. To find out more about the importance of this chapter for MS patients the results of the different validation studies must be analysed.

#### **5.1.5 Personal Factors**

According to the ICF language a considerable number of the participants' responses could be identified as *Personal Factors*. All identified *Personal Factors* of the Delphi exercise reached an agreement of more than 90 percent which demonstrate their importance for MS patients' treatment that was already reported in the study of Khan and Pallant (2007). One considerable *Personal Factor* that was identified in this study and that is consistently pointed out in literature is "Coping". Individuals' coping is defined as the result of a stress appraisal process and its purpose is to manage psychological stress (Lazarus, 2000). People with MS need to cope with

unpredictable worsening of health, changing social and intimate relationships and increasing support needs, which results in an increasing dependency from others. Dependency from others and / or devices was also seen as an important *Personal Factor* treated by physicians by the participants. The general well-being of MS patients depends upon how they adapt to these changing circumstances. The fact that things seem to be occurring that the individual's can not control may lead to negative reactions. The feeling of loosing control that was also named by the participating physicians may lead to feel helpless and become depressed (McCabe et al., 2004). The association between the way of coping and depression, psychological factors and quality of life was demonstrated in several studies (Arnett et al., 2002; McCabe et al., 2004; Goretti et al., 2009). In a qualitative study Somerset and colleagues emphasize the aspects of life that contributed to the quality of the lives of people with MS (Somerset et al., 2002). Personal control as well as uncertainty about the course of the disease and the future, which was also emphasized as a *Personal Factor* by the participants of the validation study, emerged as important factors in terms of the quality of life of the interviewed MS patients. Also support can influence quality of life either in a positive or in a negative way. Inappropriate support can result in feelings of dependency and these were accompanied by loss of personal control. Furthermore this study pointed out that health and social care professionals were well placed to provide and coordinate effective support, and to recognise and ameliorate the damaging impact of dependency. On the other hand the health professionals were also seen as a source of frustration because they fall short of MS patients' expectations. Also the majority of the participating physicians in this validation study had to face the problem of unrealistic therapeutic expectations. It becomes obvious that almost all physicians as well as other health professionals treating MS patients are confronted with the *Personal Factors* that were identified in the Delphi exercise because these *Personal Factors* are important aspects in the life of MS patients and they are not only interrelated among each other but also influence characteristic symptoms of MS patients. These findings stress the need to develop the component Personal Factors in future revisions of the ICF to get a comprehensive and complete description of relevant aspects influencing a patient's functioning and health.

### **5.1.6 Health Conditions**

Ten health conditions related to MS were named by the participating physicians, Depression and Trigeminal neuralgia even with an agreement of 100 percent. This shows that diseases resulting from MS and associated with MS play an important role in the treatment of MS patients.

### **5.1.7 Not Classified**

In the Delphi exercise several issues were identified that seem to be very important for physicians treating MS patients but are not covered by the ICF. "Diagnostic and follow-up procedures" were seen as a relevant issue as well as "information about MS". Previous studies have shown that patients with MS require a lot of information at time of receiving the diagnosis as well as in the course of the disease especially during acute exacerbations (Baker, 1998; Box et al., 2003). Lode and colleagues found that the quality of information given at the time of diagnosis is related to coping styles in patients with MS (Lode et al., 2007). Patients who were satisfied with the information employed more often actively coping than avoidance coping. However 43.2 percent of the MS patients in this study were dissatisfied with the information by the time of diagnosis. Johnson suggests in his study that imparting a diagnosis of MS should be seen as the start of a transition that needs to be made explicit to the patient and closely linked to the provision of sources of information, advice and ongoing support as people learn to live with and manage the disease (Johnson, 2003). But not only MS patients need information, all people with chronic conditions need support from providers in supply and engagement with information, in a way which gives legitimacy to the person's own self-care strategies and possible alternatives (Protheroe et al., 2008). So it is not amazing that the participants of the Delphi exercise held that diagnostic and follow-up procedures as well as well informed patients are necessary to care for their patients to recognize and treat problems or feasible relapses at an early stage. However one could say that these issues are covered by the environmental factor *e580-health services, systems and policies* but on the other hand it should be considered whether these terms are to important for all patients suffering from chronic diseases to disappear in this huge ICF category.

