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Psychometric Analysis of Craig Hospital Inventory of Environmental Factors Short Form in Spinal Cord Injury Subjects in Indian Population

Lal Prateek*, Sehgal Stuti**

*Research Student, Institute of Rehabilitation Sciences, Indian Spinal Injuries Centre, New Delhi
**Assistant Professor, Institute of Rehabilitation Sciences, Indian Spinal Injuries Centre, New Delhi

Corresponding Author: Lal Prateek

ABSTRACT

Background and Purpose: People with Spinal Cord Injury face environmental barriers which prevent them in community participation in India. Due to presence of stairs and lack of curb cuts in sidewalks decreases mobility significantly and impairs one's ability to participate fully. Hence there is a need to assess environmental barriers for people with Spinal cord Injury. Therefore, the purpose of this study is to find out the content validity, concurrent validity, intra-rater and inter-rater reliability of the Craig Hospital Inventory of Environmental factors Short Form (CHIEF – SF) scale and to compare the (CHIEF – SF) scores in Indian population with the International data available.
Materials and Method: A total of 76 subjects with spinal cord injury of more than 1 year duration had participated. Initially Phase I, II, III was applied on 30 subjects and later Phase IV on the total 76 subjects. The study was done in four phases: Phase I: content validation of the Scale; Phase II Intra – rater, Inter – rater reliability of the scale; Phase III: Concurrent Validity with Satisfaction with Life Scale (SWLS) and Craig Handicap Assessment and Reporting Technique (CHART); and Phase IV Normative data and comparison with the international data.
Results: The top 5 barriers were Transportation, Government policies, Discrimination, Natural environment and Help home. For the inter-rater and intra-rater reliability, the intraclass correlational coefficients were 0.861 and 0.844 respectively. The content validity was established by calculating the CVR ratio and was 0.99 for each CHIEF – SF item. For concurrent validity Pearson's correlational coefficient was used and significant negative correlation was found on both Satisfaction with Life Scale ($r = -0.527^{**}$, $p \leq 0.01$) and CHART scale ($r = -0.457^{*}$, $p \leq 0.05$).
Conclusion: The CHIEF – SF is a valid and reliable scale which can be used in Indian spinal cord injury subjects.

Keywords: Environment, Rehabilitation, Spinal cord injuries.

INTRODUCTION

Spinal Cord Injury occurs when the spinal cord is damaged as a result of trauma, disease process, or congenital defects. The clinical manifestation of the injury vary depending on the extent and location of the damage to the spinal cord.[1] Long term disability resulting from SCI not only translates into personal and financial losses for the affected individual, but also exert a significant loss on the economy and healthcare system through lost productivity, revenue, and the substantial costs associated with long term care and the ancillary issues that arise in the setting of SCI[2]. Researchers have found that while the level and extent of neurologic preservation does predict independence in activities of daily living (ADLs)[3,4] certain medical complications[5,6] and mortality[7], they do not strongly predict such post injury outcomes as perceived stress,[8-10] emotional distress,[11] marital stability,[12,13] long term job and employment stability,[14] productivity,[15,16] life satisfaction,

perceived well-being, or quality of life (QOL)[17,18]. Instead, these outcomes are influenced by such diverse factors as family support, adjustment and coping, productivity, self - esteem, financial stability, education, and the physical and social environment[9-18].

The fact that people with SCI face environmental barriers to community participation is well established.[19-23] Three models of disability, the World Health Organization (WHO) model, [24] the Institute of Medicine (IOM) model, [25] and the Quebec model, [26] emphasize the environment as an important determinant of disability. They differ somewhat in the detail of how this influence operates, but the models agree that disability cannot be fully understood without considering the environmental context. The Quebec model, published by Fougeyrollas et al, [27] in 1993, was the first to prominently articulate how environmental factors influence the societal participation of people with disabilities. In the Quebec model, the 3 primary determinants of participation (or life habits) are (1) organ system factors related to disability, such as impairments of body function and structure; (2) activity limitations and compensatory abilities; and (3) environmental factors, defined as all external factors that influence participation, either as a barrier or a facilitator. The IOM updated its conceptual model in the book Enabling America: Assessing the Role of Rehabilitation Science and Engineering, [25] published in 1997. This model explicitly identifies the role of the environment and shows disability more clearly as the interaction between the person and the environment. The existence of barriers in the environment promotes discrimination, prevents participation, restricts choice, and frustrates attempts at independence of those with SCI.[28] The increased emotional distress often associated with SCI may not necessarily stem from the individual's limitations, but rather from encounters with barriers in the environment that inhibit participation in life activities and access to necessary services.[29] Commonly cited reasons for lack of community participation by those with SCI are physical environmental barriers such as the presence of stairs and lack of curb cuts in sidewalks. Decreased mobility significantly impairs one's ability to participate fully in social settings.[30] Social barriers to community participation after SCI include public attitudes related to those with disability and the associated discrimination that often occurs.

