Aspects of functioning and environmental factors in medical work capacity evaluations of persons with chronic widespread pain and low back pain can be represented by a combination of applicable ICF Core Sets

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Abstract

Background: Medical work capacity evaluations play a key role in social security schemes because they usually form the basis for eligibility decisions regarding disability benefits. However, the evaluations are often poorly standardized and lack transparency as decisions on work capacity are based on a claimant’s disease rather than on his or her functional capacity. A comprehensive and consistent illustration of a claimant’s lived experience in relation to functioning, applying the International Classification of Functioning, Disability and Health (ICF) and the ICF Core Sets (ICF-CS), potentially enhances transparency and standardization of work capacity evaluations. In our study we wanted to establish whether and how the relevant content of work capacity evaluations can be captured by ICF-CS, using disability claimants with chronic widespread pain (CWP) and low back pain (LBP) as examples.

Methods: Mixed methods study, involving a qualitative and quantitative content analysis of medical reports. The ICF was used for data coding. The coded categories were ranked according to the percentage of reports in which they were addressed. Relevance thresholds at 25% and 50% were applied. To determine the extent to which the categories above the thresholds are represented by applicable ICF-CS or combinations thereof, measures of the ICF-CS’ degree of coverage (i.e. content validity) and efficiency (i.e. practicability) were defined.

Results: Focusing on the 25% threshold and combining the Brief ICF-CS for CWP, LBP and depression for CWP reports, the coverage ratio reached 49% and the efficiency ratio 70%. Combining the Brief ICF-CS for LBP, CWP and obesity for LBP reports led to a coverage of 47% and an efficiency of 78%.

Conclusions: The relevant content of work capacity evaluations involving CWP and LBP can be represented by a combination of applicable ICF-CS. A suitable standard for documenting such evaluations could consist of the Brief ICF-CS for CWP, LBP, and depression or obesity, augmented by additional ICF categories relevant for this particular context. In addition, the unique individual experiences of claimants have to be considered in order to assess work capacity comprehensively.

Keywords: International Classification of Functioning, Disability and Health (ICF), Work capacity evaluation, Chronic widespread pain, Low back pain, Standardization

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Background

Even though the process of disability evaluation varies between countries, medical work capacity evaluations usually play a crucial role in deciding on a claimant's eligibility for benefits provided by national disability insurance schemes. Because of the key role they play, such evaluations ought to be transparent and comprehensible for all persons involved [1-4]. To enhance transparency and comprehensibility, the claimant's lived experience in relation to his or her functioning as well as with regard to influencing contextual factors should be assessed comprehensively [2,5]. Moreover, the evaluations' comparability in terms of both interrater reliability between medical experts and content validity is considered as an important quality criterion [6-8]. Finally, standardization is seen as one means to ensure comparability in disability assessments [9,10].

Medical standards usually refer to features which are considered as relevant to a target group in general and less so to individuals' unique experiences [11,12]. As a basis for comprehensive disability evaluations, however, a suitable standard should also allow the description of relevant experiences unique to the individual, thus complementing the whole process of evaluation [12].

In reality, decisions on work capacity often lack transparency and comprehensibility [10,13-15]. Also, disability assessments are often insufficiently standardized [5,16,17], which affects their content validity and interrater reliability negatively [8,9,17]. In the Swiss national disability insurance scheme, for example, there is no generally accepted tool to guide the structure and content of disability evaluations [3]. Furthermore, decisions on work capacity for certain disorders are partly based on blanket rulings by the Swiss Federal Court [3]. Somatoform pain disorders, for instance, do generally not lead to incapacity for work. Because they are considered to be caused by psychosocial factors, the Swiss Social Security law does not recognize them as a sufficient reason for a disability pension, except if they are accompanied by a psychiatric co-morbidity like, for example, a depressive disorder [18]. By contrast, pain disorders caused by structural impairments (e.g. by a severe intervertebral disc disorder) normally entitle a person to receive disability benefits. However, diagnoses or impairments, are only loosely connected with functional limitations at work [19-21]. Moreover, the World Health Organization defines impairment as a loss or abnormality of a psychological, physiological, or anatomical structure or function and disability as a restriction or lack of ability to perform an activity in a manner considered to be normal for a human being [22]. Based on these definitions, focusing only on impairments is not sufficient to give a proper statement about a claimant's functional capacity at work.

Because pain is a subjective sensation, its impact on a claimant's functional capacity is difficult to objectify. Claimants with somatoform pain disorders could have the same or even a lower functional capacity than persons with a disorder related to a structural impairment. Nevertheless, according to Swiss jurisprudence their work capacity is usually rated higher. With respect to this controversy between the medical and the legal view, it seems crucial to apply a disability-oriented approach and to comprehensively assess the aspects which might influence a claimant's functioning and health in order to ensure transparent disability evaluations for persons with chronic pain.

Several attempts have been undertaken to enhance transparency and standardization in disability evaluations [23]. The Guides to the Evaluation of Permanent Impairment of the American Medical Association (AMA) are used for disability and impairment assessment and as a standard for workers' compensation evaluations in the United States and many English-speaking countries [24]. Furthermore, a number of standardized procedures for work capacity assessments have been developed like, for example, the Functional Capacity Evaluation (FCE) [25-27].

FCE, however, is not appropriate for multidisciplinary assessments as it is not geared towards a comprehensive evaluation of the claimant's functioning. It focuses on physical functional limitations and not on mental functioning [25], and it does not address environmental factors, an important component to ensure transparency in disability evaluations [5,28]. The AMA Guides have been questioned regarding their applicability in disability assessments of claimants with chronic pain [1], because they follow a diagnosis-based and impairment-oriented rather than a disability-oriented approach [29].

