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Readiness for Hospital Discharge Scale for older people: psychometric testing and short form development with a three country sample

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Abstract

Aim: To develop and psychometrically test Readiness for Hospital Discharge Scale for older people and to reduce the scale to a more practical short form.

Background: The Readiness for Hospital Discharge Scale is the only available and validated scale measuring patients' perceived readiness just prior to discharge.

Design: Secondary analysis of hospital studies data from three countries.

Method: Data were collected between 2008–2012. The study sample comprised 998 medical-surgical older patients. Factor analysis was undertaken to identify the factor structure of the Readiness for Hospital Discharge Scale. Group comparisons for construct validity and predictive validity for readmission were also conducted.

Results: The Readiness for Hospital Discharge Scale original four factor solution does not appear to be consistent with the observed data of older people in the three countries. Confirmatory factor analysis revealed that a 17-item scale with three factors produced the best model fit. Nine items, three from each factor, loaded consistently on their respective factors in each country sample. Confirmatory factor analysis of this short form model indicated that the model adequately fit the data. Patients who lived alone, were older, or who indicated 'not ready' for discharge had lower Readiness for Hospital Discharge Scale for Older People scores, which were also associated with readmission risk.

Conclusion: The revised three factor structure of the Readiness for Hospital Discharge Scale for Older People in long and short forms more adequately assesses core components of discharge readiness in the older adult population than the original adult form.

Why is this research needed?

- Readiness for discharge has been identified as an outcome metric of the discharge preparation process and a contributor to readmission risk.
- Readiness for Hospital Discharge Scale (RHDS) was not validated in older inpatients.

What are the key findings?

- The RHDS-Older People in long and short form (RHDS-OP, RHDS-SF-OP) has acceptable psychometric properties in this initial evaluation.

How should the findings be used to influence practice and research?

- RHDS-OP-SF could help clinical nurses to evaluate readiness before hospital discharge when interventions can be initiated to improve discharge preparation by anticipating and coordinating care needs for the transition to home.
- The use of RHDS-OP-SF could contribute to identification of older people at risk for readmission who may benefit from post-discharge services to avoid adverse outcomes that result in hospital readmission and emergency services use.

Introduction

The ageing of the population and resulting increase in use of healthcare services is a significant challenge for healthcare systems around the world. In the USA, 34.8% (11.1 million) of patients discharged in 2012 from US hospitals were of age at least 65 years (AHRQ, 2012). Readmissions occurred for 16.5% of all discharged patients of age at least 65 years and 18.4% of Medicare-funded patients (primarily age 65 and older) in 2012, a substantially higher rate than the overall US readmission rate of 14% and at a cost of more than 25 million US dollars (AHRQ 2012, Gerhardt *et al.* 2013). In Ireland, patients of age at least 65 years represented 33.2% of acute public hospitals discharges in 2012 (Economic and Social Research Institute 2013). Ten per cent of hospitalizations in Ireland over the period 1999–2003 were for avoidable conditions, including chronic conditions and vaccine-preventable illnesses common among older persons (Nolan 2009). The Irish readmission rate in 2012 was 11% (Mudiwa 2013). In Switzerland, 30.2% of patients discharged from Swiss hospitals in 2012 were 70 years of age and over (Office fédéral de la statistique 2012). The rate of readmission was 5.6%, hospital-specific rates ranged from 1-13%, in 2010 (Office fédéral de la statistique 2012).

Older persons are at particularly high risk for readmission, exhibiting many risk factors contributing to readmission including use of high-risk medications (e.g. anti-coagulants, anti-depressants, hypoglycaemics), polypharmacy, specific disease conditions (Chronic obstructive pulmonary disease, diabetes, heart failure, stroke, depression) and demographic risk factors such as low income and reduced social network (AHRQ 2012, Greenwald & Jack 2009). Readmissions jeopardize the health of the frail older people, who are particularly vulnerable to loss of function, hospital-acquired infections and other poor outcomes when hospitalized (Covinsky *et al.* 2011). Estimates suggest that as many as three-quarters of readmissions within 30 days for people of age at least 65 years are preventable (MEDPAC 2007).

Problems with discharge preparation, discharge care processes, problems occurring after discharge home and subsequent unplanned

use of health services are well documented, particularly for the older population (Mistiaen *et al.* 2007). Efforts to reduce readmission rates in the US have focused on improvements in systems of care for improving discharge transitional care coordination (Naylor *et al.* 2011). Initiatives to improve the process of discharge and models of discharge planning have been introduced in many countries including the USA, the UK, Australia and Ireland (Coffey 2006). Innovative discharge preparation programs to better prepare patients for the transition home have resulted in improvements in patient perceptions of being prepared discharge (Bull *et al.* 2000, Jack *et al.* 2009).

