MOBILITY ASSESSMENT AND NURSING THEORY: HUNGARIAN VALIDATION OF DEMMI AND CONCEPTUAL FRAMEWORK DEVELOPMENT WITHIN OREM'S THEORY

Ph.D. thesis

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1. Introduction

Mobility is a key component of health-related quality of life and functional capacity, especially for older adults in long-term care facilities. According to the World Health Organization's International Classification of Functioning, Disability and Health, mobility is the ability to change the position or location of the body. Mobility in itself, and through activities of daily living (ADLs), is an important aspect of the psychological well-being and social participation along with life satisfaction and quality of life.

DEMMI was created with the intention of resolving issues in assessing mobility. DEMMI is made up of 15 items which progressively become more difficult ranging from bed mobility to dynamic balance tests. The hierarchical design and interval-level scoring of the DEMMI make it a sensitive measure of change across the entire range of mobility.

Dorothea Orem has established the Self-Care Deficit Nursing Theory (SCDNT), which is the comprehensive theory of how people provide for their self-care needs, when nursing is needed, and how nurses should act.

Despite the availability of advanced tools like the DEMMI, and comprehensive nursing theories like Orem's SCDNT, a gap remains between assessment opportunities and their systematic integration in nursing theoretical frameworks in clinical practice. This gap limits the integration potential of assessment data into nursing care planning.

2. Research Objectives

The aim of this dissertation emerged during the research on mobility assessment in the Hungarian long-term care context,

where the potential for theoretical integration was discovered. In light of the literature gap identified in the introduction, the following objectives have been established that provide structure to the presentation of the completed research and theoretical proposals.

2.1 Primary Research Aim

The aim of this thesis is to develop a conceptual framework which shows how DEMMI could be integrated into Orem's Self-Care Deficit Nursing Theory, in order to improve the quality and effectiveness of geriatric nursing care.

This work builds upon completed empirical studies, and should fill the described gap between sophisticated assessment tools and nursing theories. There are three components to the aim of this thesis: (1) to present our evidence and clinical studies to demonstrate psychometric properties and clinical utility; (2) to make theoretical propositions connecting DEMMI mobility categories to Orem's nursing system classification; (3) and to highlight implications for nursing practice and possibilities for future research.

2.2 Research Objectives

This thesis has three key objectives for the two empirical studies and the theoretical work, with each step building on the previous ones.

Objective 1: To validate the Hungarian adaptation of the de Morton Mobility Index (HU-DEMMI) for institutionalized older adults, establishing a reliable and valid tool that meets international standards.

Objective 2: To examine the systematic links between DEMMI-based mobility categories and functional indicators relevant to self-care capacity. This objective provides the empirical patterns that should inform theoretical integration.

Objective 3: To develop a conceptual framework that proposes theoretical alignments between the DEMMI mobility categories and the Orem nursing system classifications through the analysis of empirical patterns in relation to theoretical constructs.

2.3 Scientific Relevance

This work can contribute to nursing science in two major areas. The HU-DEMMI validation contributes to the international evidence base of mobility assessment in older adults. The thesis shows how validated instruments can be integrated with established nursing theories to operationalize a nursing theory. We further hope to improve upon the understanding of mobility not only by itself, but also as a self-care requisite that is needed in various functions and for quality of life.

3. Methods

This section describes the methodology of the two different, but complementary phases. Phase one involves the empirical investigation which covers the studies of DEMMI validation and the clinical application. The second phase uses conceptual framework development. All empirical work process followed standard procedures for cross-cultural adaptation and psychometric assessment (Beaton et al., 2000; Mokkink et al., 2010).

3.1 Study Design and Ethics

This study was conducted in three phases, each built on the previous one(s). Our work began with the psychometric validation and cross-cultural adaptation, followed by the next phase that was a clinical application analysis of HU-DEMMI. Lastly, this thesis contains the proposal of a theoretical synthesis. All empirical studies used a cross-sectional design and involved institutionalized elderly people in long-term care facilities in Hungary.

Semmelweis University Regional and Institutional Committee of Science and Research Ethics (SE RKEB 132/2023) gave ethical approval for our study. All procedures were in accordance with the Helsinki Declaration and the Hungarian healthcare research regulations. The adaptation process has been approved by DEMMI's initial developer, Professor Jenny Keating.

3.2 Phase 1: Cross-Cultural Adaptation and Validation Study

The Hungarian DEMMI (HU-DEMMI) was developed in line with Beaton et al.'s (2000) established procedure. This process ensures the tool's language and cultural similarity with the target population. It also preserves the psychometric and measurement qualities of the instrument itself, while ensuring semantic, idiomatic, experiential, and conceptual equivalence during the whole process of translation.

The validation study had residents from three long-term care institutions in Hungary. The three institutions differed in their organization: a state-run, a church-run (urban), and a church-run small-town one near Budapest. This diversity was advantageous in enhancing representativeness.