As part of the shift in recent years from impairment-oriented to disability-oriented assessments in European social security institutions, it has been suggested that the comprehensive conceptual framework and standardized taxonomy of the International Classification of Functioning, Disability and Health (ICF) [30] could improve the disability determination process [16,31-33]. Since the ICF offers a scientific basis for describing results and determinants of functioning, disability and health which also considers contextual factors [30], standardization and transparency in disability evaluations might be enhanced if the taxonomy would be used as a blueprint.

While the ICF framework was generally well-received, the actual application of the taxonomy has been hampered by the sheer number of categories to be assessed, i.e. 362 on the second level and up to 1,424 when applying the more detailed third and fourth levels. Consequently, ICF Core Sets (henceforth ICF-CS) have been
Objective
The objective of the study was to establish whether or not and how the relevant content of medical work capacity evaluations can be captured by ICF-CS, using medical reports from disability claimants with the index conditions CWP and LBP as examples.

Specific aims
(1) We wanted to examine to what extent the relevant aspects of functioning and environmental factors in medical reports of claimants with CWP and LBP are represented by applicable ICF-CS. (2) We wanted to determine by which ICF-CS, or combinations thereof, these aspects are best represented.

Methods
Study design
A mixed methods study [53] was conducted, involving a qualitative and quantitative content analysis [54,55] of medical reports. The ICF was used for data coding.

Ethics
The study was approved by the Ethics Commission of Basel, Switzerland, project number 134/08, and was performed in accordance with the Declaration of Helsinki.

Sample
The reports analyzed were derived from an elicitation of all medical reports received by the major Swiss health and accident insurers between February 1 and April 31, 2008, as part of a study on the quality of medical work capacity evaluations in Switzerland [3]. Insurance employees selected and anonymized all reports containing a diagnosis of CWP and/or LBP based on the International Classification of Diseases (ICD-10) (see Table 1). The diagnoses were checked by two health professionals. To ensure comparability, only reports in German submitted to the Swiss national disability insurance scheme were selected. Reports in French and Italian as well as from accident, health and liability insurances were excluded.

From this basic sample a subsample was randomly drawn. The determination of the final sample size was based on two criteria: (1) heterogeneity, i.e. the relevant medical disciplines of pain-assessment and the index conditions (CWP, LBP) were to be included proportionally; and (2) saturation, i.e. the collected information was considered to be sufficient when no new second-level ICF category emerged in five successive reports analyzed [56-58]. In order to satisfy the heterogeneity requirement, i.e. a proportional inclusion of the medical disciplines and the index conditions, a minimum size of the subsample was determined.

Analysis plan
For the data analysis the sample was divided into two sub-groups: (1) reports with CWP diagnoses, and (2) reports with LBP diagnoses. Reports including both diagnoses entered the data analysis twice, once with the pure CWP and once with the pure LBP reports.

To examine the extent to which the relevant aspects of functioning and environmental factors in medical reports of claimants with CWP and LBP are represented by applicable ICF-CS, we first did a content analysis of the reports, using the ICF for data coding. We then ranked the coded categories for both sub-groups according to their relevance, i.e. their relative frequency across reports, setting thresholds at 25% and 50%. Next, we examined whether the relevant ICF categories in CWP...
Table 1 ICD-10 diagnoses included in the sample

| ICD-10 diagnoses for CWP | ICD-10 diagnoses for LBP |
|-------------------------|-------------------------|
| F45.0 Somatisation disorder | M42 Spinal osteochondrosis (0.15-0.17, 0.95-0.97) |
| F45.1 Undifferentiated somatoform disorder | M45 Ankylosing spondylitis |
| F45.4 Persistent somatoform disorder | M46 Other inflammatory spondyloarthropathies (0.1, 0.2, 0.3) |
| F54 Psychological and behavioral factors associated with disorders or diseases classified elsewhere | M47 Spondylosis and (osteo-)arthrosis of spine (0.05-0.07, 0.15-0.27) |
| F62.8 Chronic pain personality syndrome | M48 Other spondyloarthropathies (0.05-0.15, 0.27-0.27) |
| F3 Mild, moderate and severe depressive episode, with somatic symptoms | M51 Other intervertebral disc disorders (0.0, 0.1) |
| F33 Recurrent depressive disorder, with somatic symptoms | M53 Other dorsopathies, not elsewhere classified (0.25-0.27, 0.3, 0.86-0.87, 0.96-0.97) |
| F34.1 Dysthymia (in relation with pain) | M54 Dorsalgias (0.05-0.07, 0.15-0.17, 0.3, 0.4, 0.5, 0.85-0.87) |
| F43.2 Adjustment disorders | M99 Biomechanical lesions, not elsewhere classified (0.03, 0.13, 0.23, 0.33, 0.43, 0.53, 0.63, 0.73, 0.83, 0.93) |
| M79.7 Fibromyalgia | |
| R52.2 Other chronic pain | |
| R52.9 Pain, unspecified | |

Reliability and saturation
The interrater agreement was calculated using Cohen’s kappa coefficient [61]. The saturation level was checked after each additional report analyzed.