Physical environments may facilitate the participation of people with spinal cord injury or may act as barriers to participation. Accessibility is one of the cross-cutting general principles listed in Article 3 of the Convention on the Rights of Persons with Disabilities while Article 9 specifically highlights the importance of accessibility, including buildings and transportation.[31]The physical environment and transportation are among the key environmental barriers for people with Spinal Cord Injury. [32-36] Environmental barriers in people with SCI are explored progressively, beginning with housing – to which a person who recently developed SCI will have to return after rehabilitation – then continuing with transport, which will be vital to participating in the community, and finishing with public buildings – such as schools and workplaces – where access is needed to fulfil rights to education and employment. [37]Reports from countries with laws on accessibility, even those dating from 20 to 40 years ago, confirm a low level of compliance. [38-41] A technical survey of 265 public buildings in 71 cities in Spain found that not a single building surveyed was 100% compliant, and another in Serbia found compliance rates ranging between 40% and 60% [40] There are reports from countries as diverse as Australia, Brazil, Denmark, India, and the United States of similar examples of non-compliance [39,40,42,43]. There is an urgent need to identify the most effective ways of enforcing laws and regulations on accessibility – and to disseminate this information globally.

Typically, available tools for assessing the environment concentrate on only 1 category of factors and measurement scales are not used. For example, several checklists[44-52] have been developed to determine if particular types of structures or facilities meet minimum physical accessibility requirements under the Americans with Disabilities Act [53] or building codes. On the other hand, Steinfeld and Danford [54] indirectly assessed environments by objectively measuring an individual's independence in performing ADLs in different environments. Their measurement was unique to a given individual in a particular environment, but only physical aspects of the immediate environment were assessed. Gray et al [55] took a more subjective approach to measuring physical environments by assessing the extent of perceived physical barriers encountered by people with mobility impairments. The Quebec Environmental Assessment6 (QEA) is the only comprehensive instrument designed to assess the breadth of environmental factors envisioned in the recent environmental conceptualizations and taxonomies. The QEA is a detailed instrument for use by people with disabilities to document the extent to which over 100 elements of the environment act as either obstacles or facilitators to full participation in society. Respondents rate each environmental element on a 7-point scale from "major, moderate, and minor obstacle" through "no influence" to "minor, moderate, or major facilitator." Although this instrument's use has been limited to people with specific impairments such as spinal cord injury (SCI), it has shown that elements of the environment interact with individual health conditions in unique ways. These elements are obstacles for some individuals, facilitators for others. To date, no instrument for assessing environmental factors in the general population and among people with disabilities is both comprehensive in scope and designed for large-scale survey research.

Craig Hospital Inventory of Environmental Factors[56,57] scale is a self – administered questionnaire initially developed by Gale G. Whiteneck et al and published and validated in 2004 in subjects with disabilities from spinal cord injury, traumatic brain injury, multiple sclerosis, amputation, or auditory or visual impairments. The Craig Hospital inventory of Environmental factors has been translated to Brazilian, Persian and many other languages and has shown good validity and reliability. As conceptualized in the development of this measure, environmental barriers are the barriers that keep people with disabilities from functioning within the household and community and from doing what they need or want to do. These include social, attitudinal, and policy barriers, as well physical and architectural barriers. Respondents are asked to provide information about the frequency of their encounters with each type of barriers listed (daily, weekly, monthly, less than monthly, never) and the magnitude of the problem when it occurs (big or little).

