

# Identification of Relevant ICF Categories in Vocational Rehabilitation: A Cross Sectional Study Evaluating the Clinical Perspective

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**Abstract** *Introduction* Vocational rehabilitation (VR) emphasizes a need for medical support, rehabilitation and biopsychosocial approach to enable individuals to successfully participate in the workforce. Optimal rehabilitation management relies on an in-depth knowledge of the typical spectrum of problems encountered of patients in VR. The International Classification of Functioning, Disability and Health (ICF) is based on a universal conceptual model and provides a holistic view of functioning of the lived experience of people such as those undergoing VR. The objectives of this study are to describe the functioning and health of persons undergoing VR and to identify the most common problems around work and in VR using the ICF as the reference framework. *Methods* An empirical cross-sectional multicenter study was conducted using convenience sampling from March 2009 to March 2010. Data were collected using a Case Record Form rated by

health professionals which was based on an extended version of the ICF Checklist containing 292 ICF categories and sociodemographic information. *Results* 152 patients with various health conditions participated. We identified categories from all four ICF components: 24 for *body functions*, six for *body structures*, 45 for *activities and participation*, and 25 for *environmental factors*. *Conclusions* Our study identified a multitude of ICF categories that describe functioning domains and which represent the complexity of VR. Such a comprehensive approach in assessing patients in VR may help to understand and customize the process of VR in the clinical setting and to enhance multidisciplinary communication.

**Keywords** ICF · Cross-sectional study · ICF-checklist · Vocational rehabilitation

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## Introduction

Vocational rehabilitation (VR) emphasizes a need for medical support, rehabilitation and biopsychosocial approach to enable individuals to successfully participate in the workforce [1]. VR as a process may also, however, aim to integrate those who have not worked before in order to facilitate work participation.

Optimal rehabilitation management relies on an in-depth knowledge of the typical spectrum of problems encountered in persons in VR. Proper knowledge is needed as a basis to specify rehabilitation goals, selection of interventions and evaluation or re-evaluation of VR outcomes. To facilitate successful VR outcomes, communication between the different stakeholders along the continuum care of VR is essential [2, 3]. The wide range of health conditions that may affect work participation also poses a challenge to the understanding of VR because the impact of the various conditions may be different. Conditions which possibly require VR can be acquired (e.g. post-motor vehicular accident) or developmental (e.g. cerebral palsy) and may persist up to adulthood. Typical problems in VR have been identified in a number of studies which mostly describe defined patient groups, rehab settings or specific interventions [4], but there also exist numerous settings or interventions that focus on the common goal of reintegrating people into the workforce, without focusing on a specific health condition. Therefore, a common language and understanding that addresses the complexity of VR as a process of integrating the various players and conditions in which VR is necessary, would be of great value.

There are existing work disability and return to work (RTW) models based on different perspectives such as biomedical, psychosocial, ecological or biopsychosocial perspectives [5–9]. There is a need for an overarching conceptual model, that is compatible and complementary to other RTW models and that may help integrate these diverse perspectives in RTW [10, 11].

The International Classification of Functioning, Disability and Health (ICF) [12] by the World Health Organization (WHO) is based on a universal conceptual model and offers a classification system which allows a comprehensive description of health and health-related states. Drawing upon the scope of the ICF, it would be possible to provide a holistic view of functioning or the lived experience of people such as those undergoing VR. The ICF categories that state the domains of *body functions (b)*, *body structures (s)*, *activities and participation (d)*, *environmental factors (e)*, and *personal factors (not coded)* could facilitate the description and classification of all relevant aspects of functioning and health in individuals, independent of a specific assessment instrument [13]. As a classification system, the ICF provides alphanumeric codes

that are arranged in a hierarchical fashion, hence different levels, for each of the ICF categories or functioning domains. Below is an illustration of this categorization:

ICF component	d <i>activities and participation</i>
Chapter	d8 Major life areas
Second-level category	d850 Remunerative employment
Third-level categories	d8500 Self-employment
	d8501 Part-time employment
	d8502 Full-time employment

Thus, the ICF would be particularly helpful in the area of clinical evaluation of patients where different instruments are being used and where a standard list of functioning domains would be beneficial to clinician's planning of interventions and the comparison of data for population health statistics [14–16].

The objectives of this study are to describe the functioning and health of patients undergoing VR and to identify the most common problems around work and in VR using the ICF as the reference framework.

## Methods

### Study Design

An empirical cross-sectional multicenter study [17] was conducted from March 2009 to March 2010 as a part of the preliminary studies in the international project "Development of ICF Core Sets for Vocational Rehabilitation" [18]. This study is one of four studies that investigated the important aspects of functioning in VR from different perspectives. Ethics approval was obtained for each of the study centers. The Declaration of Helsinki was employed in the conduct of the study.

