# Concurrent Validity of Mobility Disability Scale among Community-dwelling Individuals

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## ABSTRACT

*Purpose: A new Mobility Disability Scale (MDS) has been developed to assess the level of mobility disability among community-dwelling individuals. For it to be used effectively, a systematic evaluation of the psychometric properties is required.*

*This study was conducted to determine the concurrent validity of the MDS among community-dwelling individuals, as compared to the Functional Independence Measure (FIM) and Functional Assessment Measure (FAM).*

*Method: Based on the survey of a semi-urban community, purposive sampling was used to select 52 individuals with mobility disability. All of them were evaluated using MDS and FIM FAM scales at the same time. Spearman's Rank correlation coefficient was used to analyse the correlation of MDS scores with the FIM FAM scale scores.*

*Results: MDS scores had statistically significant negative correlation with FIM FAM total scale scores (r= -0.711) and the correlation was stronger when analysed with the mobility components of FIM FAM scales (r= -0.724).*

*Conclusion: The MDS possesses moderate concurrent validity with an existing functional scale. This indicates that it may be a suitable tool to quantify the level of mobility disability in persons with disability living in community.*

*Limitation: The psychosocial domain, though important, could not be compared with any gold standard measures due to unavailability of suitable scales.*

*Key words: Psychometric properties, FIM FAM scale, dimensions, domains, correlation, environment.*

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# INTRODUCTION

Mobility is a strong predictor of activities of daily living (ADL) disability and instrumental activities of daily living (IADL) disability. Impaired mobility predicts the onset of disability in tasks essential to living independently in the community and caring for oneself. Mobility disability is a condition, which results due to the impairments that restrict the ability of individuals to move about in their natural environment (Patla and Shumway-Cook, 1999). Mobility disability in community ranges from  inability to turn in the bed to difficulty in climbing stairs or using transport.

Achievement of independent community mobility is considered an important goal in the rehabilitation of persons with mobility deficits. Rehabilitation to improve mobility requires comprehensive evaluation of the disability with the items related to community. Existing tools which measure mobility disability consist of items which are better suited to the hospital set-up rather than to community-dwelling individuals. These tools underestimate the individual's mobility requirements in the community and hence do not adequately measure the quantum of disability. In spite of some tools being developed for community dwelling, they did not have comprehensive items to measure mobility disability as a whole (Manikandan et al, 2014). New models suggest that determination of the degree of disability must include the extent to which the physical, social and psychological environment constrains a particular individual due to the condition (Gitlin, 2003).

To address these issues, the authors of the current study developed a Mobility Disability Scale (MDS) based on the critical environmental factors that operationally define mobility disability in community.  This scale consists of 50 items grouped under 9 domains, which range from simple self-care to complex psychosocial factors (Appendix 1). Each  item in these domains is scored on a 5-point scale ranging from 0 to 4, where 0 indicates no disability and 4 indicates 100% disability for the respective item. The middle scores represent 1 (25%), 2 (50%) and 3 (75% disability) (Manikandan et al, 2014). However, for MDS to be used as a screening tool or to quantify the impact of mobility disability on the community-dwelling individual, systematic evaluation of its psychometric properties is required. Reliability and internal consistency of MDS has been established in the community-dwelling individuals (Manikandan et al, 2014). Concurrent validity is a type of criterion validity, which indicates the degree to which the scale correlates with the gold standard measure. As it is a new scale,

MDS needs to be correlated with the existing commonly used functional measures to assess mobility disability.

Functional Independence Measure (FIM) is one of the scales most commonly used to assess the level of independence in activities of daily living, especially in neurological conditions like stroke (Haigh et al, 2001), with mobility as one of its important domains. The scale consists of 18 items, of which 13 items are physical domains based on the Barthel Index and 5 are cognition items. Each item is scored from 1 to 7 based on level of independence, where 1 represents total dependence and 7 indicates complete independence. Possible scores range from 18 to 126, with higher scores indicating more independence.

