Article

Measuring care transitions in Sweden: validation of the care transitions measure

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Abstract

Objective: To translate and assess the validity and reliability of the original American Care Transitions Measure, both the 15-item and the shortened 3-item versions, in a sample of people in transition from hospital to home within Sweden.

Design: Translation of survey items, evaluation of psychometric properties.

Setting: Ten surgical and medical wards at five hospitals in Sweden.

Participants: Patients discharged from surgical and medical wards.

Main outcome measure: Psychometric properties of the Swedish versions of the 15-item (CTM-15) and the 3-item (CTM-3) Care Transition Measure.

Results: We compared the fit of nine models among a sample of 194 Swedish patients. Cronbach's alpha was 0.946 for CTM-15 and 0.74 for CTM-3. The model indices for CTM-15 and CTM-3 were strongly indicative of inferior goodness-of-fit between the hypothesized one-factor model and the sample data. A multidimensional three-factor model revealed a better fit compared with CTM-15 and CTM-3 one factor models. The one-factor solution, representing 4 items (CTM-4), showed an acceptable fit of the data, and was far superior to the one-factor CTM-15 and CTM-3 and the three-factor multidimensional models. The Cronbach's alpha for CTM-4 was 0.85.

Conclusions: CTM-15 with multidimensional three-factor model was a better model than both CTM-15 and CTM-3 one-factor models. CTM-4 is a valid and reliable measure of care transfer among patients in medical and surgical wards in Sweden. It seems the Swedish CTM is best represented by the short Swedish version (CTM-4) unidimensional construct.

Key words: care transitions measure, patient discharge, patient transfer, psychometrics

Introduction

Care transitions—actions to ensure coordination and continuity of patient care during the transfer between or within healthcare settings [1]—are well-known risk situations in patient care trajectories. About one in five discharged patients has experienced adverse events following hospitalization [2, 3] and up to 42% of the discharged patients experienced errors in medication continuity [4] or problems with follow-up appointments or tests [5]. High usage of healthcare resources following discharge from hospital is common [6–8]; in Sweden, one in five patients was re-hospitalized within 90 days after discharge [9], and 66% of the hospitalized patients were readmitted due to the same problem that caused the first hospitalization [10].

Several studies have explored the problems associated with discharge communication [11] and conclude that patients are unprepared for discharge and the self-management activities that follow hospitalization [12, 13]. Information is given hastily and patients often leave hospital with an incomplete understanding of their diagnoses, medication changes, and plans of care [13]. According to a Swedish survey, more than 60% of elderly patients did not perceive that they were informed about their medication at discharge and nearly 70% did not know which medications they were taking or why [10]. However, no valid measure of care transitions has been reported for the Swedish speaking population.

The original American Care Transitions Measure (CTM) [14] was developed to measure the quality of care transitions [15], with the aim of guiding researchers and healthcare professionals to improve transitional care. The original measure exists in two versions, CTM-15 and CTM-3. The CTM-15 consists of 15 items and the CTM-3 includes three items which are embedded in the CTM-15 (items 2, 9 and 13). The CTM items are rated on a four-point Likert scale ranging from 1 = 'strongly disagree' to 4 = 'strongly agree', with a fifth response being 'don't know/don't remember/not applicable'. The CTM scale is constructed as a set of items assessing quality in care transitions as a unidimensional scale. The items cover the four content areas critical understanding, preferences important, management preparation and care plan [16]. The questionnaire is split into four sections covering: preferences taking into account at the hospital (items 1–3), preparations to leave the hospital (items 4–11), preparations on follow-up appointment (item 12), and medication management (items 13–15). The summarized score (excluding the 'not applicable' scores) is computed as the total sum divided with the number of answered items, minus 1 and multiplied by 100 to get a total score (0–100) for each respondent. This score reflects the overall quality of the care transition, with lower scores indicating a poorer quality transition, and higher scores indicating a better transition. In essence, the CTM aims to determine the extent to which patients perceive they were prepared for self-care. In the United States, the CTM-3 has been incorporated into the Hospital Consumer Assessment of Healthcare Providers and Systems, a patient experience survey used in every hospital that accepts federal Medicare payment. Further, it has been shown that the CTM-3 has a strong association with the risk of readmission, as for each 10 point increase in the measure the risk for readmission is reduced with 14% [17].

