

A Systematic Review of Functioning in Vocational Rehabilitation Using the International Classification of Functioning, Disability and Health

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Abstract *Background:* Vocational rehabilitation (VR) is aimed at engaging or re-engaging individuals with work participation and employment. The International Classification of Functioning, Disability and Health (ICF) by the World Health Organization can be operationalized in the context of VR. The objective of this study is to review the literature to identify outcomes or measures being used in VR using a systematic review methodology and link those measures to the ICF. *Methods:* We applied a structured search strategy using multiple databases. Items or constructs of the measures or outcomes identified were linked to the ICF by two trained individuals. *Results:* We have identified 648 measures which contained 10,582

concepts that were linked to the ICF which resulted in 87 second-level ICF categories. Out of the 87 categories, 31 (35.6%) were related to *body functions*, 43 (49.4%) were related to *activities and participation*, and 13 (14.9%) were related to *environmental factors*. No category was related to *body structures*. *Conclusions:* Our review found great diversity in the ICF contents of the measures used in different VR settings and study populations, which indicates the complexity of VR. This systematic review has provided a list of ICF categories which could be considered towards a successful VR.

Keywords ICF · Vocational rehabilitation · Review · Work · Employment · Outcomes assessment

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Introduction

Work disability (WD) may occur as a result of a health condition or a health-related event and may affect the worker at the individual level and society level. WD may be associated with limited or restricted work participation leading to a decrease in gainful employment and significant burden. Vocational rehab (VR) is a key process in WD management to engage or re-engage individuals with their work participation and employment. VR has been documented in the literature to be effective in addressing the negative consequences of WD [1–6].

The International Classification of Functioning, Disability and Health (ICF) [7] is a universal conceptual framework and classification system by the World Health Organization which has been used to interface with VR or return-to-work, or work participation [8–10]. As a conceptual model, the ICF recognizes that functioning and disability is a result of the interaction between components:

body functions (b), body structures (s), activities and participation (d), environmental factors (e), and personal factors (not coded). 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 Activities and participation
Chapter	d4 Mobility
Second-level category	d430 Lifting and carrying objects
Third-level category	d4300 Lifting

The ICF is a generic framework and intended by the WHO to understand health and functioning, to provide a common language of health and health-related states, to allow comparison between countries and health services, and to provide a uniform coding system *regardless of the application setting* [7]. However, there remains a lack of understanding of functioning within VR in terms of the ICF. Therefore, the objective of this study is to review the literature to identify outcomes or measures being used in VR using a systematic review methodology. The specific aims of this study are (1) to identify patient-reported and clinician-reported outcomes in VR studies and, (2) to identify what aspects of functioning, in the ICF language, were frequently addressed in those outcomes.

Materials and Methods

Search Strategy

We applied our search strategy using multiple databases which included Cumulative Index to Nursing and Allied Health Literature (CINAHL®), PsycINFO®, Medline, Global Health, and Vocation and Career Collection. The search strategy included key words and search terms with the Boolean operator “OR”: “Vocational rehabilitation”, “Return to work”, “Occupational rehab*”, “Work rehab*”, “Work reintegration”, “Job rehab*”, “Job reentry”, “Employ* rehab*”, “Employ* reentry”. Additional references [11, 12] on a similar research question on VR were consulted.

Studies included were in English, have been conducted using human population or subjects, studies on “vocational or work or occupational rehabilitation” settings, with a study population of working age (≥ 18 years), and published between January 2004 to December 2008. Study designs may be randomized controlled trials (RCT), clinical controlled trials (CCT), cross-sectional studies, longitudinal observational studies, qualitative studies, and case reports. Studies were excluded if they were not specific to vocational rehabilitation, conducted on or with non-human

population, were genetic studies or laboratory studies, or were phase I or II clinical trials.