### Population

In this study, a convenience sample of 152 patients in VR was gathered from four VR centers in Switzerland and one center in Germany. The following were the inclusion criteria: (1) primary diagnosis (according to the International Classification of Diseases and Health related Disorders ICD-10 [19] that causes functioning problems which required VR. (2) at least 18 years old, (3) can speak, read, and write in German, (4) able to make decision for her- or himself as attested by a health professional, (5) informed of the purpose and reason of the study, and both have been understood, and (6) signed the "patient informed consent form".

Two study centers in Switzerland had a VR setting of work evaluation, ergonomic evaluation, and work-specific physical and cognitive training. In the third center,

vocational evaluation and return to work interventions were integrated in an early stage of spinal cord injury rehabilitation. In the fourth center, work related vocational training and supported employment for outpatients were offered. The fifth center located in Germany had a VR setting of vocational orientation and vocational training for in- and out-patients. The study centers were chosen to obtain a comprehensive picture of the whole continuum of vocational rehabilitation including the diversity of health conditions and common VR interventions. Health conditions included neurologic conditions such as traumatic brain injuries, stroke and spinal cord injuries, mental diseases like depression or schizophrenia, internal medical diseases such as asthma, or cardiac infarction, and musculoskeletal conditions such as low back pain, fractures of the vertebrae or contusion, distortion, fracture or cut injuries of hands or legs.

### Instruments

Data were collected with a Case Record Form for health professionals (CRF-HP), which was documented and rated by a health professional. Sociodemographic information such as age and sex, main diagnoses, professional and work history, and the current VR intervention were extracted from the medical record. The Extended ICF Checklist [20] was administered during the interview. A pre-test of the feasibility of the CRF-HP was made. The average length of interview in the pretest ranged from 50 to 80 min.

### The Extended ICF Checklist

The basis of the Extended Checklist for VR is the ICF Checklist version 2.1a developed by the World Health Organization (WHO) [21]. It includes a selection of 125 out of 362 existing second level categories, representing the classifiable ICF components: *body function (b)*, *body structure (s)*, *activities and participation (d)*, and *environmental factors (e)*. To this checklist, more ICF categories have been added that were considered relevant to VR. This extension was first made through a literature search where common assessment instruments in VR were identified and linked to the ICF based on established linking-rules [22]. 31 second level and 75 third and fourth level categories, which were not covered by the ICF Checklist, were added, hence, “extended”. As a second step, the checklist was presented to a group of experts in VR and we asked for categories they believed were missing from the checklist. This second step resulted in the integration of all second level categories from *environmental factors* and all third level categories from *chapter e5 Services, systems and policies*. Nine more second level categories and 52 third and fourth level categories were added to the checklist.

Hence, the Extended ICF Checklist for VR contained 96 categories from *body functions* (32.9%), 19 categories from *body structures* (6.5%), 120 categories from *activities & participation* (41.1%) and 57 *environmental factors* (19.5%).

The presence of a problem was denoted for each category of the components *body functions*, *body structures* and *activities and participation* using a visual analogue scale (VAS) of 1–100 (the higher the number, the higher the magnitude of the problem, impairment, limitation, or restriction). The categories of the component *environmental factors* were rated as being a facilitator or a barrier. VAS was also used but this time with positive sign denoting as “facilitator” i.e. +1 to +100, otherwise it was considered “neutral” or “barrier”. In addition, other qualifiers were used—“8” was used if the available information was not sufficient to rate that ICF category and “9” if the category was not applicable.

The rating of each ICF category was determined by the health professional/interviewer based on his or her interaction with the patient during the interview. This determination was based on the evaluation of the response of the interviewee, observations made by the interviewer during the interview, and consultation of medical records.

### Procedure

The recruitment of the patients was performed by center representatives (CR). The CRs were made aware of the inclusion criteria and were informed about the project. Potential study participants were asked to take part in the study. If patients agreed, their names were forwarded to a study coordinator who then explained the study. Once written informed consent forms were received, a health professional who was trained in administering the study procedures and contents, examined the medical record of the patient and then conducted the interviews. The health professional filled in the CRF-HP. Written material was provided. Plausibility checks were performed by the study coordinator throughout the period of data collection. The data collected were saved in a secure electronic database Microsoft® Access 2007 (Microsoft Corporation, Redmond WA).

