

Explaining the Variability of Responses to an Abridged Version of International Classification of Functioning, Disability, and Health Tool in Community Settings of Northern India

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ABSTRACT

Introduction: The International Classification of Functioning, Disability and Health (ICFDH) gives a valid assessment for assessing the extent of impairment, level of capacity, performance, and functions along with the role of the environment. In the current study, an abridged version of ICFDH was developed and studied for its applicability in the general population for quantification along with summarizing the pattern of correlations among observed variables.

Materials and methods: Descriptive study was carried out among 72 (36 in rural and urban area each) subjects with a response to 20 variables on 14 areas of the ICFDH. Principal component analysis (PCA) using R studio package (version 3.4.4) was done to detect a set of variables forming coherent subsets that are independent of each other.

Results: Study subjects had mean age of 35 [standard deviation (SD) \pm 5.4] years and 58.0% were males. The average score indicates mild level of impairment, mildly and moderately affected performance and capacity for learning and applied knowledge, and communication. Environmental support was observed with an average score of 2.78 for products and technology, 3.47 for supports and relationships, 3.42 for attitude toward others, and 3.29 for services, systems, and platforms. Sizes of correlation were significant in the matrix, with statistically significant Bartlett's test of sphericity ($p=0.00$) with good factorability (Kaiser–Meyer=0.76). First two components explain maximum (55.0%) of variance with high loading of 15 variables on the first principal component.

Conclusion: Included variables are observed to be coherent with the theoretical construct of the ICFDH, and the study tool is quite feasible to administer in community-based settings.

Keywords: Community, Correlation, Feasibility, International Classification of Functioning, Disability and Health.

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INTRODUCTION

People suffering from an ailment with activity limitation require rehabilitative efforts to improve their quality of life. Quantification of affected lifestyle in terms of an extent of limitation of daily activities is a recommended assessment criteria for measuring the extent of morbidity. It facilitates the rational decision-making process in describing the health care needs. Disability-adjusted life years is a common and comparable indicator to assess the effect of health care interventions. However, the definition of disability depends upon on the justification of its measurement.¹ Measurement of an extent of disability at the population level helps to focus on the nature and content of public health interventions. An ICFDH has been observed as a relevant and useful tool to systematically record the information for functioning and disability.² It is the recommended classification, as preceding to the ICFDH, there was lack of tools to study the extent of community participation in people with disabilities.³

The ICFDH has been considered as a concept rather than the tool alone.⁴ It helps to quantify the levels of specific body functions, extent of impairment, nature of structural changes, limitation in the capacity and performance of daily activities, and role of environment in influencing the health.^{5,6} It has examined the constructs, as mentioned above, as a disease-independent measure, and has been observed to be feasible and useful.^{7,8} The tool observes to contain all possible codes to capture the wide spectrum of health, but it can be reduced to a limited number for better feasibility and practical use.⁹ Its use has been well studied in disease settings, but there was an attempt to understand the applicability of ICFDH in disease-independent settings in a community as a survey.

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In the current study, an abridged version of ICFDH was developed and studied for its applicability in the general population for quantification of the extent of functioning, disability, and health, along with summarizing the pattern of correlations among observed variables.

