Z. Evid. Fortbild. Qual. Gesundh. wesen (ZEFQ) 182–183 (2023) 17–25

Contents lists available at ScienceDirect

Z. Evid. Fortbild. Qual. Gesundh. wesen (ZEFQ)

journal homepage: http://www.elsevier.com/locate/zefq

Qualität und Sicherheit in der Gesundheitsversorgung / Quality and Safety in Health Care

Measuring transitional patient safety: Adaptation and validation of the German version of the Care Transitions Measure

Messung der Patientensicherheit im Entlassungsprozess: Adaptation und Validierung der deutschen Version des Care Transitions Measure

Matthias Marsall [a,*], Thorsten Hornung [b], Alexander Bäuerle [c], Matthias Weigl [a]

[a] *Institute for Patient Safety (IfPS), University Hospital Bonn, Bonn, Germany*
[b] *University Hospital Bonn, Bonn, Germany*
[c] *Clinic for Psychosomatic Medicine and Psychotherapy, LVR–University Hospital Essen, University of Duisburg-Essen, Essen, Germany*

ARTICLE INFO

Article History:
Received: 14 August 2023
Received in revised form: 30 September 2023
Accepted: 3 October 2023
Available online: 10 November 2023

Keywords:
Patient safety
Psychometric properties
Measurement invariance
Patient-reported outcome measure

ABSTRACT

Introduction: The transition between different care contexts, especially during discharge from inpatient treatment to home, is associated with risks for patient safety. Internationally established, the Care Transitions Measure (CTM) is used to assess the quality and safety of this transition from the patients' perspective. A systematic and standardized assessment of quality and safety in the discharge process from the patients' perspective has not been possible in German-speaking countries due to the lack of a German adaptation and validation of the CTM. This study aims to translate, adapt, and validate the CTM for use in German-speaking countries

Methods: The German version of the CTM was developed based on internationally accepted recommendations for translating and adapting questionnaires. Patients of all departments (except pediatric departments) of a German university hospital who were discharged home after at least three days of inpatient treatment received the questionnaire by mail between May and August 2022. A total of 806 patients participated in the survey. The validity of the CTM was tested by factor analyses. For this purpose, different factor models were compared. In addition, the measurement invariance of the instrument was examined.

Results: The construct validity of the long version of the CTM (15items) with a two-factorial model structure was confirmed with good model fit indices. The two subscales had excellent internal consistency. In addition, the one short version with four items achieved excellent model fit indices and high internal consistency. For the long version of the CTM, measurement invariance was confirmed for all sociodemographic, care-related, and survey response characteristics examined. The measurement invariance of the short version was only partially confirmed.

Discussion: The validity and reliability of the German version of the CTM were confirmed. In its long version, the instrument is measurement invariant across various characteristics and thus allows valid interpretation of group differences. The short version is partially measurement invariant and is suitable as a screening instrument for assessing the quality and safety of discharge processes due to its high validity and reliability.

Conclusions: With a validated and standardized German version of the CTM, an instrument is now available to assess the quality and safety of the discharge process from the patients' perspective. Thus, this study provides an essential tool for systematically investigating and optimizing patient safety in the discharge process.

Abbreviations: CFA, Confirmatory Factor Analysis; CFI, comparative fit index; CP, care plan; CTM, Care Transitions Measure; CU, critical understanding; df, degrees of freedom; EFA, Exploratory Factor Analysis; G-CTM, German Version of the Care Transitions Measure; I-CVI, item-based content validity index; ICU, intensive medical care; MP, management preparations; PI, preferences important; PROM, patient-reported outcome measure; RMSEA, root mean square error of approximation; S-CVI, scale-based content validity index; SRMR, standardized root mean square residual; TLI, Tucker Lewis index; WLSMV, weighted least squares means and variance adjusted

* Corresponding author. Dr. Matthias Marsall. Universitätsklinikum Bonn (UKB), Venusberg-Campus 1, Gebäude A 02, 53127 Bonn, Germany.
E-Mail: matthias.marsall@ukbonn.de (M. Marsall).

https://doi.org/10.1016/j.zefq.2023.10.002
1865-9217/

ARTIKEL INFO

Artikel-Historie:
Eingegangen: 14. August 2023
Revision eingegangen: 30. September 2023
Akzeptiert: 3. Oktober 2023
Online gestellt: 10. November 2023

Schlüsselwörter:
Patientensicherheit
Psychometrische Güte
Messinvarianz
Patientenberichtete Ergebnismessung

ZUSAMMENFASSUNG

Hintergrund: Der Übergang zwischen verschiedenen Versorgungskontexten, insbesondere bei der Entlassung aus einer stationären Behandlung nach Hause, ist für Patient*innen mit Risiken für die Patientensicherheit verbunden. International etabliert wird das Care Transitions Measure (CTM) zur Erfassung der Qualität und Sicherheit dieses Übergangs aus Patient*innenperspektive verwendet. Eine systematische und standardisierte Erfassung der Qualität und Sicherheit im Entlassungsprozess aus Patient*innenperspektive war bisher im deutschsprachigen Raum aufgrund des Fehlens einer deutschsprachigen Adaptation und Validierung des CTM nicht möglich. Das Ziel dieser Studie ist die Übersetzung, Adaptation und Validierung des CTM für den Einsatz im deutschsprachigen Raum.
Methode: Die deutschsprachige Version des CTM wurde auf der Grundlage international anerkannter Empfehlungen zur Übersetzung und Adaptation von Fragebögen entwickelt. Patient*innen aller Kliniken (mit Ausnahme der pädiatrischen Bereiche) eines deutschen Universitätsklinikums, die nach einer mindestens dreitägigen stationären Behandlung nach Hause entlassen wurden, erhielten im Zeitraum Mai bis August 2022 postalisch den Fragebogen. Insgesamt nahmen 806 Patient*innen teil. Die Validität des CTM wurde durch Faktorenanalysen überprüft. Hierzu wurden verschiedene Faktormodelle verglichen. Zusätzlich wurde die Messinvarianz des Instruments überprüft.
Ergebnisse: Die Konstruktvalidität einer Langversion des CTM (15 Items) mit einer zwei-faktoriellen Modellstruktur wurde mit guten Model-Fit-Indizes bestätigt. Die beiden Subskalen hatten exzellente interne Konsistenzen. Zusätzlich erreichte die eine Kurzversion mit vier Items hervorragende Model-Fit-Indizes und eine hohe interne Konsistenz. Für die Langversion des CTM konnte die Messinvarianz aller untersuchten soziodemografischen, versorgungsbezogenen und befragungsbezogenen Charakteristika bestätigt werden. Die Messinvarianz der Kurzversion wurde nur teilweise bestätigt.
Diskussion: Die Validität und Reliabilität der deutschsprachigen Version des CTM wurde bestätigt. Das Instrument ist in seiner Langversion über verschiedene Charakteristika messinvariant und erlaubt damit die valide Interpretation von Gruppenunterschieden. Die Kurzversion ist teilweise messinvariant und eignet sich aufgrund der hohen Validität und Reliabilität als Screeninginstrument zur Erfassung der Qualität und Sicherheit des Entlassungsprozesses.
Schlussfolgerung: Mit einer validierten und standardisierten deutschsprachigen Version des CTM liegt nun Instrument vor, um die Qualität und Sicherheit des Entlassungsprozesses aus Patient*innenperspektive zu erfassen. Damit liefert diese Studie ein wichtiges Instrument zur systematischen Untersuchung und Optimierung der Patientensicherheit im Prozess der Entlassung.