Articles Processing

Results from our search were exported to a reference system (EndNote® Windows Version X3, Copyright © 2009 Thomson Reuters) where possible duplicates were identified. Screening of abstracts and subsequently of full text articles were performed using Microsoft® Access 2007 (Microsoft Corporation, Redmond WA). Abstract screening was independently performed by two trained researchers with the project. All abstracts that were identified were screened and inclusion–exclusion criteria applied. If there was a disagreement on the inclusion or exclusion of articles, then the two individuals met and attempted to resolve the disagreement but if it was not resolved, a third person was asked. Full text articles for the included abstracts were retrieved. The order of full text articles was randomized by the computer from which the first 50% were selected to build the articles for screening by one screener (S1) and the remaining articles by another screener (S2). Twenty percent of each screener’s list of articles was randomly selected for cross-screening (i.e. 20% of articles of S1 will be reviewed by S2 and same amount of S2 by S1). If there was a disagreement on the inclusion–exclusion of the full text articles, then the two screeners met and tried to resolve disagreement. Otherwise, a third person was asked.

Data Extraction

Based on the finally included articles, the following information, when available, were extracted: country of the first author, the type of study, whether it is a qualitative study or not, whether it is a longitudinal study or not, the type of job and type of VR where the study was conducted, the study setting, and the health condition of the study population. Also extracted were information relating to sociodemographics and standard and non-standard patient-reported measures and clinician-reported measures. Standard measures may include questionnaires such as the Medical Outcomes Study Short Form Health Survey—36 items (SF-36) [13] or instrumentation/procedures that are “standardized” such as blood pressure measurement. We did not examine the psychometric properties of the measures identified but they had to be available in English.

Linking to the ICF

Items or constructs of the measures or outcomes identified were linked to the ICF using published linking rules [14].

The objective of the linking process is to be able to translate the concepts found in those items or constructs into the ICF categories. Two independent researchers, who were trained and experienced in the process, linked the responses. Twenty-five percent of the total number of measures were randomly selected and counter-linked by the two researchers. If there was a disagreement between the two, both tried to resolve the disagreement, otherwise a third person was consulted. As a result of the linking process, ICF categories were identified at the second level (common, mid-level way of reporting ICF categories) and a frequency analysis of the common ICF categories was made. Those ICF categories that have been included in at least 5% of the measures were included in the table.

Reliability of Linking

To evaluate the reliability of the linking process, the overall percentage of agreement for each questionnaire was calculated based on the two independent linkage versions (at the second-level and third-level of the ICF categories). In addition, to examine the extent to which the achieved agreement exceeds chance, the Kappa coefficient [15] and nonparametric bootstrapped confidence interval [16, 17] were calculated. We performed Kappa analysis using SAS software version 9.1 (Copyright © 2002–2003 by SAS Institute Inc., Cary, NC, USA).

Results

Literature Search

Our search strategy identified 2997 abstracts and out of which, 334 were subjected to full text screening (i.e. their full text were retrieved). The required information was extracted from 250 articles including study characteristics, VR setting, study population, and characteristics of the measures contained in the studies (Fig. 1).

Study Characteristics

Based on the first author of the final articles we surveyed ($N = 250$), most came from the United States (USA) (46.0%), followed by Canada (10.4%), and the Netherlands and Sweden (both with 6.8%). Close to a third of the studies were intervention studies (RCT, CCT, or other type of intervention design). Twenty-six percent of the studies were observational in nature (longitudinal or cross-sectional). Least represented were case studies. While only 10.8% of the studies surveyed were qualitative, longitudinal studies comprised 52.8% of the studies. We found a wide range of type of jobs (from service, professional,