The CHIEF total score has high test-retest reliability (intraclass correlation coefficients [ICC] = 0.93) and high internal consistency (Cronbach's α = 0.93) (Whiteneck et al 2004). The CHIEF-SF items reference the past year. Because the 25-item CHIEF survey takes about 10 to 15 minutes to administer by interview, it may not be practical or feasible to use in large-scale studies or for on-going surveillance activities. Thus, the final stage in developing and testing the CHIEF was the creation of a shorter version of the instrument. The goal was to select a subset of items that retained all 5 of the CHIEF subscales but provided a shorter, more practical form. In general, these criteria included items that had the highest scores (indicating greater barriers), had the highest correlations with subscale and total scores, and best differentiated between people with and without disability. Correlations between CHIEF subscales and total score from the long form and short form ranged from .794

to .960. Gale Whitenenck et al 2004 did a study in SCI subjects to determine the role of environmental factors in participation and life satisfaction with 2726 SCI subjects recruited from Model Spinal Cord injury Systems in the United States and this data will be compared with the data obtained from the present study.

The CHIEF-Short Form (CHIEF-SF), used in this study, utilized the 12 items of the longer version. Scores are calculated as stated for the CHIEF long form using only 12 items within the original 5 subscales instead of 25 items. The purpose of the study, therefore, is to find the reliability and validity of Craig Hospital Inventory of Environmental Factors Short Form (CHIEF-SF) in Spinal Cord Injury subjects in Indian population and to compare the data with the available international data.

SUBJECTS AND METHODS

76 Subjects with spinal cord injury who met the inclusion and exclusion criteria were recruited for the study from Indian Spinal Injuries Centre, New Delhi, and also from Paraplegic Foundation, Mumbai. The study was approved by the Institute's Research review committee and the institute's ethical committee. Inclusion criteria for the study included subjects, who were 1 year post spinal cord injury, were 18 years of age, able to read and understand English language and who were willing to participate in the study and sign the consent form.[23, 24] Subjects were excluded if they had other neurological disorders besides spinal cord injury, less than 1 year after spinal cord injury, uncooperative and who did not sign the consent form. All the subjects were explained about the research study and signed consent form were obtained. Detailed demographic data of the subjects were collected.

Content Validity:

Content validity refers to the extent an instrument measures what it is supposed to measure, also the extent to which the instrument provides adequate coverage of the item under study. We calculated the content validity based on the following steps which include: -

1. Creating an initial draft of the scale – initial draft was already developed in the initial stage.
2. Selecting a panel of reviewers/jury to evaluate the scale: - the final panellists for content validation were both experienced and qualified individual and focused group members. In all there were 10 jurors on the panel to evaluate the scale. The Subject Matter Experts were Three Physiotherapist, Three Occupational Therapist, One Peer Counsellor, One Psychologist, One Assistive Technologist and One Social Worker.

Jurors conducted the qualitative and quantitative review of the scale. The content validity ratio was calculated for each item in the questionnaire and the Content Validity Index was found by calculating the average of each item in the questionnaire.

Concurrent validity: - the concurrent validity of the CHIEF – SF was calculated by comparing the scale with Satisfaction with Life Scale (SWLS) and Craig Handicap Assessment and Reporting Technique (CHART). The scores of the CHIEF – SF were compared with the total scores of SWLS and CHART. To statistically quantify the correlation we used Pearson's correlation coefficient.

Reliability:

For reliability of the scale we administered the CHIEF – SF questionnaire to the sample stratified population of 30 subjects and then the next reading of the scale was done after a period of approximately 2 weeks.

To calculate the Inter – rater reliability the second reading is taken by another rater who is well versed with the CHIEF – SF questionnaire. The second rater is blinded with the evaluation of the initial reading of the scale.

To calculate the Intra – rater reliability the second reading is taken by the

same rater after a period of approximately 2 weeks.

Both the raters did not witness the initial evaluation of the CHIEF – SF scores. To statistically quantify reliability we used Intraclass correlational coefficient.