Background

Readiness for discharge has been identified as an outcome metric of the discharge preparation process and a contributor to readmission risk (Weiss *et al.* 2014). While patients generally report being ready for hospital discharge (Bobay *et al.* 2010, Weiss *et al.* 2007). Patients who report low readiness for hospital discharge are at risk for problems at home and for readmission (Weiss *et al.* 2007, 2011, 2014).

The Readiness for Hospital Discharge Scale (RHDS) was specifically developed to measure self-perception of readiness for discharge (Weiss & Piacentine 2006). The RHDS questionnaire consists of 4 dimensions of discharge readiness: personal status (PS), knowledge (KL), coping ability (CA) and expected support (ES). In the Personal Status subscale, respondents are asked to report their physical-emotional condition on the day of discharge. The Knowledge subscale measures the amount of information received about self-care after discharge and the Coping Ability subscale measures perceived ability to cope with personal and medical care needs at home. The Expected Support subscale asks about the expected availability of emotional and instrumental assistance after discharge (Weiss & Piacentine 2006).

In initial testing of the RHDS, Weiss and Piacentine (2006) reported good psychometric properties of their instrument (predictive validity testing and construct validity) by using confirmatory factor analysis and contrasted group comparisons (Weiss & Piacentine 2006). The validation of the original RHDS was tested with a mixed sample

consisting of a total of 356 participants that included 121 adult patients average 52.9 years old, 122 postpartum mothers and 113 parents of hospitalized children. Cronbach's alpha reliability estimates were 0.90 for the total scale and ranged from 0.84-0.93 across the adult, parents of hospitalized children and postpartum mothers subsamples. The relationship of readiness for discharge to postdischarge coping difficulty was confirmed in all samples and to postdischarge use in the adult patient sample. A subsequent study with a similar adult patient sample confirmed these findings (Weiss *et al.* 2011). A short form of the RHDS to be used with adults at least 18 years of age in screening patients for risk for postdischarge return to hospital was tested with results indicating reliability of parallel forms of the tool for nurse assessment and patient self-report of discharge readiness (Cronbach's alphas of 0.75 and 0.79). A low RHDS score (<7 of 10) when assessed by the nurse was significantly associated with risk of readmission. This association was not significant when the patient completed the scale (Weiss *et al.* 2014).

Studies examining the concept of readiness for hospital discharge support the implementation of this indicator of discharge preparation (Weiss *et al.* 2010, 2011, Coffey & McCarthy 2013). Results of studies showed significant association between patient perceptions of the quality of discharge teaching and readiness for hospital discharge and subsequent postdischarge health services use (Weiss *et al.* 2007, 2011). Among older adults, a significant correlation was found between quality of discharge teaching and RHDS ($r = 0.50$, $P < 0.01$) from age 65-85 but no association for patients over age 85 (Bobay *et al.* 2010). Patient's self-perception of readiness is a significant factor for safer transitions, patient's satisfaction and health outcomes (Weiss *et al.* 2007, Brent & Coffey 2013) and enough evidence has been developed to implement this assessment as a component of screening for patients at risk of rehospitalization.

The RHDS is the only available and validated scale measuring patients' perceived readiness just prior to discharge as an summative evaluation of the goal of pre-discharge interventions. As older inpatients challenge health care systems and constitute a significant proportion of costly readmissions, RHDS could be used not only as a quality metric for hospital discharge preparation, but also for identifying patients at risk for readmission.

The study

Aims

Aims of this study were: (1) to evaluate psychometric proprieties of RHDS for older hospitalized people; and (2) to develop a RHDS short form for use with older adults. Further, we seek to determine if the scale structure is valid and stable across samples from three countries.

Methodology

Parent studies

The studies from which data for the current analysis were drawn were conducted in the home countries of the authors (Weiss *et al.* 2011, Coffey & McCarthy 2013, Mabire *et al.* in press). For all studies, cross-sectional study designs were used to determine discharge readiness at discharge and use outcomes in the early postdischarge period. Data were collected from January – August 2008 in the USA, January–June 2009 in Ireland and from November 2011–October 2012 in Switzerland.

In the USA, the study was conducted on 16 medical-surgical nursing units in four acute care hospitals (275-938 beds) of a multi-hospital system. As a condition of participation in the US Medicare program, a nurse or other designated professional must perform an evaluation of discharge planning needs early in the course of hospitalization (2011). Discharge preparation normally begins during the admission assessment with determination of family and living situation. Throughout the hospitalization, learning and care coordination needs are anticipated and specific discharge instructions are given to patients and families on the day of discharge. The hospital system where the study was conducted has an active senior care services programme to assist with coordination with community based services. Discharge transition coordination services (case management, home care services, community services referrals) were documented for 35.9% of the sample.

