Psychometric Properties of Physical Activity Recall Assessment for People with Spinal Cord Injury

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Abstract

Objective: The most widely used type of physical activity measure is the self-report survey. Of the available self-report physical activity measures, the vast majorities were developed for use in the general population and typically focus on measuring participation in recreational and sport activities. As a result, the existing self-report measures are insufficiently sensitive to measure very low intensity activities that might account for the bulk of daily energy expenditure among people with SCI. The content of these measures also fails to capture activities that are part of SCI lifestyle. Physical Activity Recall Assessment for People with Spinal Cord Injury [PARA-SCI] was published in August 2005. PARA-SCI is a measure of physical activity for individuals with SCI who use a wheelchair as their primary mode of mobility. It has been translated in various languages, thus the aim of the study is to study the psychometric properties of Hindi version of physical activity recall assessment-SCI.

Material and Methods: PARA SCI was translated in phase 1 of the study and the reliability and validity of the instrument was done.

Results: There was significant correlation observed in test –retest reliability and VO_2 max calculated by 12 minute wheelchair test correlated with the subcomponent of PARA SCI

Conclusion: The Hindi version of PARA-SCI is a reliable and valid instrument.

Keywords: SCI: Spinal Cord Injury, PARA-SCI: Physical Activity Recall Assessment-SCI

Introduction

The spinal cord is the major conduit through which motor and sensory information travels between the brain and body. Spinal cord injury (SCI) affects conduction of sensory and motor signals across the site (s) of lesion (s), as well as the autonomic nervous system [1].

The incidence as well as the prevalence of SCI has been on the rise with the incidence rate being estimated to be from 15-40 cases per million world-wide. The number of people sustaining SCI has increased over the past 3 decades.

According to the International Standards for Neurological Classification of Spinal Cord Injury, SCI can be classified as complete and incomplete injury.

Complete injury: This term is used when there is an absence of sensory and motor function in the lowest sacral segments (S4-S5) (i.e., no sacral sparing).

Incomplete injury: This term is used when there is preservation of any sensory and/or motor function below the neurological level that includes the lowest sacral segments S4-S5 (i.e., presence of "sacral sparing").

Depending upon level of injury -Tetraplegia and Paraplegia is seen, where Tetraplegia refers to impairment or loss of motor and/or sensory function in the cervical segments of the spinal cord due to damage of neural elements within the spinal canal and Paraplegia refers to impairment or loss of motor and/or sensory function in the thoracic, lumbar or sacral (but not cervical) segments of the spinal cord [1].

As the various spinal columns transmit different types of information, and because most people survive SCI do not experience complete severance of their cords many different patterns of spared sensorimotor functions are possible.

The major syndromes are:

Anterior Cord Syndrome: A lesion that produces variable loss of motor function and of sensitivity to pain and temperature while preserving proprioception.

Central Cord Syndrome: A lesion occurring almost exclusively in cervical region that produces sacral sensory sparing and greater weakness in upper limb than in lower limb.

Brown Sequard Syndrome: It is a lesion that produces relatively greater ipsilateral proprioceptive and motor loss and contra lateral loss of sensitivity to pain and temperature. It results due to anterior posterior hemi section of spinal cord.

Cauda Equina Syndrome: A injury of sacral cord (conus) and lumber nerve roots within the spinal canal which usually results in an are flexic bladder, bowel and lower limbs.

Persons with SCI face unique health challenges throughout their life and their injury dissociate the normally well integrated homeostatic responses of body system known to accompany physical activity. Depending upon level and type of cord lesion, persons with SCI are the most physically deconditioned of all humans.

Young persons with chronic SCI experience accelerated pathological state and conditions normally associated with physical deconditioning and premature aging.

The physical activity limitation comes with secondary impairments like loss of cardio-respiratory and muscular function, metabolic and systemic dysfunctions. A lack of physical fitness can be a serious obstacle to autonomy following SCI, ultimately making them dependent. Here the best one can offer is an optimization of residual function.