Recent findings suggest that the CTM may have limitations [18], but because of the lack of valid instruments aimed to measure care transitions the CTM remains a widely used questionnaire. The CTM has been translated and validated in a number of languages [19–21] and settings [18, 22], reporting either different factor structure [21, 22], issues with reliability [20] or need for additional items [22].

Therefore, considering the inconsistencies in the literature regarding both the CTM-15 and CTM-3 [18–22] and the lack of a Swedish measure of care transitions, this study aims to translate and assess the validity and reliability of both the CTM-15 (full version) and the CTM-3 (short version) in the Swedish context.

Methods

The study was conducted at 10 wards (medical and surgical) at five hospitals (one university hospital, one regional hospital and three general hospitals) in three different regions (Kalmar county, Stockholm county and Gävle county) in Sweden. Swedish healthcare comprises 21 different counties that are independent, however overall quite similar in the organization of healthcare. The three counties represent a variety of rural and urban areas.

Translation and adaptation

The translation was guided by the principles for translation and cultural adaption by Wild *et al.* [23], combined with the World Health Organization (WHO) recommendations [24]. The process encompassed the following steps: preparation, forward translation, reconciliation, first expert panel, back translation, back translation review, second expert panel, harmonization, cognitive debriefing and writing of final version.

During *preparation* for the translation, the instrument developer (co-author EAC) was contacted and approved the translation to a Swedish version. In the *forward translation*, two native Swedish speakers (MF and ME) separately translated the English version into Swedish, compared their translations and *reconciled* them into one. The *first expert panel*, consisting of three researchers and three healthcare workers, reviewed the reconciled translation and identified inadequate expressions. Their suggestions were reconciled by the research group. The revised translation was sent for *back translation* to a professional translator without knowledge of the original version of the questionnaire. The back translation was *reviewed* and compared with the original version by the research group and the instrument developer. The developer raised no major concerns with the translation. The *second expert panel*, consisting of two experts on care transitions, one registered nurse (RN) with expertise in questionnaires and one physician with expertise in healthcare management, reviewed the translation. The expert panel rated the questionnaire's relevance to Swedish healthcare settings and provided suggestions for alternative translations. The research group *harmonized* the expert panel's suggestions. The *cognitive debriefing* was conducted with a sample of three patients with chronic conditions (diabetes mellitus and chronic obstructive pulmonary disease (COPD)) who were asked to read and reflect on the questions out loud. Patients were asked to reflect on both the wording of the questions and their relevance. A *final version* (in appendix) was written based on the patients' input. The main difference between the original American versions and the Swedish translation is that the phrasing 'took my preferences and those of my family or caregiver into account' in items 2 and 3 were revised to 'took my preferences into account'. The reason for this is to avoid confusion on whose preferences the answer refers to.

Instrument

The psychometric testing in this study included the 15 item version in which the 3 item version is embedded. The testing also included five socio-demographic items including gender, age, education, diagnosis and self-rated health, rated from 1 (bad) to 5 (excellent).

Participants and setting

In total, 730 questionnaires were distributed to the wards, and the professionals at the wards handed out 460 of these (63%) to patients. The remaining questionnaires were returned to the research group. The questionnaires were distributed to adult patients by team leaders or RNs at the time of hospital discharge with written and verbal information on the study and instructions to complete upon returning home. Each patient received a closed envelope containing the Swedish CTM-15, the socio-demographic questions and a stamped, addressed return envelope. No reminder was sent out as no data on patient address were collected.

The study was approved by the Regional Ethical Board in Stockholm, Sweden, no. 2014/1498-31/2.

