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Theory-driven assessment of intentions and behaviours related to mobility of older inpatients: a survey of patients and healthcare professionals

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Summary

BACKGROUND: Low mobility of patients during hospitalisation is associated with adverse outcomes. To successfully change behaviours related to mobility of older hospitalised patients, we need to better understand the mechanisms underlying patient and healthcare professional behaviours. In this study, we thus assessed patient- and healthcare professional-reported intentions and behaviours related to mobility of older patients hospitalised on an acute medical ward, based on a theoretical framework – the Health Action Process Approach (HAPA) model – and on additional barriers and facilitators to mobility.

METHODS: We conducted a cross-sectional survey in April 2022 among patients aged ≥60 years recently hospitalised on an an acute medical ward of one of three hospitals of different language/cultural regions of Switzerland, and healthcare professionals (physicians, nurses/nursing assistants, physiotherapists) working on those wards. The survey assessed the HAPA model and additional barriers and facilitators to patient mobility at hospital, as previously identified in the literature. The target behaviour studied was "to move as much as possible during hospitalisation" for patients and "to ensure my patients move as much as possible during hospitalisation" for healthcare professionals. We conducted hierarchical linear regressions to determine factors associated with the self-reported intention to perform the behaviour and with the self-reported behaviour itself.

RESULTS: A total of 142 healthcare professionals (61 physicians, 59 nurses, 22 physiotherapists) and 200 patients (mean age 74 years) completed the survey. Patients with higher intention to move as much as possible during hospitalisation scored significantly higher on factual knowledge, outcome expectancies and risk perception. Healthcare professionals with higher intention to ensure that their patients move as much as possible during hospitalisation scored higher on action knowledge, outcome expectancies and risk perception. The more the patients reported that they moved as much as possible during hospitalisation, the higher their action knowledge and action control. The more healthcare professionals reported that they ensure that patients move as much as possible during hospitalisation, the higher they scored on factual knowledge, role perception, planning and action control.

CONCLUSIONS: factual and action knowledge, self-efficacy, outcome expectancies, risk perception, planning and action control were identified as important drivers of patient- and healthcare professional-reported intentions and behaviours related to inpatient mobility. These parameters can be addressed through behaviour-change interventions and should be considered in future interventions to successfully implement practice changes, with the goal of improving mobility of older patients during hospitalisation, and thus the outcomes of this particularly vulnerable population.

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Introduction

Low mobility of patients during an acute hospitalisation has been associated with several adverse physical, psychological and societal outcomes, particularly in older adults, including muscle and bone loss, falls, delirium, depression, anxiety, orthostatic hypotension, prolonged length of hospital stay, functional decline, institutionalisation and death [1–5]. Furthermore, less than one third of patients who experience a functional decline during an acute hospitalisation have recovered one year later, while 40% of them have passed away [6]. While a significant proportion of patients already have functional limitations at admission [7, 8], it is crucial to prevent further functional decline during hospitalisation.

Several interventions have been conducted in the last few decades in an effort to improve patient mobility during acute hospitalisation, and thus reduce the adverse consequences of low mobility [9–15]. However, many of them present limitations making them hardly scalable in clinical practice, so that they have not led to broad-scale practice changes. For instance, they did not give sufficient consideration to real-world resources (e.g. staff availability, costs) or did not fully address possible barriers and facilitators for mobility in hospitals.

To successfully change behaviours related to mobility of older hospitalised patients, we first need to better understand the mechanisms underlying behaviours of key stakeholders, which include patients and healthcare profession-

als (HCPs). Several studies have assessed patient and HCP attitudes or behaviours regarding patient mobility [16–20], but none assessed the mechanisms of behaviours, a better understanding of which would contribute to the development and successful implementation of mobility-fostering interventions. Furthermore, local data in Switzerland are limited.

Mechanisms of behaviour can be studied with the Health Action Process Approach (HAPA) model, one of the most comprehensive health behaviour change models [21, 22]. This theoretical framework suggests that the adoption, initiation and maintenance of health behaviours is a process consisting of two main phases: (1) a motivation phase, in which a person develops an intention, and (2) a volition or action phase, in which the person implements the behaviour. Self-efficacy, outcome expectancies and risk perception are major drivers of the intention (motivation phase). Intention, planning and action control are major drivers of the behaviour (volition phase). The HAPA model has already been applied to older people and to physical activity [23–25], as well as to HCPs [26, 27].