Assessment of cardio respiratory fitness in persons with SCI requires specialized knowledge of both Exercise-Testing (ET) procedures and unique physiology that ensures SCI. ET modalities for these individuals commonly employed over the ground wheelchair propulsion on a treadmill or wheelchair rollers, cyclical arm ergometry and variations of electrically stimulated exercise. The mode commonly used in ET of person with SCI is the arm crank ergometer. It follows the same general protocols for as normal, but here as the VO_2 peak is dependent on level of SCI, lower intensity loads are applied than those used in standard exercise testing [2,3].

Exercise training has been shown to reduce pain and depression too among people with SCI [4-6]. There is evidence that among persons with SCI, physical activity is associated with positive changes in disease risk factors such as triglyceride levels, body fat, and insulin resistance [7-9].

However, the specific activity types, durations, and intensities that produce these health outcomes have not yet been established within the SCI population. The lack of such information makes it virtually impossible to develop physical activity guidelines for the SCI population, and study in this area has been impeded by the lack of a valid and reliable self-report measure of physical activity for people with SCI.

The most widely used type of physical activity measure is the self-report survey. Of the available self-report physical activity measures, the vast majorities were developed for use in the general population and typically focus on measuring participation in recreational and sport activities that require independent ambulation. However, independent ambulation is uncommon among people with SCI and most of their energy expenditure is accounted for by activities of daily living and passive leisure activities.

As a result, the existing self-report measures are insufficiently sensitive to measure very low intensity activities that might account for the bulk of daily energy expenditure among people with SCI. The content of these measures also fails to capture activities that are part of this population's lifestyle [10].

An SCI-specific physical activity measure would help researchers to fill a number of voids in the SCI and physical activity literature. In particular, a measure that assesses the performance of specific activities and their associated intensities would facilitate collection of epidemiological data necessary to develop health-promoting, physical activity prescription guidelines for people with SCI. An SCI-specific measure would also allow researchers to develop and test activity-enhancing interventions for the SCI population.

'Physical Activity Recall Assessment for People with Spinal Cord Injury' [PARA-SCI] was published in August 2005. PARA-SCI is a measure of physical activity for individuals with SCI who use a wheelchair as their primary mode of mobility. PARA-SCI is widely used, it is already present in 13 other language Chinese, Czech, Dutch, English, French, German, Greek, Italian, Portuguese, Punjabi, Swedish, Spanish, Russian.

It is self-report physical activity measure for people with SCI. The assessment is completed using a semi-structured interview protocol. It aims to measure frequency, type, intensity, duration of physical activity performed by persons of SCI who use wheelchair as their primary mode of mobility. It utilizes 3 day recall and can be used in paraplegia and tetraplegia, and is designed to capture three categories of physical activity: first Leisure time physical activity (LTPA) that one chooses to do during free time, such as playing sports or working out at the gym. Activities of Daily Living (ADL) that are part of one's daily routine, such as personal hygiene, household chores, work-related activity, passive leisure activity. And Cumulative activity: The combination of LTPA and lifestyle activity [2].

The English version of PARA-SCI is a valid and reliable measure [10]. This type of self-report instruments are able to access the fundamental dimensions of physical activity (i.e., frequency, intensity, type, duration) and can be easily administrated to large segments of population relatively easily and inexpensively. Given these advantages, it has played a crucial role in generating epidemiological data used to formulate physical activity prescriptions and guidelines for general populations. But till date there is no Hindi scale available for the same. So this study deals with the psychometric properties of Hindi version of physical activity recall assessment-SCI.

Research Methodology

Work plan

Study centre: Indian Spinal Injury Centre, Institute of Rehabilitation Sciences, New Delhi, India.

Study design: Methodological study.

Sample size: 100.

Procedure of study

First of all permission for Hindi translation from the author of Physical Activity Recall Assessment -SCI questionnaire, Kathleen Martin Ginis was taken through an e-mail.