Statistical analysis

Descriptive statistics are presented as median (IQR) or as percentages. Statistical analyses included Cronbach's alpha and composite reliability to examine the reliability of the instrument, exploratory factor analysis (EFA) to evaluate dimensionality followed by a confirmatory factor analysis (CFA) to investigate construct validity.

Parallel analysis (PA) was used to determine the number of factors to retain in the EFA, and the eigenvalues from the PA were compared to those computed from the study data. Following the EFA, a CFA was performed to validate the resulting constructs from the EFA.

In the CFA we hypothesized that the 15 item and the 3 item CTM representation would be replicated in this analysis, and we examined the dataset in order to evaluate the construct validity. To investigate the factorial validity, a series of CFA were conducted based on the original measure, previous translations/validations and our theoretical assumptions. Nine models were tested in the CFA:

- Model 1: all 15 items.
- Model 2: a three-factor solution based on the four sections in the CTM-15 (items 1–3 'Preference taking into account at the hospital'; items 4–11 'Preparation to leave the hospital' plus item 12 'Preparations on follow-up appointment'; and items 13–15 'Medication management'). The 'Preparation' items 4–12 were included in one factor as at least two items must be included in a factor.
- Model 3: 14 items (item 15 removed because of low squared multiple correlation).
- Model 4: two-factor solution based on the EFA with components 'Shared preparation for self-care' (items 1–5, 7–8, 12) and 'Critical understanding and responsibility' (items 6, 9–11, 13–15).
- Model 5: three-factor solution following the Hebrew, Arabic and Chinese models [20, 21] with the components labelled 'Patients knowledge and skills' (items 5, 6, 8, 9, 10, 11, 13), 'Interactive self-care preparation' (items 1, 2, 3, 4, 7, 12) and 'Medication management' (item 14, 15).
- Model 6: summarized model with items 1–11 'Preparation items' and items 13–15 as 'Follow up items'.
- Model 7: CTM-3 (the original short version) model.
- Model 8: short Swedish version that includes 4 items of the CTM-15 (items 1, 4, 7 and 10) reflecting one item each from the content areas of the original CTM-15 [16].
- Model 9: based on the original item structure of the content areas 'critical understanding' (items 9, 10, 11, 13, 14, 15), 'Preferences important' (items 1, 2, 3), 'Management preparation' (items 4, 5, 6, 8) and 'Care plan' (items 7, 12) of the original CTM-15 [16].

Thus nine distinct factor models, with uncorrelated measurement error terms, were specified and tested using confirmatory factor analysis (CFA).

We employed the commonly reported indexes to assess the fitness of the model: Chi-square/df, CFI (Comparative Fit Index) and Root-Mean-Square Error of Approximation (RMSEA). The following cut-off values were used as the level of acceptance: CFI equal to or greater than 0.90 [25]; RMSEA equal to or less than 0.08 [26]; CMIN/DF < 3 [27] an acceptable fit and CMIN/DF < 5 reasonable fit. Multicollinearity and outlier problems were examined and assumption of normality checked. Convergent validity was assessed by average variances extracted (AVE). AVE values greater than 0.5 indicate that there is no problem of convergent validity. Composite reliability (CR) was calculated to determine reliability and values above 0.7 indicate reliable factor measurement. A Cronbach's alpha was reported to enable comparison with other studies and of a value 0.7 or more was considered as acceptable for internal consistency (reliability). The maximum likelihood expected cross validation index (MECVI) and the Akaike Information Criterion (AIC) were used to compare the models—lower values indicate a better fit. EFA was carried out by using SPSS 25 and CFA was carried out by using Amos 25. The level of significance was specified at 0.05.

We used the sample size approach advocated by Myers *et al.* [28], rules of thumb for determining adequate sample size for CFA include, but are not limited to: ratio of N (number of subjects) to the number of variables in a model (*p*), $N/p \geq 10$. The minimum sample size for CFA was satisfied, with a final sample size of 194, providing a ratio of 12.9 per variable. Floor and ceiling effects were examined and considered problematic if more than 15% of participants achieved the lowest or highest possible score [29]. A floor effect refers to the situation when a large proportion of the individuals answer using the lowest scores. A ceiling effect is the opposite; a large proportion of the patients choose the highest possible response alternative. In both situations this leads to problems with internal consistency reliability; when there is too little variability in the data, such items cannot be used to identify subgroups of individuals.