Inclusion Criteria: Over the age of 60 years; minimum 4-week residence in the institution; ability to understand and follow test instructions; written informed consent.

Exclusion Criteria: Sensory aphasia; medical contraindications to mobilization; severe dementia; a terminal illness with imminent death; refusal to participate.

Since we had been planning to use confirmatory factor analysis, the adequate sample size was 10 subjects per item. With 15 items and calculating for a 10% dropout rate, 170 of the 457 eligible residents were randomly selected.

The HU-DEMMI was administered by trained physiotherapists, who followed protocols set by the original developers. The instrument consists of 15 mobility items with increasing level of difficulty, which are divided into 5 categories: bed mobility, chair-based mobility, static balance, walking, and dynamic balance.

A randomly selected group of 55 participants were used for inter-rater reliability testing. Two physiotherapists assessed the participants independently, 2 hours apart. To evaluate temporal stability, the same 55 participants were tested with the same physiotherapist after seven days.

3.3 Phase 2: Clinical Application Study

The clinical application study involved 209 residents from the same three long-term care institutions, with the same inclusion and exclusion criteria as the validation study.

DEMMI scores were categorized using cut-off values proposed by Thorsted et al. (2024): Very low mobility: 0-26 points; Low

mobility: 27-40 points; Moderately reduced mobility: 41-61 points; Independent mobility: 62-100 points.

3.4 Conceptual Framework Development

The method used for examining the potential integration of DEMMI in Orem's framework was conceptual framework development. This conceptual development included the thorough examination of fundamental works on Orem's Self-Care Deficit Nursing Theory and the development and validation of DEMMI. The results from our validation and clinical application studies were also examined for potential alignment with Orem's nursing systems.

The conceptual connection was examined between the mobility categories of DEMMI and Orem's nursing system classifications. The steps were the following: *Pattern recognition*: Identifying relationships between mobility levels and care dependency indicators in the acquired data. *Theoretical alignment*: Matching the identified patterns to Orem's three nursing systems. *Proposition creation*: Making specific theoretical propositions to use in clinical practice. *Framework for integration*: A systematic way to use assessment results for care decisions.

4. Results

This chapter presents the findings of the two empirical studies that serve as the foundation for the theoretical integration of this thesis. The results are divided in three main sections: the results from the validation study of HU-DEMMI, the results from the clinical application study, and the evidence for theoretical integration with Orem's Self-Care Deficit Nursing Theory.

4.1 Validation Study Results

The validation study involved 170 participants, recruited from three long-term care institutions in Budapest, Hungary. After dropouts and exclusions were taken into account, 158 participants completed the whole assessment protocol, which equals a 93% completion rate.

The sample involved 135 women (85.4%) and 23 men (14.6%), with the mean age of 84.14 years (SD = 8.93). The average score of Mini Mental State Examination (MMSE) was 21.89 (SD = 5.41), which indicated mild to moderate cognitive impairment. This is considered typical of institutionalized older adults.

The HU-DEMMI had an excellent internal consistency score with a Cronbach's alpha value of 0.906, well in the ideal range of 0.70-0.95. The inter-rater reliability was excellent, with the intraclass correlation coefficient (ICC) of 0.981 (95% CI: 0.966-0.989). The test-retest reliability was considered stable over a 7-day period, with an ICC of 0.989 (95% CI: 0.980–0.993).

The value of minimal detectable change at 90% confidence level (MDC90) was 6.803 points, so clinicians presented with a 7 points change in the DEMMI score can be 90% confident that real change has occurred in mobility.

All seven a priori hypotheses for construct validity were confirmed. The HU-DEMMI showed strong correlations with established measures of functional capacity: Barthel Index: $\rho = 0.764$; Functional Ambulation Category: $\rho = 0.850$; 30-second sit-to-stand test: $\rho = 0.715$; Timed Up and Go test: $\rho = -0.711$.

The unidimensional structure of the HU-DEMMI was further supported by confirmatory factor analysis. The single-factor model provided a good fit for the data. There were no floor or ceiling effects.

4.2 Clinical Application Study Results

The study of clinical application of HU-DEMMI involved 209 residents from the same three long-term care facilities. The study included 149 women (71.3%) and 60 men (28.7%), who had an average age of 81.34 years (SD = 8.92).

The 209 participants were categorized into four mobility groups: Very low mobility (DEMMI 0-26): n = 53 (25.4%); Low mobility (DEMMI 27-40): n = 41 (19.6%); Moderately reduced mobility (DEMMI 41-61): n = 64 (30.6%); Independent mobility (DEMMI 62-100): n = 51 (24.4%).

The distribution indicates that 45% of the residents have very low or low mobility, while 55% have moderately reduced or independent mobility.