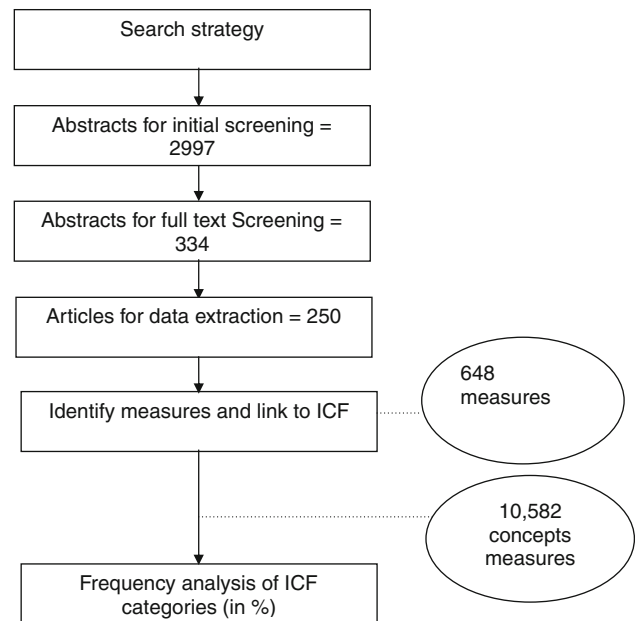


Fig. 1 Search strategy and articles processing flow

administration, technical, to self-employed), study population (with mental, musculoskeletal, and neurologic health conditions), and study settings (outpatient, supported employment, community rehabilitation). Close to 8% of the studies did not specify the VR setting. Specifically, about 17% of those studies where settings were specified applied to outpatient facilities or clinics and the least represented was community-based rehabilitation setting (5.6%). Mental health conditions such as depression comprised the majority (45.2%) of the study population and with musculoskeletal conditions such as back pain following second (33.2%) (Table 1). Some studies did not specify their study population (6.8%).

Overview of Measures

As shown in Fig. 1, we have identified a total of 648 measures. Of these measures, there were 155 questionnaires or clinical tests, 121 one-item measures (e.g. pain, employment arrangement, etc.), and 371 “other” measures. Table 2 provides a list of measures that were used in the studies we found. We only included those which have been used in at least five studies.

Included in Table 2 are the number of times a measure has been used and a short description of the measure. There were 11 self-reported or patient-reported measures with the Medical Outcomes Study 36-item Short Form (SF-36) [13] being the most frequently used (21) and there were 8 provider-reported or third-party reported measures with the Positive and Negative Syndrome Scale (PANSS) [49] with the most frequently used (28). We also extracted

Table 1 Study characteristics

Country (< 3% not included here)	USA (46%) Canada (10.4%) Netherlands (6.8%) Sweden (6.8%) Hong Kong (5.2%) United Kingdom (4.4%) Australia (3.2%)
Study type (< 3% not included here)	Intervention study (RCT) (22%) Observational study (longitudinal) (17.2%) Observational study (cross-sectional) (8.8%) Intervention study (CCT) (7.2%) Retrospective chart review (4.4%) Data analysis (4%) Intervention study (other) (3.6%) Case study (3.2%)
Qualitative study	10.8%
Longitudinal study	52.8%
Type of job (as worded and specified by the study)	Service Professional Administration Technical Self-employed
Study setting (as worded and specified by the study) (< 3% not included here)	Outpatient (16.8%) Supported employment/Individual support and employment (14.4%) Setting not specified (7.6%) Community rehabilitation (5.6%)
Health condition (< 3% not included here)	Mental (e.g. bipolar disorders, depression) (45.2%) Musculoskeletal (e.g. back pain) (33.2%) Other (24.8%) Neurologic (e.g. stroke, brain injury) (12.4%) Condition not specified (6.8%)

RCT randomized controlled trials, CCT controlled clinical trials

non-standard measures and single item questions, and we included sample items on how each measure was operationalized. We found that “work status” (e.g. working or not, full-time or part-time) (75) was the most frequently used parameter in those studies, followed by “work participation” (e.g. difficulties in staying employed, carrying out work responsibility, etc.) (72), “work intervention” (e.g. type of VR service received) (54), “pain” (47), “work hours” (34), “workplace” (e.g. support and guidance) (29), and “cost” and “income” (both with 21).

ICF Categories in the Measures

The measures we found contained 10,582 concepts that were linked to the ICF. There were 87 unique second-level ICF categories that were identified. Only those that were contained in at least 5% (arbitrary) of the measures were included. Out of the 87 categories, 31 (35.6%) were related to *body functions* (Table 3), none (0%) were related to

body structures, 43 (49.4%) were related to *activities and participation* (Table 4), and 13 (14.9%) were related to *environmental factors* (Table 5).