Results

In total, we received 203 of the 460 questionnaires sent out, corresponding to a response rate of 44%. Participants with over 50% missing values were excluded from the analysis (*n* = 9). In total, we analysed responses from 194 patients, of which 105 (54.1%) were male. The median age of responders was 71 years, range 21–97 years. About half of the responders had a primary school or lower education and one fifth (*n* = 42) had a university education. The most common diagnoses were chronic obstructive pulmonary disease (*n* = 40) and heart failure (*n* = 38). More than half of the responders (60.3%) rated their health as good or very good and only six (3.1%) responders rated their health as very poor. The details of the baseline characteristics are presented in Table 1.

The median CTM-15 item score was 3. The total transformed score was median 66.67, mean 65.8 and range 0–100.

Evaluation of measurement properties

For the CTM-15, Cronbach's alpha coefficient was 0.946, demonstrating very satisfactory internal consistency. For the CTM-3, Cronbach's alpha coefficient was 0.74.

The proportion of missing items was small and under 10% for items 1–13 (ranging from 1.5% to 9.3%), which is not considered problematic. However, for items 14 and 15, 13.9% and 16.9% of participants did not respond (Table 2).

For the CTM-15, the floor effect was small: under 10% for items 1–14 and 12.9% for item 15. The ceiling effect was very large, reaching 67% for item 1, and was over 10% for all measured items.

Table 1 Baseline characteristics and descriptive statistics of participants (*n* = 194)

Variables	No. (%)
Gender	
Male	105 (54.1)
Female	88 (45.4)
Missing	1 (0.5)
Education	
Lower than primary school (less than 9 years)	21 (10.8)
Primary school exams (=9 years)	65 (33.5)
High school (or vocational training)	63 (32.5)
University	42 (21.6)
Missing	5 (1.5)
Main diagnosis	
Chronic obstructive pulmonary disease	40 (20.6)
Heart failure	38 (19.6)
Atrial fibrillation	5 (2.6)
Cancer	33 (17.0)
Diabetes	3 (1.5)
Others	75 (38.7)
General health	
Very good	39 (20.1)
Good	78 (40.2)
Neither good nor poor	46 (23.7)
Poor	24 (12.4)
Very poor	6 (3.1)
Missing	1 (0.5)
Type of ward	
Medical	81 (41.8)
Surgical	113 (58.2)

Factor analysis

Firstly, we performed an exploratory FA which revealed a two-factor solution. Both factors had eigenvalues larger than one and this two-factor solution was further supported by parallel analysis. The first component explained 58.66% of the variance in data and the second component added a further 8.12% to the explained variance, while Cronbach's alpha showed sufficient internal consistency of the two components (0.93 vs. 0.88, respectively). The first component (items 1–5, 7–8, 12) (all factor loadings higher than 0.638) was labelled '*Shared preparation for self-care*'. The second component (items 6, 9–11, 13–15), with factor loadings higher than 0.587, was labelled '*Critical understanding and responsibility*'.