In Ireland, the study was conducted in five medical units of one large university hospital (800 beds). A national code of practice for integrated discharge planning was introduced in 2008 and a local guideline for nurse/midwife-facilitated discharge planning was introduced during this study by the Health Service Executive (2009). These guidelines addressed many of the prior inconsistencies in discharge documentation and referral from hospital to primary care. Discharge preparation began during the admission, coordinated by unit nursing staff and involved multidisciplinary teams and family caregivers.

Finally, the Swiss study was conducted in medical units in four hospitals in the western, French-speaking, part of Switzerland. Three were regional hospitals with the number of beds ranging from 130-197 and one was a university hospital with 914 beds. In these hospitals, usual discharge care requires a collaboration between physicians, nurses, physical therapists and other healthcare professionals. A liaison nurse assesses the patient and caregivers' needs, determines whether home care is required and, if necessary, co-ordinates care between hospital and home.

Participants

The sample for this study was aggregated from the three parent studies. The US sample consisted of 398 patients of age at least 65 years from the original sample of 1892 with an age range of 18-102 years. The Irish and Swiss parent study samples were exclusively older persons of age at least 65 years. The samples included 335 from Ireland and 265 patients from Western Switzerland. In all studies, patients had been hospitalized for more than 48 hours in a medical or surgical ward, could read English in the USA and Ireland and read French in Switzerland and were discharged to their own home. Those discharged home with hospice care (US and Irish sample) or with an estimated life expectancy under 6 months (Swiss sample) and patients with a diagnosis of dementia or cognitive impairment precluding the interview were excluded.

The final sample for analysis was 998 older adults' patients. A sample size estimate, taking into consideration communalities ranging in magnitude between 0.20-0.80 and four variables per factor,

resulted in a minimum required sample size for factor analysis of 900 observations (Mundfrom *et al.* 2009).

Instrument

RHDS consists of 23 items of which 22 (items 2-23) are rated on an 11 point (0-10) Likert scale, with a single dichotomous item (item 1) asking patients if they are ready for discharge. This item is not computed in the scale score and therefore has not been considered for factor analysis. An item mean score of 7 or above indicates readiness for discharge (Bobay *et al.* 2010). The four dimensions of the original RHDS are distributed in the following manner: personal status (items 2-8), knowledge (items 9-16), coping ability (items 17-19) and expected support (items 20-23). For the study in Switzerland, translation of the RHDS into the French version was done with the TRAPD [Translate, Review, Adjudicate, Pretest and Document] method (Willis *et al.* 2008).

In all included studies, as recommended by Weiss *et al.* (2006), the RHDS was presented to patients the day of their discharge. In cases where patients were fatigued or had physical limitations (such as arthritis or limited vision) that required assistance to complete the scale, verbal responses were recorded (the researchers noted this as relatively common occurrence in older patients). Patient characteristics and hospitalization factors were collected from the medical records.

Statistical methods and data analysis

Descriptive statistics using Stata 13.1 (Stata 2013) were calculated for each item. As recommended by the authors (Weiss *et al.* 2006), the RHDS is calculated as an item mean score (sum of values for all items responded to divided by the number of items answered). The subscales scores were also calculated similarly (PS, KL, CA and ES).

The internal consistency of the RHDS was examined for the combined sample using Cronbach's alpha coefficient (Cronbach 1951) on the raw Likert scale scores. The average inter-item correlations and

adjusted item-total scale correlations were also calculated (Streiner & Kottner 2014, Nunnally & Bernstein 1994).

A two step process was performed to evaluate psychometrics proprieties (aim 1). In the first step, a confirmatory factor analysis (CFA) was performed with maximum likelihood estimation to test the original structure of the RHDS for older people. The goodness-of-fit indices used to evaluate the fit of the model were the chi-square and the chi-square/degree of freedom ratio, the root mean square error of approximation (RMSEA), the comparative fit index (CFI), the Tucker-Lewis index (TLI), the standardized root mean squared residual (SRMR, Hu & Bentler 1999) and the Akaike's information criterion (AIC). The chi-square goodness-of-fit and the chi-square/degree of freedom ratio assesses the magnitude of discrepancy between the sample and fitted covariance matrices (Hu & Bentler 1999). The RMSEA considers how much error there is for each degree of freedom. The CFI assesses the extent to which the proposed model provided a better structural fit than the independence model. Hu and Bentler (1998, 1999) recommended using joint criteria when determining whether to retain or reject a model as being plausible: RMSEA should be equal or below to 0.06, CFI and TLI should be higher or equal to 0.95, SRMR should be equal or below to 0.08 (Acock 2013).

In the second step, exploratory factor analysis (EFA) using principal axis factor analysis was then undertaken, to determine whether an alternative structure may appear. The numbers of factors were chosen to achieve 90% explained variance (Rencher & Christensen 2012). In addition, factors that appeared above the break in the scree plot were regarded as potentially meaningful and retained. A Promax (oblique) rotation was selected because the dependence of the factors cannot be excluded. The criteria for item retention on factors and factor retention in the EFA were: (a) factor loading above 0.30 as recommended by Kline (2011); (b) no cross-loading of items on two or more factors, i.e a difference of <0.10 in loadings on other factors (Tabachnick & Fidell 2013), (c) uniqueness below 0.80 and (d) at least three items loading on each obtained factor. When multiple items do not meet these criteria, they were removed one by one and the model was reassessed each time.