Our reliability calculation between linkers (researchers) at the second-level ICF categories resulted in an overall percentage agreement of 73.4%, an estimated 0.72 Kappa coefficient, and a confidence interval (bias corrected percentile method) of 0.70–0.74. For the third-level categories, the overall percentage agreement was 69.7%, estimated 0.68 Kappa coefficient, and a confidence interval (bias corrected percentile method) of 0.66–0.70.

Discussion

VR is a key enabling process in work disability management. VR as a complex process aimed towards engaging or re-engaging people in gainful employment covers a wide variety of factors. Based on our findings, we found VR to

Table 2 Measures which have been used in at least 5 studies reviewed in vocational rehabilitation

Name of measure	Number of citations where measure was used	Brief description of measure/sample items
<i>Standard self-reported or patient-reported measures</i>		
Medical Outcomes Study 36-item Short Form (SF-36) [13]	21	Generic measure of limitations in <i>physical</i> activities because of health problems, limitations in <i>social</i> activities because of physical or emotional problems, limitations in usual <i>role</i> activities because of physical health or emotional problems, bodily <i>pain</i> , general <i>mental</i> health (psychological distress and well-being), vitality (energy and fatigue), and general health perceptions
Beck Depression Inventory II [29]	9	Assesses the severity of depression (i.e. symptom of depression)
Tampa Scale for Kinesiophobia [32]	9	Assesses fear of movement/(re)injury in individuals with pain
Roland-Morris Disability Questionnaire [36]	8	Assesses difficulty or limitation with activities due to low back pain
Pain Disability Index [33]	6	Measures the impact that pain has on the ability of a person to participate in essential life activities
Fear-avoidance Belief Questionnaire [37]	5	Measures how much fear and avoidance are affecting a patient with low back pain
Hospital Anxiety and Depression Scale (HADS) [50]	5	Instrument for anxiety and depression in patients with both somatic and mental problems
McGill Pain Questionnaire (Pain Rating Index) [34]	5	Measures three dimensions of pain experience: the sensory, the affective and the evaluative dimensions of pain
Oswestry Low Back Pain Disability Questionnaire (ODQ) [38]	5	Assesses pain-related disability in persons with low back pain, assess patients with low back pain by determining its impact on the activities of daily living
Pain Catastrophizing Scale [35]	5	Measures “catastrophizing” of pain- which is hypothesized to be related to various levels of pain, physical disability and psychological disability
WHO Quality of Life Measure (WHO-QOL) [31]	5	Assesses quality of life and the individual’s perceptions in the context of their culture and value systems, and their personal goals, standards and concerns
<i>Standard Provider-reported or Third-party reported measures</i>		
Positive and Negative Syndrome Scale (PANSS) [49]	28	Psychiatric measure of positive and negative symptoms and gauges their relationship to one another and to global psychopathology
Wisconsin Card Sorting Test [51]	16	Allows the clinician to assess the following “frontal” lobe functions: strategic planning, organized searching, utilizing environmental feedback to shift cognitive sets, directing behaviour toward achieving a goal, and modulating impulsive responding
Joint range of motion (ROM)	9	Sample operationalization: ROM of cervical spine
Strength	9	Sample operationalization: grip strength
Trail Marking Test [52]	9	Neuropsychological test of visual attention and task switching
Brief psychiatric rating scale (BPRS) [30]	6	Assesses the level of symptom constructs such as hostility, suspiciousness, hallucination, and grandiosity
Gorham’s Proverbs Test [53]	6	A test for the study of intellectual functioning; measurement of verbal comprehension
Global Assessment of Functioning Scale (GAF) Part of DSM-IV [54]	5	Rates the social, occupational, and psychological functioning of adults, e.g. how well or adaptively one is meeting various problems-in-living
<i>Nonstandard measures</i>		
Work status	75	Are you working at the time of data collection (admission and discharge)? Do you expect to be able to resume work (full time or part time)? Stable employment, improved employment, or unstable employment?
Work participation	72	Do you expect difficulties in returning to or staying in gainful employment because of your current health situation? Job tenure- total duration of continuous employment over 12 months Work adjustment (carrying out duty and responsibility)
Work intervention	54	What types or VR services have you received? What were the strengths (or positives) of the VR program?