MATERIALS AND METHODS

A survey was carried among 72 individuals (rural: 36; urban: 36) using an abridged form of ICFDH questionnaire, version 2.1a. A team of three-member public health experts identified the following areas: functions (mental, sensory and pain, voice and speech, and neuromusculoskeletal and movement-related), brain and spine, structures related to movement, learning and applied knowledge, communication, self-care, interpersonal interactions and relationships, and environment (products and technology, support and relationships, attitude toward others, and services, systems, and platforms). As recommended by ICFDH, functions were assessed by a scoring for the extent of impairment as a first qualifier: 0 = No impairment means the person has no problem, 1 = Mild impairment means a problem that is present less than 25% of the time, with an intensity a person can tolerate and which happens rarely over the last 30 days, 2 = Moderate impairment means that a problem that is present less than 50% of the time, with an intensity, which is interfering in the persons day-to-day life and which happens occasionally over the last 30 days, 3 = Severe impairment means that a problem that is present more than 50% of the time, with an intensity, which is partially disrupting the person's day-to-day life and which happens frequently over the last 30 days, 4 = Complete impairment means that a problem that is present more than 95% of the time, with an intensity, which is totally disrupting the person's day-to-day life and which happens every day over the last 30 days. 8 = Not specified means there is insufficient information to specify the severity of the impairment, 9 = Not applicable means it is inappropriate to apply a particular code (e.g., b650 Menstruation functions for a woman in premenarche or postmenopause age). Impairment of body structures was assessed for; the extent of impairment and nature of change. The former was scored like scoring for functions, and the latter was scored as; 0 = No change in structure, 1 = Total absence, 2 = Partial absence, 3 = Additional part, 4 = Aberrant dimensions, 5 = Discontinuity, 6 = Deviating positions, 7 = Qualitative changes in structure, including accumulation of fluid, 8 = Not specified, and 9 = Not applicable. Activity limitation and participation restriction were assessed for performance and extent of restriction, and both were scored as the scoring was done for impairment of body structures. Scoring was done for barrier and facilitator to assess

the environment, with the coding as: 0 = No, 1 = Mild, 2 = Moderate, 3 = Severe, and 4 = Complete.¹⁰

Principal component analysis using R studio package (version 3.4.4) was done to detect a set of variables forming coherent subsets that are independent of each other. It has helped to summarize the pattern of correlations among observed variables by reducing them into a small number of components. All variables were normally distributed and had a linear relationship with each other. Factorability of the reproduced matrix depends on the size of the correlation between variables and components. In the current study, reproducibility of the matrix has been interpreted by the size of correlations and Bartlett's test of sphericity, a recommended test in small sample size. Sampling adequacy was also assessed using Kaiser–Meyer measure where a value of >0.6 is recommended for PCA. Before running the PCA, all variables were centered and scaled and components with an eigenvalue of more than one were reported in the current study. An eigenvector of each variable with components with a value of more than one was reported, where a correlation between variable and component was presented only for the first two extracted components. Correlations less than 0.30 were not reported in the current study. However, the sample size was limited, but, for the rural and urban area, the “*gg plot*” was examined to look for any difference in the pattern of correlations between variables and components.

RESULTS

Study subjects had a mean age of 35 (SD ± 5.4) years and 58.0% were males. The average score did not show any statistically significant difference in the rural and urban area. The average score for functions ranges from 0.37 to 1.04, indicating mild impairment. Mild impairment and total to partial absence, as a nature of change, of brain and spine, were observed with an average score of 0.47 to 1.10 respectively. Like brain and spine, mild impairment with no change in structure was observed as a nature of change in structures related to movement. The average score for performance and capacity was observed to be 1.31 (mild) and 1.53 (moderate) respectively for learning and applied knowledge. Similarly, mild-to-moderate score was also observed for communication in its performance and capacity. Assessment for self-care was observed with an average score of 0.41 for performance and 0.54 for capacity, whereas the average score of performance and capacity was observed to be 0.65 and 0.78 respectively for interpersonal interactions and relationships. Environmental support was observed with an average score of 2.78 for products and technology, 3.47 for supports and relationships, 3.42 for attitude toward others, and 3.29 for services, systems, and platforms (Table 1).

Table 1: Score distribution on the ICFDH tool among a small subset of general population, Himachal Pradesh, India