In addition to these psychometric criteria, decisions regarding item reduction (aim 2) were based on the principle of items loading consistently on the same factor in the three countries.

Similar to Weiss *et al.* (Weiss & Piacentine 2006), a comparison group analysis was conducted to assess construct validity. 'Not ready for discharge' on the single item dichotomous measure (item 1), lives alone, older than the median age were hypothesized to be associated to have lower RHDS scores. Predictive validity was assessed to determine if the RHDS score predicted hospital readmission or emergency visits within 30 days after discharge in the combined sample.

Ethical considerations

The research protocols for the parent studies were approved in the US by the Marquette University Institutional Review Board (IRB) and the study site IRB, in Ireland by the Clinical Research Ethics Committee of the University Teaching Hospitals and in Switzerland by the Ethical commission on human research of the Canton de Vaud (CER 307-11). The patients in all 3 countries received verbal and written information about the study and gave their written consent. The patients were informed that they were free to withdraw at any time. All data were treated confidentially and de-identified data sets from the parent study were aggregated for these psychometric analyses.

Results

Sample characteristics and descriptive statistics

Characteristics of the participants are presented in Table 1. Participants' age ranged from 65-102 years old and the mean age of patients was 77 years old (sd 7.3). About half were women (53.9%) and more than one-third lived alone (35.6%). The average length of stay was 8 days and ranged from 4.3 days in USA, and 10.9 days in Ireland. The most frequent Major Diagnostic Categories were circulatory system (33.6%), respiratory system (15.7%) and digestive system (10.2%).

Table 1. Characteristics of the sample

Characteristics	Total	U.S.	Ireland	Switzerland	P
Gender, <i>n</i> (%)					
Male	460 (46.1)	175	158	127	0.54a
Female	538 (53.9)	223	177	138	
Social support, <i>n</i> (%)					
Caregivers	623 (64.4)	248 (67.6)	229 (68.4)	146 (55.1)	0.001a
Lives alone	344 (35.6)	119 (32.4)	106 (31.6)	119 (44.9)	
Age (years), M (sd)	77.04 (7.33)	75.42 (7.28)	76.95 (6.62)	79.59 (7.58)	0.001b
Length of stay, M (sd)	8.03 (9.56)	4.27 (3.27)	10.87 (10.13)	10.09 (12.79)	0.001c
Major diagnostic categories, <i>n</i> (%)					
Circulatory system	325 (33.6)	144 (36.2)	102 (30.4)	79 (33.6)	
Respiratory system	152 (15.7)	43 (10.8)	90 (26.9)	19 (8.1)	
Digestive system	99 (10.2)	55 (13.9)	22 (6.6)	22 (9.4)	
Musculoskeletal system	77 (7.9)	52 (13.1)	12 (3.6)	13 (5.5)	
Nervous system	72 (7.4)	21 (5.3)	36 (10.7)	15 (6.4)	
Sample					
Hospitals	9	4	1	4	
Older inpatient	998	398	335	265	

^aChi-square test.

^bANOVA.

^cKruskal–Wallis rank test.

The item mean score on the RHDS was mean = 7.7 (sd 1.2) ranging from 7.3–8.2 (See supporting information Table S1). The highest mean score of the subscales was 8.5 (sd 2.0) for Coping Ability and the lowest was 6.5 (sd 2.9) for the Expected Support (Table 2).

Table 2. RHDS-OP scale statistics

	Total	US	IR	CH	P (1)
Personal status					
M (sd)	7.8 (1.5)	7.6 (1.5)	7.8 (1.6)	8.0 (1.4)	0.02
α	0.76	0.77	0.79	0.68	
Knowledge					
M (sd)	8.1 (1.8)	8.4 (1.6)*	7.0 (1.8)*	9.0 (1.2)*	0.001
α	0.80	0.88	0.73	0.60	
Coping					
M (sd)	8.5 (2.0)	8.6 (1.7)*	7.6 (2.5)*	9.5 (1.0)*	0.001
α	0.90	0.88	0.93	0.55	
Expected support					
M (sd)	6.5 (2.9)	8.0 (2.4)*	6.8 (2.8)*	3.9 (1.8)*	0.001
α	0.76	0.84	0.78	0.58	

	Total	US	IR	CH	P (1)
Total					
M (sd)	7.7 (1.2)	8.2 (1.3)*	7.3 (0.7)*	7.6 (1.2)*	0.001
α	0.87	0.91	0.85	0.80	

(1)ANOVA Oneway between the three groups and Bonferroni test.(* indicates Significant difference with two other countries).