Table 2 continued

Name of measure	Number of citations where measure was used	Brief description of measure/sample items
Pain	47	Length of pain duration Pain radiation in both legs? Pain diary Perceived pain intensity
Work hours	34	Average number of hours worked Number of full time employee hours
Workplace	29	Did anyone from your workplace contact you after your injury (excluding co-workers)? Company provides guidance for new workers Support provided by supervisors or managers
Cost	21	Case expenditures Health care cost Dollar value of provider payments
Income	21	Salary
Time of injury, intervention, and RTW	19	Time from onset of injury to program admission Time from referral to outcome of claimants Time to job placement
Satisfaction	18	Satisfaction with current job Satisfaction with treatment Satisfaction: clinician explained what to expect, concern for safety, and confidence in staff skills
Sick leave	18	Sickness absence in days Time off work
Diagnosis	17	Diagnostic tests (e.g. CT scan) Pre-injury chronic health problems
Medication	13	Are you currently taking psychiatric medication? When you take your medication, how much do you take?
Work ability/capacity	13	To what degree is your ability to perform your ordinary work reduced today? Ability to work in % of a full time job Maximal lifting capacity
Benefits	12	Amount of sickness allowance Disability pension
Physical capacity	11	Sit to stand test- number of sit to stands in one min Strength of the trunk flexors/extensors via isokinetic test
Intervention outcome	10	Dropout from care After VR: working, studying, unemployed but with working capacity, or further rehabilitation or assessment
Work demands	10	How often do you sit continuously for more than 1 h without any standing or walking? Exposure to vibration
Substance abuse	8	Substance abuse history Drug test
Work type	8	Characteristics of job
Employment rate	7	Unemployment level in percentage
Healthcare provider (HCP)	7	Number of visits to new healthcare providers Your HCP made contact with your employer?

Table 2 continued

Name of measure	Number of citations where measure was used	Brief description of measure/sample items
Brakes	6	How often do you have short breaks during your computer work? Do you have exercise breaks at work?
Hospitalization	6	Number of hospitalization days Age during first hospitalization
Body Mass Index	5	Height and body weight
Physical examination	5	Clinical examination
Staff	5	Staff accountable for transition to competitive employment Staff perception of factors that positively and negatively affected program performance
Walk	5	Ability to walk
Work accommodation	5	Did you accept the work accommodation offer? Presence of material/immaterial adaptations at work
Work limitation	5	Experience of job-related barriers and successes Work difficulties during employment

Table 3 ICF component of *body functions* ($N = 31$) (categories with < 5% representation not included)

ICF Code	Title	Percentage (%)
b152	Emotional functions	48
b130	Energy and drive functions	42
b126	Temperament and personality functions	39
b160	Thought functions	32
b280	Sensation of pain	32
b164	Higher-level cognitive functions	27
b140	Attention functions	26
b180	Experience of self and time functions	25
b134	Sleep functions	23
b147	Psychomotor functions	23
b156	Perceptual functions	20
b765	Involuntary movement functions	20
b110	Consciousness functions	18
b114	Orientation functions	18
b167	Mental functions of language	17
b830	Other functions of the skin	17
b780	Sensations related to muscles and movement functions	16
b270	Sensory functions related to temperature and other stimuli	14
b735	Muscle tone functions	12
b730	Muscle power functions	11
b144	Memory functions	8
b440	Respiration functions	8
b117	Intellectual functions	7
b289	Sensation of pain, other specified and unspecified	7
b455	Exercise tolerance functions	7
b530	Weight maintenance functions	7
b410	Heart functions	6

Table 3 continued

ICF Code	Title	Percentage (%)
b535	Sensations associated with the digestive system	6
b760	Control of voluntary movement functions	6
b240	Sensations associated with hearing and vestibular functions	5
b460	Sensations associated with cardiovascular and respiratory functions	5

Table 4 ICF component of activities and participation ($N = 43$) (categories with < 5% representation not included)