On its own, the FIM scale had ceiling effects, so the Functional Assessment Measure (FAM) was proposed, which extends the coverage of the FIM (Turner-Stokes et al, 2009). Of the 12 new items added by the FAM, the authors used 8 items relevant to mobility disability in community- dwelling individuals. These items include community access, car transfer, emotional status, attention, writing, employability, adjustment to limitations and safety judgement. The FIM scale and the FAM scale both provide many items relevant for individuals living in community, and hence could be combined and used as a standard measure to test the psychometric properties of the new scale.

## Objective

The objective of this study was to determine the concurrent validity of the MDS by correlating the domain and total scores of this new scale with that of FIM FAM scales among community-dwelling individuals.

The study protocol was submitted to the institutional ethical committee and approval to conduct the study was obtained at the outset.

# METHOD

### Study Design

A correlational study design was adopted. The setting was either in individual houses in a semi-urban area or at the physiotherapy outpatient department in a tertiary care hospital.

Persons with mobility deficits, with the onset duration of more than one month,

who were living at home and who were able to understand and follow instructions, were included by purposive sampling.

Persons with coexisting acute illness who required immediate management were excluded from the study.

**Procedure**

Persons with disability, identified through a survey in the community, were selected according to the study criteria. Informed consent was obtained from the selected 52 persons. Sample size was estimated using the correlation formula, with the expected level of correlation coefficient as 0.5, 99% confidence interval and 90% power. The MDS was administered during the interview. Individuals were asked whether they were able to perform the particular item in the scale and were scored for the particular item according to their answers. The flow chart for scoring the items in the scale is given in Figure 1.

**Figure 1: Flow chart for Scoring Items in the MDS (except for Psychosocial Domain)**
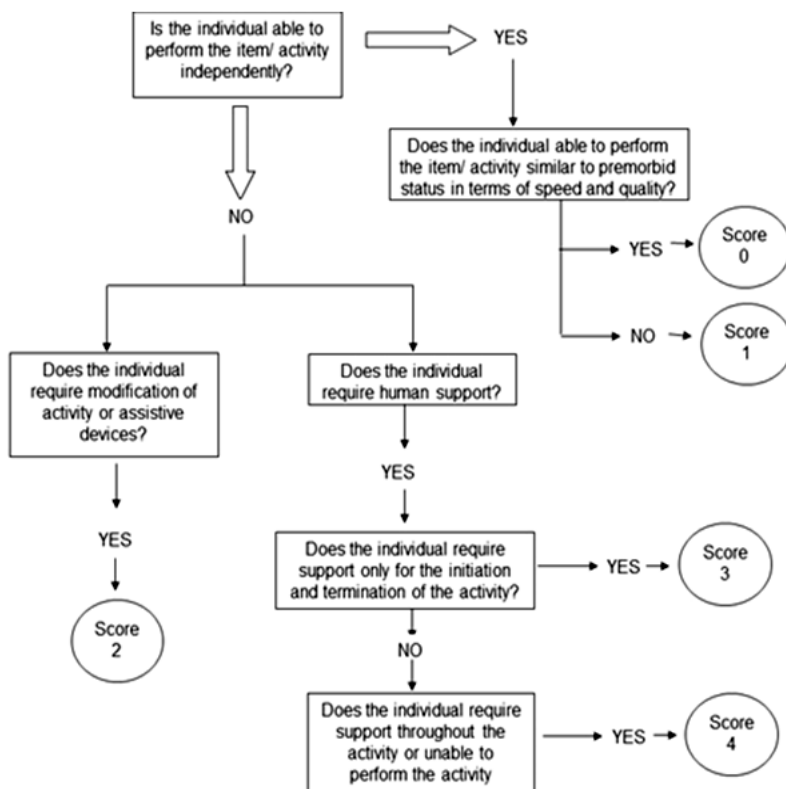
Adequate explanations were given to help participants understand the item and examples of situations were provided, where required, to help them understand the scoring options. In situations where two scores were applicable, the highest score was recorded. All the items in the particular domain were completed before moving on to the next domain. If there had been any ambiguity in scoring, individuals would have been asked to perform the activity to decide the scoring option; however, such situations did not arise since all the individuals were able to score the items without ambiguity.