Strongly associated with "information about MS" is the statement "pregnancy planning". Since the age of onset of MS is between 20 and 40 years a lot of women in childbearing age are affected by this issue. So it is important that the physician informs and advises the patient about all topics related to pregnancy and MS and clarifies that pregnancy does not adversely affect the course of the disease and vice versa (Lee & O'Brian, 2008). The PRIMS study proved that pregnancy is probably neutral overall in terms of disease activity (Vukusic et al., 2004). An approximate 70 percent reduction in relapse rate was seen in the third trimester of pregnancy, while there was a compensatory increase in the first postpartum trimester. Also the disease progression was not affected by pregnancy (Vukusic et al., 2004). Nevertheless the risks of drugs used for the treatment of MS in pregnancy must be considered. While Prednisolon and Azathioprine seem to be safe in pregnancy, Methotrexat as well as Interferone- $\beta$  should be stopped before conception (Lee & O'Brian, 2008). So physicians should support MS patients in pregnancy planning by giving information about the positive and negative impacts of pregnancy in MS. Since this issue affects all patients with chronic diseases the development of a category "pregnancy planning" in the ICF in addition to the category *b660-Procreation* functions should be aspired.

Another issue that was identified is "falls". In the study of Nilsagard and colleagues 63 percent of the analysed MS patients reported repetitive falls during the course of their disease whereas most falls occurred indoors during activities of daily life (Nilsagard et al., 2009). The odds of falling were increased by the use of walking aids, by disturbed proprioception and increased spasticity. So falls are consequences of various factors like disordered *Body Functions* and additional *Environmental Factors*, which are already covered by the ICF classification.

The remaining four identified statements that were not classified in the ICF are "Professional future", "Use of adaptive devices", "Travelling with medications" and "Change of roles/role models".

The identified term "Professional future" is associated with the ICF category *d850-Remunerative employment*. The study of Gronning and colleagues showed that approximately 50 percent of MS patients are unemployed within ten years of disease onset (Gronning et al., 1990). Khan and colleagues reported that work-related problems were common in patients with MS and that there are still not enough

specific interventions to support vocation or to lessen the impact of unemployment (Khan et al., 2006). Besides occupation is often linked with high stress and high physical or mental work that can worsen the disease (Simmons et al., 2004). "Professional future" is highly connected with the term "uncertainty about future" which was already discussed in the chapter Personal Factors.

"Travelling with medications" is another issue MS patients as well as all other individuals with acute or chronic diseases must mind. There are special regulations about medications in each country which have to be regarded. In general it is important to keep all medication and syringes in their original packaging. Often a medical certification of the physician that describes the imperative of using this medication and the accurate dosing is necessary (Auswärtiges Amt, 2009). Airlines and airports usually have strict rules about travelling with medications, so this should also be checked before travelling. Furthermore the storage and transport of the drugs must be considered, for example some drugs can only be out of the fridge for a certain length of time (MS Society, 2009). There are a lot of things that must be kept in mind when travelling with a chronic disease like MS and physicians can assist their patients in planning a travel. However, it is no term for the description of health and health-related states like it is provided by the ICF classification.

The identified term "Use of adaptive devices" could be covered on closer examination by several ICF categories of the chapter *1-Products and technologies* of the component *Environmental Factors*, so an additional inclusion of this term into the ICF seems not required.

The last statement that is not classified in the ICF classification is "Change of role / role models". Obviously the role of MS patients as well as of their family members, friends and care givers change during the course of the disease. As the study of Gronning and colleagues showed many MS patients become unemployed during the course of their disease, so they do not earn their own money any more and are hooked on their spouses or social insurances (Gronning et al., 1990). Also the increasing disability leads to a larger dependence on family members or caregivers. So during the course of the disease the active autonomous individual could change to a needy constrained patient. However, also family members especially spouses experience a change of their role. They adopt more and more the role of a caregiver (Courts et al., 2005) with consequences in relationship satisfaction and quality of life.

The study of Patti and colleagues demonstrated that caregiving was associated with lower mental health, vitality and general health scores, compared to healthy subjects (Patti et al., 2007). Furthermore different health professionals like physicians, nurses, physiotherapists or occupational therapists play an increasing role in the daily life of MS patients caused by the incremental disability.

In this validation study several statements emerged which are not yet covered by the ICF classification. Analysing the results of other validation studies the development of appropriate categories should be aspired.

## **5.2 Discussion of the methods**

The Delphi technique proved to be an appropriate method for this study. In this study response rates of 85 to 94 percent between the three rounds were achieved, in contrast to attrition rates of 50 percent or higher reported in the literature (Geschka 1977, Race & Planek 1992). However, regarding the external validity and reliability of this study there are some limitations which should be mentioned. Since no database of the target population is available it was not possible to randomize the sample. That means although the sample of this study included 84 physicians from 36 countries it is not assured that it represents a representative sample of physicians who are experienced in the treatment of MS patients. However, qualitative research methods in general and the Delphi technique in particular are characterized by the impossibility of random sampling (Hasson et al., 2000; Williams & Webb, 1994).