For all measured variables, significant differences across the four categories of mobility were found (Kruskal-Wallis ANOVA, all $p < 0.001$). The Barthel Index showed significant differences in all mobility categories. The median Barthel Index scores of the four groups: very low mobility (20 points), low mobility (60 points), moderately reduced mobility (80 points), and independent mobility (90 points). All adjacent group comparisons were statistically significant.

4.3 Empirical Patterns for Integration

The validation study proved that HU-DEMMI scores are strongly correlated with other functional measures. This

indicated that mobility assessment with DEMMI likely captures several aspects of functional capabilities.

The degree of differences in scores between adjacent mobility categories was greater than the measurement error thresholds, suggesting that the measured differences could be clinically meaningful. The consistent nature of differences in various domains shows that the DEMMI-based classification, even in itself, could reflect important aspects of the functional status of older adults.

The continuous changes through the degrees of dependence seem consistent with Orem's theory on self-care deficits. These empirical outcomes provide the evidence to further examine the theoretical integration potential with this nursing framework in the discussion chapter.

5. Discussion and Conclusions

5.1 Validation of Hungarian DEMMI

The validation of the Hungarian DEMMI showed psychometric properties that meet, or even exceed international standards. The internal consistency was examined through Cronbach's alpha, and was found that $\alpha = 0.906$, which was comparable to other validated DEMMI adaptations. The reliability coefficients achieved were exceptional. It can be stated, based on the results, that the Hungarian version has sufficient measurement precision for clinical or research purposes.

The overall construct validity was confirmed through all 7 pre-specified hypotheses. The Barthel Index had a strong correlation with the study findings ($\rho = 0.764$), which supports that assessing mobility can provide useful insights on broader self-care capabilities.

One important benefit of the DEMMI over conventional measures of mobility is the successful avoidance of floor and ceiling effects. HU-DEMMI with the calculated MDC90 of 6.803 points can be used for the precise detection of clinical changes in order to help guide treatment decisions and outcome assessment.

5.2 Clinical Application Findings

In our sample, almost half of the long-term care facility residents in Hungary required long-term mobility support of some intensity. The other half maintained some level of independence. This distribution aligns with results from international studies of similar populations.

The link between mobility categories and cognitive function illustrates a strong association between physical and cognitive ability, and supports a more holistic approach to care. The increasing autonomy seen in self-care over mobility groups is evidence for the association of mobility and overall functional capabilities, and confirms its integration to nursing theory.

5.3 Theoretical Integration: DEMMI and Orem's Self-Care Deficit Nursing Theory

The research findings show clear patterns across all mobility categories, which may empirically support a potential conceptual fit with Orem's nursing system classifications. Mobility is a requirement that is universal to self-care, which allows the individual to meet its basic need for activity and hazard avoidance.

Participants with very low mobility (DEMMI 0-26) showed characteristics indicating the need for a wholly compensatory nursing system. With a median score of 20 on the Barthel

Index, most people would require maximal support with the ADLs.

Individuals with low and moderately reduced mobility (DEMMI 27-61) showed mixed dependence levels. These represent the typical signs of choosing a partly compensatory nursing system. Although both require partly compensatory approach, the interventions required could be tailored to their abilities, allowing for a more precise planning and optimal use of resources.

Participants with independent mobility (DEMMI 62-100) showed properties suggesting that supportive-educative nursing system would be the appropriate choice for them. Despite living in long-term care, they still had a considerable capability for self-care.

5.4 Limitations

The cross-sectional design of our studies does not permit to interpret our results as causal evidence for the relationship between mobility and other functional capabilities. We conducted these studies in the Budapest area, which might limit the generalizability in Hungary. The theoretical integration is more of a conceptual development than empirical validation, and that is clearly articulated throughout this work. This would need further validation in various settings for feasibility and effectiveness. The lack of validation for cut-off values from Thorsted et al.'s work (2024) is another limitation of the study.

5.5 Key Findings and Implications

During the validation HU-DEMMI showed excellent psychometric properties as the inter-rater reliability with an ICC = 0.981, test-retest reliability with ICC = 0.989, and

internal consistency with Cronbach's α = 0.906 all meet international standards.

In the clinical application study systematic patterns were uncovered in the four DEMMI-based mobility categories, with significant and progressive differences among them in functional domains related to self-care capacity.

The proposed integration framework should be understood as a middle-range theory – with further validation it can serve as a guide for establishing specific protocols on a firm theoretical basis. It could offer the general concept of turning available mobility assessment data into care decisions: it has the potential to improve the reproducibility, quality, and effectiveness of clinical interventions, while supporting a more optimal resource allocation in healthcare facilities.

This thesis contributes to the field of evidence-based and theory driven geriatric care. The proposed framework could be a step in the direction of bridging the gap between detailed mobility assessment and personalized nursing care, an important advancement for healthcare systems in an aging world.

6. Bibliography of the candidate's publications

Publications related to the thesis:

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