The items in the psychosocial domains were scored in terms of frequency. Privacy of the individual was ensured when scoring the items under this domain, in order to prevent any influence from the family members.The tester provided the necessary explanation if the item was not understood, and ensured that all the items in the scale were scored. The scores were added to calculate the individual domain as well as the total score.

To determine the concurrent validity, the FIM FAM scales were administered along with the MDS to the participating persons with disability. The FIM FAM scales were administered as per the procedure guidelines given by the authors of these scales. In order to prevent sequence bias, the new scale and FIM FAM scales were used alternately for the first evaluation, followed by the other scale, respectively. The item scores of each domain were combined to calculate the domain and total scores for the FIM FAM scales.  Concurrent validity was determined by correlating the domain and total scores of the MDS with the combined total scores of FIM FAM scales.

**Data Analysis**

Descriptive statistics were used to summarise the demographic characteristics of the persons with disability. Spearman's Rank Correlation Coefficient was used to analyse the correlation of total scores as well as the individual domain scores of the MDS with FIM FAM scales.

## RESULTS

Although 53 persons with disability were screened for the study, one person who required medical attention during the assessment was excluded. The median and Interquartile range (IQR) for the age of the selected 52 individuals was 47.5 (33.5, 62) years, and the duration of condition ranged from 1 month to 180

months. Fifteen of them (25%) had stroke resulting in hemiparesis or hemiplegia, while the remaining 45 had varied conditions including orthopaedic and other neurological impairments.

The combination of FIM FAM scales resulted in 28 items, with the scores ranging from 28 to 196, whereas the MDS scale consisted of 50 items, with the scores ranging from 0 to 200. The severity of conditions in the study sample varied considerably, with the total scores ranging from 12 to 177 out of 200 in the MDS. The median (IQR) of FIM total score was 103.5 (64.5, 113) and the FAM total score was 37.5 (27.3, 47). The sum of all the FIM and FAM item scores was used to calculate the FIM FAM total score.

Figure 2 shows the correlation of MDS total score with the FIM FAM total scores in the scatter plot. The correlation of MDS with FIM total score (r= -0.693) and FAM total score (r=-0.676) was significant but less when compared with the FIM FAM total score. As the primary concern of the study was mobility, the authors combined the mobility- related components of FIM and FAM scales and correlated this with the total score of MDS which had a high negative correlation ($\varrho$ = -0.724)

**Figure: 2. Correlation between MDS and FIM FAM Scale total scores (n=52)**
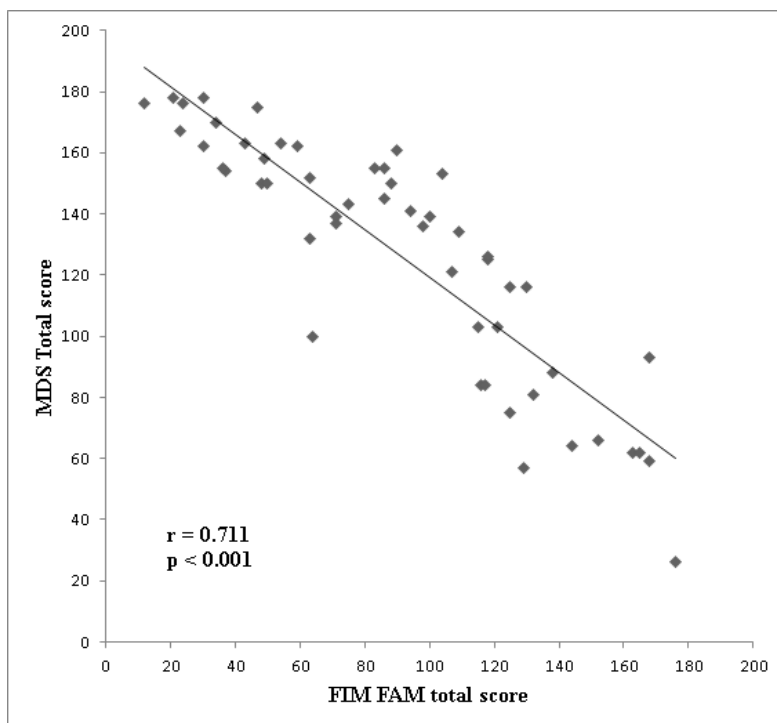
The authors also correlated the individual domains scores of MDS with the mobility domain components of FIM FAM scale. The coefficient values for the correlation between domain scores of MDS with mobility domain component scores of FIM FAM scale are given in Table 1. These results show that all the domains of MDS had high correlation except for psychosocial domain which had moderate correlation (Portney and Watkins, 2000) with the mobility components of FIM FAM scale.