The majority of the participants come from the European Region. Therefore it could be possible that this influences the results. The reasons for the dominance of European participants might be a better e-mail access in Europe compared to South America or Africa. Also the prevalence rate of MS differ depending on the country (Gleixner et al., 2007; Bhigjee et al., 2007; Kesselring, 2005), so in Europe there are more physicians who are experienced in MS than in Africa. However, the results of the statistic tests show that there is no significant difference between the physicians of the different WHO World regions regarding age, professional and practical experience. Nevertheless, further validation studies should include physicians from countries not sufficiently represented in this study.

The linking of the statements of the participants of the first Delphi round was performed by two trained medical doctoral students. Perhaps other health care professionals would have linked differently. On the other hand the linking agreement of the two students was calculated by using kappa statistics and proved to be satisfactory.



## 6 Conclusion

The Comprehensive ICF Core Set for MS represents the typical spectrum of problems in functioning of patients with MS. For the validation of this ICF Core Set the physician's perspective is extremely important because physicians deliver the diagnosis and accompany the patient in the treatment and course of the disease. The current version of the Comprehensive ICF Core Set for MS could be largely confirmed by the participating physicians. However, several additional ICF categories not included in the Comprehensive ICF Core Set for MS emerged and several ICF categories included in the Comprehensive ICF Core Set for MS were not confirmed by the participants. The findings of this study also stress the need to develop the component *Personal factors*.

It is important to analyse and discuss the results of further finished or ongoing validation studies of the Comprehensive ICF Core Set for MS during the revision process with the aim of a potentially modified version of the Comprehensive ICF Core Set for MS which describes health and health-related states of MS patients as best as possible.

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## 8 List of abbreviations

BPPV	benign paroxysmal positioning vertigo
CNS	central nervous system
e-mail	electronic mail
hc	health condition
HLA-DR2	Human Leukocyte Antigen DR2
ICF	International Classification of Functioning, Disability and Health
IFN $\beta$	Interferon beta
MRI	Magnetic Resonance Imaging
MS	Multiple Sclerosis
MVN	medial vestibular nucleus
nc	not classified
nd	not definable
pf	Personal Factors
PPMS	Primary progressive multiple sclerosis
PRMS	Progressive relapsing multiple sclerosis
RRMS	Relapsing-remitting multiple sclerosis
SPMS	Secondary-progressive MS
WHO	World Health Organisation

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## 10 Appendix

### *Appendix 1 Comprehensive ICF Core Set for Multiple Sclerosis*

#### Body Functions

ICF Code		ICF Category Title
2nd level	3rd level	
<b>b114</b>		Orientation functions
<b>b126</b>		Temperament and personality functions
	<b>b1300</b>	Energy level
	<b>b1301</b>	Motivation
	<b>b1308</b>	Energy and drive functions, other specified (Fatigue)
<b>b134</b>		Sleep functions
<b>b140</b>		Attention functions
<b>b144</b>		Memory functions
<b>b152</b>		Emotional functions
<b>b156</b>		Perceptual functions
<b>b164</b>		Higher-level cognitive functions
<b>b210</b>		Seeing functions
<b>b235</b>		Vestibular functions
<b>b260</b>		Proprioceptive function
<b>b265</b>		Touch function
<b>b270</b>		Sensory functions related to temperature and other stimuli
<b>b280</b>		Sensation of pain
<b>b310</b>		Voice functions
<b>b320</b>		Articulation functions
<b>b330</b>		Fluency and rhythm of speech functions
<b>b445</b>		Respiratory muscle functions
<b>b455</b>		Exercise tolerance functions
	<b>b5104</b>	Salivation
	<b>b5105</b>	Swallowing
<b>b525</b>		Defecation functions
	<b>b5500</b>	Body temperature
	<b>b5508</b>	Thermoregulatory functions, other specified (Sensitivity to heat)
	<b>b5508</b>	Thermoregulatory functions, other specified (Sensitivity to cold)
<b>b620</b>		Urination functions
<b>b640</b>		Sexual functions

ICF Code		ICF Category Title
2nd level	3rd level	
<b>b710</b>		Mobility of joint functions
<b>b730</b>		Muscle power functions
<b>b735</b>		Muscle tone functions
<b>b740</b>		Muscle endurance functions
<b>b750</b>		Motor reflex functions
<b>b760</b>		Control of voluntary movement functions
	<b>b7650</b>	Involuntary contractions of muscles
	<b>b7651</b>	Tremor
<b>b770</b>		Gait pattern functions
<b>b780</b>		Sensations related to muscles and movement functions