Introduction

Transitioning patients between different care contexts is a particularly critical step, with an increased risk of experiencing harm and negative health consequences such as adverse events [1] or medication errors [2,3]. Particularly during discharge from hospital-based, inpatient treatment to 'self-directed' care at home, patients pass a sector boundary at which roles change, and responsibility for care is transferred back to patients – with increased risks for safety and failures [4,5]. Consequently, the World Health Organization highlighted the relevance of ensuring safe transitions between care contexts and strengthening patient-centeredness to prevent avoidable harm [6]. Since then, increased attention has been directed towards the quality of out-of-hospital transitions and the safety of patient discharge processes.

However, incidences of hospital readmission within 30 days after discharge ranges between 14 and 22% in Germany [7]. Deficits in the post-discharge process and poor communication significantly contribute to unplanned patient readmissions and safety incidents at home [8–10]. Research has increasingly focused on examining safety-related processes in discharge management and identifying quality- and safety-critical aspects in this care transition [11–14]. For this purpose, the Care Transitions Measure (CTM) was developed, which is internationally the mainly applied instrument for measuring the quality of care transitions from patients' perspective [15–17]. Translations and validations of this original English language tool are now available in different languages [18–22]. Several studies have undermined its validity and utility: higher CTM-scores are related to lower readmission risks, better health outcomes, higher eHealth literacy, lower readmissions of infants after neonatal intensive care as well as higher medication adherence after emergency department discharge [9,18,23–25]. Moreover, capturing patient experiences in care as well as their active involvement in research are encouraged to achieve patient-centered care, i.e., through utilizing patient-reported outcomes measures (PROM) [26]. Therefore, CTM, which validly captures patient experiences in the discharge process, is an important PROM for evaluating and improving care transitions.

Notwithstanding its wide adoption in health services research, a German version of the CTM is still missing. This impedes comparative examinations of discharge process quality and related outcomes. As a result, the quality of care transition from patients' perspectives in Germany has been insufficiently studied so far [27]. Moreover, the availability of valid and robust tools is essential for developing and evaluating interventions to ensure safe transitions between care contexts. In summary, there is a relevant research gap in the ability to assess patient-centered and safe care in discharge management in Germany.

Objective

This study aims to translate the care transition measure (CTM) [16], test its measurement characteristics, and introduce a version adapted to the German-speaking healthcare context. With this, we contribute to the impetus of investigating patient safety in transitions between different care contexts in Germany and promote the development or adaptation of interventions.

Adopting measurement tools in different cultural contexts and national healthcare settings should be accompanied by systematic and thorough investigations for validity and reliability [28]. We focus mainly on examining factorial validity since different factorial structures with three or four dimensions and different

short versions of the CTM have been investigated so far [19,23,29]. In addition, measurement invariance of the CTM tool concerning important sociodemographic and treatment-related characteristics must be established. This is particularly important to highlight the extent to which the CTM can be used to examine group differences, which is vital for the comparability of different studies [30–32].

Method

A stepwise translation, refinement, adoption process, and an ensuing cross-sectional survey were conducted with the German version of the Care Transitions Measure (G-CTM) among patients after hospital discharge. This study is part of a larger project investigating hospital discharge processes and post-discharge outcomes in Germany. The investigation was conducted accordingly to the declaration of Helsinki and approved by the Ethics Committee of the Medical Faculty of the University of Bonn (Nr. 107/22). The study protocol was registered at the German Clinical Trials Register (Code DRKS00028947). The reporting guidelines 'Strengthening the Reporting of Observational Studies in Epidemiology' (STROBE) were applied [33].

Study design

This study was conducted across various medical specialties and departments (except pediatric clinics) of an academic teaching hospital in Germany that is a maximum-care hospital that treats around 350,000 outpatients, 50,000 inpatients, and 40,000 emergency patients per year. We chose a heterogeneous sample in terms of disease entities and specialties to avoid compromising external validity of our results by limiting them to single diseases/clinics.

Data was collected using paper-based questionnaires sent to patients via mail three weeks after discharge. No reminder was sent out. Patients' relatives might fill out the questionnaire on patient's behalf if incapable. By allowing relatives to fill out the questionnaire, respective test of measurement invariance enabled us to investigate whether the G-CTM can be used validly and comparably independent of the person answering the instrument. As an alternative to the paper version, a web-based, online version via the online survey system Unipark (Tivian XI GmbH) was provided. For this purpose, a hyperlink and a QR code were printed on paper version of the questionnaire.

A total of 3945 questionnaires were sent out between May and August 2022. Study participation was not compensated. No personal data were collected as part of the survey. The questionnaire contained a comprehensive study disclosure form.

Stepwise translation, refinement, and adoption process of German CTM

Our stepwise translation and adaptation process of the CTM was carried out in line with international recommendations for the development and adaptation of instruments in cross-cultural health research [28]:

In step 1, forward translation was performed. Two of the study authors (MM and MW) independently translated the original English items of the CTM into German. This step resulted in two forward-translated versions of the CTM.

In step 2, these combined translations were synthesized through a discussion between two translators. All ambiguities and discrepancies in the two translations were discussed between the two translators. Afterwards, a third researcher was involved in discussing the translation differences and achieving consensus to define the preliminary, initially translated G-CTM version.