### Data Analysis

Descriptive statistics were used to characterize the study population and to examine the frequency of problems recorded in the Extended ICF Checklist. The ICF categories in the components *body functions*, *body structures*, and *activities & participation* that were rated on the VAS with 5 or more points out of the 100 were arbitrarily regarded as impaired, limited, or restricted. Ratings below 5 were not

considered for analyses at this time. In the component *environmental factor*, barriers or facilitators rated below of 5 points out of 100 (meaning neither a facilitator nor a barrier) were also not included in the analyses. Missing values and response options rated as “not applicable” and “not definable” were not considered in the analyses, while co-morbidities were duly noted. The ICF categories that were problematic in at least 20% (arbitrary cut-off) of the patients were reported. The results for the study population and sub-population based on health condition groups were examined: neurologic condition, mental condition, internal medical condition, musculoskeletal condition concerning the trunk (“MSC\_trunk”), musculoskeletal condition concerning the extremities (“MSC\_ext”). The results for “MSC\_trunk” and “MSC\_ext” were presented separately, due to the distinction made in the literature between the two.

Data analyses were performed with SPSS.14.0 for Windows (SPSS Inc., Chicago, IL USA) for the descriptive presentation and to examine relevant second-level categories (aggregated to).

**Results**

The sample characteristics of the patients are shown in Table 1. Most of the patients were male (77.6%). On average, the work experience was 11 years with range of 0–42 years. More than half of the patients were in VR due to a musculoskeletal condition followed by neurologic and mental conditions. Internal medical conditions as main diagnoses consisted 5.3% of the study sample. Sixteen and half percentage points of the patients had relevant internal medical co-morbidity conditions.

Tables 2, 3, 4, 5 show the ICF categories which were relevant in at least 20% of the patients. Percentages are shown for the sample and for the condition subgroups. In the

component *environmental factors*, percentage of barriers and facilitators is shown for each category rated in at least 20% of the patients as either a barrier or as facilitator.

Overall, there were 90 ICF categories that were identified as relevant. Twenty-four categories came from component *body function*, 6 from the component *body structures*, 45 from the component *activities and participation*, and 25 from *environmental factors*.

**Discussion**

VR is a multidisciplinary and complex process and plays a key role in facilitating or improving work participation. The objective of this study was to describe functioning and health of individuals in VR from the clinical perspective using the ICF. The Extended ICF checklist proved to be a useful instrument to comprehensively capture relevant problems in functioning and environmental barriers and facilitators in different VR settings and health conditions. The breadth of functioning domains in VR is reflected in the categories covering *body functions*, *body structures*, *activities and participation*, and *environmental factors*. The facilitating role of VR combined with the knowledge of these factors that ought to be addressed in VR can be useful in work disability management.

The population in our study consists of patients with different professions and trades and who have received different VR interventions. The diverse study sample was desired with the assumption that the relevant factors describing VR may apply to all forms of VR. We found specificity of some categories to certain diagnostic groups, especially in the component *body structures*. There were categories that were directly related to a certain diagnostic group (e.g. *Spinal cord and related structures (s120)* that is mainly related to neurologic conditions such as spinal cord injuries and musculoskeletal-trunk related diseases such as

**Table 1** Characteristics of the study population

	Sample		Neurologic condition		Mental condition		Internal condition		Musculoskeletal condition trunk		Musculoskeletal condition extremities	
<i>n</i>	152		39	25.7%	16	10.5%	8	5.3%	35	23.0%	54	35.5%
Age (years), mean (SD)	39.3	SD 10.75	40.33	SD 11.8	37.56	SD 7.81	39.88	SD 10.99	41.11	SD 10.34	37.8	SD 11.03
Gender Male (%)	118	(77.6%)	31	79.5%	11	68.8%	5	62.5%	26	74.3	45	83.3%
Married (%)	54	(35.5%)	14	35.9%	1	6.3%	3	37.5%	13	37.1%	23	42.6%
Years of professional experience Mean (SD)	17.28	SD 11.17	17.68	SD 12.07	12.25	SD 8.39	16.38	SD 10.71	18.65	SD10.1	17.85	SD11.85
Setting out-patient (%)	56	36.80%	9	23.10%	5	31.30%	4	50%	17	48.60%	21	38.90%
In-patient (%)	96	63.20%	30	76.90%	11	68.80%	4	50%	18	51.40%	33	61.10%
With relevant co-morbidities	80	52.6%	26	66.7%	9	56.3%	6	75.0%	24	68.6%	15	27.8%