α , Cronbach's alpha coefficient of reliability.

Reliability analysis

The standardized Cronbach's alpha coefficient for the whole scale was 0.87. This coefficient was above 0.7, the minimum recommended level (Streiner & Norman 2008) and was not above 0.9, which if it occurred may suggest a level of redundancy of item domains consistent with a unidimensional scale. For the sub-scales [Personal Status (PS), Knowledge (KL), Coping Ability (CA) and Expected Support (ES)], reliability estimates ranged from 0.76-0.90 (Table 2) (See supporting information Table S2 for item analysis).

Confirmatory factor analysis

Like Weiss *et al.* (2006), a CFA was conducted with the 22 items loaded on their respective four correlated factors (PS, KL, CA and ES) (See supporting information Table S3). The resulting model was not adequate: CFI = 0.78, AIC = 96155.1, TLI = 0.75, SRMR = 0.09, RMSEA = 0.10, $\chi^2/d.f.$ = 12.05 (χ^2 = 2447.5, d.f. = 203) $P < 0.001$. All goodness-of-fit indices exceed the suggested cut-off values. Moreover, the Chi-square/degree of freedom ratio indicating the goodness-of-fit in each country suggested an unacceptable fit of the model to data in every country. As such, the RHDS original four factor solution does not appear to be consistent with the observed data of older people in these countries. The inadequacy of the original structure of the scale lead to consideration of an EFA. This second step was used to analyse the data structure associated with the sample.

Explanatory factor analysis

When EFA with principal axis analysis and promax rotation was applied, the cumulative variance was greater than 90% for a three factor solution (93.02%). The slope of the Scree plot explicitly

demonstrated the existence of the three factors. Table 3 presents the distribution of items in these three factors for the combined sample and each of the three country samples. For the combined sample, ten items loaded on the first factor, four items loaded on the second factor and three items loaded on the third factor. Because item 11 cross-loaded on two factors with the observed difference in loadings of 0.04 between two factors, it was deleted. Items 3, 6, 13 and 20 were also deleted because they had uniqueness higher than 0.80. The final factors for the Readiness for Hospital Discharge Scale-Older People (RHDS-OP) were renamed: Factor 1 – Self-care readiness (SR); Factor 2 – Knowledge (KL); Factor 3 – Expected Support (ES). Reliability of each factor were 0.89, 0.72 and 0.88 respectively and 0.87 for total scale.

Table 3. RHDS-OP exploratory factor analysis: factor loadings of RHDS items for combined sample and country samples

RHDS subscales	Item loadings			
	Combined sample	U.S.	Ireland	Switzerland
Factor 1				
2 – Physically ready	0.64	0.45	0.57	0.58
3 – Pain today	0.32	(0.34)	0.33	0.46
4 – Strength today	0.64	(0.82)	0.77	0.39
5 – Energy today	0.62	(0.79)	0.72	0.43
6 – Stress today	0.40	–	0.35	0.59
7 – Emotionally ready	0.57	(0.46)	{0.44}	0.55
8 – Physical ability to care for self	0.70	(0.37)	0.77	{–0.71}
9 – Know about caring for yourself	0.64	0.62	0.59	0.59
10 – Know about personal needs	0.57	0.72	(0.51)	0.41
17– Handle the demands	0.72	0.50	0.82	0.42
18 – Perform personal care	0.72	0.52	0.81	{–0.80}
19 – Medical treatments	0.70	0.59	0.80	(0.71)
Factor 2				
11 – Medical needs	0.49	[0.79]	0.66	0.73
12 – Problems to watch	0.62	[0.83]	0.57	0.37
13 – Who and when to call	0.37	[0.70]	{0.39}	–
14 – Restrictions	0.64	[0.78]	0.54	0.30
15 – Happens next	0.49	[0.72]	0.47	0.69
16 – Services and Information	0.46	[0.52]	0.34	–
Factor 3				
20 – Emotional support	0.33	0.46	0.60	–
21 – Help with personal care	0.86	0.85	0.66	0.81
22 – Help with household activities	0.76	0.80	0.67	0.52
23 – Help with medical care	0.84	0.86	0.66	0.44

Factor loading are derived using a promax rotation.

^a This table only shows loadings greater than 0.30 and uniqueness above 0.80. In analysis of country samples. () indicates a factor 1 item in combined sample that loaded on factor 2; { } indicates a factor 1 item that loaded on the Factor 3; [] indicates a factor 2 item that loaded on the factor 1.

Analysis of the results for each country showed that the factor loadings were not identical across the three country samples. Items 2, 9 and 17 systematically loaded on factor 1; items 12, 14 and 15 loaded consistently on factor 2 (KN); and items 21, 22 and 23 on Factor 3 (ES). Reliability of each factor were 0.71, 0.72 and 0.88 respectively and 0.75 for total short form scale. This factor structure was then evaluated by CFA.