## Body Structures

ICF Code		ICF Category Title
2nd level	3rd level	
<b>s110</b>		Structure of brain
<b>s120</b>		Spinal cord and related structures
<b>s610</b>		Structure of urinary system
<b>s730</b>		Structure of upper extremity
<b>s750</b>		Structure of lower extremity
<b>s760</b>		Structure of trunk
<b>s810</b>		Structure of areas of skin

## Activities & Participation

ICF Code		ICF Category Title
2nd level	3rd level	
d110		Watching
d155		Acquiring skills
d160		Focusing attention
d163		Thinking
d166		Reading
d170		Writing
d175		Solving problems
d177		Making decisions
d210		Undertaking a single task
d220		Undertaking multiple tasks
d230		Carrying out daily routine
d240		Handling stress and other psychological demands
d330		Speaking
d350		Conversation
d360		Using communication devices and techniques
d410		Changing basic body position
d415		Maintaining a body position
d420		Transferring oneself
d430		Lifting and carrying objects
d440		Fine hand use
d445		Hand and arm use
d450		Walking
d455		Moving around
d460		Moving around in different locations
d465		Moving around using equipment
d470		Using transportation
d475		Driving
d510		Washing oneself
d520		Caring for body parts
d530		Toileting
d540		Dressing
d550		Eating
d560		Drinking
d570		Looking after one's health
d620		Acquisition of goods and services
d630		Preparing meals

ICF Code		ICF Category Title
2nd level	3rd level	
<b>d640</b>		Doing housework
<b>d650</b>		Caring for household objects
<b>d660</b>		Assisting others
<b>d710</b>		Basic interpersonal interactions
<b>d720</b>		Complex interpersonal interactions
<b>d750</b>		Informal social relationships
<b>d760</b>		Family relationships
<b>d770</b>		Intimate relationships
<b>d825</b>		Vocational training
<b>d830</b>		Higher education
<b>d845</b>		Acquiring, keeping and terminating a job
<b>d850</b>		Remunerative employment
<b>d860</b>		Basic economic transactions
<b>d870</b>		Economic self-sufficiency
<b>d910</b>		Community life
<b>d920</b>		Recreation and leisure
<b>d930</b>		Religion and spirituality

## Environmental Factors

ICF Code		ICF Category Title
2nd level	3rd level	
	<b>e1101</b>	Drugs
	<b>e1108</b>	Products or substances for personal consumption, other specified (Special formulations of food to maintain safety and nutrition)
<b>e115</b>		Products and technology for personal use in daily living
<b>e120</b>		Products and technology for personal indoor and outdoor mobility and transportation
<b>e125</b>		Products and technology for communication
<b>e135</b>		Products and technology for employment
<b>e150</b>		Design, construction and building products and technology of buildings for public use
<b>e155</b>		Design, construction and building products and technology of buildings for private use
<b>e165</b>		Assets
	<b>e2250</b>	Temperature
	<b>e2251</b>	Humidity
	<b>e2253</b>	Precipitation
<b>e310</b>		Immediate family
<b>e315</b>		Extended family
<b>e320</b>		Friends
<b>e325</b>		Acquaintances, peers, colleagues, neighbours and community members
<b>e330</b>		People in positions of authority
<b>e340</b>		Personal care providers and personal assistants
<b>e355</b>		Health professionals
<b>e360</b>		Other professionals
<b>e410</b>		Individual attitudes of immediate family members
<b>e415</b>		Individual attitudes of extended family members
<b>e420</b>		Individual attitudes of friends
<b>e425</b>		Individual attitudes of acquaintances, peers, colleagues, neighbours and community members
<b>e430</b>		Individual attitudes of people in positions of authority
<b>e440</b>		Individual attitudes of personal care providers and personal assistants
<b>e450</b>		Individual attitudes of health professionals
<b>e460</b>		Societal attitudes
<b>e515</b>		Architecture and construction services, systems and policies
<b>e525</b>		Housing services, systems and policies
<b>e540</b>		Transportation services, systems and policies
<b>e550</b>		Legal services, systems and policies

ICF Code		ICF Category Title
2nd level	3rd level	
<b>e555</b>		Associations and organizational services, systems and policies
<b>e570</b>		Social security services, systems and policies
<b>e575</b>		General social support services, systems and policies
<b>e580</b>		Health services, systems and policies
<b>e585</b>		Education and training services, systems and policies
<b>e590</b>		Labour and employment services, systems and policies