In step 3, a back-translation of the preliminary initial translated version of the instrument into English was performed. For this purpose, two professional English to German-language translators were engaged to translate all G-CTM items independently back into English to compare them to the original CTM items. This step resulted in two back-translated versions of the CTM.

In step 4, to determine a preliminary version of the German translation, a multidisciplinary panel discussed the original English version, the two (German) forward translations, and the two (English) backward translations in terms of conceptual, semantic, and content equivalence. The multidisciplinary panel consisted of two forward translators (both psychologists), one further psychologist, two nursing scientists, and a physician. In this step, all inconsistencies and ambiguities in the translation of the items were resolved, and the preliminary version of the G-CTM was defined.

In step 5, an external expert panel was established to evaluate each CTM item for its clarity, comprehensibility, and relevance in assessing discharge processes' quality and safety. Nine persons, covering physicians, psychologists, and nurses holding academic degrees (from post-graduated professionals to professors) took part in this expert panel. This step used an online questionnaire with all items from the preliminary G-CTM version. Two questions were asked about each item: 'Please indicate below for each item whether it is well understood or not from your point of view' and 'For each item, please indicate below whether it is relevant from your perspective to assess the quality and safety of discharge from a hospital after inpatient treatment.' Moreover, free-text feedback for each item was obtained via text boxes.

All items achieved an item-based content validity index (I-CVI) of at least 75%. The scale-based content validity index (S-CVI) was 79%. A few items were rephrased based on feedback from the expert panel to gain greater clarity of item wording and content relevance of individual items. This version of the items was defined as the final version of the German version of the Care Transitions Measure (G-CTM). The German items of the G-CTM are presented in Table 1. The original English items of the CTM are shown in Appendix A, A.

Patients

We sent out surveys to all patients who met the following inclusion criteria in the period mentioned above: patients had to be at least 18 years old, discharged to home from hospital inpatient care, and hospital stay for at least three days or more. Patients discharged to any other post-inpatient treatment facility or follow-up care (e.g., nursing home, inpatient rehabilitation) were excluded.

Measurements

Initially, the CTM was proposed with four subscales that represent different, distinct components of patient experiences during high-quality hospital discharge processes:

- critical understanding (CU) assesses patient involvement in their self-care responsibilities (six items),
- preferences important (PI) captures patient involvement in the environment of care after discharge from the clinic (three items),
- management preparations (MP) indicate patients' understanding of their health status and how to influence their health (four items),

Table 1
Items of the German Version of the Care Transitions Measure (G-CTM).

#	German item
ctm 1	Vor der Entlassung aus der Klinik einigten sich das Klinikpersonal und ich auf Ziele für meine Gesundheit und wie ich diese erreichen kann.
ctm 2	Das Klinikpersonal berücksichtigte meine Vorstellungen und die meiner Angehörigen bei der Entscheidung, was meine gesundheitlichen Bedürfnisse nach der Entlassung aus der Klinik sind.
ctm 3	Das Klinikpersonal berücksichtigte meine Vorstellungen und die meiner Angehörigen bei der Entscheidung, wo (z.B. zu Hause, ambulante Versorgungseinrichtung) meine gesundheitlichen Bedürfnisse nach der Entlassung aus der Klinik am besten erfüllt werden.
ctm 4	Bei der Entlassung aus der Klinik hatte ich alle notwendigen Informationen, um mich selbst versorgen zu können.
ctm 5	Bei der Entlassung aus der Klinik hatte ich genau verstanden, wie ich mit meiner Gesundheit umgehen muss.
ctm 6	Bei der Entlassung aus der Klinik hatte ich genau verstanden, auf welche Warnzeichen und Symptome ich achten muss, um meinen Gesundheitszustand zu überwachen.
ctm 7	Bei der Entlassung aus der Klinik habe ich schriftliche und leicht verständliche Informationen darüber erhalten, wie meine gesundheitliche Versorgung sichergestellt werden kann.
ctm 8	Bei der Entlassung aus der Klinik hatte ich ein gutes Verständnis für meinen Gesundheitszustand und was diesen verbessert oder verschlechtert.
ctm 9	Bei der Entlassung aus der Klinik hatte ich ein gutes Verständnis für die Dinge, um die ich mich hinsichtlich meiner Gesundheitsversorgung selbst kümmern muss.
ctm 10	Bei der Entlassung aus der Klinik wusste ich genau, was ich für meine Gesundheit tun muss.
ctm 11	Bei der Entlassung aus der Klinik war ich überzeugt, dass ich tatsächlich das tun kann, was ich für meine Gesundheit tun muss.
ctm 12	Bei der Entlassung aus der Klinik habe ich eine schriftliche und leicht verständliche Liste mit Terminen oder Untersuchungen für die nächsten Wochen erhalten.
ctm 13	Bei der Entlassung aus der Klinik hatte ich genau verstanden, wofür ich jedes meiner Medikamente einnehmen sollte.
ctm 14	Bei der Entlassung aus der Klinik hatte ich genau verstanden, wie ich jedes meiner Medikamente einnehmen muss (inklusive Dosierung und Zeitpunkt der Einnahme).
ctm 15	Bei der Entlassung aus der Klinik hatte ich genau verstanden, welche möglichen Nebenwirkungen jedes meiner Medikamente haben kann.

Notes. Original CTM: © Eric A. Coleman, MD, MPH all rights reserved.
Response options English: 1 = Strongly Disagree – 4 = Strongly Agree; 5 = Don't Know/Don't Remember/Not Applicable; Response options German: 1 = Stimme überhaupt nicht zu –4 = Stimme voll und ganz zu; 5 = Ich weiß nicht/ich erinnere mich nicht/trifft nicht zu

- care plan (CP) asks patients whether they were provided with understandable and comprehensive written plans to be prepared after release from hospitalization (2items) [16–17].

The original CTM consists of 15 items with response options from 1 = 'Strongly Disagree' to 4 = 'Strongly Agree'. Further, the fifth response option 'Doṅt Know/Doṅt Remember/Not Applicable' was offered. This fifth response option was not included in the calculations of means nor factor analyses but was treated as a missing value in these analyses.

We captured the following information on patients' sociodemographic characteristics: age (exact indication in years) and sex (female, male, diverse).