**Table 1: Correlation between MDS and Mobility Domain Scores of FIM FAM Scales (n=52)**

|  | **MDS Domains** | **Spearman's Rank Correlation Coefficient ($\varrho$)\*** |
|---|---|---|
| 1. | Self-care | -0.833 |
| 2. | Ambulation | -0.788 |
| 3. | Ambient conditions | -0.860 |
| 4. | Postural transitions | -0.851 |
| 5. | Terrain characteristics | -0.804 |
| 6. | Attention demands | -0.746 |
| 7. | IADL | -0.753 |
| 8. | Transport | -0.721 |
| 9. | Psychosocial | -0.699 |

*All the values were statistically significant with p values < 0.001

## DISCUSSION

Concurrent validity of the scale was tested by correlating the domain and total scores of MDS with those of the FIM FAM scales. There are no gold standard tools available to measure mobility disability for community-dwelling individuals; hence the FIM scale was used. It is the most commonly used scale to grade the independence level of individuals in the important domains including mobility. The FAM scale, which includes components important for community mobility, was added to the FIM components to assess the concurrent validity of the MDS. FIM/FAM scales are not culturally validated but are frequently used as there are few alternate scales available.The scoring criteria of the FIM FAM scales were similar to the MDS, which was another reason to consider them for comparison

with the MDS. Other reasons for choosing FIM and FAM scales to evaluate concurrent validity of the MDS were:

a) They are generic and can be applied to all types of persons with disabilities;

b) Both these scales in combination consist of more items relevant to measure mobility disability of individuals living in community than other scales do; and,

c) Both these scales have been studied extensively in different groups of persons with disabilities (Granger et al, 1990; Pallicino et al, 1992) and possess excellent psychometric properties like internal consistency and reliability (Hawley et al, 1999).

The significant variations in the conditions and their severity among the selected persons with disability provided the best opportunity to determine concurrent validity. Thus, it was possible to assess whether the variations in severity as evaluated by FIM FAM scales were adequately evaluated by the MDS as well. The high correlation of MDS with FIM FAM scores suggests that the MDS possesses good concurrent validity with these scales. The negative correlation suggests that the MDS quantifies the mobility disability as opposed to FIM FAM scales which measure the independence level of the individuals in relation to their activities of daily living.

FIM and FAM scales are generally used in isolation according to the situation, and hence the authors correlated the MDS scores with FIM and FAM scale scores separately. The decrease in the correlation with the FIM scale separately, as compared to the FIM FAM total score, could be due to the lack of FAM items like community access, car transfer, employability, etc, which are important components of mobility assessment for community-dwelling individuals. Similar results were noted when only FAM items were correlated with the MDS. This also suggests that FIM or FAM scales on their own may not comprehensively assess mobility in community- dwelling individuals, even though mobility components are present in both scales. The strength of correlation could also be less owing to difference in the length of the scale; the observed changes could be because the FIM and FAM scales are shorter when used singly than when used in combination.