## **Appendix 2 Brief ICF Core Set for Multiple Sclerosis – candidate categories**

### **Body Functions**

<b>ICF Code</b>	<b>ICF Category Title</b>
<b>b130</b>	Energy and drive functions
<b>b140</b>	Attention functions
<b>b144</b>	Memory functions
<b>b152</b>	Emotional functions
<b>b164</b>	Higher-level cognitive functions
<b>b210</b>	Seeing functions
<b>b280</b>	Sensation of pain
<b>b455</b>	Exercise tolerance functions
<b>b620</b>	Urination functions
<b>b640</b>	Sexual functions
<b>b730</b>	Muscle power functions
<b>b735</b>	Muscle tone functions
<b>b760</b>	Control of voluntary movement functions
<b>b770</b>	Gait pattern functions

### **Body Structures**

<b>ICF Code</b>	<b>ICF Category Title</b>
<b>s110</b>	Structure of brain
<b>s120</b>	Spinal cord and related structures
<b>s610</b>	Structure of urinary system



## Activities & Participation

ICF Code	ICF Category Title
<b>d175</b>	Solving problems
<b>d230</b>	Carrying out daily routine
<b>d240</b>	Handling stress and other psychological demands
<b>d450</b>	Walking
<b>d455</b>	Moving around
<b>d530</b>	Toileting
<b>d570</b>	Looking after one's health
<b>d640</b>	Doing housework
<b>d760</b>	Family relationships
<b>d770</b>	Intimate relationships
<b>d850</b>	Remunerative employment
<b>d870</b>	Economic self-sufficiency

## Environmental Factors

ICF Code	ICF Category Title
<b>e115</b>	Products and technology for personal use in daily living
<b>e120</b>	Products and technology for personal indoor and outdoor mobility and transportation
<b>e310</b>	Immediate family
<b>e355</b>	Health professionals
<b>e410</b>	Individual attitudes of immediate family members
<b>e540</b>	Transportation services, systems and policies
<b>e570</b>	Social security services, systems and policies
<b>e580</b>	Health services, systems and policies

## **Appendix 3 First e-mail**

### **WHO research project on Multiple Sclerosis and physicians**

Dear [xxx]/[member of xxx],

In the context of a WHO international research project (please find a detailed description of our study in the attached files) we are currently searching for physicians with outstanding expertise in treatment of patients with Multiple Sclerosis (MS).

We are just wondering whether any of your member(s) might be interested in participating in our international study, which is to validate the **Comprehensive ICF Core Set for MS** from the perspective of physicians. It would be a great support if you were able to name expert(s) in your association or country who are experienced in the treatment of MS patients.

The International Classification of Functioning, Disability and Health (ICF) Research Branch is located at the Department of Physical Medicine and Rehabilitation at the Ludwig-Maximilian University of Munich, Germany. Professor Gerold Stucki is the director of our department as well as of the ICF Research Branch. Briefly, our target is to implement the ICF, which was approved by the World Health Assembly in May 2001, in clinical practice. Recently, we have developed ICF Core Sets for sixteen diseases, including MS.

To validate the Comprehensive ICF Core Set for MS we are going to evaluate whether all relevant interventions applied to patients with MS by physicians are included in the respective ICF Core Set.

A Delphi exercise (via email) will be performed to gather the experts-opinion of health professionals worldwide. The participation of physicians will be one of the most important parts of this project.

On behalf of Professor Stucki, we would like to thank you for your co-operation and collaboration in this vital WHO international research project.

We look forward to hearing from you as soon as possible.

Yours sincerely,

Stephanie Berno, PhD student

Michaela Coenen, PhD, MPH

---

Please respond to:

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## Appendix 4 Kruskal-Wallis-Test

Verarbeitete Fälle						
	Fälle					
	Eingeschlossen		Ausgeschlossen		Insgesamt	
	N	Prozent	N	Prozent	N	Prozent
Age * WHO_region	84	100,0%	0	,0%	84	100,0%
prof_exp * WHO_region	84	100,0%	0	,0%	84	100,0%
pract_exp * WHO_region	84	100,0%	0	,0%	84	100,0%

Zusammenfassung von Fällen			
Gruppiertes Median			
WHO_region	Age	prof_exp	pract_exp
European Region	44,2857	17,6000	13,0000
South-East Asia Region	47,0000	18,5000	11,5000
Western Pacific Region	44,0000	13,0000	7,3333
Region of the Americas	52,0000	24,5000	16,6667
African Region	37,0000	10,0000	8,0000
Eastern Mediterranean Region	45,0000	20,0000	12,6667
Insgesamt	45,7778	18,3750	13,0000

Ränge		
WHO_region	N	Mittlerer Rang
Age European Region	54	39,69
South-East Asia Region	6	45,83
Western Pacific Region	6	38,25
Region of the Americas	10	63,55
African Region	3	30,33
Eastern Mediterranean Region	5	39,10
Gesamt	84	
prof_exp European Region	54	40,23
exp South-East Asia Region	6	42,17