Relevance ranking
Referring to the absolute frequency for determining relevance was deemed potentially misleading because different writing styles of medical experts could have led to varying degrees of content repetitions. Therefore, we operationalized the relevance of a coded category as its relative frequency across reports, i.e. the percentage of reports in which it appeared as a limitation, barrier or facilitator for the claimant. In order to ensure comparability with the ICF-CS, which refer to aspects that are problematic or supportive for the patients, we did not include the ICF categories assessed as no problem or facts in the ranking. Moreover, since the concepts not appropriately codeable with the ICF were not further specified in this study, they were not included in the ranking. Thus, the final ranking involved only second-level ICF categories coded either as a limitation, barrier or facilitator. For the ensuing data analysis we defined two thresholds of minimum relevance, the more lenient one at 25% or more of the reports, the more stringent one at 50% or more.

Coverage and efficiency ratios
We used two criteria to examine the extent to which the relevant content of medical reports involving CWP and LBP is represented by ICF-CS. (1) The coverage ratio, i.e. the ability of ICF-CS to capture the relevant aspects of the context in which they are applied (namely the index
conditions CWP and LBP and the assessment of work capacity as part of disability evaluations). It was calculated as the number of ICF-CS categories above the threshold of 25% (or 50%) divided by the total number of ICF categories above the threshold. (2) The **efficiency ratio**, i.e. the ability of ICF-CS to be manageable and to contain only as many categories as necessary. It was calculated as the number of ICF-CS categories above the threshold divided by the total number of categories in the ICF-CS. A definition of efficiency which is similar to ours was applied in a recent study where it was defined as the ability of a measurement instrument to be manageable and to contain as few items as possible that measure variables outside a domain set of ICF categories used in that study [62].

ICF-CS should ideally show a high coverage ratio and be efficient at the same time.

Referring to Figure 1, the operationalization of the coverage and efficiency ratios can be further illustrated as follows:

\[
\text{Coverage ratio (Brief ICF–CS)} = \frac{(B \cap R)}{(I \cap R)}
\]

\[
\text{Coverage ratio (Comprehensive ICF–CS)} = \frac{(C \cap R)}{(I \cap R)}
\]

\[
\text{Efficiency ratio (Brief ICF–CS)} = \frac{(B \cap R)}{B}
\]

\[
\text{Efficiency ratio (Comprehensive ICF–CS)} = \frac{(C \cap R)}{C}
\]

**Results**

**Sample characteristics**

In order to satisfy the heterogeneity requirement, the required minimum sample size had been determined to be 72 medical reports, representing about one third of the basic sample of 209 reports. The saturation criterion was already reached after coding 30 reports. The number and type of disciplines in the reports are displayed in Table 2.

27 reports contained only a CWP diagnosis, 22 only a LBP diagnosis, and 23 both a CWP and LBP diagnosis. Of the 50 reports with CWP diagnoses, 24 (48%) also included a diagnosis of the ICD-10-four-character subcategory “Mood [affective] disorders”. Of the 45 reports with LBP diagnoses, 13 (29%) additionally

![Figure 1 Operationalization of an ICF Core Set’s coverage and efficiency ratios.](image)

**Table 2 Medical disciplines represented in the reports**

| Number of medical disciplines in report | CWP | LBP |
|----------------------------------------|-----|-----|
| One                                    | 20  | 14  |
| Two                                    | 4   | 5   |
| More than two                          | 26  | 26  |

**Medical discipline**

| Psychiatry                              | 45  | 31  |
| Rheumatology                            | 21  | 22  |
| Internal medicine                       | 16  | 16  |
| Neurology                               | 10  | 11  |
| Orthopedics                             | 9   | 12  |
| General medicine                        | 11  | 9   |
| Neurosurgery                            | 1   | 5   |
| Orthopedic surgery                      | 1   | 3   |
| Neuropsychology                         | 1   | 3   |
| Pneumology                              | 1   | -   |
| Hand surgery                            | 1   | 1   |
| Functional capacity evaluation          | -   | 1   |
| Rank | ICF code | ICF category | CWP Brief (k=24) | LBP Brief (k=35) | Depression Brief (k=31) | Relative frequency (%) | Absolute frequency |
|------|----------|--------------|------------------|------------------|------------------------|------------------------|-------------------|
| 1    | b280     | Sensation of pain | X | X | X | X | 100 | 2531 |
| 2    | b152     | Emotional functions | X | X | X | X* | 98 | 640 |
| 3    | b130     | Energy and drive functions | X | X | X | X | 98 | 393 |
| 4    | d850     | Remunerative employment | X | X | X | . | 96 | 344 |
| 5    | b126     | Temperament and personality functions | . | X | . | X* | 94 | 445 |
| 6    | b134     | Sleep functions | X | X | X | . | 92 | 222 |
| 7    | e310     | Immediate family | X | X | X | X | 90 | 332 |
| 8    | e110†    | Products or substances for personal consumption | X* | X* | X | X | 90 | 184 |
| 9    | d240     | Handling stress and other psychological demands | X | X | X | X | 86 | 177 |
| 10   | d570     | Looking after one's health | . | X | . | X | 86 | 154 |
| 11   | b270     | Sensory functions related to temperature and other stimuli | . | X | . | . | 82 | 225 |
| 12   | e1101    | Drugs | X | X | X* | X* | X | 82 | 140 |
| 13   | b160†    | Thought functions | X* | X* | . | . | . | 80 | 337 |
| 14   | b730     | Muscle power functions | X | X | X | X | 78 | 180 |
| 15   | b710     | Mobility of joint functions | . | X | X | X | . | 74 | 365 |
| 16   | b1602    | Content of thought | X | X | . | . | X | 74 | 145 |
| 17   | e570     | Social security services, systems and policies | X | X | X | X | X | 74 | 130 |
| 18   | s760     | Structure of trunk | . | . | X | X | . | 70 | 571 |
| 19   | d415     | Maintaining a body position | . | X | X | X | . | 70 | 201 |
| 20   | e165     | Assets | . | . | . | . | . | X | 70 | 89 |
| 21   | d450     | Walking | X | X | X | X | . | 68 | 141 |
| 22   | d760     | Family relationships | X | X | X | X | X | 68 | 103 |
| 23   | d230     | Caring out daily routine | X | X | . | . | X* | 68 | 98 |
| 24   | b435     | Immunological system functions | . | . | . | . | . | 64 | 207 |
| 25   | b735     | Muscle tone functions | . | X | X | X | . | 64 | 122 |
| 26   | d430     | Lifting and carrying objects | X | X | X | X | . | 64 | 104 |
| 27   | b455     | Exercise tolerance functions | X | X | X | X | . | 64 | 102 |
| 28   | d870     | Economic self-sufficiency | . | . | . | . | . | X | 64 | 73 |
| 29   | d920     | Recreation and leisure | X | X | . | X | . | 64 | 66 |
| 30   | d770     | Intimate relationships | X | X | . | X | X | 62 | 74 |
| 31   | d410     | Changing a basic body position | X | X | X | X | . | 58 | 84 |
| 32   | d750     | Informal social relationships | . | . | . | . | . | X | 58 | 53 |
| 33   | s750     | Structure of lower extremity | . | . | . | X | . | . | 56 | 179 |
| 34   | d845     | Acquiring, keeping and terminating a job | . | X | X | X | X | 56 | 68 |
| 35   | b140     | Attention functions | . | X | . | . | X | 56 | 60 |
| 36   | b147     | Psychomotor functions | X | X | . | . | X | 54 | 80 |
| 37   | b144     | Memory functions | . | . | . | . | . | X | 52 | 65 |
| 38   | b530     | Weight maintenance functions | . | . | . | . | . | X | 50 | 86 |
| 39   | e565     | Economic services, systems and policies | . | . | . | . | . | 48 | 50 |
| 40   | e410     | Individual attitudes of immediate family members | X | X | X | X | X | 46 | 72 |
|      | e225     | Climate | . | . | X | . | X | 44 | 53 |
Table 3  Relative frequency ranking of the ICF categories found in the CWP reports (n = 50) (Continued)