Moreover, we assessed the following care-related information: length of the inpatient hospital treatment (in days), whether they received intensive medical care (ICU) treatment (yes, no), the perceived timeliness of hospital discharge (too early, too late, in time), and patients' health insurance (different private and public health insurances).

Further, we assessed survey response variables: whether the patient or a relative had filled in the survey and whether the survey was filled out paper-based or via the online survey.

Statistical analysis

First, study sample characteristics were reported by means and standard deviations (for continuous variables) and by numbers and percentages for categorical variables.

Second, we reported item statistics (percentage of missing, means, standard deviations, skewness, and distribution of responses) of the G-CTM items.

Third, an explorative factor analysis (EFA) was conducted with the entire study sample to examine the factorial structure of G-CTM. Evaluation of the appropriateness of the items for factor analysis was performed under consideration of the Kaiser-Meyer-Olkin (KMO) and Bartlett test of sphericity. EFA was applied using maximum likelihood estimation with Promax rotation. Factor extraction was based on the Kaiser criterion with Eigenvalue > 1 [34]. Factor loadings higher than 0.4 were assumed as significant [34].

Fourth, multiple models of the G-CTM were examined using confirmatory factor analyses (CFA). A baseline model (Model 1) was tested as a one-factorial model with all items loading on one factor. Model 2 was derived from the results of the EFA. In Model 3, we tested the four-factorial structure reported in the original study [16]. In Model 4, we established a three-factorial structure which has been suggested in previous studies [18,20]. Moreover, we wanted to test short versions of the instrument: Model 5 tested the original three-item (items ctm2, ctm9, and ctm13) version [16] and model 6 tested a Swedish four-item (items ctm1, ctm4, ctm7, and ctm10) version [19]. CFA were conducted using weighted least squares means and variance adjusted (WLSMV) as an appropriate estimator for categorical indicator variables [35]. We evaluated the models using the criteria from Hu & Bentler [36]: comparative fit index (CFI $\geq$ .95), Tucker Lewis index (TLI $\geq$ .95), root mean square error of approximation (RMSEA $\leq$ .06), and standardized root mean square residual (SRMR $\leq$ .08). Factor reliabilities were examined as internal consistency Cronbachs' Alpha [CA].

Fifth, measurement invariance was tested as an essential requirement for applying and interpreting mean differences between groups [30–31]. We respectively examined measurement invariance regarding the following characteristics: participants' age (two groups via median split, Median = 64 years); sex (only female and male patients were included in the analyses); respondent (patient vs. relative), survey type (paper-based vs. online); kind of health insurance (we summarized any public health insurance as one group and any private health insurance as another; other health insurances were excluded [n = 4]); length of hospital stay (three groups: group 1: patients with a three-day inpatient stay, group 2: patients with up to one week, group 3: patients with a longer stays); and perceived timeliness of discharge (timely discharged vs. discharged too early; discharged to late were excluded due to small subgroup sample [n = 16]). We conducted three consecutive, increasingly restrictive multigroup-CFA for each of the characteristics respectively: [1] equality of factorial structure across groups (configural invariance); [2] additional equality of factor loadings across groups (metric invariance); and [3] additionally

equality of item intercepts across groups (scalar invariance) [32,37]. Evaluation of measurement invariance was based on examining the changes in CFI (ΔCFI) between the models of each level of invariance (configural vs. model from regular CFA, metric vs. configural, and scalar vs. metric). It should not be greater than −0.01 [38]. In addition, changes in RMSEA (ΔRMSEA) which should not exceed 0.015, were also used for model evaluation [38].

Sixth, we calculated G-CTM scores as linear transformations of the individual means into a 0–100 scale according to the original study [16]. The scores were used the examine associations with sociodemographic, care-related, and survey response variables via t-tests, analyses of variance, and Pearson correlations. Linear regression was used to estimate the variance explained by the long G-CTM version by the short version of the G-CTM. All statistical analyses were performed using R (R Core Team, 2022) and RStudio (Posit Team, 2022).

Results

Study sample characteristics

We received 825 patient questionnaires (response rate: 20.9%). We excluded 17 cases as they indicated they were not discharged to home. Moreover, 2 cases were excluded due to having been treated as an inpatient for only one day. The final sample consisted of 806 questionnaires.

The patients' mean age was 60.8 years (Standard deviation [SD] = 18, Range 19 to 94). The average length of hospital stay was 10.1 days (SD = 16.3, Range 3 to 165, Median = 5). Further sample characteristics are summarized in Table 2.

Descriptive statistics of the German Version of Care Transitions Measure

A summary of the item statistics of the G-CTM items is presented in Table 3. Overall, missings per item ranged from 2.5 % to 5.9 %. The fifth response option ('Doṅt Know/Doṅt Remember/Not Applicable') was primarily used on item ctm15 (5.9 %). All items, except item ctm15, were slightly negatively skewed. Item means ranged from M = 2.54 to 3.33, meaning there was a high agreement of patients regarding a high quality of care transition.

Table 2
Study sample characteristics.

Characteristic	n	%
Sex		
female	383	47.5
male	399	49.5
diverse	3	0.4
missing	21	2.6
ICU care		
no	550	68.2
yes	206	25.6
missing	50	6.2
Perceived timeliness of discharge		
timely	632	78.4
too early	109	13.5
too late	16	2
missing	49	6.1
Health insurance		
public health insurance	538	66.7
public health insurance with additional private insurance	69	8.6
private health insurance	52	6.5
private health insurance with reimbursement by the employer (Beihilfe)	113	14
other	4	0.5
missing	30	3.7
Respondent		
patient	637	79
relative	80	9.9
missing	89	11
Survey type		
paper-pencil	666	82.6
online	140	17.4

Factorial validity of the German Version of the Care Transitions Measure

Explorative factor analysis (EFA)

EFA revealed that the items were suitable for factor analysis. The Bartlett test of sphericity was significant (Chi^2[df = 105] = 10481.76, $p < 0.001$) and the KMO value was 0.944. The Kaiser criterion suggested extracting two factors. The factor loadings of the two-factorial solution are shown in Appendix A, B. The two factors accounted for 65.9% of the variance.

Confirmatory factor analysis (CFA)

Based on the results of the EFA, we performed a two-factorial model (Model 2) in the CFA with items ctm1 to ctm11 as one factor and items ctm12 to ctm15 as the second factor. The results of the confirmatory factor analyses are shown in Table 4.