SD standard deviation

**Table 2** ICF categories of the component *body functions* rated as an impairment in at least 20% of participants

ICF category		Sample		Neurologic conditions		Mental conditions		Internal conditions		MSC_trunk conditions*		MSC_extr. conditions#	
Code	Title	n	%	n	%	n	%	n	%	n	%	n	%
Chapter 1: Mental functions													
b126	Temperament and personality functions	105	69.1	32	82.1	15	93.8	3	37.5	22	62.9	33	61.1
b130	Energy and drive functions	107	70.4	31	79.5	14	87.5	4	50.0	25	71.4	33	61.1
b134	Sleep functions	86	56.6	25	64.1	9	56.3	2	25.0	22	62.9	28	51.9
b140	Attention functions	83	54.6	27	69.2	12	75.0	4	50.0	14	40.0	26	48.1
b144	Memory functions	45	29.6	17	43.6	5	31.3	2	25.0	6	17.1	15	27.8
b147	Psychomotor functions	75	49.3	23	59.0	12	75.0	3	37.0	16	45.7	21	38.9
b152	Emotional functions	118	77.6	37	94.9	14	87.5	5	62.5	25	71.4	37	68.5
b156	Perceptual functions	64	42.1	5	12.8	10	62.5	2	25.0	13	37.1	24	44.4
b164	Higher-level cognitive functions	58	38.2	24	61.5	11	68.8	2	25.0	10	28.6	11	20.4
b180	Experience of self and time functions	73	48.0	20	51.3	8	50.0	6	75.0	22	62.9	17	31.5
Chapter 2: Sensory functions and pain													
b210	Seeing functions	40	26.3	14	35.9	3	18.8	1	12.5	8	22.9	14	25.9
b260	Proprioceptive function	38	25.0	12	30.8	1	6.3	2	25.0	11	31.4	12	22.2
b265	Touch function	42	27.6	15	38.5	1	6.3	4	50.0	8	22.9	14	25.9
b270	Sensory functions related to temperature and other stimuli	73	48.0	16	41.0	3	18.8	3	37.5	19	54.3	29	53.7
b280	Sensation of pain	130	85.5	29	74.4	8	50.0	4	50.0	35	100	53	98.1
Chapter 4: Functions of the cardiovascular, haematological, immunological and respiratory systems													
b455	Exercise tolerance functions	82	53.9	31	79.5	10	62.5	5	62.5	20	57.1	16	29.6
Chapter 5: Functions of the digestive, metabolic and endocrine systems													
b530	Weight maintenance functions	55	36.2	8	20.5	6	37.5	3	37.5	12	34.3	26	48.1
Chapter 7: Neuromusculoskeletal and movement-related functions													
b710	Mobility of joint functions	109	71.7	26	66.7	3	18.8	4	50.0	29	82.9	47	87.0
b715	Stability of joint functions	66	43.4	11	28.2	2	12.5	2	25.0	22	62.9	29	53.7
b730	Muscle power functions	120	78.9	35	89.7	6	37.5	6	75.0	32	91.4	41	75.9
b735	Muscle tone functions	46	30.3	16	41.0	2	12.5	1	12.5	15	42.9	12	22.2
b740	Muscle endurance functions	110	72.4	34	87.2	5	31.3	5	62.5	29	82.9	37	68.5
b755	Involuntary movement reaction functions	78	51.3	28	71.8	0	0	3	37.5	21	60.0	26	48.1
b760	Control of voluntary movement functions	47	30.9	17	43.6	1	6.3	2	25.0	12	34.5	15	27.8

\* MSC\_trunk = Musculoskeletal conditions of the trunk

# MSC\_extr. = Musculoskeletal conditions of the extremities

sciatic pain). There were other categories which were relevant to all diagnostic areas in our sample (e.g. *muscle power functions (b730)* or *muscle endurance functions (b740)*). We found that patients undergoing VR experience a certain degree of homogeneity with regard to their limitation in functioning independent of their health condition or the VR setting. This finding is consistent with the findings of Holtslag and colleagues which showed that in the long term, functional limitations associated with different health conditions become more and more similar [23, 24].

We found the highest prevalence of relevant problems in the component *body functions, chapter 1: mental functions*. Categories such as *b126 temperament and personality*

*functions* and *b152 emotional functions* point out the burden of distress created by the situation of health-related work absence [25]. The category *b130 energy and drive functions* and *b134 sleep functions* highlight that individuals in VR often experience a lot of stress, and prolonged or poor recuperation, while having to deal with an energy consuming situation [26, 27]. In clinical practice, these factors are often neglected [28]. We also found a high prevalence of *sensation of pain (b280)* (85.5%) in our population. This is consistent with the literature and hence, addressed in intervention planning [4].