Normative Data: A sample of 76 subjects were taken. The spinal cord injury subjects were recruited based on the inclusion and exclusion criteria. The duly signed consent form was obtained from subjects willing to participate in the research. Detailed demographic data was collected. The CHIEF – SF was administered and the Frequency, Magnitude and the Total score was calculated. Cross-sectional samples were collected from the community to administer CHIEF-SF. Data was collected in person through interview and the scores were also calculated from Paraplegic foundations, Sion, Mumbai and Differently abled charitable trust Thane, Mumbai. Data was also collected telephonically randomly from places in southern India like Chennai, Coimbatore, Bengaluru etc. The normative data was calculated based on the total scores collected on CHIEF - SF.

Data Analysis:

All Statistical analysis were performed using the Statistical package for Social Sciences (SPSS) for windows software version 22. Demographic data of the subjects with spinal cord injury was analysed using Kruskal Wallis test across various variables like age, gender, years post injury, marital status at the time of injury, educational status at the time of injury, neurological level and impairment. Interclass correlation coefficient (ICC) was used to find out the inter – rater and intra – rater reliability of CHIEF – SF. Pearson's correlational coefficient was used to find the concurrent validity of CHIEF – SF with SWLS and CHART scales. A significant level of $p \leq 0.05$ was used to determine statistical significance.

RESULTS

A total of 30 spinal cord injury subjects were recruited for psychometric analysis of CHIEF - SF that met the inclusion and exclusion criteria. The variables used in this study are Craig Hospital Inventory of Environmental Factors – Short Form (CHIEF - SF), Satisfaction with Life Scale (SWLS) and Craig Handicap Assessment and Reporting Technique (CHART). The following section documents the observations and results obtained as a result of statistical analysis. These results have also been tabulated and represented graphically.

The 3 Variables used in this study are - Craig Hospital Inventory of Environmental Factors – Short Form (CHIEF - SF), Satisfaction with Life Scale (SWLS), and Craig Handicap Assessment and Reporting Technique (CHART).

A total of 76 spinal cord injury subjects were recruited that met the inclusion and exclusion criteria for the estimation of normative data which was compared with the available international data.

Mean and Standard deviation of age in spinal cord injury subjects

Mean and Standard deviation of the age of spinal cord injury subjects were 31.6711± 10.83376 respectively.

Percentage distribution in spinal cord injury subjects according to Gender, Marital status, occupation status and educational status

Percentage Gender distribution of the spinal cord injury subjects revealed there were 14.5 % of Females and 85.5 % of Males. Percentage marital distribution of the spinal cord injury subjects showed 71.1% of Single subjects and 28.9% of married subjects. Percentage distribution of educational status of the spinal cord injury subjects were as follows subjects whose educational status was below high school were 42.1%, subjects whose educational status was senior secondary were 27.6%, subjects who were Graduates were 25.0%

and subjects who were Post – Graduate were 5.3%. Percentage distribution of occupation at the time of injury of the spinal cord injury subjects were as follows: Subjects who were employed at the time of injury were 31.6%, subjects who were student at the time of injury were 51.3%, subjects who were homemaker were 4%, subjects who were unemployed were 3.9% and subjects who were in others category were 7.9%

Table 1: Inter – rater Reliability of Craig Hospital Inventory of Environmental Factors

Variable	ICC	95% Confidence Interval
CHIEF-SF FR vs. CHIEF-SF SR	0.861	0.773 - 0.925

CHIEF-SF FR: Craig Hospital Inventory of Environmental Factors score by First rater.
CHIEF-SF SR: Craig Hospital Inventory of Environmental Factors score by Second rater.

Table 2: Intra – rater Reliability of Craig Hospital Inventory of Environmental Factors

Variable	ICC	95% Confidence Interval
CHIEF-SF FR 1 vs. CHIEF-SF FR2	0.844	0.745 - 0.916

CHIEF-SF FR 1: Craig Hospital Inventory of Environmental Factors score by First rater first reading.
CHIEF-SF FR2: Craig Hospital Inventory of Environmental Factors score by First rater second reading.