Results of the CFA for all models displayed that most of the loadings exhibited values between 0.7 and 0.9 (Table 3) and all factor loadings were significant. However, the model indices did not show acceptable fit (Table 4) except Model 8. The Chi-square test for Model 7 and 8 were not statistically significant ($P = 0.27$ and $P = 0.78$, respectively). The CFA results of Model 1 with all 15 items and one latent construct showed the following values: CFI = 0.77, RMSEA = 0.16 and CMIN/DF = 5.7. In addition in Model 1, item 15 had low standardized regression weight and the model did not fit as reflected by the fit indices. The item showed low factor loadings in both the EFA and CFA to warrant consideration of exclusion in the CFA (as tested in Model 3). Model 5 revealed a better result with AIC 387.8, CFI = 0.89, RMSEA = 0.098 and CMIN/DF = 3.35 (Table 4). A lower AIC value indicates a better trade-off between fit and complexity. Model 5, based on forced three-factor solution following the Hebrew, Arabic and Chinese models, has three latent constructs representing interaction, knowledge and skill and medical management. All factor loadings were significant at $P < 0.001$ level. The standardized factor loadings varied as follows: between 0.82 and 0.87 for the latent variable interaction, 0.63 and 0.91 for knowledge and skill and between 0.52 and 0.91 for medical management. However, Chi-square value for the overall model fit

Table 2 Descriptive statistics with median and number and percentage of the CTM items

No.	CTM item statement	Floor *n* (%)	Ceiling *n* (%)	Missing *n* (%)
1	Before I left the hospital, the staff and I agreed about clear health goals for me and how these would be reached	2 (1.0)	130 (67.0)	3 (1.5)
2	The hospital staff took my preferences and those of my family or caregiver into account in deciding what my health care needs would be when I left the hospital	4 (2.0)	98 (50.5)	3 (1.5)
3	The hospital staff took my preferences and those of my family or caregiver into account in deciding where my health care needs would be met when I left the hospital	8 (4.1)	70 (36.0)	3 (1.5)
4	When I left the hospital, I had all the information I needed to be able to take care of myself	8 (4.1)	117 (60.3)	16 (8.2)
5	When I left the hospital, I clearly understood how to manage my health	8 (4.1)	71 (36.6)	2 (1.0)
6	When I left the hospital, I clearly understood the warning signs and symptoms I should watch for to monitor my health condition	5 (2.6)	88 (45.3)	4 (2.0)
7	When I left the hospital, I had a readable and easily understood written plan that described how all of my health care needs were going to be met	3 (1.5)	92 (47.4)	7 (3.6)
8	When I left the hospital, I had a good understanding of my health condition and what makes it better or worse	9 (4.6)	75 (38.6)	3 (1.5)
9	When I left the hospital, I had a good understanding of the things I was responsible for in managing my health	14 (7.2)	52 (26.8)	9 (4.6)
10	When I left the hospital, I was confident that I knew what to do to manage my health	17 (8.8)	40 (20.6)	13 (6.7)
11	When I left the hospital, I was confident I could actually do the things I needed to do to take care of my health	14 (7.2)	44 (22.7)	18 (9.3)
12	When I left the hospital, I had a readable and easily understood written list of the appointments or tests I needed to complete within the next several weeks	19 (9.8)	23 (11.9)	14 (7.2)
13	When I left the hospital, I clearly understood the purpose for taking each of my medications	19 (9.8)	37 (19.1)	10 (5.1)
14	When I left the hospital, I clearly understood how to take each of my medications, including how much I should take and when	2 (1.0)	64 (33.0)	27 (13.9)
15	When I left the hospital, I clearly understood the possible side effects of each of my medications	25 (12.9)	25 (12.9)	32 (16.5)

Table 3 Results of the confirmatory factor analysis with standardized regression coefficients of the items of the nine models

Item	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
CTM-1	0.77	0.84	0.78	0.83	0.85	0.78		0.81	0.85
CTM-2	0.77	0.92	0.78	0.83	0.87	0.78	0.62		0.92
CTM-3	0.75	0.89	0.75	0.79	0.84	0.75			0.88
CTM-4	0.81	0.78	0.81	0.84	0.82	0.81		0.85	0.82
CTM-5	0.81	0.79	0.81	0.82	0.73	0.81			0.83
CTM-6	0.72	0.73	0.72	0.70	0.71	0.73			0.74
CTM-7	0.68	0.67	0.68	0.71	0.69	0.69		0.73	0.88
CTM-8	0.81	0.83	0.81	0.76	0.84	0.81			0.80
CTM-9	0.76	0.80	0.76	0.85	0.85	0.76	0.79		0.85
CTM-10	0.82	0.87	0.82	0.91	0.91	0.82		0.72	0.92
CTM-11	0.75	0.78	0.74	0.82	0.82	0.74			0.84
CTM-12	0.61	0.59	0.61	0.62	0.63	0.60			0.75
CTM-13	0.66	0.91	0.66	0.67	0.91	0.90	0.67		0.67
CTM-14	0.58	0.83	0.58	0.56	0.84	0.84			0.55
CTM-15	0.48	0.52		0.48	0.52	0.52			0.48