Procedure consists of following two phases:

1) Translation of instrument to Hindi language.

2) Psychometric evaluation of Hindi version of PARA-SCI instrument.

Phase 1 – Translation phase

Forward translation: As per the procedure, two translators were recruited for forward translation; having their native Hindi language speakers bilingual in English. They were provided with the original English version of questionnaire and was asked to independently translate it in Hindi language avoiding any technical language. Hence first phase of translation gave us two Hindi version of PARA-SCI questionnaire English version. This two versions were combined to form a single Hindi translated PARA-SCI questionnaire.

Backward translation: It involves English translation of Hindi translations obtained from forward translation this step again required two translators who had translated the two Hindi versions, without having any access to original English version of questionnaire. As per the procedure, the back translation was checked against original English version of PARA-SCI questionnaire and their accuracy was determined.

The scale was reviewed by the expert review committee. The comments and suggestion of the review committee was then sent back to the translators for corrections into the next intermediate Hindi version of the scale.

After repeating this process several times the final translate Copy had then used for pilot study. We have also used the PHQ9 and FSS to check the fatigue and depression among the spinal cord injured patients. Even the heart rate variability (HRV) was assessed among the spinal cord injured patients.

Phase 2 – Psychometric evaluation

Test retest reliability and validity of scale was established.

Test retest reliability: Test retest reliability was done by administrating the questionnaire to SCI patients with in a gap of three days as the questionnaire is a three days recall questionnaire.

Construct validity: The convergent validity of a physical activity scale is typically indicated by demonstrating expected relationships between the scale scores and measures of physical fitness.

Inclusion criteria:

1. Subjects with traumatic spinal cord injury of duration more than 3months.

2. Age -18-60 years.

3. Subject should understand Hindi.

4. Subject should be a case of traumatic spinal cord injury below T1-L5 level.

5. Subject should be able to propel manual wheelchair.

Exclusion criteria:

1. Subjects diagnosed with any systemic/ psychiatric illness, any infectious disease.

2. Subjects having any neurological impairment which might hamper his/her participation in the study.

3. Subjects diagnosed with any kind of visual or vestibular deficits.

4. Subjects with memory deficit.

5. Professional wheelchair sportsperson.

Physical fitness

Muscle strength: Muscle strength was assessed to determine the maximal load that could be lifted in one repetition (1RM) for chest press (unilaterally) and biceps curl (unilaterally). Tests will be terminated at the participant's point of fatigue.

Attainment of 1RM confirmed by participants indication that their last lift was ''heavy intensity'' activity, as defined by the PARA-SCI activity intensity classification system.

Aerobic fitness: The 12 min wheelchair performance test for cardio respiratory endurance.

Equipment required: 400 m running track, marking cones, recording sheets and stop watch.

Procedure: place markers at set intervals i.e., at every 50 m to aid measuring the completed distance. Participant wheel around track for 12 min, and the distance covered was recorded.

Scoring: Recorded the completed distance to the nearest 100 meters.

Calculate VO_2 max from following formula:

$$VO_2 \text{ max} = (29.623 \times \text{Distance}) - 10.916 = mg/kg/min$$

Data analysis: Correlation will be computed between the scores of PARA-SCI and muscular strength and cardio respiratory endurance.

Factor analysis will be done for validity.

Results

Phase one includes the steps of Hindi translation suggested by author.

Two Forward Translators (non-healthcare professional) and two Backward Translators (one health professional and non-health professionals) were recruited for translation.

From the two forward translators, a synthesized version was obtained. The synthesis was done by committee. The final approved synthesis was reviewed by Guides and was back translated first by a health professional. This back translation was sent to the author for review. The author has advised to compare the back translation with the original questionnaire.