Model 2, based on the EFA results, had the best fit to the data, and all items had factor loadings greater than 0.74. CFI, TLI, and SRMR indicated an excellent model fit. RMSEA exceeded the recommended value of 0.08 but was similar to previous CTM validation studies [18–19]. Reliabilities of the two subscales were very good at CA = 0.96 for factor 1 and CA = 0.85 for factor 2. The model is shown in Appendix A, C. Factor 1 and factor 2 had means of M = 3.10 (SD = 0.82) and M = 3.00 (SD = 0.90). Factor 1 represents the general involvement of patients in their care after hospitalization. Factor 2 covers the extent to which patients have received specific information about appointments, examinations, and their medication regime.

In models 5 and 6, we tested potential short versions of the G-CTM. The three-item short version of the CTM achieved a poor model fit. The four-item short version achieved an excellent model fit and a good reliability of CA = 0.87. The mean of the four-item version was M = 3.06 (SD = 0.84).

To summarize, model 2, as a long version, and model 6, as a short version, were accepted as valid and reliable G-CTM models and used in the subsequent analyses.

Measurement invariance of the German Version of the Care Transitions Measure

Based on the accepted two-factorial model, we tested the measurement invariance regarding all sociodemographic, care-related, and survey response characteristics. The results of these analyses are summarized in Table 5.

Results of these analyses showed that neither CFI nor RMSEA indicated significant deterioration of the model fits for the explored characteristics in the consecutive measurement invariance models. CFI and RMSEA showed slightly increased model fits for some comparisons due to different scaling parameters of the compared models, which underlines the invariance of the models [39]. Measurement invariance of the G-CTM was fully confirmed regarding all characteristics.

These analyses were conducted with the four-item short version as well. The results for these analyses are presented in Appendix A, D. Measurement invariance of the four-item short version of the G-CTM could only be confirmed for the length of hospital stay, yet partially for all remaining variables.

Table 3
Item statistics of the G-CTM items and original subscales.

Scales and items	Mean	SD	Skew	Response distribution (%)*					
				miss.	1	2	3	4	5
Preferences important	**3.09**	**0.94**	**−0.82**						
ctm1: agree health goals	3.09	0.99	−0.77	3.2	8.7	14.6	28	40.1	5.3
ctm2: consider health needs	3.05	1.03	−0.74	3.7	10.3	13.9	26.3	38.6	7.2
ctm3: consider care needs	3.14	1.01	−0.89	4.6	9.1	11.9	24.3	42.2	7.9
Management preparations	**3.15**	**0.86**	**−0.85**						
ctm4: health information provided	3.24	0.96	−1.02	3.2	7.4	12.3	25.2	49.4	2.5
ctm5: understand health needs	3.18	0.96	−0.93	2.7	7.8	13	28.7	46.3	1.5
ctm6: understand symptoms	3.05	1.03	−0.74	2.5	11	14.4	27.5	40.8	3.7
ctm8: understand health influences	3.12	0.93	−0.79	2.9	7	15.1	32.4	40.4	2.2
Critical understanding	**3.09**	**0.79**	**−0.67**						
ctm9: understand responsibility	3.16	0.91	−0.83	3.1	6.1	14.3	32.2	41.3	3
ctm10: maintain health	3.12	0.91	−0.75	2.9	6	16.3	32.4	40.1	2.2
ctm11: health confidence	3.11	0.9	−0.7	2.9	5.4	16.6	33.3	37.9	4
ctm13: understand medication	3.22	0.99	−1.02	4.7	8	11.2	20.8	46.5	8.7
ctm14: understand medication dosage	3.33	0.92	−1.27	5	6.4	7.9	22.8	49.5	8.5
ctm15: understand medication side effects	2.54	1.10	0.01	5.9	17.6	25.2	18.7	22.2	10.5
Care plan	**2.87**	**1.00**	**−0.44**						
ctm7: care plan received	2.82	1.09	−0.43	3.3	15.6	17.2	26.3	32.1	5.3
ctm12: written appointments received	2.9	1.19	−0.53	3.7	18	13.3	17	40.1	7.9

Notes. *miss. = missing values in percent; Response options English: 1 = Strongly Disagree – 4 = Strongly Agree; 5 = Don't Know/Don't Remember/Not Applicable; Response options German: 1 = Stimme überhaupt nicht zu – 4 = Stimme voll und ganz zu; 5 = Ich weiß nicht/ich erinnere mich nicht/trifft nicht zu. The fifth response option was not considered for the calculation of means, standard deviations, and skewness.

Table 4
Summary of the CFA.

Long models	n	Chi^2	df	CFI	TLI	RMSEA	SRMR
Model 1 (one factor)	519	1488.26	90	0.958	0.951	0.173	0.098
Model 2 (2 factors; EFA-based)	519	859.51	89	0.977	0.973	0.129	0.055
Model 3 (4 factors; original model)	519	1027.75	84	0.972	0.965	0.147	0.079
Model 4 (3 factors)	519	1303.67	87	0.964	0.956	0.164	0.089
Short models	**n**	**Chi^2**	**df**	**CFI**	**TLI**	**RMSEA**	**SRMR**
Model 5 (3 items)*	620	63.97	1	0.953	0.858	0.319	0.079
Model 6 (4 items)	668	3.16	2	1	0.999	0.029	0.009

Notes. Estimator: WLSMV; df: degrees of freedom; CFI: comparative fit index; TLI: Tucker Lewis index; RMSEA: root mean square error of approximation; SRMR: standardized root mean square residual. * factor variance was set to zero; otherwise, the degrees of freedom would have been zero, and no model fit indices could have been estimated

Associations of G-CTM scores with sociodemographic, care-related, and survey response variables

We calculated an aggregated G-CTM score with all 15 items (G-CTM-15 score) and another for the four-item short version (G-CTM-4 score). The mean G-CTM-15 score was M = 69.3 (SD = 25.6), mean G-CTM-4 score was M = 68.8 (SD = 28.1). The G-CTM-4 score explained 89 % of the variance of the G-CTM-15 score. The associations between G-CTM scores and sociodemographic, care-related, and survey response variables are presented in Table 6.

The G-CTM-15 score, as well as the G-CTM-4 score, were significantly related to patients' age (both correlations: r = 0.08, p < 0.05). There was no significant relation to the duration of hospital stay (G-CTM-15 score: r = −0.02, p = 0.56; G-CTM-15 score: r = −0.01, p = 0.72).