	Western Pacific Region	6	35,83
	Region of the Americas	10	60,65
	African Region	3	30,00
	Eastern Mediterranean Region	5	46,60
	Gesamt	84	
pract _exp	European Region	54	42,34
	South-East Asia Region	6	40,83
	Western Pacific Region	6	23,33
	Region of the Americas	10	61,25
	African Region	3	27,17
	Eastern Mediterranean Region	5	40,90
	Gesamt	84	

Statistik für Test <sup>a,b</sup>			
	Age	prof_exp	pract_exp
Chi-Quadrat	9,320	7,408	10,892
df	5	5	5
Asymptotische Signifikanz	,097	,192	,054
a. Kruskal-Wallis-Test			
b. Gruppenvariable: WHO_region			

## Appendix 5 Results of the second Delphi round

### Body Functions

ICF Code			ICF Category Title	Round 2 n=79
2nd level	3rd level	4th level		% agreement
<b>b114</b>	b1101		Continuity of consciousness	69.6
			Orientation functions	
			Temperament and personality functions	
<b>b126</b>	b1263		Psychic stability	89.9
			Optimism	
b130	<b>b1300</b>		Energy and drive functions	74.7
			Energy level	
			Motivation	
			Energy and drive functions, other specified (fatigue)	
<b>b134</b>			Sleep functions	73.4
<b>b140</b>			Attention functions	74.7
<b>b144</b>			Memory functions	78.2
<b>b152</b>	b1440		Short-term memory	70.9
			Emotional functions	
<b>b156</b>	b1522		Range of emotion	75.6
<b>b164</b>	b1600		Pace of thought	74.4
			Higher-level cognitive functions	
<b>b210</b>	b1641		Organization and planning	78.2
b215			Seeing functions	88.3
b230			Functions of structures adjoining the eye	75.3
<b>b235</b>			Hearing functions	64.1
b240			Vestibular functions	
			Sensations associated with hearing and vestibular function	91.1
b250	b2401		Dizziness	93.7
b255			Taste function	51.9
<b>b260</b>			Smell function	45.6
<b>b265</b>			Proprioceptive function	
<b>b270</b>			Touch function	86.1
			Sensory functions related to temperature and other stimuli	85.9
	b2700		Sensitivity to temperature	88.5
	b2702		Sensitivity to pressure	80.8
<b>b280</b>			Sensation of pain	96.2

ICF Code			ICF Category Title	Round 2 n=79
2nd level	3rd level	4th level		% agreement
	b2800		Generalized pain	89.9
		b28010	Pain in head and neck	87.3
		b28012	Pain in stomach or abdomen	61.0
		b28013	Pain in back	86.1
		b28014	Pain in upper limb	88.6
		b28015	Pain in lower limb	91.1
		b28016	Pain in joints	79.7
<b>b310</b>			Voice function	
<b>b320</b>			Articulation functions	78.5
<b>b330</b>			Fluency and rhythm of speech functions	79.7
b435			Immunological system functions	78.5
		b43501	Non-specific immune response	73.1
b440			Respiration functions	65.8
<b>b445</b>			Respiratory muscle functions	69.2
<b>b455</b>			Exercise tolerance functions	
	b4552		Fatiguability	96.2
	b5101		Biting	57.1
	b5102		Chewing	58.2
	<b>b5104</b>		Salivation	
	<b>b5105</b>		Swallowing	85.9
<b>b525</b>			Defecation functions	96.2
	b5252		Frequency of defecation	89.9
	b5253		Faecal continence	94.9
b550			Thermoregulatory functions	65.8
	<b>b5500</b>		Body temperature	68.4
	<b>b5508</b>		Thermoregulatory functions, other specified (Sensitivity to heat)	
	<b>b5508</b>		Thermoregulatory functions, other specified (Sensitivity to cold)	
<b>b620</b>			Urination functions	93.7
	b6200		Urination	94.9
	b6201		Frequency of urination	93.7
	b6202		Urinary continence	98.7
<b>b640</b>			Sexual functions	93.6
	b6400		Functions of sexual arousal phase	77.9
	b6403		Functions of sexual resolution phase	69.2
b660			Procreation functions	67.1
	b6700		Discomfort associated with sexual intercourse	88.5
<b>b710</b>			Mobility of joint functions	80.8
<b>b730</b>			Muscle power functions	87.3
	b7303		Power of muscles in lower half of the body	87.3