Table 3: Correlation of CHIEF - SF score with SWLS

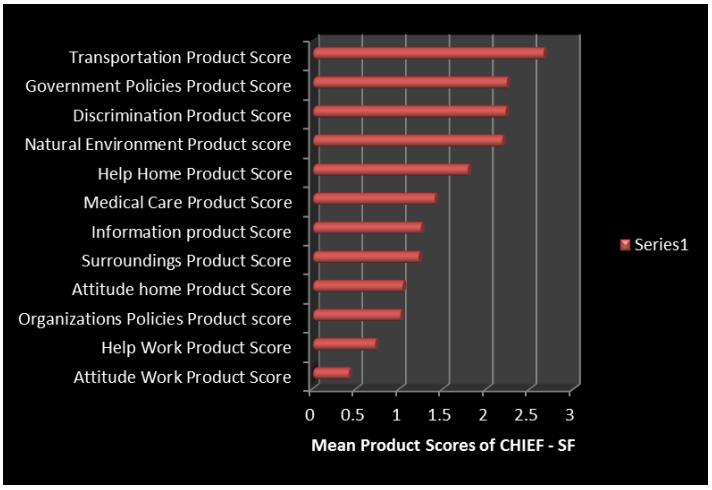
Variables	SWLS Total
Chief – Physical	-0.441*
Chief –Services	-0.438*
Chief – Work	-0.298
Chief – Attitudinal	-0.493**
Chief – Policy	-0.148
Chief – Total	-0.527**

*** Correlation is significant at the 0.01 level (2-tailed).*
** Correlation is significant at the 0.05 level (2-tailed).*
SWLS: Satisfaction with Life Scale.

Table 4: Correlation of CHIEF – SF with CHART.

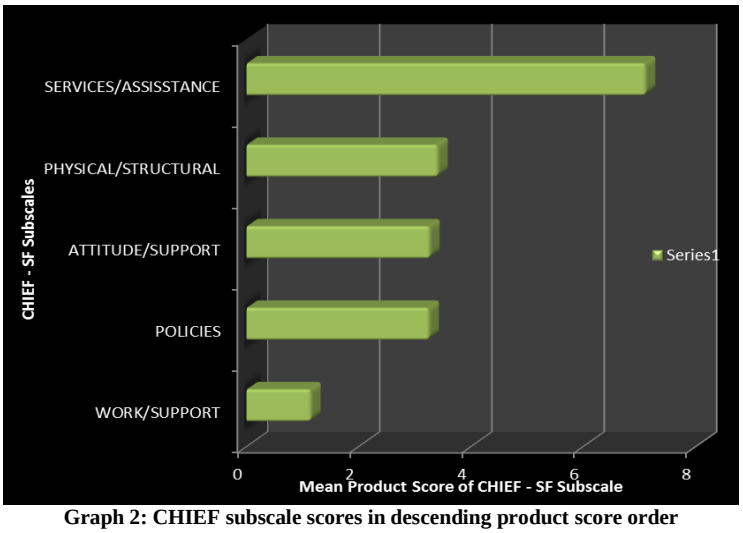
Variables	Chart Physical	Chart Cognitive	Chart Mobility	Chart Occupation	Chart Social Integration	Chart Economic Self-Sufficiency	Chart Total
Chief- Physical	-0.315	-0.234	-0.519**	-0.295	-0.301	-0.173	-0.408*
Chief-Services	-0.301	-0.091	-0.417*	-0.344	-0.296	-0.464*	-0.482**
Chief – Work	-0.163	-0.118	-0.244	-0.324	-0.318	-0.271	-0.319
Chief – Attitudinal	-0.343	-0.324	-0.400*	-0.474**	-0.156	-0.122	-0.420*
Chief – Policy	0.054	0.348	0.108	0.143	-0.100	0.072	0.082
Chief – Total	-0.327	-0.143	-0.459*	-0.371*	-0.351	-0.272	-0.457*

*** Correlation is significant at the 0.01 level (2-tailed).*
** Correlation is significant at the 0.05 level (2-tailed).*
CHART: Craig Handicap Assessment and Reporting Technique



Graph 1: CHIEF – Short Form item score in descending product score order

Figure 1 depicts the average product score of chief scale and shows that transportation, government policies, discrimination, natural environment and help home were among the top 5 barriers as reported by the subjects with spinal cord injury. In the previous study the top 5 environmental barriers were reported to be Natural environment, transportation, help at home, health care and government policies respectively.