Discussion

Patient safety does not end when patients are treated but is especially important when patients are discharged home [40–41]. Examination and improvement of procedures in discharge management have an essential role in mitigating adverse events in post-hospital care transitions and in how patients are enabled to care for themselves after being discharged from the hospital. Until now, a systematic investigation of quality in the discharge process has been impossible in Germany due to a lack of validated instruments to measure the quality of care transition. Therefore, this study aimed to adapt and validate the internationally most used instrument, the Care Transitions Measure [16], in German. We performed the translation and adaptation according to guidelines for cross-cultural healthcare research in order to achieve a strong content validity of the G-CTM [28]. The study's results confirm the construct validity of the G-CTM, albeit with a factor structure that differs from previous research. Nevertheless, this is consistent with previous heterogeneous research, as no common factor structure could be found, most probably due to different national healthcare systems and structures [19]. Nonetheless, both subscales of the two-factorial structure of the G-CTM shown in this study had good to excellent reliabilities.

The originally proposed, three-item short version could not be confirmed. However, good factorial validity and reliability of a four-item short scale based on the Swedish short scale were confirmed [19]. The G-CTM-4 explained a substantial proportion of the variance of the G-CTM-15, underlining its criterion validity and indicating that the short form of the G-CTM is a valid screening instrument for assessing the quality of care transition.

The examination of measurement invariance showed for the 2-factorial long scale that the instrument can be validly used for the investigation of group differences across different sociodemographic, care-related, and survey response variables. This is an essential prerequisite for future research in using the instrument in terms of comparing studies and interpreting group differences.

Table 5
Test of measurement invariance regarding sociodemographic, care-related, and survey response characteristics.

Characteristic	Model	CFI	ΔCFI	RMSEA	ΔRMSEA
Age	**baseline (CFA)**	**0.977**	**–**	**0.129**	**–**
	configural	0.977	0.000	0.126	0.003
	metric	0.981	−0.004	0.112	0.015
	scalar	0.977	0.004	0.115	−0.003
Sex	**baseline (CFA)**	**0.977**	**–**	**0.129**	**–**
	configural	0.98	−0.003	0.124	0.006
	metric	0.982	−0.003	0.111	0.013
	scalar	0.979	0.003	0.112	−0.001
Length of hospital stay	**baseline (CFA)**	**0.977**	**–**	**0.129**	**–**
	configural	0.982	−0.005	0.122	0.007
	metric	0.986	−0.004	0.104	0.018
	scalar	0.981	0.004	0.109	−0.004
ICU care	**baseline (CFA)**	**0.977**	**–**	**0.129**	**–**
	configural	0.978	−0.001	0.130	−0.001
	metric	0.981	−0.003	0.117	0.013
	scalar	0.978	0.003	0.119	−0.001
Perceived timeliness of discharge	**baseline (CFA)**	**0.977**	**–**	**0.129**	**–**
	configural	0.976	0.001	0.128	0.001
	metric	0.982	−0.006	0.109	0.020
	scalar	0.977	0.005	0.114	−0.006
Health insurance	**baseline (CFA)**	**0.977**	**–**	**0.129**	**–**
	configural	0.982	−0.005	0.120	0.009
	metric	0.986	−0.004	0.103	0.018
	scalar	0.983	0.003	0.106	−0.003
Respondent	**baseline (CFA)**	**0.977**	**–**	**0.129**	**–**
	configural	0.98	−0.003	0.119	0.010
	metric	0.984	−0.005	0.102	0.018
	scalar	0.981	0.004	0.105	−0.004
Survey type	**baseline (CFA)**	**0.977**	**–**	**0.129**	**–**
	configural	0.982	−0.005	0.118	0.011
	metric	0.986	−0.003	0.103	0.015
	scalar	0.983	0.003	0.104	−0.001

Table 6
Associations of G-CTM-15 and G-CTM-4 scores with sociodemographic, care-related and survey response variables.

	G-CTM-15			G-CTM-4		
Characteristic	**Mean**	**SD**	**Difference Test**	**Mean**	**SD**	**Difference Test**
Sex			t(776) = 1.26,			t(770) = 1.06,
female	70.8	24.4	p = 0.21	70.2	27	p = 0.29
male	68.5	26.4		68.1	28.9	
diverse*	57.0	25.8		55.6	25.5	
ICU care			t(751) = 2.34,			t(746) = 2.04,
no	71.0	24.7	**p < 0.05**	70.4	27.2	**p < 0.05**
yes	66.2	26.8		65.7	29.5	
Perceived timeliness of discharge			t(736) = 7.89,			t(731) = 6.83,
timely	73.2	23.5	**p < 0.01**	72.7	26.1	**p < 0.01**
too early	53.4	27.3		53.6	30.5	
too late*	50.4	27.4		46.4	29.2	
Health insurance			F(3,765) = 1.64,			F(3,759) = 2.26,
public health insurance	69.0	25.8	p = 0.18	69.0	28.1	p = 0.08
public health insurance with additional private insurance	73.9	23.1		74.0	24.8	
private health insurance	65.0	25.3		60.7	29.9	
private health insurance with reimbursement by the employer (Beihilfe)	71.9	25.2		69.8	28.7	
other*	72.5	30.2		70.8	29.3	
Respondent			t(710) = 2.79,			t(705) = 2.06,
patient	70.4	24.8	**p < 0.01**	69.6	27.6	**p < 0.05**
relative	62.0	27.9		62.7	30.1	
Survey type			t(797) = −0.32,			t(791) = −0.39,
paper-pencil	69.2	25.7	p = 0.75	68.6	28.5	p = 0.70
online	69.9	25		69.6	26.2	

Notes. * Response options were not included for difference tests due to small sample sizes (c.f., Table 1). Numbers in bracket indicate degrees of freedom (df). Bold p-values indicate significant differences.

Especially the confirmed measurement invariance regarding the person who filled out the survey (patient or relative) and the survey type is highly relevant for the future application of the G-CTM. First, the equivalence of assessment can be assumed regardless of whether the patients directly or their relatives answer the questionnaire by proxy. Second, the online version of the G-CTM is equivalent to using the paper-based questionnaire regarding factorial validity, which is vital for interpreting results from different studies or findings stemming from varying response accesses to different patient and relative cohorts.