Categories from chapter 2: *general tasks and demands* in the component *activities and participation* e.g. *carrying out*

**Table 3** ICF categories of the component *body structures* rated as an impairment in at least 20% of participants

ICF category		Sample		Neurologic condition		Mental condition		Internal condition		MSC_trunk *		MSK_extr. *	
<i>N</i>		152		39		16		8		35		54	
Code	Title	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Chapter 1: Structures of the nervous system													
s120	Spinal cord and related structures	35	23.0	15	38.5	1	6.3	0	0	14	40.0	5	9.3
Chapter 7: Structures related to movement													
s710	Structure of head and neck region	36	23.7	11	28.2	2	12.5	2	25.0	16	45.7	5	9.3
s720	Structure of shoulder region	38	25.0	11	28.2	3	18.8	2	25.0	8	22.9	14	25.9
s730	Structure of upper extremity	45	29.6	8	20.5	3	18.8	3	37.5	7	20.0	24	44.4
s750	Structure of lower extremity	76	50.0	15	38.5	4	25.0	4	50.0	15	42.9	38	70.4
s760	Structure of trunk	56	36.8	38	97.4	4	25.0	2	25.0	26	74.3	10	18.5

\* MSC\_trunk = Musculoskeletal condition\_trunk \*1 MSC\_extr. = Musculoskeletal condition\_extremities

daily routine (d230) and handling stress (d240) and other psychological demands that we found in our study point out the needs already addressed in chapter 1 of the component *body functions*, e.g. emotional functions (b152). In chapter 4: mobility, changing basic body position (d410) maintaining a body position (d415), lifting and carrying objects (d430) and the category moving around (d455) seem to cover the most important restrictions concerning movement. These findings seem to validate the items assessed by existing outcome measures, for physical capacity evaluation [29, 30]. Categories from chapter 8: major life areas provide some insight in a person’s work life, as defined in the category d850 remunerative employment. The results (prevalence of 92.8%) for d850 was not totally unexpected as VR has a major focus on remunerative or gainful employment. Also striking is the number of patients who are also restricted in their leisure activities—92.8% of the patients reported problems in the category d920 recreation and leisure. Looking at life areas not directly related to work may help to understand the whole range of limitations from a holistic view and to find resources that can be used to facilitate the return to work process with consideration of the non-work factors. This insight strengthens the need to comprehensively evaluate patients in order to decide the appropriate interventions [31].

In terms of *environmental factors*, relative frequencies for barriers and facilitators have been reported. Obtaining adequate information about the barriers and facilitators to returning to work can be critical, since these factors can often be addressed by providing simple interventions such as adapting the workplace or work scheduling. In such adaptation, the employer or supervisor play important roles. Modified job duties are reported to be an

intermediate step in returning back to work. In some cases, a facilitator can simultaneously be a barrier, e.g. e310 immediate family or e570 social security services, systems and policies. For instance, while workers can get physical help from their family, it is also possible that the same family can prevent them, for fear of re-injury, from doing what the worker wants. The social network as represented in chapter e3: support and relationships could impact VR outcomes positively and negatively [32, 33]. Financial and organizational support during VR appeared to be strong facilitators. The support from social security services and providers (e570 social security services, systems and policies) and health care services and providers as (e580 health services, systems and policies), were perceived as facilitators in over 70% of the patients [34]. In contrast, procedural complexities of the workers’ compensation, and health care systems as well as the uncertainty regarding coverage for VR seem to be major barriers [35–38]. To address *environmental factors* in VR often points to a mediator that can be essential in bringing a worker back to work. For example, appropriate work and supportive workplace-relationships as well as job coaching were identified as encouraging return to work [32, 39, 40].

The existence of co-morbidity is an important consideration in the understanding of our study population, as 52% suffered from a relevant co-morbidity such as depression, migraine, heart diseases, asthma or musculoskeletal pain in the back, neck or upper extremities [41]. Co-morbidities seem to exacerbate the main health issues and additionally contribute to its impact. Often, persons in VR experience a lot of minor limitations during their working life, which in the end leads to a loss of work ability or decrease in work participation. Co-morbidities not only seem to lower quality



**Table 4** ICF categories of the component *activities and participation* rated as a limitation or restriction in at least 20% of participants