| Category                                                | Frequency |
|---------------------------------------------------------|-----------|
| 41 d720 Complex interpersonal interactions              | X         | 44 45 |
| 42 d160 Focusing attention                              | X         | 44 44 |
| 43 d475 Driving                                         | X         | 44 38 |
| 44 b240 Sensations associated with hearing and vestibular function | .         | 42 47 |
| 45 b810 Protective functions of skin                    | .         | 42 39 |
| 46 d445 Hand and arm use                                | X         | 40 56 |
| 47 b420 Blood pressure functions                        | .         | 40 44 |
| 48 d350 Conversation                                    | .         | 40 32 |
| 49 b460 Sensations associated with cardiovascular and respiratory functions | .         | 38 44 |
| 50 s720 Structure of shoulder region                    | .         | 38 43 |
| 51 b110 Consciousness functions                         | .         | 38 40 |
| 52 e325 Acquaintances, peers, colleagues, neighbours and community members | X         | 38 28 |
| 53 e315 Extended family                                 | .         | 36 31 |
| 54 d440 Fine hand use                                   | .         | 34 52 |
| 55 b620 Urination functions                             | X         | 34 42 |
| 56 b535 Sensations associated with the digestive system  | .         | 34 34 |
| 57 e120 Products and technology for personal indoor and outdoor mobility and transportation | X         | 32 67 |
| 58 d640 Doing housework                                 | X X X X X | 32 35 |
| 59 e245 Time-related changes                            | .         | 32 35 |
| 60 b780 Sensations related to muscles and movement functions | X         | 32 33 |
| 61 b415 Blood vessel functions                          | .         | 32 31 |
| 62 b510 Ingestion functions                             | .         | 32 24 |
| 63 d166 Reading                                         | X         | 32 16 |
| 64 b525 Defecation functions                            | .         | 30 33 |
| 65 b770 Gait pattern functions                          | X         | 30 31 |
| 66 s740 Structure of pelvic region                      | X         | 30 30 |
| 67 d660 Assisting others                                | X X X X X | 28 27 |
| 68 s120 Spinal cord and related structures              | X X       | 28 27 |
| 69 b750 Motor reflex functions                          | X         | 28 26 |
| 70 d540 Dressing                                        | X X X X   | 28 25 |
| 71 e355 Health professionals                           | X X X X X | 28 23 |
| 72 d455 Moving around                                   | X X       | 28 20 |
| 73 e320 Friends                                         | X X       | 28 18 |
| 74 d740 Formal relationships                            | .         | 26 33 |
| 75 b164 Higher-level cognitive functions                | X         | 26 25 |
| 76 b830 Other functions of the skin                    | .         | 26 20 |
| 77 s730 Structure of upper extremity                   | .         | 24 45 |
| 78 e430 Individual attitudes of people in positions of authority | X         | 24 37 |
| 79 d460 Moving around in different locations            | X         | 24 27 |
| 80 e510 Services, systems and policies for the production of consumer goods | .         | 24 24 |
| 81 d710 Basic interpersonal interactions                | X         | 24 23 |
involved a diagnosis related to “Obesity and other hyperalimentation”.

The overall interrater agreement (Cohen’s kappa) at the second ICF-level was 0.80 (0.79 - 0.81; 95% bootstrap confidence interval [63]).