Graph 2: CHIEF subscale scores in descending product score order

Figure 2 graphs not only the average product score but also the average frequency and average magnitude scores. Figure 2 also states that the Natural Environment which has fourth highest product score ranks second on the frequency score indicating that barriers by natural environment are more frequent but not very problematic. Similarly barriers due to help at home has been ranked fifth based on product score but ranks third on frequency score revealing that the barriers due to help at home is more frequent. With these two exceptions rest all the frequency, magnitude and product scores follow the same pattern throughout. Medical care, information, surrounding, attitude home and organization policy posed less severe environmental barriers. Help and attitude at work or school received the lowest scores.

Figure 3 graphs the average CHIEF – SF sub scores. People with spinal cord injury reported that barriers in the transportation, information, medical care and help at home (the Service and assistance subscale) were the most problematic, followed by barriers in natural environment and surrounding (which make up the Physical/structural subscale), attitudes at home and discrimination (attitude/support subscale), barriers in business and government (the policies subscale) and help and attitudes at work or school (work/school subscale). In the previous study the Physical/structural subscale was ranked the highest score which was followed by services/assistance, policies, attitudes/ support and work/school.

Inter – rater reliability of Craig Hospital Inventory of Environmental Factors – Short Form

Inter – class correlation coefficient was calculated for inter – rater reliability. 95% confidence interval was also calculated. The result shows a high inter – rater reliability of Craig Hospital Inventory of Environmental Factors – Short Form in spinal cord injury subjects in Indian population.

Inter – rater correlation coefficient for Craig Hospital Inventory of Environmental Factors – Short Form was good and was calculated to be 0.861**. 95% confidence interval for Craig Hospital Inventory of Environmental Factors – Short Form ranged from 0.773 to 0.925**. Figure 1 graphically represents the Inter – rater reliability of Craig Hospital Inventory of Environmental Factors – Short Form. Similar results were found in the previous studies.

Intra – rater reliability of Craig Hospital Inventory of Environmental Factors – Short Form

The intra – rater reliability of Craig Hospital Inventory of Environmental Factors – Short Form was calculated by intra – class correlation coefficient. 95%

confidence interval was also calculated. The result showed high intra rater reliability of Craig Hospital Inventory of Environmental Factors – Short Form in spinal cord injury subjects in Indian population.

Intra – rater reliability of the Craig Hospital Inventory of Environmental Factors – Short Form was good and calculated to be 0.844**. 95% confidence interval was also calculated for Craig Hospital Inventory of Environmental Factors – Short Form and it ranged from 0.745 to 0.916**. Figure 2 illustrates graphically the intra – rater reliability of the Craig Hospital Inventory of Environmental Factors – Short Form. Similar results were found in the previous studies.

Correlation of Craig Hospital Inventory of Environmental Factors – Short Form with Satisfaction with Life Scale (SWLS)

A significant negative correlation with r value of -0.527** was found when the total scores of Craig Hospital Inventory of Environmental Factors – Short Form was compared with Satisfaction With Life Scale in spinal cord injury subjects in Indian population. Similar results were observed in the previous study by Gale Whiteneck et al 2004.

Correlation of Craig Hospital Inventory of Environmental Factors – Short Form with Craig Handicap Assessment and Reporting Technique

A significant negative correlation was discovered with r value of -0.457* when the total score of Craig Hospital Inventory of Environmental Factors – Short Form with Craig Handicap Assessment and Reporting Technique were compared. However, most of the subscales of Craig Hospital Inventory of Environmental Factors – Short Form with Craig Handicap Assessment and Reporting Technique showed significant negative correlation. Mobility subscale of Craig Handicap Assessment and Reporting Technique showed negative significant correlation with Physical, Services and Attitudinal barriers of Craig Hospital Inventory of Environmental Factors – Short Form and also with Total CHIEF – SF score i.e. – 0.579*, – 0.417*, – 0.400* and – 0.459* respectively. Occupation subscale of CHART illustrated significant negative correlation with Attitude subscale and CHIEF – SF total score with – 0.474* and – 0.371* respectively. CHART total score represented significant negative correlation with Physical, Services, Attitudinal subscales and Total CHIEF scores with – 0.408*, - 0.482*, - 0.420* and - 0.457* respectively. Similar results were observed in the previous study by Gale Whiteneck et al 2004.