Again the Hindi version was translated by a non-health professional and matched with the original English version. Both the backward translations were matched with original The final synthesized version was reviewed by the committee members and the author and a final Hindi version of physical activity recall assessment for spinal cord injured people was obtained [11-13].

In phase two, the participants were interviewed twice with a gap of seven days with the instrument and simultaneously the aerobic capacity and muscular strength was also measured to correlate it with PARA-SCI scores (LTPA, ADL, Cummulative).

The Mean and S.D. were calculated. The number of patients recruited was 40 **Table 1.**

Table 1: Mean and S.D. were calculated. The number of patients recruited was 40.

Variables	SCI (Total)	Tetraplegics	Paraplegics
Age (Years) (Mean ± S.D.)	29.30 ± 9.00	32.45 ± 10.27	28.10 ± 8.35
Gender (M:F)	5.25:1	4.5:1	3.8:1
Mode Of Injury	T= 46	T= 11	T=25
	NT=4	NT=0	NT=4

The Mean and S.D. of PARA-SCI scores (LTPA, ADL, Cummulative) of the first day (T1) and seventh day (T2) were noted. The whole data of 40 SCI patients were divided into two group tetraplegics (11) and paraplegics (29) **Table 2.**

Table 2: The mean and S.D. of PARA-SCI scores (LTPA, ADL, Cummulative) of the first day (T1) and seventh day (T2).

Sub-scales of PARA- SCI	SCI (Total) N= 40		Tetraplegia N= 11		Paraplegia N= 29	
	T1	T2	T1	T2	T1	T2
LTPA (Total)Unit Mean ± S.D.	358.60 ± 425.80	368.25 ± 453.02	350.50 ± 508.50	199.1 ± 328.20	361.70 ± 400.13	432.42 ± 481.55
LTPA (MILD) Mean ± S.D.	113.50 ± 244.19	123.15 ± 271.41	00.00 ± 00.00	00.00 ± 00.00	156.03 ± 275.90	226.75 ± 375.32
LTPA (Moderate) Mean ± S.D.	193.70 ± 292.87	203.3 ± 320.12	00.00 ± 00.00	00.00 ± 00.00	173.44 ± 271.41	244.16 ± 352.83
LTPA (Heavy) Mean ± S.D.	12.25 ± 49.84	21.85 ± 77.02	24.45 ± 84.42	175.90 ± 264.72	7.24 ± 28.64	70.72 ± 110.06
ADL (Total) Mean ± S.D.	741.19 ± 493.20	818.54 ± 480.7	1014.10 ± 576.12	1050.00 ± 529.18	635.70 ± 425.00	730.74 ± 439.15
ADL (Mild) Mean ± S.D.	317.95 ± 245.23	395.30 ± 493.20	276.81 ± 99.60	313.71 ± 147.71	333.60 ± 281.62	482.60 ± 295.77
ADL (Moderate) Mean ± S.D.	343.45 ± 383.60	420.80 ± 396.10	593.93 ± 433.00	630.83 ± 385.30	248.44 ± 332.50	343.40 ± 346.65
ADL (Heavy) Mean ± S.D.	10.5 ± 48.98	87.85 ± 61.48	.00 ± .0000	.00 ± .0000	14.50 ± 57.29	109.50 ± 71.44
Cummulative Mean ± S.D.	1139.53 ± 323.71	1067.56 ± 311.25	1357.95 ± 247.00	1151.21 ± 251.10	1056.70 ± 313.60	1035.82 ± 329.58

Test retest reliability: Test retest reliability was tested with a gap of seven days with the scores of subscales of day 1 was compared with day 7 with Pearson's correlation. Here day 1 ADL was significantly correlating with ADL (r >00.00) and LTPA (r >00.00) and with cumulative (r > 0.028) of day 7. LTPA of day 1 was significantly correlating with ADL (r >00.00) and LTPA (r >0.00) only. There was an over lapping in assumption of physical activity division by patients which has affected the results. Where the cumulative activity of day 1 was significantly correlating with cumulative activity (r >00.00) and ADL (r >0.022).