ICF code	Title	Percentage (%)
d850	Remunerative employment	71
d920	Recreation and leisure	31
d540	Dressing	23
d855	Non-remunerative employment	23
d450	Walking	22
d177	Making decisions	21
d230	Carrying out daily routine	21
d410	Changing basic body position	21
d455	Moving around	20
d845	Acquiring, keeping and terminating a job	19
d430	Lifting and carrying objects	18
d510	Washing oneself	18
d760	Family relationships	18
d350	Conversation	17
d720	Complex interpersonal interactions	17
d750	Informal social relationships	17
d640	Doing housework	16
d710	Basic interpersonal interactions	16
d770	Intimate relationships	15
d445	Hand and arm use	14
d570	Looking after one's health	14
d160	Focusing attention	12
d315	Communicating with- receiving- nonverbal messages	12
d335	Producing nonverbal messages	12
d859	Work and employment, other specified and unspecified	10
d415	Maintaining a body position	9
d475	Driving	9
d650	Caring for household objects	8
d825	Vocational training	8
d220	Undertaking multiple tasks	7
d470	Using transportation	7
d550	Eating	7
d620	Acquisition of goods and services	7
d820	School education	7
d830	Higher education	7
d440	Fine hand use	6
d498	Mobility, other specified	6
d660	Assisting others	6
d870	Economic self-sufficiency	6
d175	Solving problems	5
d210	Undertaking a single task	5

Table 4 continued

ICF code	Title	Percentage (%)
d240	Handling stress and other psychological demands	5
d420	Transferring oneself	5

Table 5 ICF component of environmental factors ($N = 13$) (categories with < 5% representation not included)

ICF code	Title	Percentage (%)
e580	Health services, systems and policies	33
e590	Labour and employment services, systems and policies	28
e310	Immediate family	21
e355	Health professionals	21
e165	Assets	20
e110	Products or substances for personal consumption	19
e570	Social security services, systems and policies	10
e320	Friends	9
e330	People in positions of authority	9
e315	Extended family	8
e540	Transportation services, systems and policies	8
e325	Acquaintances, peers, colleagues, neighbors and community members	7
e155	Design, construction and building products and technology of buildings for private use	5

operate in diverse health-condition and service provision-type setting, research study design, and job types. This diversity is likely to be indicative of the array of measures being used. We also found that VR is reported in the literature mostly from developed countries. Using the ICF by the WHO offers us a generic framework so as to understand VR's multitude of factors and players with the benefits of the ICF's common language and cross-setting and multi-cultural application. We investigated measures that were reported in the literature through a systematic review and linked those measures to the ICF. In that way, outcomes or simply variables can be interpreted to be meaningful to ICF users. The ICF contents of the measures we found in the literature reflect the breadth of VR as a field of research and practice.

Knowledge of the factors we found would be helpful to inform appropriate intervention and care in facilitating optimal VR, and hence work participation. The factors in the ICF language provide us with a uniform language of functioning and disability that is in line with WHO. We believe that this study would contribute to improve outcomes measurement in VR.

Systematic reviews do give us a rich source of information on the state of a research agenda which look into the applicability of the findings to the field as a whole or to a subset of the field [18, 19]. Similarly, information gathered from synthesizing the literature provides a comprehensive and rich source of understanding workers with

disability in terms of what measures or outcomes are available out there and how we can make use of them effectively.

Our review showed that most of the studies originated or were conducted in the developed countries such as the USA, Canada, and European countries. This observation implies that literature in VR is skewed towards countries that have VR infrastructure in place. VR services and how they are being delivered even differ between developed countries [20, 21] due to systems difference. Personal factors and attitudinal factors and diverse sociodemographics may influence VR outcomes in one part of the world to a different degree [22]. However, it could also be possible that since the articles need to be in English to qualify for our screening, we got articles from countries that do speak English.