Area	Type	Average score (mean \pm SD)			
		Rural (36)	Urban (36)	p-value	Both (72)
Functions	Mental	0.91 (1.11)	0.70 (0.92)	0.375	0.81 (1.00)
	Sensory and pain	0.31 (0.40)	0.42 (0.53)	0.360	0.37 (0.48)
	Voice and speech	0.85 (1.13)	1.11 (1.36)	0.394	1.04 (1.29)
	Neuromusculoskeletal and movement-related	0.69 (0.64)	0.68 (0.61)	0.943	0.67 (0.62)
Impairment	Brain and spine	0.47 (0.70)	0.50 (0.70)	0.862	0.47 (0.69)
Nature of change	Brain and spine	1.05 (1.60)	0.93 (1.43)	0.725	1.10 (1.52)
Impairment	Structure related to movement	0.25 (0.32)	0.42 (0.59)	0.130	0.33 (0.48)
Nature of change	Structure related to movement	0.29 (0.54)	0.65 (0.87)	0.045	0.48 (0.74)
Performance	Learning and applied knowledge	1.41 (1.28)	1.17 (1.09)	0.402	1.31 (1.18)
Capacity	Learning and applied knowledge	1.56 (1.37)	1.47 (1.34)	0.790	1.53 (1.35)
Performance	Communication	1.04 (1.01)	1.08 (1.01)	0.864	1.09 (1.01)
Capacity	Communication	1.27 (1.21)	1.42 (1.27)	0.600	1.38 (1.24)
Performance	Self-care	0.47 (0.81)	0.37 (0.64)	0.564	0.41 (0.72)
Capacity	Self-care	0.59 (0.93)	0.51 (0.84)	0.720	0.54 (0.87)
Performance	Interpersonal interactions and relationships	0.72 (1.22)	0.60 (1.01)	0.646	0.65 (1.10)
Capacity	Interpersonal interactions and relationships	0.84 (1.40)	0.74 (1.19)	0.743	0.78 (1.27)
Environment	Products and technology	2.39 (1.96)	1.99 (1.91)	0.383	2.78 (2.68)
	Support and relationships	3.76 (1.30)	3.02 (2.22)	0.088	3.47 (1.97)
	Attitude toward others	3.40 (1.13)	3.38 (1.53)	0.965	3.42 (1.42)
	Services, system, and platforms	3.19 (1.32)	2.92 (1.51)	0.417	3.29 (1.81)

In a small sample of 72 individuals (rural: 36; urban: 36), PCA with varimax rotation was performed on 20 times of the ICFDH tool. Sizes of correlation were significant in the matrix with statistically significant Bartlett's test of sphericity ($p = 0.00$) with good factorability (Kaiser-Meyer = 0.76). Totally five factors were extracted with an eigenvalue of more than 1 to display the eigenvectors. These five factors explain 77.0% of the total variance, the first factor explains 41.9%, second 13.9%, third 10.4%, and the last two factors explain 5.0% each. Since two components explain the most of variance, looking at covariance of these two factors, it is observed that the first factor accounts for 75.0% and the second one explains 25.0% of the variance in the solution. All variables well explained the extracted components, as the variable "technology" had the lowest communality value of 0.50, and 13 variables had the communality value of more than 0.70. It indicates that almost all variables load to the components reflecting the homogeneity of ICF items.

The first two components explain maximum (55.0%) of variance, so the variables loading to them are reported and discussed. For the first component, the variables with positive and high loading are: performance of learning (0.92), capacity of learning (0.91), mental functions (0.90), performance of communication (0.85), capacity of communication (0.85), capacity of interpersonal interactions and relationships (0.83), performance of interpersonal interactions and relationships (0.81), impairment of brain and spine (0.79), extent of change of brain and spine (0.74), capacity of self-care (0.63), and performance of

self-care (0.66). Relative to the first component, voice (0.55), technology (0.33), and system (0.30) are positively loaded to the second extracted component. Impairment in movement (-0.57), the capacity of self-care (-0.55), the performance of self-care (-0.52), the performance of interpersonal interaction (-0.37), and capacity of interpersonal relations (-0.34) have negative loadings (Table 2 and Graph 1). The said difference in the pattern of correlations was observed to be indifferent to the rural and urban area (Graph 2).