In this study, we thus aimed to identify determinants of behaviours related to mobility of older medical patients during an acute hospitalisation, as reported by patients and HCPs (nurses/nursing assistants, physicians, physiotherapists), based on the HAPA model [21, 22], and on barriers and facilitators identified in previous studies [18].

Methods

Design and setting

We conducted a cross-sectional survey in April 2022 in three hospitals of Switzerland: Bern University Hospital (Inselspital); Tiefenau Hospital, a small non-university hospital in Bern; and Fribourg Cantonal Hospital (HFR-Fribourg), a large non-university hospital. To increase data generalisability, we selected hospitals of both the German- and French-speaking regions of Switzerland (also reflecting different cultural aspects) and of different sizes and types (university and non-university). Exemption from ethical approval was granted by the Ethics Committee of the University of Bern, as the study did not fall under the remit of human research as defined by Swiss regulations (Request number 2021-01383). Participation was voluntary and participants provided informed consent to participate. Participants were informed that their data would be analysed anonymously. The study was performed in accordance with the Declaration of Helsinki. Findings are reported according to the STROBE reporting standard.

Participants, sample size and data collection

We surveyed both patients and healthcare professionals (HCPs), including physicians, nurses, nursing assistants and physiotherapists. The proportions of patients and HCPs from each hospital were chosen to reflect the size of each hospital. We aimed for a margin of error of 7% with a confidence level of 95%. This level was chosen because, as a rule of thumb, an acceptable margin of error for a survey falls between 4% and 8%, and 7% would allow realistic recruitment numbers with our population sizes.

Patients

Patients were recruited by telephone by two authors (RH, PH) based on a list of all patients aged 60 years or older hospitalised in a medical ward of one of the participating hospitals in the previous year. Patient inclusion criteria were: (a) age 60 years or older; and (b) hospitalisation in a general internal medicine ward of one of the three hospitals during the last year. We excluded patients with cognitive disorders (based on medical records) and those unable to walk (e.g. wheelchair-bound patients) before hospital admission. Based on a mean discharge number of 5000 patients yearly (the total for the three hospitals), we calculated that 189 patients would provide a margin of error of 7% with a confidence level of 95%. Based on previous experience, we expected that some patients accepting to participate would not return the survey. We therefore increased the recruitment target by 20% to account for the expected non-response rate. After verifying the eligibility criteria of all patients of the list using electronic health records, two authors (RH, PH) contacted them directly by telephone in alphabetical order (to avoid any selection bias). A maximum of three attempts were made to call each patient. During the telephone call, the study was explained to the patients. Those who agreed to participate received the survey in paper form by post, together with written information on its goal, a consent form to sign, as well as a pre-paid envelope to return the survey and the consent form. Patients who did not return the survey were called back by the same two authors. There was no financial compensation for participation. Patient answers were transferred from paper into an electronic file by the senior author (CEA). Missing data were left empty.

Healthcare professionals

The only inclusion criterion for HCPs was to be working on a general internal medicine ward of one of the three selected hospitals. Based on the number of HCPs working on the medical wards of the three included hospitals (about 500), we calculated that 141 HCPs would provide a margin of error of 7% with a confidence level of 95%. Since we were more interested in assessing the mechanisms of behaviour of physician and nursing staff than of physiotherapists (fostering mobility being a main task of physiotherapists in the studied setting), we planned to include more physicians and nurses/nursing assistants than physiotherapists. We aimed for similar proportions of physicians and nurses/nursing assistants, because even if fostering patient mobility might be perceived more as a nursing task, the physician's role might be as important. Nurses (i.e. registered/licensed nurses) and nursing assistants (i.e. practice nurses) were selected for participation by the heads of nursing, while physiotherapists and physicians were recruited by e-mail by the senior author (CEA). HCPs were informed that their participation was anonymous and voluntary. Those agreeing to participate received a link to answer the survey on surveymonkey.com (SurveyMonkey®). Since the survey could not be completed without answering all questions, there were no missing data.