### Reports with CWP diagnoses

#### Content analysis

21,562 units of meaning gave rise to 45,365 (100%) codings. 30,042 (66.2%) represented links to ICF categories. The remainder (15,320 or 33.8%), i.e. R/I in Figure 1, were not classifiable appropriately with the ICF. Of these, 4,276 (9.4%) codings represented **personal factors**, the as yet unspecified fifth component of the ICF. 4,094 (9%) codings were labeled as **not covered**, 4,710 (10.4%) as **not definable**, and 2,243 (4.9%) as **health condition**.

#### Relevance ranking

76 ICF categories passed the 25% and 37 the 50% threshold and were identified as relevant for CWP reports.

Table 3 shows if the categories are included in the ICF-CS for CWP, LBP and depression.

### Coverage and efficiency ratios

Focusing on the more inclusive 25% threshold, the relevant aspects of functioning and environmental factors in CWP reports are represented with a coverage of 29% [54%] and an efficiency of 92% [61%] by the Brief [Comprehensive] ICF-CS for CWP (see Table 4).

When combining the ICF-CS for CWP, LBP and depression, the coverage ratio of the Brief [Comprehensive] ICF-CS was with 49% [82%] substantially higher and the efficiency ratio with 70% [47%] lower compared to the ICF-CS for CWP.

### Reports with LBP diagnoses

#### Content analysis

21,707 units of meaning led to 42,116 (100%) codings. 28,876 (68.6%) represented ICF categories. Of the 13,240 (31.4%) codings not classifiable appropriately with the ICF, 3,111 (7.4%) were labeled as **personal factors**, 3,322

### Table 3 Relative frequency ranking of the ICF categories found in the CWP reports (n = 50) (Continued)

| Rank | ICF Code | Category                              | X | X | X | X | X | X | X | X | X | X | X |
|------|----------|---------------------------------------|---|---|---|---|---|---|---|---|---|---|---|
| 82   | d950     | Political life and citizenship         |   |   |   |   | X |   |   |   | X |   |   |
| 83   | b640     | Sexual functions                      |   |   | X |   |   | X |   |   | X |   |   |
| 84   | e115     | Products and technology for personal use in daily living |   |   |   |   |   |   |   |   |   |   |   |
| 85   | d330     | Speaking                              |   |   |   |   |   |   | X |   |   |   |   |
| 86   | s320     | Structure of mouth                    |   |   |   |   |   |   |   |   | X |   |   |
| 87   | d620     | Acquisition of goods and services     |   | X |   | X |   |   | X |   |   | X |   |

**Note:** k = total number of categories in the respective ICF Core Set; † = ICF categories that were ignored in the ranking because the Brief and Comprehensive ICF Core Sets for CWP contain them on the more specific third level; X = included in the particular ICF Core Set (CWP, LBP or depression); * = in the particular ICF Core Set the stated category is included at the next lower (third) or next higher (second) level.

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Table 4 Coverage and efficiency ratios of the different ICF Core Sets for the CWP-reports (n = 50) and the two relevance thresholds

| Relevance threshold ≥ 25% (m = 76) | Number of overlapping categories | Coverage ratio (%) | Efficiency ratio (%) |
|-----------------------------------|----------------------------------|-------------------|---------------------|
| CWP Brief (k = 24) | 22 | 29 | 92 |
| CWP Comprehensive (k = 67) | 41 | 54 | 61 |
| LBP Brief (k = 35) | 29 | 38 | 83 |
| LBP Comprehensive (k = 78) | 43 | 57 | 55 |
| Depression Brief (k = 261) | 19 | 25 | 73 |
| Depression Comprehensive (k = 901) | 43 | 57 | 48 |
| CWP + LBP + Depression Brief (k = 531*) | 37 | 49 | 70 |
| CWP + LBP + Depression Comprehensive (k = 1311*) | 62 | 82 | 47 |

| Relevance threshold ≥ 50% (m = 37) | Number of overlapping categories | Coverage ratio (%) | Efficiency ratio (%) |
|-----------------------------------|----------------------------------|-------------------|---------------------|
| CWP Brief (k = 24) | 19 | 51 | 79 |
| CWP Comprehensive (k = 67) | 29 | 78 | 43 |
| LBP Brief (k = 35) | 21 | 57 | 60 |
| LBP Comprehensive (k = 78) | 26 | 70 | 33 |
| Depression Brief (k = 261) | 14 | 38 | 54 |
| Depression Comprehensive (k = 901) | 26 | 70 | 29 |
| CWP + LBP + Depression Brief (k = 531*) | 29 | 78 | 55 |
| CWP + LBP + Depression Comprehensive (k = 1311*) | 36 | 97 | 27 |

Note: m = total number of ranked categories above the respective threshold; k = total number of categories in the respective ICF Core Set; † = categories aggregated on the second level (except categories only available on the third level in the Comprehensive ICF Core Sets); * = adjusted for overlap between the categories of the three ICF Core Sets.

ICF-CS was with 47% [80%] substantially higher and the efficiency ratio with 78% [41%] lower compared to the ICF-CS for LBP.

Discussion

We found that the relevant content of medical work capacity evaluations involving CWP and LBP can be captured to a considerable, albeit not perfect, extent by a combination of applicable ICF-CS. The relevant aspects of functioning and environmental factors in the reports were either represented by the ICF-CS for the index conditions (CWP, LBP) or for major co-morbidities (depression, obesity). In both groups of reports and for both relevance thresholds, a combination of the ICF-CS analyzed showed substantially higher coverage ratios than the condition-specific ICF-CS, i.e. they represented the relevant aspects of medical work capacity evaluations involving CWP and LBP to a higher extent. There is, however, a trade-off. Due to the increased number of categories when combining the ICF-CS, the efficiency ratios decreased considerably compared to the condition-specific ICF-CS in most cases.