We accomplished our objective of determining the content and concurrent validity and the inter and intra – rater reliability of Craig Hospital Inventory of Environmental Factors short form and also defining the normative data for spinal cord injury subjects in Indian population.

The Content Validity Ratio was estimated to be 0.99 by Ten Subject Matter Experts. The minimum CVR according to C. H. Lawshe for 10 Subject Matter Experts is 0.62. Therefore, the Craig Hospital Inventory of Environmental Factors short form in spinal cord injury subjects in Indian population establishes good content validity.

To calculate the reliability of Craig Hospital Inventory of Environmental Factors short form in spinal cord injury subjects in Indian population, intraclass correlation coefficient (ICC) were calculated. Intraclass correlation coefficient values were interpreted according to Shrout and Fleiss as follows: less than 0.00 indicates poor; 0.00 to 0.10 virtually none; 0.11 to 0.40 slight; 0.41 to 0.60 fair; 0.61 to 0.80 moderate and 0.81 to 1.00 substantial agreement. (P.E. Shrout and J.L.Fleiss, Intraclass correlation; uses in assessing rater reliability, Psychol Bull 1979; 420-428).

In the present study the inter – rater reliability and intra – rater reliability was good and calculated to be 0.861 and 0.844 respectively. This was similar to that which was reported in the previous study by Gale

Whiteneck et al, 2004 (intra class correlation coefficient ICC 0.93).

In evaluating the concurrent validity the Craig Hospital Inventory of Environmental Factors short form with the Satisfaction with Life Scale and Craig Handicap Assessment and Reporting Technique both showed significant negative correlation. The correlation between Craig Hospital Inventory of Environmental Factors short form and Satisfaction with Life Scale was found out to be -0.527**. The significant negative correlational values with Satisfaction With Life Scale were expected since Craig Hospital Inventory of Environmental Factors short form assesses the environmental factors which keeps the subject from doing what he wants or needs to do and to function within the household and community and Satisfaction With Life Scale assess the satisfaction of life revealing that with greater scores of perceived environmental barriers the satisfaction of life scores will decrease. As the correlational values are significant it suggests that environmental barriers have an effect on the satisfaction in life.

Three subscales of Craig Hospital Inventory of Environmental Factors short form showed significant negative correlation with Satisfaction with Life Scale which are Physical barriers, Barriers due to Services and Attitudinal barriers (- 0.441*, - 0.438*, - 0.493** respectively).The Physical subscale includes barriers from natural environment and barriers from surrounding, which is inversely proportional to the scores in Satisfaction with Life Scale since there is negative correlation so with increasing barriers there will be decrease in the scores of satisfaction with life. Therefore barriers from natural environment and barriers from surrounding have a significant impact on quality of life. Similar results were revealed from the Services subscale which includes barriers from transportation, information, medical care and help home. Since these activities are basic needs in daily living it will significantly affect the quality of life of individual with spinal cord injury. Attitudinal barriers which showed significance at 0.01 level with negative correlation has greater impact on the quality of life of individual with spinal cord injury.

There was significant negative correlation of Craig Hospital Inventory of Environmental Factors short form with Craig Handicap Assessment and Reporting Technique which professes that increasing scores in environmental barriers will prevent community participation. Moreover, the Craig Hospital Inventory of Environmental Factors short form subscales (Physical, Services, Attitude) had a significant effect on Craig Handicap Assessment and Reporting Technique Mobility subscale signifying due to increase in the Physical, services and attitudinal barriers mobility of the person with spinal cord injury is hampered. Similar results were shown in the previous studies.

Physical subscale of Craig Hospital Inventory of Environmental Factors short form revealed significant negative correlation with Mobility subscale and Total score of Craig Handicap Assessment and Reporting Technique. Mobility is the individual's ability to move about effectively in his/her surroundings. [45] So due to barriers from natural environment and barriers from surrounding, the individual with spinal cord injury will not be able to move about effectively which is in accordance with the results of the present study.