In contrast, limited measurement invariance was demonstrated for the four-item version of the G-CTM. Therefore, the comparison results of groups should be interpreted with caution. For practical reasons, we argue that the G-CTM-4 is an appropriate instrument

for screening the quality of care transition. However, if comparisons between different groups of patients or clinical areas are of interest, the G-CTM-15 should be applied.

Both G-CTM-15 and G-CTM-4 were similarly sensitive to identifying group differences in sociodemographic, care-related, and survey response characteristics. Both G-CTM scores did not vary over patients' sex, their kind of health insurance, the type of survey used, and their duration of hospital stay. These results emphasize the instrument's validity and align with previous findings, as these general characteristics are not associated with the perceived quality of care transition [16,23]. However, we found that patients who underwent ICU care perceived significantly lower quality of care transitions. This result resonates well with previous research pointing out the unique needs of patients after ICU care [42].

Nevertheless, a recent review has revealed that more research is needed to gain knowledge about associations between direct discharges to home from ICUs and patient safety outcomes [43]. Consistent with previous findings, better quality of care transition was associated with lower age and length of stay [16,20,44], indicating that older patients and patients with a more extended hospital stay perceive lower quality in care transitions. Likewise, when relatives completed the survey as a proxy of the patients, the G-CTM score was significantly lower than when patients completed the survey themselves. This indicates that when patients (e.g., due to health limitations) were unable to complete the questionnaire themselves, this is associated with more complex and less satisfactory discharge processes from the relatives' perspective. Thus, it is evident that the relationship between quality of care transition and health-related outcomes should be further investigated.

Discharge management in Germany is subject to legal regulations (Code of Social Law No. 5; SGB V, §39), similar to regulations in other countries, pointing out the utter relevance of safe hospital discharges in the course of patient safety [45]. The G-CTM is a valid and reliable instrument for measuring the quality of care transitions that can be used for systematic research in German-speaking countries. Moreover, this is internationally the first study to examine the measurement invariance of the CTM concerning different sociodemographic, care-related, and survey response characteristics. This lays the foundation for investigating and developing interventions to improve transitional patient safety.

This study is subject to different limitations. The study sample is a convenience sample of patients from one university hospital in Germany. As participation in the survey was entirely voluntary, a sampling bias might be present in the data. On the other hand, we collected a large and heterogeneous patient sample, strengthening our findings' validity and reliability. Since data were collected from only one hospital, the generalizability of the results may be limited, even though the data were gathered from various clinical areas and specialties. As in previous research, patients of this sample were relatively old, and the applicability of the G-CTM and its coverage of the health care need of younger patients remains uncertain and should be investigated in future studies.

Conclusions

The G-CTM is a valid, reliable, and measurement invariant instrument for assessing the quality of care transition for patients being discharged to home in German-speaking countries. The validity and reliability of the four-item short version of the G-CTM were confirmed, emphasizing its applicability as a screening tool. With the G-CTM, we offer – for both research and practice purposes (e.g., quality control in discharge processes) – an instrument for determining the current quality of hospital discharge processes and a basis for improving patient safety in trans-sectoral transitions of patients and beyond mere treatment in the hospital.

Acknowledgment

We thank Miriam Buchhorn, Christine Noèl, Alfred Dahmen, and Johannes Kammann for their support in the survey development and the project administration. Further, we would like to thank the translators as well as the participants in the multidisciplinary panel and the external expert panel for their support in the translation process.

The Open Access Publication Fund of the University of Bonn supported this work.

Conflict of interest

All authors declare that there is no conflict of interest.

CRediT author statement

Matthias Marsall: Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. Thorsten Hornung: Methodology, Resources, Writing – original draft, Writing – review & editing. Alexander Bäuerle: Writing – original draft, Writing – review & editing. Matthias Weigl: Conceptualization, Methodology, Resources, Supervision, Writing – original draft, Writing – review & editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.zefq.2023.10.002.

References

[1] Forster AJ, Clark HD, Menard A, Dupuis N, Chernish R, Chandok N, et al. Adverse events among medical patients after discharge from hospital. CMAJ Can Med Assoc J J Assoc Medicale Can 2004;170(3):345–9.
[2] Moore C, Wisnivesky J, Williams S, McGinn T. Medical errors related to discontinuity of care from an inpatient to an outpatient setting. J Gen Intern Med 2003;18(8):646–51.
[3] Forster AJ, Murff HJ, Peterson JF, Gandhi TK, Bates DW. Adverse drug events occurring following hospital discharge. J Gen Intern Med 2005;20(4):317–23.
[4] Laugaland K, Aase K, Barach P. Interventions to improve patient safety in transitional care – a review of the evidence. Work 2012;41:2915–24.
[5] Forster AJ, Murff HJ, Peterson JF, Gandhi TK, Bates DW. The incidence and severity of adverse events affecting patients after discharge from the hospital. Ann Intern Med 2003;138(3):161.
[6] World Health Organization. Global patient safety action plan 2021–2030: towards eliminating avoidable harm in health care [Internet]. Geneva; 2021 [cited 2021 Aug 5]. Available from: https://www.who.int/publications-detail-redirect/9789240032705
[7] Ruff C, Gerharz A, Groll A, Stoll F, Wirbka L, Haefeli WE, et al. Disease-dependent variations in the timing and causes of readmissions in Germany: a claims data analysis for six different conditions. PLOS ONE 2021;16(4):e0250298.
[8] Ballard J, Rankin W, Roper KL, Weatherford S, Cardarelli R. Effect of ambulatory transitional care management on 30-day readmission rates. Am J Med Qual 2018;33(6):583–9.
[9] Goldstein JN, Hicks LS, Kolm P, Weintraub WS, Elliott DJ. Is the care transitions measure associated with readmission risk? Analysis from a single academic center. J Gen Intern Med 2016;31(7):732–8.
[10] Poldervaart JM, van Melle MA, Reijnders LJ, de Wit NJ, Zwart DL. Transitional safety incidents as reported by patients and healthcare professionals in the Netherlands: a descriptive study. Eur J Gen Pract 2019;25(2):77–84.
[11] Foust JB, Vuckovic N, Henriquez E. Hospital to home health care transition: patient, caregiver, and clinician perspectives. West J Nurs Res 2012;34(2):194–212.
[12] Greenwald JL, Denham CR, Jack BW. The hospital discharge: a review of a high risk care transition with highlights of a reengineered discharge process. J Patient Saf 2007;3(2):97–106.
[13] Kiran T, Wells D, Okrainec K, Kennedy C, Devotta K, Mabaya G, et al. Patient and caregiver experience in the transition from hospital to home—brainstorming results from group concept mapping: a patient-oriented study. CMAJ Open 2020;8(1):E121–33.
[14] Zwart DLM, Schnipper JL, Vermond D, Bates DW. How do care transitions work? Med Care 2021;59(8 Suppl 4):S387–97.