These results are further supported by the study findings which showed that mobility related components of FIM and FAM scales showed higher correlation

when correlated with the total score of MDS. The items combined under mobility domain were bed/chair/wheelchair transfer, toilet transfer, bath tub/shower transfer, car transfer, walking/wheelchair use, using stairs and community access. This higher correlation value also indicates that the MDS measures the construct, i.e., mobility disability, effectively in comparison with the commonly used scales. This further strengthens the concurrent validity of the MDS.

The mobility components of FIM FAM scale showed high correlation with all the domains of MDS except with the psychosocial domain which had moderate correlation. Though considered an important domain in the MDS scale, the psychosocial domain could not be compared with adequate gold standard measures. These are self-perceived measures which, when correlated with the observation- based measures like FIM and FAM scales, may not correlate strongly. The lower correlation in this domain could be because of the difference in the construct that each scale measures, as well as the difference in the scoring options of the items in both the scales. The MDS used frequency options to score the psychosocial items, whereas the FIM FAM scale used the observation rating method. The FAM scale measures the ability of the individual to control or cope with these issues in general life situations, whereas the MDS measures the frequency of the impact of these items on community mobility. The strongest correlation existed for the self-care domains which could be well explained by the presence of related items in both the scales.

Even though the MDS contains a greater number of items than the FIM FAM, it provides a more comprehensive assessment of mobility disability – which no other scale currently assesses. Direct interviews of persons with disability during the initial development of this scale have also demonstrated that this number of items is important for comprehensive assessment of mobility disability (Manikandan et al, 2014). Thus, MDS has good concurrence and also possesses adequate number of items to measure mobility disability in community-dwelling individuals.

## CONCLUSION

The MDS possesses moderate concurrent validity with an existing functional scale. This indicates that the MDS may be suitable as a tool to quantify the level of mobility disability in persons with disability living in community. Additional measurement properties remain to be tested.

## ACKNOWLEDGEMENT

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# Appendix 1

## Mobility Disability Scale

| Client Name: | | Age: | Diagnosis: | | Duration: |
|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 |
| Item No. | **Domain: Self-care** | Able to do without any difficulty | Able to do independently but not faster or perfectly as premorbid | Able to do independently but requires aid or modification of the tools | Unable to do independently, requires human help to initiate and/ or to complete the task | Unable to do independently, requires human support throughout the task or avoids the activity |
| 1 | Wearing footwear | | | | | |
| 2 | Eating | | | | | |
| 3 | Dressing | | | | | |
| 4 | Buttoning | | | | | |
| 5 | Combing | | | | | |
| 6 | Toileting | | | | | |
| 7 | Bathing | | | | | |
| 8 | Brushing | | | | | |
| 9 | Squatting and getting up | | | | | |
| Item No. | **Domain: Ambulation** | Able to ambulate without any difficulty | Able to ambulate but slower or less distance than premorbid | Able to ambulate independently but requires aids or modification of the task | Unable to ambulate independently, requires human supervision or help to initiate or propel | Unable to ambulate independently, requires complete human support/ Avoids walking / Bedridden |
| 10 | Household ambulation (6 metres) Walking/ wheelchair | | | | | |
| 11 | Community ambulation (100 metres) Walking / wheelchair) | | | | | |
| Item No. | **Domain: Ambient conditions** | Able to do without any difficulty | Able to do but not faster or perfectly as premorbid | Able to do independently but requires aids or modification of task | Unable to do independently, requires human supervision or help to initiate and/or to complete the task | Unable to do without complete human support/ Avoids the activity |