Confirmatory factor analysis of the short form RHDS-Older People (RHDS-OP-SF)

In the CFA where the short form model of 9 items was loaded on their respective three factors (Figure 1), the result was judged to represent an reasonable model fit with CFI = 0.96, AIC = 42623, TLI = 0.93, SRMR = 0.05 in the acceptable range. RMSEA of 0.07 approached the established criterion of ≤ 0.06 , The chi-square/d.f. of 6.6 ($\chi^2 = 151.82$, d.f. = 23, $P < 0.001$) raised questions about fit in this multi-country sample.

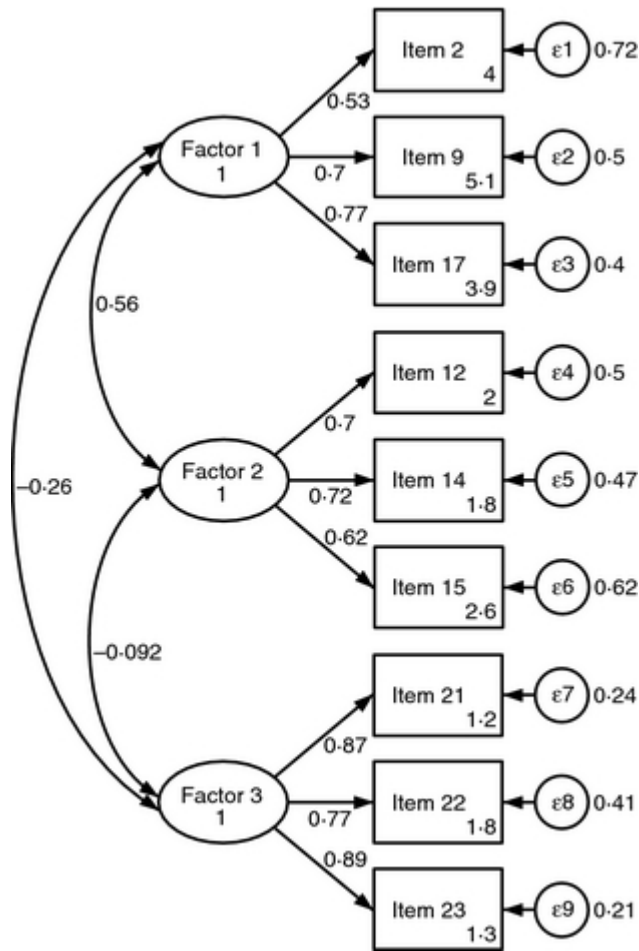


Figure 1. Confirmatory factor analysis of the RHDS-SF-older people.

Group comparison and prediction analysis

A comparison groups analysis was conducted to assess construct validity by hypothesizing that living alone, being older than the median age and being not ready for discharge (item 1 of the RHDS) were associated with lower RHDS-OP-SF scores. Participants who indicated in item 1 they were not ready for discharge scored lower on the RHDS (Not ready: mean_y = 5.96, sd 1.50; Ready: mean_n = 7.51, sd 1.5, $P < 0.001$). RHDS scores were significantly lower among patients who reported living alone (Live alone: mean = 7.04, sd 1.45; Lives with caregiver: mean = 7.60, sd 1.54, $P < 0.001$) and those who were older than average (Older: mean = 7.17, sd 1.49; Younger: mean = 7.69, sd 1.55, $P < 0.001$).

Predictive validity was assessed to determine if the RHDS score predicted hospital readmission or emergency visits in the combined sample. In logistic regression analysis of RHDS-OP-SF as a predictor of readmission or emergency visits, patients with higher scores were less likely to be readmitted (OR = 0.89, CI (95%) = 0.80-0.98, $P = 0.03$).

Discussion

The analysis of the combined data from three countries reveals that the structure of the model used in prior US analyses with a broad range of adult patient from age 18 to more than 100 years did not adequately fit the data of an exclusively older adult population. A revised structure of 3 factors was identified through EFA and reduced to a short form of the RHDS for older people (RHDS-SF-OP). Fit statistics for the new RHDS-SF-OP were promising, although the multi-country sample may have led to some fit statistics outside the recommended criteria. Further refinement and validation with single and multi-country samples will enhance scale development.

Through the EFA, a 17 item, three factor RHDS-OP was derived from the original 22 item, four factor RHDS. Items related to personal status, knowledge of personal care and coping ability with personal, home and medical care needs were combined into a single factor representing Self-Care Readiness. Two factors from the original scale were retained, Knowledge had a reduced number of items that specifically related to information needed for problem management and for future care needs. One item was deleted (emotional support) from the expected support scale leaving measures of tangible support.