ICF category		Sample		Neurologic condition		Mental condition		Internal condition		MSC_trunk *		MSC_extr. *	
<i>N</i>		152		39		16		8		35		54	
Code	Title	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Chapter 1: Learning and applying knowledge													
d115	Listening	32	21.1	19	48.7	4	25.0	0	0	3	8.6	6	11.1
d155	Acquiring skills	46	30.3	19	48.7	6	37.5	2	25.0	8	22.9	11	20.4
d160	Focusing attention	86	56.6	31	79.5	10	62.5	3	37.5	16	45.7	26	48.1
d163	Thinking	42	27.6	17	43.6	9	56.3	2	25.0	6	17.1	8	14.8
d175	Solving problems	49	32.2	22	56.4	8	50.0	2	25.0	9	25.7	8	14.8
d177	Making decisions	45	29.6	18	46.2	5	31.3	3	37.5	10	28.6	9	16.7
Chapter 2: General tasks and demands													
d210	Undertaking a single task	52	34.2	19	48.7	7	43.8	3	37.5	7	20.0	16	29.6
d220	Undertaking multiple tasks	50	32.9	20	51.3	5	31.3	1	12.5	8	22.9	16	29.6
d230	Carrying out daily routine	98	64.5	31	79.5	11	68.8	4	50.0	25	71.4	27	50.0
d240	Handling stress and other psychological demands	104	68.4	31	79.5	15	93.8	6	75.0	23	65.7	29	53.7
Chapter 4: Mobility													
d410	Changing basic body position	113	74.3	28	71.8	6	37.5	4	50.0	35	100	40	74.1
d415	Maintaining a body position	117	77.0	31	79.5	5	31.3	5	62.5	35	100	41	75.9
d420	Transferring oneself	35	23.0	9	23.1	1	6.3	2	25.5	14	40.0	9	16.7
d430	Lifting and carrying objects	129	84.9	31	79.5	6	37.5	6	75.0	35	100	51	94.4
d435	Moving objects with lower extremities	93	61.2	22	56.4	3	18.8	2	25.0	29	82.9	37	68.5
d440	Fine hand use	46	30.3	15	38.5	4	25.0	4	50.0	6	17.1	17	31.5
d445	Hand and arm use	65	42.8	11	28.2	1	6.3	4	50.0	14	40.0	35	64.8
d450	Walking	109	71.7	31	79.5	3	18.8	5	62.5	32	91.4	38	70.4
d455	Moving around	124	81.6	35	89.7	3	18.8	6	75.0	32	91.4	48	88.9
d465	Moving around using equipment	33	21.7	10	25.6	0	0	0	0	5	14.3	18	33.3
d470	Using transportation	43	28.3	18	46.2	5	31.3	1	12.5	8	22.9	12	22.2
d475	Driving	83	54.6	28	71.8	2	12.5	4	50.0	18	51.4	31	57.4
Chapter 5: Self-care													
d510	Washing oneself	33	21.7	11	28.2	1	6.3	0	0	7	20.0	14	25.9
d540	Dressing	35	23.0	13	33.3	1	6.3	0	0	8	22.9	13	24.1
d570	Looking after one's health	91	59.9	32	82.1	11	68.8	6	75.0	22	62.9	20	37.0
Chapter 6: Domestic life													
d620	Acquisition of goods and services	96	63.2	28	71.8	4	25.0	1	12.5	28	80.0	35	64.8
d630	Preparing meals	59	38.8	18	46.2	3	18.8	1	12.5	13	37.1	24	44.4
d640	Doing housework	90	59.2	22	56.4	2	12.5	5	62.5	29	82.9	32	59.3
d650	Caring for household objects	105	69.1	24	61.5	3	18.8	6	75.0	32	91.4	40	74.1
d660	Assisting others	81	53.3	25	64.1	7	43.8	4	50.0	15	42.9	25	46.3
Chapter 7: Interpersonal interactions and relationships													
d710	Basic interpersonal interactions	72	47.4	28	71.8	11	68.8	3	37.5	11	31.4	19	35.2
d720	Complex interpersonal interactions	70	46.1	26	66.7	10	62.5	3	37.5	8	22.9	23	42.6
d730	Relating with strangers	37	24.3	13	33.3	6	37.5	2	25.0	8	22.9	8	14.8
d740	Formal relationships	39	25.7	14	35.9	6	37.5	1	12.5	6	17.1	12	22.2
d750	Informal social relationships	48	31.6	16	41.0	10	62.5	3	37.5	6	17.1	13	24.1
d760	Family relationships	55	36.2	14	35.9	10	62.5	2	25.0	14	40.0	15	27.8
d770	Intimate relationships	43	28.3	10	25.6	10	62.5	3	37.5	10	28.6	10	18.5