Table 4 Results of CFA by model and indices

Model	RMSEA	CFI	Chisq/df	AIC
Model 1 (one-factor, CTM-15)	0.155	0.77	5.65	598.7
Model 2 (three-factor, 15 item)	0.102	0.88	3.59	407.6
Model 3 (one-factor, 14 item)	0.155	0.77	5.65	598.7
Model 4 (two-factor, 15 item)	0.119	0.84	4.49	490.9
Model 5 (three-factor, 15 item)	0.098	0.89	3.35	387.8
Model 6 (two-factor, 15 item)	0.123	0.82	4.72	512.4
Model 7 (original CTM-3)	0.289	1.0	17.1	18.0
Model 8 (one-factor, CTM-4)	0.000	1.0	0.25	24.5
Model 9 (four-factor, 15 item)	0.111	0.89	3.4	385.3

RMSEA, root-mean-square error of approximate; CFI, comparative fit index; Chisq, chi-square; df, degree of freedom; AIC, Akaike Information Criterion.

was significant ($P < 0.001$) suggesting a lack of fit between the hypothesized model and the data. Model 8, the Swedish short version with 4 items, was found to be acceptable using the criteria indicated earlier. The results are: Chi square/df = 0.25; CFI = 1.0 and Root-Mean-Square Error of Approximation (RMSEA) = 0.0. The AVE value was 0.61indicating absence of problem of convergent validity and the composite reliability was 0.86. The Cronbach's alpha for CTM-4 was 0.85.The assumption of normality was fulfilled and no multicollinearity and outlier problems were observed.

The maximum likelihood expected cross validation index (MECVI) value of 3.14 of model 1 compared with the substantially lower MECVI value of 1.597 for the model 5 of the Swedish version confirm the inferior fit of model 1. However, the MECVI value of 1.597of model 5 compared with the substantially lower MECVI value of 0.14 for model 8 confirm the inferior fit of model 5 compared with model 8. It seems the Swedish CTM is best represented by the short Swedish version (CTM-4) unidimensional construct.

Discussion

This translation and validation of the Care Transitions Measure (CTM-15 and CTM-3) was tested in a representative population of persons discharged from 10 different medical or surgical wards at five hospitals in Sweden. Given the inconsistencies in the literature concerning the appropriate factor structure of the CTM, and the lack of measures to assess the quality of care transitions among Swedish patient populations, we have examined a series of models of the CTM, using CFA. Nine models were specified and tested and items were allowed to load, with uncorrelated measurement error terms. On the basis of the fit indices, a one-factor model, comprising of four CTM items, was considered to be an adequately fitting model, and provided a better fit to the data than the alternative models. The Swedish version of the CTM-15 lacks acceptable fit in CFA but showed excellent internal consistency (Cronbach's alpha = 0.946). The high reliability is comparable to other translations of the CTM [21], as well as to the original construct [15].

Though European policy and interest for care transitions are not comparable to those in the United States, the European Union has funded major research projects on integrated care [30] and care transitions [31]. As a measure of the quality of care transitions, the CTM-15 has previously been translated and tested in several countries [19–21] and settings [18, 22], and this study represents the first published translation in Sweden. The measure was tested in a population of patients from medical and surgical wards with high illness burden as well as those with less serious illness burden. Both patients living with complex and long-term conditions and patients admitted for minor surgery need thorough discharge communication with healthcare professionals to handle the necessary post-discharge self-care activities and follow-ups [32, 33].