ICF Code			ICF Category Title	Round 2 n=79
2nd level	3rd level	4th level		% agreement
<b>b735</b>	b7305		Power of muscles of the trunk	78.5
			Muscle tone functions	93.7
	b7350		Tone of isolated muscles and muscle groups	89.9
	b7353		Tone of muscles of lower half of body	91.1
	b7354		Tone of muscles of all limbs	91.1
	b7355		Tone of muscles of trunk	86.1
<b>b740</b>	b7356		Tone of all muscles of the body	88.6
			Muscle endurance functions	77.2
<b>b750</b>	b7401		Endurance of muscle groups	75.9
<b>b760</b>			Motor reflex functions	
<b>b760</b>			Control of voluntary movement functions	91.1
b765			Involuntary movement functions	89.9
	<b>b7650</b>		Involuntary contractions of muscles	
	<b>b7651</b>		Tremor	96.2
<b>b770</b>			Gait pattern functions	89.9
<b>b780</b>			Sensation related to muscles and movement functions	
	b7800		Sensation of muscle stiffness	96.2
	b7801		Sensation of muscle spasm	97.5
b810			Protective functions of the skin	62.8
b840			Sensation related to the skin	93.7

## Body Structures

ICF Code		ICF Category Title	Round 2 n=79
2nd level	3rd level		% agreement
<b>s110</b>		Structure of brain	
	s1106	Structure of cranial nerves	72.9
<b>s120</b>		Spinal cord and related structures	
<b>s610</b>		Structure of urinary system	
<b>s730</b>		Structure of upper extremity	
<b>s750</b>		Structure of lower extremity	
<b>s760</b>		Structure of trunk	
<b>s810</b>		Structure of areas of skin	62.9

## Activities & Participation

ICF Code		ICF Category Title	Round 2 n=79
2nd level	3rd level		% agreement
<b>d110</b>		Watching	62.0
<b>d155</b>		Acquiring skills	
<b>d160</b>		Focusing attention	
<b>d163</b>		Thinking	
<b>d166</b>		Reading	68.4
<b>d170</b>		Writing	
<b>d175</b>		Solving problems	
<b>d177</b>		Making decisions	
<b>d210</b>		Undertaking a single task	
<b>d220</b>		Undertaking multiple tasks	
<b>d230</b>		Carrying out daily routine	82.1
	d2303	Managing one's own activity level	78.5
<b>d240</b>		Handling stress and other psychological demands	
	d2401	Handling stress	80.8
<b>d330</b>		Speaking	75.9
d335		Producing nonverbal messages	64.6
<b>d350</b>		Conversation	
<b>d360</b>		Using communication devices and techniques	
<b>d410</b>		Changing basic body position	79.5
	d4103	Sitting	79.5
	d4104	Standing	81.0
<b>d415</b>		Maintaining a body position	
	d4154	Maintaining a standing position	78.5
<b>d420</b>		Transferring oneself	79.7
<b>d430</b>		Lifting and carrying objects	
<b>d440</b>		Fine hand use	79.7
<b>d445</b>		Hand and arm use	79.7
<b>d450</b>		Walking	84.8
	d4500	Walking short distances	83.5
	d4501	Walking long distances	78.5
<b>d455</b>		Moving around	
	d4551	Climbing	70.9
	d4552	Running	68.4
<b>d460</b>		Moving around in different locations	78.5
	d4600	Moving around within the home	80.8
	d4601	Moving around within buildings other than home	71.8
	d4602	Moving around outside the home and other buildings	74.4
<b>d465</b>		Moving around using equipment	75.9
<b>d470</b>		Using transportation	74.4
<b>d475</b>		Driving	80.5



ICF Code		ICF Category Title	Round 2 n=79
2nd level	3rd level		% agreement
	d4751	Driving motorized vehicles	82.1
<b>d510</b>		Washing oneself	78.2
	d5101	Washing whole body	74.7
<b>d520</b>		Caring for body parts	
<b>d530</b>		Toileting	75.3
	d5301	Regulating defecation	75.9
<b>d540</b>		Dressing	73.4
<b>d550</b>		Eating	78.2
<b>d560</b>		Drinking	79.2
<b>d570</b>		Looking after one's health	84.6
	d5701	Managing diet and fitness	80.5
	d5702	Maintaining one's health	83.3
<b>d620</b>		Acquisition of goods and services	
	d6200	Shopping	62.8
<b>d630</b>		Preparing meals	64.1
<b>d640</b>		Doing housework	68.8
	d6402	Cleaning living area	65.8
<b>d650</b>		Caring for household objects	
<b>d660</b>		Assisting others	
<b>d710</b>		Basic interpersonal interactions	
<b>d720</b>		Complex interpersonal interactions	
<b>d750</b>		Informal social relationships	
<b>d760</b>		Family relationships	75.3
<b>d770</b>		Intimate relationships	70.5
	d7702	Sexual relationships	72.7
<b>d825</b>		Vocational training	
<b>d830</b>		Higher education	
<b>d845</b>		Acquiring, keeping and terminating a job	70.9
	d8451	Maintaining a job	70.9
<b>d850</b>		Remunerative employment	62.0
d855		Non-remunerative employment	59.7
<b>d860</b>		Basic economic transactions	
<b>d870</b>		Economic self-sufficiency	
<b>d910</b>		Community life	
<b>d920</b>		Recreation and leisure	64.9
	d9201	Sports	59.7
	d9204	Hobbies	55.3
<b>d930</b>		Religion and spirituality	34.6
	d9300	Organized religion	32.9