[15] van Melle MA, van Stel HF, Poldervaart JM, de Wit NJ, Zwart DLM. Measurement tools and outcome measures used in transitional patient safety; a systematic review. PLOS One 2018;13(6):e0197312.
[16] Coleman EA, Mahoney E, Parry C. Assessing the quality of preparation for posthospital care from the patient's perspective: the care transitions measure. Med Care 2005;43(3):246–55.
[17] Coleman EA, Smith JD, Frank JC, Eilertsen TB, Thiare JN, Kramer AM. Development and testing of a measure designed to assess the quality of care transitions. Int J Integr Care 2002;1(2):e02.
[18] Cao X, Chen L, Diao Y, Tian L, Liu W, Jiang X. Validity and reliability of the Chinese version of the care transition measure. PLOS ONE 2015;10(5):e0127403.
[19] Flink M, Tessma M, Cvancarova Småstuen M, Lindblad M, Coleman EA, Ekstedt M. Measuring care transitions in Sweden: validation of the care transitions measure. Int J Qual Health Care 2018;30(4):291–7.
[20] Shadmi E, Zisberg A, Coleman EA. Translation and validation of the Care Transition Measure into Hebrew and Arabic. Int J Qual Health Care 2009;21(2):97–102.
[21] Bakshi AB, Wee SL, Tay C, Wong LM, Leong IYO, Merchant RA, et al. Validation of the care transition measure in multi-ethnic South-East Asia in Singapore. BMC Health Serv Res 2012;12(1):256.
[22] Acosta AM, Lima MADS, Marques GQ, Levandovski PF, Weber LAF. Brazilian version of the Care Transitions Measure: translation and validation. Int Nurs Rev 2017;64(3):379–87.
[23] Hwang JI, Chung JH, Kim HK. Psychometric properties of transitional care instruments and their relationships with health literacy: brief PREPARED and Care Transitions Measure. Int J Qual Health Care 2019;31(10):774–80.
[24] Yeh AM, Song AY, Vanderbilt DL, Gong C, Friedlich PS, Williams R, et al. The association of care transitions measure-15 score and outcomes after discharge from the NICU. BMC Pediatr 2021;21(1):7.
[25] Sabbatini AK, Gallahue F, Newson J, White S, Gallagher TH. Capturing emergency department discharge quality with the care transitions measure: a pilot study. Acad Emerg Med 2019:acem.13623.
[26] Coulter A. Measuring what matters to patients. BMJ 2017;356:j816.
[27] Noest S, Ludt S, Klingenberg A, Glassen K, Heiss F, Ose D, et al. Involving patients in detecting quality gaps in a fragmented healthcare system: development of a questionnaire for Patients' Experiences Across Health Care Sectors (PEACS). Int J Qual Health Care 2014;26(3):240–9.
[28] Sousa VD, Rojjanasrirat W. Translation, adaptation and validation of instruments or scales for use in cross-cultural health care research: a clear and user-friendly guideline. J Eval Clin Pract 2011;17(2):268–74.
[29] Yoshimura M, Sato M, Sumi N. Validity and reliability of the Japanese version of the Care Transitions Measure. Int J Health Plann Manage 2018;33(2):380–90.
[30] Vandenberg RJ, Lance CE. A review and synthesis of the measurement invariance literature: suggestions, practices, and recommendations for organizational research. Organ Res Methods 2016;3(1):4–70.
[31] Dimitrov DM. Testing for factorial invariance in the context of construct validation. Meas Eval Couns Dev 2010;43(2):121–49.
[32] Milfont TL, Fischer R. Testing measurement invariance across groups: applications in cross-cultural research. Int J Psychol Res 2010;3(1):111–30.
[33] Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. The Lancet 2007;370(9596):1453–7.
[34] Field A. Discovering statistics using IBM SPSS statistics. 4th ed. Los Angeles: SAGE Publications Ltd; 2013.
[35] Li CH. Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. Behav Res Methods 2016;48(3):936–49.
[36] Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct Equ Model Multidiscip J 1999;6(1):1–55.
[37] Widaman KF, Reise SP. Exploring the measurement invariance of psychological instruments: applications in the substance use domain [cited 2021 Aug 13]. In: Bryant KJ, Windle M, West SG, editors. The science of prevention: Methodological advances from alcohol and substance abuse research [Internet]. Washington: American Psychological Association; 1997. p. 281–324. http://content.apa.org/books/10222-009.
[38] Putnick DL, Bornstein MH. Measurement invariance conventions and reporting: the state of the art and future directions for psychological research. Dev Rev DR 2016 Sep;41:71–90.
[39] Hirschfeld G, Von Brachel R. Improving multiple-group confirmatory factor analysis in R-A tutorial in measurement invariance with continuous and ordinal indicators. Pract Assess Res Eval 2014;19(7).
[40] Vincent CA, Coulter A. Patient safety: what about the patient? Qual Saf Health Care 2002;11(1):76–80.
[41] Rennke S, Nguyen OK, Shoeb MH, Magan Y, Wachter RM, Ranji SR. Hospital-initiated transitional care interventions as a patient safety strategy: a systematic review. Ann Intern Med 2013;158(5_Part_2):433.
[42] Murphy DJ, Weaver BW, Elizabeth SM. Meeting the needs of ICU survivors: a gap requiring systems thinking and shared vision*. Crit Care Med 2023 Feb;51(2):319.
[43] Lau VI, Donnelly R, Parvez S, Gill J, Bagshaw SM, Ball IM, et al. Safety outcomes of direct discharge home from ICUs: an updated systematic review and meta-analysis (direct from ICU sent home study)*. Crit Care Med 2023 Jan;51(1):127.
[44] Parry C, Mahoney E, Chalmers SA, Coleman EA. Assessing the quality of transitional care: further applications of the care transitions measure 2008;7
[45] Dräger S. Who is responsible for a safe discharge from hospital? A prospective risk analysis in the German setting. Z Für Evidenz Fortbild Qual Im Gesundheitswesen 2016;113:9–18.