Convergent validity: The convergent validity of a physical activity scale is typically indicated by demonstrating expected relationships between the PARA-SCI scores and measures of physical fitness.

The PARA-SCI scores are calculated by assessing the LTPA, ADL and Cumulative activity where, Leisure time physical activity (LTPA) that one chooses to do during free time, such as playing sports or working out at the gym. Activities of Daily Living (ADL) that are part of one's daily routine, such as personal hygiene, household chores, work-related activity, passive leisure activity.

Cumulative activity: The combination of LTPA and lifestyle activity.

Muscle strength: Muscle strength was assessed to determine the maximal load that could be lifted in one repetition (1RM) for chest press (unilaterally) and biceps curl (unilaterally). Tests will be terminated at the participant's point of fatigue. Attainment of 1RM confirmed by participants indication that their last lift was ''heavy intensity'' activity, as defined by the PARA-SCI activity intensity classification system.

Aerobic fitness: The 12 min wheelchair performance test for cardio respiratory endurance.

As the patient is an SCI so the primary mode of mobility is wheelchair so to measure aerobic capacity this test was used. Where Participant wheel around track for 12 min, and the distance covered was recorded.

Scoring: Recorded the completed distance to the nearest 100 meters.

Calculate VO_2 max from following formula:

VO_2 max = (29.623 × Distance)-10.916 = mg/kg/min

For the convergent validity Pearson's method was used. PARA-SCI scores were correlated with chest press, biceps curl, VO_2 max where the chest press was significantly correlated with biceps curl (r >0.00), distance (r >0.041) and VO_2 max (r >0.041) here a negative correlation was found of chest press with LTPA (r >0.010) as due to overlapping of the physical activity subscales (Patients were confused for physiotherapy inactive an passive sessions where it should lie in ADL or LTPA).

Biceps curl was significantly correlated with distance (r >0.006) and VO_2 max (r >0.006). Distance was correlated with VO_2 max (r >0.00). ADL was correlated with LTPA (r >0.00) and Cumulative (r >0.018) [14].

Discussion

The objective of study was to establish the psychometric properties of Hindi version of physical activity recall assessment-SCI.

The physical activity recall assessment (PARA-SCI) has been proposed as an essential measure for assessing SCI patients or a self-reporting survey but till date there is no Hindi scale available for the same.

Since Hindi is most commonly read and spoken in India and among Indian languages only Punjabi translation is available, so there was a dire need to translate this scale in Hindi language.

The whole study was done in two phases. Where in phase one we have obtained two forward translated Hindi versions and then those two copies were merged and sent for backward translation. After obtaining the two English versions they were merged and match with the original.

The scale was reviewed by the expert review committee. The comments and suggestion of the review committee was taken and sent back to the translators for corrections. After repeating this process several times the final translate Copy was used for pilot study.

Conclusion

The Hindi version of PARA-SCI is a reliable and valid instrument. In phase two, Test retest reliability and validity of scale was established by administrating the questionnaire to SCI patients with in a gap of seven days. The convergent validity of a physical activity scale was typically indicated by demonstrating expected relationships between the scale scores and measures of physical fitness. Muscle strength and aerobic endurance were taken as the measures of physical fitness.

Limitations of Study

• Overlapping was seen in ADL and LTPA activities as physiotherapy comes as a daily routine and active and passive physiotherapy both are part of routine.

• For assessing aerobic capacity instead of 12 min wheelchair test instrument gas analyzer could have been used.

• Cannot assess the physical activity of high cervical quadriplegics with AIS- A.

• Because of field method used to assess the aerobic capacity, minimum of 300 meters the patient should be able propel wheelchair as below that score the VO_2 max value was going in negative.

Future Recommendations

• Other Psychometric properties in subscales of quadriplegics and paraplegics can be done and factor analysis using the age groups can be done.

• Study can be carried out on a large population.

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