Outcomes

We assessed two outcomes in two distinct analyses (see in the "Data analysis" section below), separately for patients and for HCPs: (1) self-reported intention and (2) self-reported behaviour. Both outcomes were rated on a 5-point Likert scale. The intention was defined as "I intend to move as much as possible during a future hospitalisation" (for patients) and "I want to ensure during the next 3 months that my patients move as much as possible during their hospitalisation" (for HCPs). The behaviour was defined as "I moved as much as possible during hospitalisation" (for patients, referring to the last hospitalisation on the medical ward) and "I ensure my patients move as much as possible during hospitalisation" (for HCPs).

Survey instrument

The survey questions were based on the HAPA model and on barriers and facilitators to medical inpatient mobility identified in previous studies [18]. The items from the HAPA model assessed (referred to as "HAPA variables") were:

- self-efficacy (belief in ability to perform the behaviour)
- outcome expectancies (expectations of performing the behaviour, beliefs about the consequences of the behaviour)
- risk perception (subjective assessment of the risks of not performing the behaviour)
- intention
- planning (consisting of action planning – when, where and how to perform the behaviour – and coping planning – anticipating potential barriers to achieving the behaviour)
- action control (self-monitoring of behaviour implementation)
- behaviour

These items referred to the target behaviours described in the "Outcomes" section above. The planning variable was not collected in the patient survey, because the assessed behaviour was in the past. The items assessed based on barriers and facilitators for mobility at hospital (referred to as "non-HAPA variables") were: factual knowledge, action knowledge, role perception, fear and organisation-environment. The survey was developed in German and then translated into French by bilingual members of the research team using a forward-backward translation method [28, 29]. An English version of the questions is provided in tables S1 and S2 in the appendix. The questions were rated on a 5-point Likert scale (1 = "disagree", 2 = "rather disagree", 3 = "neutral", 4 = "rather agree", 5 = "agree").

In addition, we collected participant baseline characteristics. For patients, these included age, sex, educational level, living situation (before and after hospitalisation), use of walking aids and life-space level according to the University of Alabama in Birmingham Study of Aging Life-Space Assessment [30]. For HCPs, baseline characteristics included age, sex, years of work experience, percentage of work time, graduation year and board certification (for physicians only). The surveys were tested using a thinking-aloud method [31] with four patients and six HCPs from all three hospitals, and the questions were adapted accordingly.

Data analysis

HAPA and non-HAPA variables were created by calculating the mean of the answers to the different questions assessing each respective variable (when applicable). Negatively formulated questions were recoded positively (see tables S1 and S2 in the appendix) to allow grouping of the questions. Internal consistency between the different questions assessing one variable was assessed using Cronbach's alpha.

We conducted hierarchical regressions to assess the determinants of intention and behaviour. Non-HAPA variables were entered in the model first as they are supposed to precede HAPA variables in the mediation pathway of intention/behaviour (for example, knowledge leads to outcome expectancies and then to intention). HAPA variables were then added sequentially based on their proximity to the outcomes: level 1: self-efficacy, outcome expectancies and risk perception; level 2: intention; level 3: planning; level 4: action control. Some non-HAPA and HAPA variables could not be included, because of the nature/content of the questions. For example, when the behaviour was finished for the patients but ongoing for HCPs. Figure 1 summarises the intention and behaviour frameworks for patients and HCPs. Thus, the analysis of intention included only two models (figures 1A and 1B): (1) model 1 with non-HAPA variables; (2) model 2 with non-HAPA and level 1 HAPA variables. The analysis of patient behaviour included two models (figure 1C): (1) model 1 with non-HAPA variables; (2) model 2 with action control in addition. The analysis of healthcare professional behaviour included five models (figure 1D): (1) model 1 with non-HAPA variables; (2) model 2 with level 1 HAPA variables in addition (i.e. self-efficacy, outcome expectancies and risk perception); (3) model 3 with the level 2 HAPA variable in addition (i.e. intention); (4) model 4 with the level 3 HAPA variable in addition (i.e. planning); (5) model 5 with the level 4 HAPA variable in addition (i.e. action control). In addition to these unadjusted main models, we conducted sensitivity analyses adjusting for age and sex.