An interesting finding with regard to the medical disciplines involved in the medical reports was that, in fact, psychiatry appeared in both groups of reports as the most frequent discipline. This clearly indicates the relevance of psychiatric assessments for multidisciplinary medical work capacity evaluations of persons with CWP and LBP and is also in line with the finding that a considerable percentage of our medical reports included a co-morbid disorder from the ICD-10 chapter “Mood [affective] disorders”.

Overall, our results are in line with previous research in the field which found that the Comprehensive ICF-CS for CWP and LBP have a potential for structuring work capacity assessments [37].

Our findings are also in agreement with the recently developed ICF Core Sets for vocational rehabilitation [64] regarding the importance of highlighting the components activities, participation and environmental factors in the context of work and work capacity.

Finally, with regard to the generic core set for disability evaluation in social security [32] we feel that its lack of environmental factors may be a potential limitation if one aims for a comprehensive and transparent documentation of a claimant’s work capacity. While the authors argue that environmental aspects are implicitly covered by the participation items, we found in our analysis of medical reports prepared in the context of disability evaluations that a number of environmental factors (e.g. e310 Immediate family; e165 Assets) are explicitly and frequently reported as barriers or facilitators for the claimants (see Tables 3 and 5).
| Rank | ICF Code | ICF Category                                      | LBP Brief (k=35) | CWP Brief (k=24) | Obesity Brief (k=8) | Relative Frequency (%) | Absolute Frequency |
|------|----------|--------------------------------------------------|------------------|------------------|---------------------|------------------------|-------------------|
| 1    | b280     | Sensation of pain                                | X                | X                | X                   | X                      | 100               | 2462              |
| 2    | d415     | Maintaining a body position                      | X                | .                | X                   | .                      | 100               | 289               |
| 3    | s760     | Structure of trunk                               | X                | X                | .                   | .                      | 98                | 958               |
| 4    | b710     | Mobility of joint functions                      | X                | X                | .                   | X                      | 98                | 490               |
| 5    | d850     | Remunerative employment                          | X                | X                | .                   | X                      | 91                | 325               |
| 6    | b730     | Muscle power functions                           | X                | X                | X                   | X                      | 91                | 192               |
| 7    | b270     | Sensory functions related to temperature and other stimuli | .                | .                | X                   | .                      | .                | 87                | 260               |
| 8    | d450     | Walking                                          | X                | X                | X                   | X                      | 87                | 158               |
| 9    | b735     | Muscle tone functions                            | X                | X                | .                   | .                      | 87                | 119               |
| 10   | b134     | Sleep functions                                  | X                | X                | X                   | X                      | 84                | 157               |
| 11   | d430     | Lifting and carrying objects                     | X                | X                | X                   | .                      | 84                | 151               |
| 12   | d570     | Looking after one's health                       | X                | .                | X                   | X                      | 82                | 122               |
| 13   | b152     | Emotional functions                              | X                | X                | X                   | X                      | 80                | 446               |
| 14   | b126     | Temperament and personality functions            | .                | X                | .                   | X                      | 80                | 335               |
| 15   | b130     | Energy and drive functions                       | X                | X                | X                   | X                      | 80                | 277               |
| 16   | d410     | Changing basic body position                     | X                | X                | .                   | X                      | 80                | 171               |
| 17   | e110     | Products or substances for personal consumption  | X                | X                | X                   | X                      | 78                | 188               |
| 18   | e580     | Health services, systems and policies            | X                | .                | X                   | X                      | 76                | 101               |
| 19   | e310     | Immediate family                                 | X                | X                | X                   | X                      | 73                | 171               |
| 20   | b435     | Immunological system functions                   | .                | .                | .                   | .                      | 71                | 171               |
| 21   | e570     | Social security services, systems and policies   | X                | X                | X                   | X                      | 69                | 97                |
| 22   | s750     | Structure of lower extremity                     | .                | X                | .                   | X                      | 64                | 275               |
| 23   | b530     | Weight maintenance functions                     | .                | .                | .                   | X                      | 64                | 81                |
| 24   | e165     | Assets                                           | .                | .                | .                   | .                      | 64                | 57                |
| 25   | b160     | Thought functions                                | .                | .                | X                   | X*                     | 62                | 202               |
| 26   | d240     | Handling stress and other psychological demands  | X                | X                | X                   | X                      | 62                | 137               |
| 27   | d920     | Recreation and leisure                           | .                | X                | X                   | .                      | 62                | 73                |