In VR, where outcomes could fluctuate from being off from work to being back to work full-time to part-time, it is essential to capture these processes over time. Indeed, this temporal component of VR was indicated by about half of the studies for which there was information available, were longitudinal studies. However, this was not the case with qualitative studies as it only constituted a mere tenth of the studies, despite the continuing support for using qualitative methodology in addressing WD issues [23, 24]. Our findings also revealed that VR does cover a variety of jobs (physical demands, mental demands, or a combination of both) and can be implemented in different health care

settings (outpatient, inpatient, supported employment) although the latter observation may depend on what is allowed by the system of that country within a particular state of work disability (i.e. eligibility for VR services over time). Health conditions were mostly mental and musculoskeletal in nature. This finding is indicative of the prevalence and burden that both groups of health conditions (alone or in coexistence) pose [25–28].

The type of measures we found varied which was an expected finding to reflect the spectrum of health conditions in VR. We can say that the type of measure used in a study is driven by the type of population being investigated. For example, most of studies dealt with mental health and hence, the Positive and Negative Syndrome Scale (PANSS) [49] and Beck Depression Inventory II (BDI) [29] were commonly used and both are psychological-psychiatric measures. A look at the measures that were used in at least 5 studies revealed a diverse list. Different domains and constructs were covered in mental health such as the Beck Depression Inventory (BDI) [29] and the Brief Psychiatric Rating Scale (BPRS) [30] to quality of life such as the WHO Quality of Life measure (WHO-QOL) [31]- this finding reflects the many health conditions that fall under VR. The popular Medical Outcomes Study Short Form 36-items (SF-36) [13] was the most commonly used generic self-report measure but many measures were also intended to capture “pain” and the surrounding factors around it [32–35]. More specifically, back pain as a health condition, is central to some of these measures such as the Roland-Morris Disability Questionnaire (RMDQ) [36], Fear-avoidance Belief Questionnaire (FABQ) [37], and the Oswestry Low Back Pain Disability Questionnaire (OLBPQ) [38]. Some measures were patient-reported and others clinician-reported or third-party reported (e.g. caregiver, family). We decided a priori to take both types of measures so as to give us a comprehensive picture of what is being reflected in the general world of measures used in VR.

There were more nonstandard measures (i.e. no uniform way of gathering the information) than standard measures like those stated earlier. This is particularly interesting because the standard measures while widely used in VR, are not necessarily specific to “work” or are not enough to capture VR and work disability as a process. Therefore, we were not surprised to see a list of specific work-related questions (e.g. work status, level of work participation, work intervention, etc.) which we believe adds value to examining VR outcomes from a comprehensive perspective. Moreover, some of nonstandard items, which we presumed would have had a “standard” definition, were actually defined differently. For example, the item “work status” was not confined to being at work or off-work but was rather operationalized in different ways: “*What will be*

your condition when you return to work or unemployment status?” [39], “*Have you resumed your previous job with modifications or changed to a new job?”* [40], or “*Do you expect to be able to resume work (full time or part time)?*” [41]. Despite the relatively high number of measures in VR that we found, only a few of them were used frequently in the literature. The selection of standard measures seem to rely on the type of health condition, while non-standard measures, given that they are a central theme around the area of “work”, does not.

This literature study covered three classifiable components of the ICF: *body functions, activities and participation, and environmental factors*. Of these components, *activities and participation* had the most categories followed by *body functions*. The least representation was found for *environmental factors*. This finding signifies a broad societal perspective rather than a consideration for the individual structure-level alone. It is consistent with findings of relevant ICF components in the mental health field [42] and is also consistent with the conceptualization of work functioning by Sandqvist and Henriksson (2004) which emphasized the role of work participation and performance, individual capacity, and environmental factors [43].

Work resumption or absence from work is commonly used as an indicator of VR success [3, 44–46]. For *activities and participation*, remunerative or gainful employment was most frequently contained in the measures. Other work-relevant categories were *d845 acquiring, keeping and terminating a job*, *d177 making decisions* (perhaps applicable to mental-type of health conditions or jobs that demand mental competency), and *d430 lifting and carrying objects* (perhaps applicable to physical-type of health conditions or jobs that demand physical skills), for example. However, the role of traditionally non-work relevant factors such as *d855 non-remunerative employment* (e.g. *volunteer*), *d920 recreation and leisure*, and *d230 carrying out daily routine*, were evident. These factors point to the multi-faceted dimensions of VR that go beyond the traditional confines- to include what people do outside of their work and how it impacts their ability to return to work or assume work [47]. This also proves that “employment” in a sense, does not have to necessarily be paid to be considered “work”.