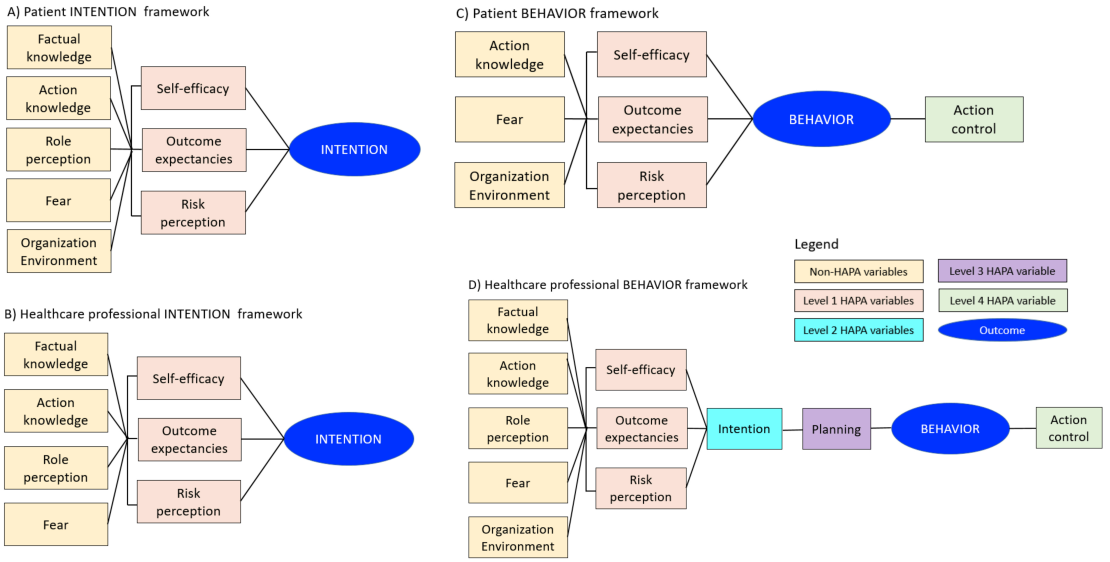
We tested model assumptions using residual plots, variance inflation factor to assess multicollinearity, and the Breusch-Pagan/Cook-Weisberg test for heteroscedasticity. We used robust standard error when the heteroscedasticity test was significant. We presented the results as beta coefficients with 95% confidence intervals (95% CI). We used delta R-squared (R^2) to assess the improvement of the models through the different steps (i.e. how much more of the variance is explained by the variables added to the model). The significance level was set at an alpha level of 0.05.

We performed all analyses using Stata/MP 16.0 (StataCorp LP, College Station, Texas, USA).

Ethical approval and consent to participate

The study was granted a waiver from ethical approval by the Ethics Committee of the University of Bern, given that it did not fall under the remit of human research as defined by Swiss regulations. Participation was voluntary

Figure 1: Analytical framework for patient and healthcare professional (HCP) intention and behaviour hierarchical regression models. In the different models of the hierarchical regression, the variables were added consecutively based on theory: non-HAPA variables (yellow boxes: factual knowledge, action knowledge, role perception, fear, organisation-environment), HAPA level 1 variables (pink-orange boxes: self-efficacy, outcome expectancies, risk perception), HAPA level 2 variable (turquoise box: intention), HAPA level 3 variable (purple box: planning) and HAPA level 4 variable (green box: action control). Not all variables could be included in all frameworks, due to the nature of the assessment. (A) Patient intention framework; (B) HCP intention framework; (C) patient behaviour framework; (D) HCP behaviour framework. HAPA: Health Action Process Approach.



and participants provided informed consent to participate. The protocol was defined in the grant submission but not registered on a public registry.

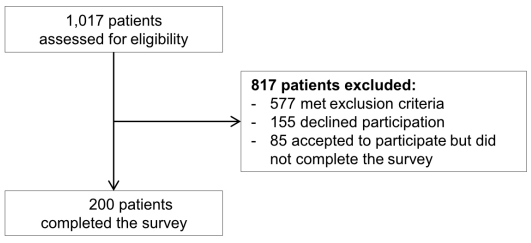
Consent for publication: Study participants were informed that the results of the study would be published in peer-reviewed journals.