| 28   | d230     | Carrying out daily routine                       | .                | .                | X                   | .                      | 60                | 90                |
| 29   | b420     | Blood pressure functions                         | .                | .                | .                   | .                      | 60                | 40                |
| 30   | d870     | Economic self-sufficiency                        | .                | .                | .                   | X                      | 58                | 55                |
| 31   | d760     | Family relationships                             | X                | X                | X                   | .                      | 56                | 64                |
| 32   | d845     | Acquiring, keeping and terminating a job         | X                | X                | .                   | X                      | 53                | 40                |
| 33   | b455     | Exercise tolerance functions                     | X                | X                | X                   | .                      | 51                | 57                |
| 34   | s720     | Structure of shoulder region                     | .                | .                | .                   | .                      | 49                | 48                |
| 35   | e225     | Climate                                          | X                | .                | .                   | X                      | 47                | 52                |
| 36   | d445     | Hand and arm use                                 | .                | X                | .                   | .                      | 44                | 49                |
| 37   | b750     | Motor reflex functions                           | .                | X                | .                   | .                      | 44                | 43                |
| 38   | d750     | Informal social relationships                    | .                | .                | X                   | .                      | 44                | 38                |
| 39   | d455     | Moving around                                    | .                | X                | X                   | X                      | 44                | 38                |
| 40   | d770     | Intimate relationships                           | .                | X                | X                   | X                      | 42                | 35                |
| 41   | b147     | Psychomotor functions                            | .                | X                | X                   | .                      | 40                | 60                |
| 42   | b770     | Gait pattern functions                           | .                | X                | .                   | .                      | 40                | 42                |
|   | Category                                                                 | Frequency | Rank |
|---|--------------------------------------------------------------------------|-----------|------|
| 43| b144 Memory functions                                                    | 38        | 61   |
| 44| e565 Economic services, systems and policies                             | 38        | 44   |
| 45| d440 Fine hand use                                                       | 36        | 50   |
| 46| b140 Attention functions                                                | 36        | 49   |
| 47| e245 Time-related changes                                               | 36        | 35   |
| 48| s740 Structure of pelvic region                                         | 36        | 34   |
| 49| b415 Blood vessel functions                                             | 36        | 28   |
| 50| d350 Conversation                                                        | 36        | 25   |
| 51| b810 Protective functions of the skin                                   | 36        | 22   |
| 52| s120 Spinal cord and related structures                                  | X         | 33   |
| 53| b620 Urination functions                                                | X         | 33   |
| 54| s730 Structure of upper extremity                                       | .         | 31   |
| 55| b240 Sensations associated with hearing and vestibular functions         | .         | 31   |
| 56| d160 Focusing attention                                                 | X         | 31   |
| 57| d640 Doing housework                                                    | X         | 30   |
| 58| d475 Driving                                                             | X         | 31   |
| 59| d540 Dressing                                                            | X         | 31   |
| 60| b755 Involuntary movement reaction functions                            | .         | 31   |
| 61| b715 Stability of joint functions                                       | X         | 31   |
| 62| d720 Complex interpersonal interactions                                  | X         | 31   |
| 63| e325 Acquaintances, peers, colleagues, neighbours and community members | X         | 31   |
| 64| b525 Defecation functions                                               | .         | 31   |
| 65| e315 Extended family                                                    | .         | 29   |
| 66| e115 Products and technology for personal use in daily living           | .         | 29   |
| 67| b535 Sensations associated with the digestive system                    | X         | 27   |
| 68| e410 Individual attitudes of immediate family members                   | X         | 27   |
| 69| b460 Sensations associated with cardiovascular and respiratory functions | .         | 27   |
| 70| b780 Sensations related to muscles and movement functions               | X         | 27   |
| 71| b740 Muscle endurance functions                                         | X         | 27   |
| 72| e430 Individual attitudes of people in positions of authority           | X         | 27   |
| 73| b640 Sexual functions                                                   | X         | 27   |
| 74| d166 Reading                                                             | .         | 27   |
| 75| e120 Products and technology for personal indoor and outdoor mobility and transportation | X         | 24   |
| 76| b164 Higher-level cognitive functions                                   | .         | 24   |
| 77| e510 Services, systems and policies for the production of consumer goods | X         | 24   |
| 78| b110 Consciousness functions                                            | .         | 22   |
| 79| s320 Structure of mouth                                                 | .         | 22   |
| 80| b755 Involuntary movement functions                                     | .         | 22   |
| 81| d620 Acquisition of goods and services                                  | X         | 22   |
| 82| s770 Additional musculoskeletal structures related to movement          | X         | 22   |
Study limitations