Items deleted in the original long version of the form were related to pain, stress, taking care of medical needs, who to call and emotional support. The pain item is only relevant to a subset of patients perhaps explaining its poor performance in psychometric testing. The stress item was also deleted in the most recent publications on the RHDS (Weiss *et al.* 2011) due to poor performance in psychometric analyses. For many older people, living with chronic illness and the related medical needs is a part of daily life and may therefore not be perceived as foundational to their readiness to go home. Whom to call and emotional support may not have fared well in the older adult sample, because one-third of the sample lived alone.

Regarding the short form, the resulting items created a balanced approach to discharge readiness assessment where each factor is represented by three items. Two items in each of the three factors in the RHDS-OP-SF represent six of eight items that are in the recently developed RHDS-SF for use with the broader adult population (Weiss *et al.* 2014). The omitted items from the RHDS-SF include content on PS- level of energy and CA- ability to perform personal care. These were replaced by SR-Knowledge about care of self, KL, know what will happen next in treatment plan and ES and help with household activities. The level of energy item was noted to be confusing to patients in the Swiss sample for its similarity to the meaning of the French term for strength. In addition, energy may not be experienced in the same way for older adults as for younger persons. Ability to perform self-care was replaced with a related concept, knowledge of self-care in the SR subscale and the concept of personal care was also reflected in the ES subscale with the item on help with personal care. Important to older adults was knowing next steps in the treatment plan, perhaps reflecting recognition of the chronicity of their condition. The inclusion of household support may reflect the recognition of longer recovery periods with age.

The RHDS, both the original and the OP versions assess readiness prior to discharge, unlike other related tools that are designed to measure the discharge transition after discharge from the hospital. The RHDS, Care Transitions Measure (CTM) (Coleman *et al.* 2005) and the B-PREPARED tool (Graumlich *et al.* 2008) were all developed and validated with adult inpatient samples age 18 years and older. The CTM, developed for assessing the quality of preparation for posthospital care and administered 6–12 weeks after discharge, includes 4 dimensions of a quality discharge transition. CTM dimensions of 'critical understanding' and 'management preparation' contain items related to self-care readiness and knowledge as measured in the RHDS-OP. 'Preferences important' and 'care plan' include items important for care coordination activities and are not measured in the RHDS. B-PREPARED, administered 1 week after discharge, assesses three dimensions of preparedness: self-care information, equipment and services and confidence. The RHDS-OA-SF Knowledge subscale addresses self-care information content and the Self-care Readiness subscale contains 2 items (feel physically ready, able to handle the demands of life at home) that are conceptually

consistent with the B-PREPARED confidence questions (feeling prepared, confident about managing at home). Knowledge of community services is included in the RHDS-OP long form of the scale. Neither the CTM nor the B-PREPARED tool were specifically developed for older adults or for administration prior to discharge for use in anticipating post-hospital transition difficulty and the related problems and increased use associated with poor preparation and lack of readiness.

Limitations

This study has some limitations. The data collection protocol and discharge processes differed in some ways across countries and that variability may influence the findings. Cultural norms and differences in patient and family expectations for hospital discharge and postdischarge care will influence how patients respond to questions about discharge readiness. Significant differences between countries in length of stay, age and social support may also have affected results. While attempts to verify the accuracy of the French translations were undertaken, we cannot completely rule out the possibility that there may be some inaccuracies in the translations.

The short form reported here is a derivation of the long form of the RHDS using data from three independent study samples. This analysis therefore constitutes a reuse of these data and was subject to the limitations of availability of common data elements. Fit statistics were not acceptable for the long form, originally designed for adult patients, when tested with this older adult sample. The revised RHDS-SF derived through EFA has good initial psychometric properties but will require confirmatory testing. Although generally favourable, there were some deficiencies in the fit statistics for RHDS-SF-OP that may in part be due to country differences in hospital discharge expectations and experiences. These results suggest the need for continuing psychometric validation of RHDS for older people. It would be informative to check content validity of items to the older people by cognitive interviews. In future research, assessment of this RHDS-OP-SF in a new sample is needed to confirm factor analysis results, stability, construct validity and predictability of this scale to support continuing use in research and practice evaluation studies with older

people. For older people, this RHDS-OP-SF reduces the response burden that can be fatigue-producing in this population.

Conclusions

The RHDS-Older People in long and short form has demonstrated acceptable psychometric properties in this initial evaluation. It has advantages over previous versions of the RHDS and other related tools for use with older patients in that it is derived exclusively from data provided by older adults from a broad international sample. The RHDS-OP-SF has potential broad applicability. In this initial testing, appears to be reliable and valid in the three country sample; further validation internationally is needed. This assessment tool could help nurses in completing discharge planning to improve their patients' preparation and to better anticipate and coordinate care needs. The use of RHDS-OP-SF could contribute to identification of older people at risk for readmission who may benefit from postdischarge services to avoid adverse outcomes that result in hospital readmission and emergency services use. Implementing this assessment in discharge protocols could promote identification of patients who do not have adequate physical well-being, self-management knowledge and skills, coping abilities, or support to handle postdischarge recovery at home. Interventions in response to assessments of low readiness prior to discharge might include additional patient and family caregiver teaching, case management, community referrals, additional in-hospital surveillance or transitional care nursing (Naylor 2012). Adding discharge readiness as a variable in models for predicting readmission risk and preventable hospitalizations could improve their usefulness for pre-discharge identification of high-risk patients (Weiss *et al.* 2010).