**Table 4** continued

ICF category		Sample		Neurologic condition		Mental condition		Internal condition		MSC_trunk *		MSC_extr. *	
<i>N</i>		152		39		16		8		35		54	
Code	Title	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Chapter 8: Major life areas													
d810	Informal education	31	20.4	13	33.3	4	25.0	2	25.0	4	11.4	8	14.8
d825	Vocational training	33	21.7	6	15.4	7	43.8	2	25.0	7	20.0	11	20.4
d840	Apprenticeship (work preparation)	71	46.7	19	48.7	8	50.0	5	62.5	15	42.9	24	44.4
d845	Acquiring, keeping and terminating a job	119	78.3	32	82.1	2	12.5	8	100	29	82.9	36	66.7
d850	Remunerative employment	142	93.4	37	94.9	1	6.3	8	100	30	85.7	52	96.3
d870	Economic self-sufficiency	42	27.6	12	30.8	4	25.0	1	12.5	6	17.1	19	35.2
Chapter 9: Community, social and civic life													
d910	Community life	75	49.3	25	64.1	9	56.3	3	37.5	19	54.3	19	35.2
d920	Recreation and leisure	141	92.8	37	94.9	12	75.0	6	75.0	34	97.1	52	96.3

\* MSC\_trunk = Musculoskeletal condition\_trunk \*1 MSC\_extr. = Musculoskeletal condition\_extremities

**Table 5** ICF categories of the component *environmental factors* rated as a barrier (Ba) or facilitator (Fac) in at least 20% of participants

ICF category		Sample		Neurologic condition		Mental condition		Internal condition		MSC_trunk * condition		MSC_extr. * condition	
<i>N</i>		152		39		16		8		35		54	
Code	Title	Ba %	Fac %	Ba %	Fac %	Ba %	Fac %	Ba %	Fac %	Ba %	Fac %	Ba %	Fac %
Chapter 1: Products and technology													
e110	Products or substances for personal consumption	16.4	55.3	17.9	48.7	12.5	43.8	37.5	87.5	14.3	68.6	14.8	50.0
e115	Products and technology for personal use in daily living	2.6	38.8	0	41.0	6.3	25.0	100	37.5	2.9	48.6	3.7	35.2
e120	Products and technology for personal indoor and outdoor mobility and transportation	5.9	38.2	7.7	41.0	12.5	12.5	12.5	37.5	2.9	37.1	3.7	44.4
e125	Products and technology for communication	0.7	34.2	2.6	56.4	0	37.5	0	50.0	0	20.0	1.9	24.1
e150	Design, construction and building products and technology of buildings for public use	24.3	5.3	35.9	7.7	18.8	0	0	0	17.1	8.6	25.9	3.7
e165	Assets	47.4	9.9	41.0	5.1	56.3	37.5	37.5	12.5	42.9	5.7	53.7	7.4
Chapter 2: Natural environment and human-made changes to environment													
e220	Flora and fauna	34.9	7.2	33.3	5.1	6.3	12.5	25	12.5	42.9	5.7	40.7	7.4
e225	Climate	49.3	3.3	41.0	2.6	31.3	6.3	62.5	12.5	60.0	5.7	51.9	1.9
e250	Sound	23.7	1.3	33.3	5.1	37.5	0	12.5	0	25.7	2.9	13.0	0
Chapter 3: Support and relationships													
e310	Immediate family	21.1	76.3	23.1	82.1	43.8	62.5	37.5	100	14.3	85.7	14.8	66.7
e320	Friends	13.8	59.9	2.6	71.8	37.5	50.0	12.5	50.0	14.3	57.1	14.8	57.4
e325	Acquaintances, peers, colleagues, neighbours and community members	11.2	40.1	5.1	51.3	31.3	37.5	12.5	12.5	20.0	40.0	3.7	37.0
e330	People in positions of authority	26.3	30.3	17.9	41.0	18.8	18.8	50.0	25.0	37.1	37.1	24.1	22.2
e355	Health professionals	18.4	71.7	15.4	84.6	25.0	62.5	12.5	37.5	22.9	71.4	16.7	70.4
e360	Other professionals	11.2	36.2	2.6	33.3	6.3	25.0	12.5	37.5	11.4	34.3	18.5	42.6
Chapter 4: attitudes													
e410	Individual attitudes of immediate family members	23.0	71.7	20.5	84.6	37.5	62.5	25.0	87.5	25.7	77.1	18.5	59.3
e420	Individual attitudes of friends	11.2	61.8	5.1	66.7	12.5	50.0	12.5	62.5	11.4	62.9	14.8	61.1
e450	Individual attitudes of health professionals	21.1	64.5	15.4	71.8	18.8	56.3	25.0	37.5	28.6	68.6	20.4	63.0