## Environmental Factors

ICF Code		ICF Category Title	Round 2 n=79
2nd level	3rd level		% agreement
	<b>e1101</b>	Drugs	88.6
	<b>e1108</b>	Products or substances for personal consumption, other specified	82.3
<b>e115</b>		Products and technology for personal use in daily living	78.2
	e1150	General products and technology for personal use in daily living	59.0
	e1151	Assistive products and technology for personal use in daily living	89.9
<b>e120</b>		Products and technology for personal indoor and outdoor mobility and transportation	86.1
	e1201	Assistive products and technology for personal indoor and outdoor mobility and transportation	89.9
<b>e125</b>		Products and technology for communication	
<b>e135</b>		Products and technology for employment	71.8
<b>e150</b>		Design, construction and building products and technology of buildings for public use	55.1
<b>e155</b>		Design, construction and building products and technology of buildings for private use	56.4
<b>e165</b>		Assets	42.3
	<b>e2250</b>	Temperature	58.2
	<b>e2251</b>	Humidity	34.6
	<b>e2253</b>	Precipitation	
	e2600	Indoor air quality	35.4
<b>e310</b>		Immediate family	65.8
<b>e315</b>		Extended family	46.8
<b>e320</b>		Friends	
<b>e325</b>		Acquaintances, peers, colleagues, neighbours and community members	53.2
<b>e330</b>		People in positions of authority	
<b>e340</b>		Personal care providers and personal assistants	89.9
<b>e355</b>		Health professionals	96.2
<b>e360</b>		Other professionals	69.6
<b>e410</b>		Individual attitudes of immediate family members	
<b>e415</b>		Individual attitudes of extended family members	
<b>e420</b>		Individual attitudes of friends	
<b>e425</b>		Individual attitudes of acquaintances, peers, colleagues, neighbours and community members	
<b>e430</b>		Individual attitudes of people in positions of authority	
<b>e440</b>		Individual attitudes of personal care providers and personal assistants	
<b>e450</b>		Individual attitudes of health professionals	
<b>e460</b>		Societal attitudes	

ICF Code		ICF Category Title	Round 2 n=79
2nd level	3rd level		% agreement
<b>e510</b>		Services, systems and policies for the production of consumer goods	53.2
<b>e525</b>		Housing services, systems and policies	57.7
<b>e540</b>		Transportation services, systems and policies	60.3
	e5400	Transportation services	61.5
<b>e550</b>		Legal services, systems and policies	
<b>e555</b>		Associations and organizational services, systems and policies	65.8
	e5550	Associations and organizational services	67.1
<b>e570</b>		Social security services, systems and policies	70.5
	e5700	Social security services	74.4
<b>e575</b>		General social support services, systems and policies	64.9
	e5750	General social support services	69.2
<b>e580</b>		Health services, systems and policies	94.7
	e5800	Health services	96.2
<b>e585</b>		Education and training services, systems and policies	
<b>e590</b>		Labour and employment services, systems and policies	61.0
	e5950	Political services	45.5

## Personal Factors

Answer	Round 2 n=79
	% agreement
Coping	87.2
Dependency from others / devices	88.5
Loss of control	87.2
Self-esteem	88.5
Uncertainty about future	88.5
Unrealistic therapeutic expectations	91.0

## nc - not classified

Answer	Round 2 n=79
	% agreement
Diagnostic and follow-up procedures (diagnosis, MS relapses, prognosis, disease course)	96.2
Use of adaptive devices	93.7
Change of roles /role models	72.2
Falls	94.4
Information about MS	97.5
Pregnancy planning	96.2
Professional future	91.1
Travelling with medications	92.4

## hc – health conditions

Answer	Round 2 n=79
	% agreement
<b>Depression</b>	100.0
<b>Dementia</b>	88.6
<b>Trigeminal neuralgia</b>	93.7
<b>Epilepsy</b>	86.1
<b>Oscillopsia</b>	82.1
<b>Aspiration pneumonia</b>	87.3
<b>Ileus and subileus</b>	81.8
<b>Restless legs</b>	82.3
<b>Psychotic disorders</b>	83.5
<b>Osteoporosis</b>	83.5