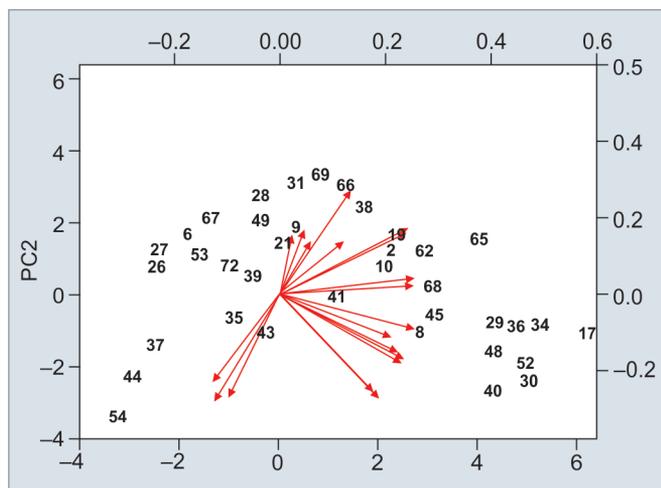
DISCUSSION

The ICFDH application for a community-based assessment of functioning, disability, and health revealed mild functional limitation related to mental, sensory and pain, voice and speech, and neuromusculoskeletal and movement. Brain and spine, and structures related to movement were also observed with mild-to-moderate level of impairment. The assessed population had more of spinal problems, so a relatively high average score (1.10) was observed indicating a change in structure. However, nature of change had a low average score of 0.48, indicating "no change" in structures related to movement. The capacity and performance of learning and applied knowledge, communication, self-care, and interpersonal interactions and relationships were observed to be mildly limited. Looking for nature of the environment, it was observed to be a barrier of moderate-to-severe nature. The ICFDH observed a limited environmental support and mildly affected functioning,

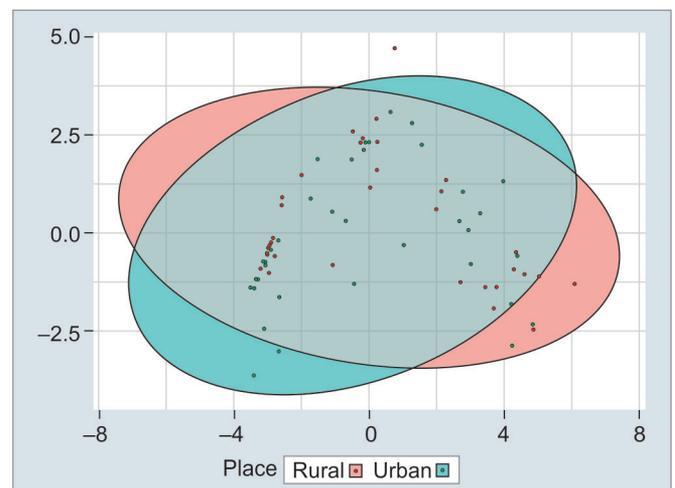
Table 2: Principal component analysis of the ICFDH tool among a small subset of general population, Himachal Pradesh, India

Area	Type	PC1	PC2	Communalities
Functions	Mental	0.90	-0.18	0.8424
	Sensory and pain	0.42	0.27	0.2493
	Voice and speech	0.47	0.55	0.5234
	Neuromusculoskeletal and movement related	-0.33	-0.55	0.4114
Impairment	Brain and spine	0.79	-0.31	0.7202
Nature of change	Brain and spine	0.74	-0.22	0.5960
Impairment	Structure related to movement	-0.43	-0.57	0.5098
Nature of change	Structure related to movement	-0.44	-0.46	0.4052
Performance	Learning and applied knowledge	0.92	0.04	0.8480
Capacity	Learning and applied knowledge	0.91	0.08	0.8345
Performance	Communication	0.85	0.32	0.8249
Capacity	Communication	0.85	0.35	0.8450
Performance	Self-care	0.63	-0.52	0.6673
Capacity	Self-care	0.66	-0.55	0.7381
Performance	Interpersonal interactions and relationships	0.81	-0.37	0.7930
Capacity	Interpersonal interactions and relationships	0.83	-0.34	0.8045
Environment	Products and technology	0.16	0.33	0.1345
	Support and relationships	0.20	0.27	0.1129
	Attitude toward others	0.15	0.04	0.0241
	Services, system, and platforms	0.08	0.30	0.0964
	Sum of square loading			10.9809
Proportion of variance		0.41	0.13	
SD		2.89	1.67	
Proportion of covariance		0.75	0.25	