**Table 5** continued

ICF category		Sample		Neurologic condition		Mental condition		Internal condition		MSC_trunk * condition		MSC_extr. * condition	
Code	Title	Ba %	Fac %	Ba %	Fac %	Ba %	Fac %	Ba %	Fac %	Ba %	Fac %	Ba %	Fac %
		152		39		16		8		35		54	
e455	Individual attitudes of health-related professionals	10.5	28.3	2.6	20.5	12.5	25.0	0	25.0	8.6	37.1	18.5	29.6
e460	Societal attitudes	32.9	6.6	30.8	7.7	31.3	6.3	62.5	0	31.4	11.4	31.5	3.7
Chapter 5: Services, systems and policies													
e540	Transportation services, systems and policies	10.5	23.7	15.4	17.9	12.5	37.5	0	50.0	5.7	28.6	11.1	16.7
e570	Social security services, systems and policies	38.8	74.3	30.8	87.2	37.5	93.8	37.5	75.0	42.9	74.3	42.6	59.3
e580	Health services, systems and policies	34.2	73.0	30.8	87.2	43.8	62.5	50.0	62.5	34.3	82.9	31.5	61.1
e585	Education and training services, systems and policies	17.8	27.6	10.3	23.1	25.0	68.8	37.5	25.0	20.0	31.4	16.7	16.7
e590	Labour and employment services, systems and policies	23.6	28.3	20.5	38.5	18.8	31.3	37.5	25.0	28.6	37.1	20.4	14.8

\* MSC\_trunk = Musculoskeletal condition\_trunk \*1 MSC\_extr. = Musculoskeletal condition\_extremities

of life, they also appear to be a major risk factor for unsuccessful return to work [23, 42].

This cross-sectional study has provided us with broad lists of ICF categories that are relevant to the patients' lived experience and that cover functioning at the individual and societal level. The results of this study could help advance our understanding of factors crucial to successful VR [25]. This study, therefore, provides us with the "what" to look at in the evaluation of individuals in VR from a clinical perspective. An issue remains and that is to determine the use of such set of variables in disability prevention among individuals at risk for work loss due to a health-related issue [43, 44]. Whether or not the ICF categories can provide meaningful information to inform disability prevention strategies is yet to be explored.

When interpreting these results, some issues may be considered. The study results could be biased due to the specific patient selection and convenience sampling employed in our study centers. In current statistics, as shown in the 'Sickness, Disability and Work report 2009' from the Organisation for Economic Co-operation and Development (OECD), approximately one-third of conditions reported were mental and one-third musculoskeletal in nature [45–47]. In our sample, mental conditions represented only 10.5% of the participants, while the majority of our sample represented musculoskeletal conditions. Therefore, some condition-specific categories might have been missed out. However, the sample we had reflects the "typical" sample of patients in the social systems in Switzerland and Germany [48, 49]. Stratification of job types was not made, hence, it will be difficult to extend our study findings to determine which ICF categories are more meaningful to one type of job versus another job. Another point for consideration is the ICF as a classification system and a taxonomy for health and functioning. It might be

prudent to keep in mind the balance of selecting between general definitions of ICF categories (so as to be applicable in various settings and health conditions) and precise definitions (so as to capture the details required by some disciplines). The definition of a single ICF category can be further clarified to define true ICF constructs within that code [50]. Critics have argued that the classification requires further operational definition, if to be useful in practice [11]. Finally, while this study provided a comprehensive list of variables to address VR and functioning, the ICF was not directly linked to concepts like work status, work productivity, work ability, and job type. Therefore, supplementing the ICF with VR-specific indicators such as work status or job type coupled with contextual and personal factors, will further increase the utility of the ICF in clinical practice.

## Conclusions

The ICF, as an overarching conceptual framework and classification system to describe functioning and disability, has been integrated in work-specific and RTW-relevant literature demonstrating compatibility [32, 51, 52]. In this study, we found the ICF to be useful and comprehensive in identifying a set of variables (ICF categories) that describe functioning problems and relevant environmental factors among individuals participating in VR. This set of ICF categories could help in the clinical decision making process of clinicians, and consequently guide appropriate interventions and promote transdisciplinary communication. We encourage clinicians and researchers in VR to further examine the list of variables presented in this study. Further explorative analyses to filter the most significant categories are needed and are being planned in other

patient populations and VR settings. Another step we encourage is to explore the operationalization of the ICF categories for the purpose of evaluating functioning of the individuals and measuring the relevant factors beyond the traditional biomedical approach. For clinical documentation, the set of ICF categories could serve as the domains to develop a standard profile of functioning for each patient and to identify the barriers and facilitators within the return to work process. To measure and document outcomes of VR in the practice and in research is required if we want to improve people's lives by increasing their work participation and fulfilling their societal role in general.

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