The ceiling effect found in CTM-15 was higher than that for the original construct [16], and somewhat higher but comparable to other reported psychometric evaluations [18, 21]. The high proportion of responders who achieved a ceiling effect might be an effect of the survey having only four item responses, meaning that an equal distribution across each item response would yield 25% as the ceiling. However, an acceptable level of the ceiling effect is normally set to 15%, which means that all items except 12 and 15 reached this effect.

Previous translations [20, 21] have not found a factor structure comparable to the original unidimensional American construct. In line with the other translations [20, 21], our CFA of the Swedish CTM-15 showed a close to reasonable fit with a three-factor solution. However, there is no substantial evidence to support this claim that the CTM-15 may be best specified as assessing three distinct, yet related constructs in the Swedish sample. On the basis of the fit indices, the one-factor model, comprising of four CTM items, was

considered to be an adequately fitting model, and provide a better fit to the data than the alternative models. The AVE displayed that CTM-4 has a good convergent validity. Reliability measured in both composite reliability and Cronbach's alpha exceeded the minimum of 0.7 indicating satisfactory reliability. The results consequently provide support for a one-dimensional model of the CTM in the sampled Swedish population. The items included in the Swedish short version (items 1, 4, 7, 10) represent an item each from the original American four content areas 'Critical understanding' (item 10), 'Preferences important' (item 1), 'Management preparation' (item 4) and 'Care plan' (item 7) [16]. The Swedish short version hence follows the structure that high quality care transitions are related to an agreement between patient and provider on health goals, provision of information on self-management and follow-up, as well as patient confidence on how to manage their health [16]. These findings are comparable to studies of care transitions in Sweden, showing that patients are empowered to manage the post-discharge needs through information and active participation [34] as well as national legal incitements of involving patients in decisions and establishment of individual care plans [35, 36]. As model 5 has close values to the reasonable fit, this model appears to be the most attractive full length model based on theory and on previous findings [20, 21]. However, as the missing rates increased with the number of items, the issue of patients experiencing response fatigue should be raised. The slight trend towards response fatigue could indicate that further studies are warranted to explore if the Swedish short version CTM-4 could be preferable to the longer version.

A major strength of the study is the systematic translation using input from various types of patients, researchers and healthcare professionals, which ensures that the items are phrased in an easily comprehensible way. However, a limitation is that only three persons were included in the cognitive debriefing, where the literature suggests 5–8 persons [23]. Another limitation of this study is the relatively low response rate and the manner in which the questionnaires were distributed among possible responders. As we wanted to gather data from multiple hospital settings in various regions, the questionnaire distribution was delegated to nurses and team leaders at different wards. The busy setting at a ward, especially at the time of patient discharge, is one possible reason for the low distribution rate. This could also have led to patients not receiving adequate information about the questionnaire, which may have diminished their interest in sending it back. We chose not to ask the wards to gather personal data on included (or unwilling) patients, to make the ward personnel more inclined to participate in distribution of questionnaires. However, this meant that we do not have any information on number of patients who declined participation, nor were we able to send out reminders or perform a non-response analysis.

In an attempt to validate the Swedish version and reconcile contrary findings in the literature [18–21] we tested nine alternative models, including the traditional CTM-15 and CTM-3 models along with a series of two-factor and three-factor model conceptualizations. We found evidence by using CFA that a Swedish version of the Care Transition Measure could be represented by CTM-4 unidimensional construct. However, the one-factor full (CTM-15) and short (CTM-3) versions may not apply to the Swedish context, due to cultural, hospital environment or practice differences which may impact on the process and implementation of care transfer. This study hence adds to the previous reported problems with the CTM-15 and CTM-3 [18–21].

In conclusion, CTM-4 is a valid and reliable measure of care transfer among patients in medical and surgical wards in Sweden.

The Swedish version of CTM was found to assess one-dimensional construct of four CTM items and not the one-factor CTM-15 or CTM-3 constructs that were originally conceptualized [16].

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