Surrounding people such as family (*e310 immediate family, e315 extended family*), friends (*e320 friends*), and co-workers (*e325 acquaintances, peers, colleagues, neighbours and community members*) could impact VR outcomes. This finding reinforces the importance of support and relationship as part of one’s social environment [8, 46]. Moreover, the support that comes from health care services and providers (*e580 health services, systems and policies* and *e355 health professionals*), labour services and providers (*e590 labour and employment services, systems*

and policies), and social security services and providers (*e570 social security services, systems and policies*) was also evident in the measures surveyed. At a quick glance, these three areas of services on health, labour, and social security seem to be the “trifecta” in VR provision. Assets (*e165*) in the form of money, income, salary, or financial benefit were not unexpected because it could facilitate or sustain return to work [8].

Looking at the *body functions* categories, it is notable that they are so varied to the effect that they could be applied to a variety of diseases that may either be physical or mental in nature, or both. For example, mental health-related categories include *b126 temperament and personality functions* and *b160 thought functions*, while physical health-related categories include *b765 involuntary movement functions*. This finding may not necessarily be surprising because most of the studies, as previously mentioned, were on mental and musculoskeletal disease settings.

Looking at the different dimensions of functioning we found based on the measures we reviewed, the literature is driven toward *activities and participation* which is logical because work or employment is a major life area and as such is related to activity and participation. Clearly, the gap is in the area of environmental factors because of its less representation despite its importance in the facilitation work functioning [43]. Looking at each ICF component, a high number of *body functions* categories related to the chapter on mental functions- a consistent finding since most study populations were on mental health. The distribution was relatively non-pronounced in the other ICF components.

With regards to our linking methodology, there was not only a satisfactory agreement between the linkers but the agreement also exceeded chance. This shows that the linking procedure was reliable in this study.

We do recognize the limitations of our study. First, the results of our systematic review could not be made generalizable if not applicable to all settings of VR. While the review made an attempt to capture the broadest representation of measures used in VR, the review covered a limited period of 5 years. Secondly, not all the studies we included had the information we required. For example, some studies did not specify or were not explicit about the type of job that the VR patients had, or what the specific type of setting it was (outpatient versus inpatient). The nature of the health conditions of the population examined was missing in some studies. Therefore, we only calculated the percentages based on the studies that did provide information which could lead to underestimation. Thirdly, the studies were not evaluated in terms of their quality of evidence. Although this was not the purpose of this review, information on the quality may help in judging whether or not the factors identified in those studies carry scientific robustness [48].

This systematic review has provided us with ICF categories that were considered in the measures used in VR which can help advance our understanding of the factors around successful VR. This study, therefore, provides us with the “what” to measure in the VR based on the systematic review of the literature. Knowing what to measure could better inform us with the challenges ahead when managing patients in VR. Moreover, by identifying the variety of standard and nonstandard measures that were used in the literature further adds to the complexity of “how” to measure or operationalize the ICF categories and creating an outcome measure that will truly reflect the improvement during or after a VR program. This study also proposed a list of variables that would apply to VR programs regardless of the health condition, setting, region, or culture. Looking at the ICF categories, they are truly representative of many settings and are covered to varying extent by the measures we found. Moreover, the findings of this study could also inform us in developing new outcome measures or instruments or validating existing ones.

Conclusions

We encourage the VR clinical and research community and ICF users to further examine the list of variables as provided in our literature review. Empirical testing will be needed and validation studies are being planned to operationalize the ICF categories amidst the multiple and possibly inter-related variables of VR. The measurement of outcomes in the practice and research of VR is imperative if we want to improve people’s lives by increasing their work participation and fulfilling their societal role in general. We believe that this study is one starting point towards advancing measurement in VR.

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Conflict of interest None.

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