Our study has some limitations. Our sample only included medical reports in German of the Swiss national disability insurance scheme with an ICD-10-diagnosis for CWP and/or LBP. The results may therefore not be generalizable to other health conditions, nor to other insurance schemes or other countries with different disability evaluation procedures. Future research should involve validation studies which look into the generalizability of our findings.

Another limitation was the significant amount of content not appropriately addressed in the current ICF taxonomy. This refers mainly to some specific aspects of functioning related to work capacity (e.g. demanding activities) and to personal factors, which may influence work capacity [65] and could, when explicitly addressed, contribute to more transparent disability evaluations [66]. This limitation could have potentially missed factors critical and relevant to the process of work capacity evaluation which should be taken into account in future research.

Finally, one could argue that context-specific ICF-CS relevant to the field of work capacity evaluation, like the ones for vocational rehabilitation or the generic core set for disability evaluation in social security, may have been included in our analysis as well. However, as our sample included medical reports with the index conditions CWP and LBP, we decided to focus rather on condition-specific ICF-CS than on context-specific or generic ones. It might be an issue for further research to determine the extent to which these ICF-CS are representing the content of medical reports of disability claimants.

Practical implications

Combining ICF-CS (e.g. CWP with LBP and depression, or LBP with CWP and obesity) is a more

| Table 5 Relative frequency ranking of the ICF categories found in the LBP reports (n = 45) (Continued) |
|-----------------------------------------|-----------------|-----------------|-----------------|
| Ranking of the remaining categories of the Brief ICF Core Sets for LBP, CWP and obesity: |     |     |     |
| 89 e355 Health professionals | X | X | X | . | X | 20 | 11 |
| 92 d859 Work and employment, other specified and unspecified | X | X | . | . | . | 18 | 20 |
| 94 e135 Products and technology for employment | X | X | . | . | . | 18 | 15 |
| 103 e450 Individual attitudes of health professionals | . | . | X | X | . | 16 | 13 |
| 104 b760 Control of voluntary movement functions | X | X | . | . | . | 16 | 13 |
| 105 e155 Design, construction and building products and technology of buildings for private use | X | X | . | . | . | 16 | 11 |
| 122 e550 Legal services, systems and policies | X | X | . | . | . | 11 | 13 |
| 201 d175 Solving problems | . | . | X | X | . | 2 | 1 |
| - d530 Toileting | X | X | . | . | . | 0 | 0 |

Note: k = total number of categories in the respective ICF Core Set; X = included in the particular ICF Core Set (LBP, CWP or obesity); * = in the particular ICF Core Set the stated category is included at the next lower (third) or next higher (second) level.

| Table 6 Coverage and efficiency ratios of the different ICF Core Sets for the LBP-reports (n = 45) and the two relevance thresholds |
|--------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------|-----------------|
| Number of overlapping categories | Coverage ratio (%) | Efficiency ratio (%) |
|----------------------------------|-----------------|-----------------|-----------------|
| Relevance threshold ≥ 25% (m = 74) | | | |
| LBP Brief (k = 35) | 27 | 36 | 77 |
| LBP Comprehensive (k = 78) | 43 | 58 | 55 |
| CWP Brief (k = 24) | 21 | 28 | 88 |
| CWP Comprehensive (k = 67) | 41 | 55 | 61 |
| Obesity Brief (k = 8) | 8 | 11 | 100 |
| Obesity Comprehensive (k = 1081) | 41 | 55 | 38 |
| LBP + CWP + Obesity Brief (k = 451†) | 35 | 47 | 78 |
| LBP + CWP + Obesity Comprehensive (k = 1431†) | 59 | 80 | 41 |
| Relevance threshold ≥ 50% (m = 33) | | | |
| LBP Brief (k = 35) | 21 | 64 | 60 |
| LBP Comprehensive (k = 78) | 25 | 76 | 32 |
| CWP Brief (k = 24) | 17 | 52 | 71 |
| CWP Comprehensive (k = 67) | 26 | 79 | 39 |
| Obesity Brief (k = 8) | 7 | 21 | 88 |
| Obesity Comprehensive (k = 1081) | 27 | 82 | 25 |
| LBP + CWP + Obesity Brief (k = 451†) | 26 | 79 | 58 |
| LBP + CWP + Obesity Comprehensive (k = 1431†) | 32 | 97 | 22 |

Note: m = total number of ranked categories above the respective threshold; k = total number of categories in the respective ICF Core Set(s); † = categories aggregated on the second level; * = adjusted for overlap between the categories of the three ICF Core Sets.
effective approach for work capacity evaluations involving CWP and LBP than using solely condition-specific ICF-CS. Taken together, the ICF-CS show a potential for guiding comprehensive multidisciplinary assessments. In particular, they could ensure transparency in disability evaluations as well as standardize them in terms of what should be documented. However, efficiency and practicability become problematic when simply combining ICF-CS due to the high number of categories to be assessed. To ensure high coverage and efficiency, a suitable standard for medical work capacity evaluations involving CWP and LBP could include:

(1) All categories of the Brief ICF-CS for the index conditions and major co-morbidities because Brief ICF-CS are considered as a minimum standard or data set to be reported in different settings so as to enhance comparability [35];
(2) Those categories of the Comprehensive ICF-CS identified as relevant for the present context;
(3) Those categories not included in the ICF-CS but identified as relevant for the present context (e.g. b435 Immunological system functions for CWP reports; e165 Assets for LBP reports).

Our relevance rankings display the categories which should be included in the standard. To ensure comprehensive evaluations, we recommend to focus on categories above the 25% threshold. Before being applied, however, future research would have to focus on a validation of the categories by experts in the field of work capacity evaluation.

Furthermore, the proposed ICF categories are the basis for a transparent documentation of those aspects of functioning which are relevant for a claimant’s work capacity and should be seen as a complement to the claimant’s diagnosis without necessarily having a direct implication on the work capacity decision itself. Whereas the categories can be used as a guideline for the evaluations in terms of what aspects should be documented, they are not addressing the issue of how these aspects should be assessed. This latter problem could be approached by assigning existing validated rating instruments to the suggested ICF categories.

Last but not least, it is important to emphasize that aspects of functioning which refer to the unique individual experience of a claimant, but are not necessarily addressed by the abovementioned ICF categories, should be considered in addition as complementary source of information to provide a comprehensive picture of the claimant.

Conclusions
The relevant content of medical work capacity evaluations involving CWP and LBP can be represented to a considerable extent by a combination of the ICF-CS for the index conditions and major co-morbidities. A suitable approach for a standardized documentation of the evaluations and for enhancing their transparency could consist of the Brief ICF-CS, augmented by additional ICF categories relevant for this particular context. Aspects not appropriately addressed in the current ICF taxonomy, such as personal factors, should be specified and eventually incorporated in such a standard as well. In addition, the unique individual experiences of claimants have to be taken into account in order to assess work capacity comprehensively.

Competing interests
The authors declare that they have no competing interests.

Authors’ contributions
Urban Schwegler and Bruno Trezzini prepared the first draft of this paper. All other co-authors made substantial comments on the content of this manuscript. All authors read and approved the final manuscript.

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