| Item No. | | Able to do without any difficulty | Able to do but not faster or perfectly as premorbid | Able to do but requires aids like banister / railings | Unable to do independently, requires human supervision or help to initiate and/or to complete the task | Unable to do independently, requires complete human support or avoids the activity |
|---|---|---|---|---|---|---|
| 12 | Walking/ moving around in wet toilet | | | | | |
| 13 | Walking in rain | | | | | |
| 14 | Walking at night | | | | | |
| 15 | Going to space-constrained areas | | | | | |
| 16 | Walking in crowd | | | | | |
| Item No. | **Domain: Terrain characteristics** | Able to do without any difficulty | Able to do but not faster or perfectly as premorbid | Able to do but requires aids like banister / railings | Unable to do independently, requires human supervision or help to initiate and/or to complete the task | Unable to do independently, requires complete human support or avoids the activity |
| 17 | Walking uneven surface (slopes) | | | | | |
| 18 | Climbing stairs | | | | | |
| 19 | Crossing or avoiding the obstacle | | | | | |
| Item No. | **Domain: Attentional demands** | Able to do without any difficulty | Able to do but not faster or perfectly as premorbid | Able to do independently but requires aids or modification of task | Unable to do independently, requires human supervision or occasional help | Unable to do independently, requires complete human support or avoids the activity |
| 20 | Balance while crossing roads | | | | | |
| 21 | Walking while speaking into phone or looking into the other person's face | | | | | |
| 22 | Reacting to traffic lights while driving | | | | | |
| Item No. | **Domain: Postural transitions** | Able to do without any difficulty | Able to do but not faster or perfectly as premorbid | Able to do independently but requires aids or modification of task | Unable to do independently, requires human supervision or help to initiate and/or to complete the task | Unable to do without complete human support/ Avoids the activity |

| Item No. | | Able to do without any difficulty | Able to do but not faster or perfectly as premorbid | Able to do independently but requires aids or modification of task | Unable to do independently, requires human supervision or help to initiate and/or to complete the task | Unable to do without complete human support/ Avoids the activity |
|---|---|---|---|---|---|---|
| 23 | Rolling in the bed | | | | | |
| 24 | Getting up from bed | | | | | |
| 25 | Sitting | | | | | |
| 26 | Sit to stand | | | | | |
| 27 | Turning while walking | | | | | |
| 28 | Standing | | | | | |
| 29 | Bend and pick up objects | | | | | |
| 30 | Sitting on floor | | | | | |
| Item No. | **Domain: IADL** | Able to do without any difficulty | Able to do but not faster or perfectly as premorbid | Able to do independently but requires aids or modification of task | Unable to do independently, requires human supervision or help to initiate and/or to complete the task | Unable to do without complete human support/ Avoids the activity |
| 31 | Writing | | | | | |
| 32 | Signing | | | | | |
| 33 | Shopping | | | | | |
| 34 | Cooking/ shaving | | | | | |
| 35 | Gardening | | | | | |
| 36 | Using mobile or fixed phone | | | | | |
| 37 | Using computer or any such gadgets | | | | | |
| 38 | Manipulating objects in hand | | | | | |
| Item No. | **Domain: Transport** | Able to do without any difficulty | Able to do but needs to be selective in choosing time, route or vehicle | Able to do independently but requires aids or modification of vehicle | Unable to do independently requires human supervision or help to move in and out of vehicle | Unable to do without complete human support/ Avoids the activity |
| 39 | Riding/driving the vehicle | | | | | |
| 40 | Using the public transport (Bus/ train) | | | | | |

| Item No. | Domain: Psychosocial | Never | Rarely | Occasionally | Frequently | Always |
|---|---|---|---|---|---|---|
| 41 | Travelling by private transport (Auto/taxi) | | | | | |
| 42 | Feel fear of falling while walking | | | | | |
| 43 | Feel depressed | | | | | |
| 44 | Feel for disturbance in family role | | | | | |
| 45 | Feel less motivation in doing activities | | | | | |
| 46 | Feel dependent for personal care | | | | | |
| 47 | Feel cannot participate in functions | | | | | |
| 48 | Feel cannot continue the job | | | | | |
| 49 | Feel tiredness during activities | | | | | |
| 50 | Feel pain during activities | | | | | |