Services subscale of Craig Hospital Inventory of Environmental Factors short form demonstrated significant negative correlation with Mobility, Economic self-sufficiency and Total score of the Craig Handicap Assessment and Reporting Technique. The services subscale of Craig Hospital Inventory of Environmental Factors short form includes barriers from transportation, information, medical care and help home. Increased barriers from transportation, information, medical care and help home will decrease the individual's ability to move about effectively in his/her

surroundings. Likewise if the individual is not economically self-sufficient or not able to sustain customary socio-economic activity and independence [45] it may contribute to increased barriers faced from transportation, information, medical care and help home which in turn may reveal activity limitation and dependence in Activities of Daily Living (ADL).

Attitudinal subscale of Craig Hospital Inventory of Environmental Factors short form also displayed significant negative correlation with Mobility and Occupational subscale of Craig Handicap Assessment and Reporting Technique and also with Total score of Craig Handicap Assessment and Reporting Technique. Attitudinal subscale includes attitude at home and discrimination by others this will greatly reduce the mobility of an individual with spinal cord injury. Occupational subscale of Craig Handicap Assessment and Reporting Technique assess an individual's ability to occupy time in the manner customary to that person's gender, age and culture, it also include volunteer work, recreational pursuits and self-improvement activities these are greatly influenced by the attitude and support of family and others.

Total scores of Craig Hospital Inventory of Environmental Factors short form also exhibited significant negative correlation with Mobility, Occupation subscale and Total scores of Craig Handicap Assessment and Reporting Technique. This indicates that with increasing barriers as determined by total score of Craig Hospital Inventory of Environmental Factors short form will significantly affect and reduce the mobility and Occupational activities of an individual with spinal cord injury. This is in compliance with the previous studies done by Gale Whiteneck et al.

In the present study the top 5 environmental barriers were transportation, government policies, discrimination, natural environment and help home. These barriers are consistent with environmental issues discussed in spinal cord injury literature. In the previous study done by Gale Whiteneck et al 2004 the top 5 environmental factors were Natural environment, transportation, help at home, health care and government policies. This difference in the environmental barriers of the present study with previous study may be due to problems in accessibility which is one of the cross-cutting general principles listed in Article 3 of the Convention on the Rights of Persons with Disabilities while Article 9 specifically highlights the importance of accessibility, including buildings and transportation.[31]The physical environment and transportation are among the key environmental barriers for people with Spinal Cord Injury. [32-36] Reports from countries with laws on accessibility, even those dating from 20 to 40 years ago, confirm a low level of compliance. [38-41] There are reports from countries as diverse as Australia, Brazil, Denmark, India, and the United States of similar examples of non-compliance. [39,40,42,43] These reasons of non – compliance in accessibility and transportation is in accordance with the environmental barriers discovered in the present study.

The average CHIEF – SF scores and subscale scores did not differ significantly by several demographic and injury characteristics which may be due to the relatively small sample size. Group reporting more environmental barriers included subjects belonging to younger age group, men, married, low educational level, those who were self – employed, those injured more recently, those injured with higher level of injury and those subjects who sustained injury by road traffic accident. It may be possible that those belonging to younger age group, men and married subjects were physically active and travelled for work and social gatherings thereby encountering more environmental barriers. Subjects with low educational level and who were self-employed may have experienced social exclusion and attitudinal barriers. Subjects with higher level of injury, recent injury and with vehicular accident would have had greater activity limitation and more physical barriers.

Clinical Relevance

As the study has proved the inter and intra-rater reliability and content and concurrent validity of the Craig Hospital Inventory of Environmental Factors short form in spinal cord injury subjects in Indian population. This assessment tool can also be used widely to measure perceived environmental factors in subjects with spinal cord injury.

Since the scale is the shorter version so it is easy and quick to administer and can be widely used in large scale research studies and surveys to assess the perceived environmental factors. This will help a rehabilitation professional to consider environmental factors also, as he plans the treatment protocol for rehabilitation and reintegration of spinal cord injury subjects.

Future research

1. Construct validity needs to be established.
2. Improved measures of environmental factors may reveal stronger relationship between environment and participation than we identified.

Limitation of the Study

1. The sample size was relatively small.
2. Craig Hospital Inventory of Environmental Factors short form only assesses a person's subjective perceptions. The relation between perceived and actual barriers is not known.

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