PC: Principal component



Graph 1: R plot for direction of loadings on first two extracted PC for variables of the ICFDH tool among a small subset of general population, Himachal Pradesh, India. PC: Principal component



Graph 2: The “gg plot” difference in loadings for rural and urban differential on the first two extracted PC for the ICFDH tool among a small subset of general population, Himachal Pradesh, India. PC: Principal component

disability, and health observed in the study population. The assessment of ICFDH scale observed that the first two extracted principal components explain 54.0% of the variability of 20 included variables of the ICFDH and 75.0% of variables explain the variance in the first extracted component. Irrespective of the geographic differential (rural and urban), it has been observed to be a feasible method for administering in general population

with a better correlation among variables with the extracted components.

Evidence confirms that the ICFDH tool has a very broad range of classification covering most of the health-related concepts and domains capturing human experience of functioning and disability, and the influencing environmental factors (Table 3).¹¹ Current experience of assessing the applicability of ICFDH observed that a large

Table 3: Abbreviations for the “R Plot”

Area	Type	Abbreviations
Functions	Mental	mental
	Sensory and pain	sensory
	Voice and speech	voice
	Neuromusculoskeletal and movement related	Muscle
Impairment	Brain and spine	brainspineimp
Nature of change	Brain and spine	brainspinechange
Impairment	Structure related to movement	movementimp
Nature of change	Structure related to movement	movementchange
Performance	Learning and applied knowledge	learningperform
Capacity	Learning and applied knowledge	learningcapacity
Performance	Communication	commperform
Capacity	Communication	commcapacity
Performance	Self-care	selfcareperform
Capacity	Self-care	selfcarecapacity
Performance	Interpersonal interactions and relationships	ipperform
Capacity	Interpersonal interactions and relationships	ipcapacity
Environment	Products and technology	technology
	Support and relationships	support
	Attitude toward others	attitude
	Services, system, and platforms	system

amount of variability was observed to be largely due to the variables assessing the extent of activity limitation and participation restriction. Variables assessing the nature of environment did not explain much of the variables in the dataset. Included variables were observed to be coherent with the theoretical construct of the ICFDH, and the study tool is quite feasible to administer in clinics and research with a benefit to observe the changing trends of disability with the supporting environment. Regular community-based assessment for the degree of functioning, disability, and health helps to review the performance of the health interventions focusing on various diseases causing disability. It also helps to reorient the community-based rehabilitative programs to improve health outcomes.^{12,13}

Application of the ICFDH tool in general population helps to give a unique understanding of human functioning and guide to formulate the comprehensive programs. It promises a suitable, comprehensive, and valid measure to optimally measure the human functioning.¹⁴ It serves as a baseline and a progressive monitoring indicator to measure the individual and community-based rehabilitative efforts. Continuous capturing gives a time trend and assists to identify the focus areas like improving capacity and performance of activities by facilitating the improvement in body functions and structures, and/or creating an enabling environment. It can be well tailored to the nature of disease and disability in order to align the secondary and tertiary prevention.

The ICFDH was observed with difficulty in documenting the findings and often observed to be a time-consuming exercise. Although it gives a valid assessment

to observe the progress toward the goal of the intervention,¹⁰ in the current study, no such effect of any intervention was assessed. However, the applicability of abridged version of ICFDH in a community-based setting has been observed without any rural and urban differentials. Twenty variables were included to assess the functioning, disability, and health with a limited sample size of a normal population, and the variables explained good amount of variability in the collected information. The ICFDH gives a real-time presentation of the collected information due to its contribution toward the understanding of the continuum of health. It gives an opportunity to understand the health as a process, living life, and the influencing factor. It is a valid tool and focuses on the interest of the patients by incorporating patients' perspective. The assessment of nature and effect of morbidity on daily life helps to formulate reliable public health interventions. The joint use of ICFDH and International Classification of Disease has been quite appreciated and promoted for use among clinicians of all rehabilitative disciplines.

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