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Conflict of interest

No conflict of interest has been declared by the authors.

Author contributions

All authors have agreed on the final version and meet at least one of the following criteria [recommended by the ICMJE (<http://www.icmje.org/recommendations/>)]:

- substantial contributions to conception and design, acquisition of data or analysis and interpretation of data;
- drafting the article or revising it critically for important intellectual content.

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Ancillary

Supporting Information

Filename

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Supplementary information file/ Table S1. Items Mean Scores for Combined and Country-specific Samples

Item	<i>Total</i>	<i>US</i>	<i>IR</i>	<i>CH</i>	<i>p</i> *
RHDS 2	8.32	8.48	7.96*	8.52*	0.001
RHDS 3	7.83	7.67	8.42*	7.33*	0.001
RHDS 4	6.44	6.47	6.52	6.29	0.46
RHDS 5	6.27	6.21*	5.79	6.97*	0.001
RHDS 6	7.77	7.34*	8.12*	7.99	0.001
RHDS 7	9.26	8.81*	9.54*	9.58	0.001
RHDS 8	8.49	8.42*	8.10	9.10*	0.001
RHDS 9	9.02	8.86*	8.63	9.74*	0.001
RHDS 10	9.35	9.80*	9.32	9.80*	0.001
RHDS 11	8.71	8.75*	8.08*	9.43*	0.001
RHDS 12	7.39	8.17	5.75*	8.16*	0.001
RHDS 13	9.38	8.98*	9.74*	9.53	0.001
RHDS 14	7.18	8.45	4.60*	8.54*	0.001
RHDS 15	7.97	8.38	6.77*	8.87*	0.001
RHDS 16	5.83	6.69*	3.25*	7.77*	0.001
RHDS 17	8.38	8.48*	7.38*	9.49*	0.001
RHDS 18	8.59	8.71*	7.84*	9.33*	0.001
RHDS 19	8.56	8.69	7.59*	9.64*	0.001
RHDS 20	9.01	8.67	9.38	9.07	0.001
RHDS 21	5.06	7.83*	4.75*	1.28*	0.001

RHDS 22	6.62	7.97	7.68	3.28*	0.001
RHDS 23	5.42	7.62*	5.54*	1.94*	0.001

Note : ANOVA Oneway between the three groups and Bonferroni test (indicates significant difference with other country(ies)).

Supplementary information file/ Table S2. Reliability examination

Items	Adjusted item-total correlation	Average interitem correlation	alpha if item deleted
2 - Physically ready	0.51	0.23	0.86
3 - Pain today	0.14	0.24	0.87
4 - Strength today	0.45	0.23	0.86
5 - Energy today	0.49	0.23	0.86
6 - Stress today	0.27	0.24	0.87
7 - Emotionally ready	0.43	0.23	0.86
8 - Physical Ability	0.67	0.22	0.85
9 - Know caring for yourself	0.67	0.22	0.85
10 - Know personal needs	0.62	0.22	0.86
11 - Know medical needs	0.60	0.22	0.86
12 - Know problems to watch	0.37	0.23	0.86
13 - Know who and when to call	0.35	0.23	0.86
14 - Know restrictions	0.35	0.23	0.86
15 - Know happens next	0.50	0.23	0.86
16 - Know services and Information	0.25	0.24	0.87
17 - Handle the demands	0.71	0.22	0.85
18 - Perform personal care	0.71	0.22	0.85
19 - Medical treatments	0.75	0.21	0.85
20 - Emotional support	0.20	0.24	0.87
21 - Help with personal care	0.30	0.24	0.87
22 - Help with household activities	0.21	0.24	0.87
23 -Help with medical care	0.30	0.24	0.87
Total scale		0.15	0.80

Supplementary information file/ Table S3. Confirmatory factor analysis of original RHDS structure scale

	<i>Total</i>	<i>US</i>	<i>IR</i>	<i>CH</i>
χ^2	2447.54	967.89	1093.07	1131.96
χ^2/df	12.05			
RMSEA	0.105	0.097	0.114	0.131
AIC	96155.06	35491.27	32826.22	24334.80
CFI	0.778	0.839	0.758	0.492
TLI	0.747	0.817	0.724	0.422
SRMR	0.091	0.075	0.117	0.116