Results

Descriptive results

Between December 2021 and March 2022, we recruited 142 HCPs (61 physicians, 59 nurses/nursing assistants, 22 physiotherapists) who completed the survey. Among 1017 screened patients, 577 (56.7%) did not meet eligibility criteria and 440 (43.3%) were invited to participate (figure 2). Of them, 285 (64.8%) initially accepted to participate and 200 (45.5%) finally completed the survey. Participants' baseline characteristics are reported in table 1. Patients had a mean age of 74 years (standard deviation [SD]: 7.6, range: 60–92) and 74 (37.0%) were female. HCPs had a mean age of 32 years (SD: 8.6, range: 19–62) and 107 (75.4%) were female.

Figure 2: Flow chart of patient recruitment.



The distribution of HAPA and non-HAPA variables for patients and HCPs are reported in table 1. All mean values of HAPA variables were higher than neutral (neutral corresponding to 3 on the 5-point Likert scale), ranging for patients from 3.7 (SD: 0.7) for self-efficacy to 4.3 (SD: 0.9) for intention, and for HCPs from 3.4 (SD: 0.9) for planning to 4.4 (SD: 0.7) for risk perception and 4.4 (SD: 0.8) for intention. Similar results were obtained for non-HAPA variables, except for organisation-environment for HCPs (mean: 2.8, SD: 1.0) and for fear (mean: 1.8, SD: 1.2 for patients; mean: 2.2, SD: 0.6 for HCPs).

Correlations and assessment of model assumptions

Patient variables that correlated most were self-efficacy and risk perception (Pearson coefficient: 0.51; table S3 in the appendix). For HCPs, the highest correlations were found between self-efficacy and planning (Pearson coefficient: 0.52), Outcome expectancies and intention (Pearson coefficient: 0.58), and role perception and Behaviour (Pearson coefficient: 0.60; table S4 in the appendix). The variance inflation factor was below 2.1 for all variables, making relevant multicollinearity unlikely. The test for heteroscedasticity was significant for patient and HCP intention models and the patient behaviour model, so that we used robust standard errors for those models.

Patient intention models

The patient full unadjusted model explained 35.0% of the variance in patient-reported intention to move as much as possible during hospitalisation (table 2). Factual knowledge, outcome expectancies and risk perception were associated with patient-reported intention. Patient-reported intention increased on average by 0.14 points (95% CI: 0.01–0.26) for each point increase in factual knowledge, by 0.43 points (95% CI: 0.19–0.67) for each point increase

in outcome expectancies, and by 0.26 points (95% CI: 0.04–0.49) for each point increase in risk perception. The results were similar in the sensitivity analysis adjusting for age and sex. Model 2 performed better than model 1, explaining 21.0% more of the variance (p value for delta R^2 <0.001).

Healthcare professional intention models

The HCP full unadjusted model (model 2) explained 50.0% of the variance in HCP-reported intention to ensure patients move as much as possible (table 2). Action knowledge, self-efficacy, Outcome expectancies and risk perception were associated with HCP-reported intention. HCP-reported intention increased on average by 0.17 points (95% CI: 0.03–0.30) for each point increase in action knowledge, by 0.21 points (95% CI: 0.01–0.40) for each point increase in self-efficacy, by 0.42 points (95% CI: 0.14–0.70) for each point increase in outcome expectancies, and by 0.24 points (95% CI: 0.11–0.37) for each point increase in risk perception. The results were similar in the sensitivity analysis adjusting for age and sex. Model 2 was better than model 1, explaining 21.0% more of the variance (p value for delta R^2 <0.001).

Patient behaviour models

The patient full unadjusted model (model 2) explained 32.0% of patient-reported behaviour (table 3). Patient-reported mobility increased on average by 0.37 points (95% CI: 0.14–0.60) for each point increase in action knowledge, and by 0.42 points (95% CI: 0.25–0.60) for each point increase in action control. The results were similar in the sensitivity analysis adjusting for age and sex. Model 2 was better than model 1, explaining 9.0% more of the variance (p value for delta R^2 was 0.009).

Healthcare professional behaviour models

The HCP full unadjusted model (model 5) explained 65.0% of HCP-reported behaviour (table 3). Factual knowledge (beta coefficient: 0.26 [95% CI: 0.00–0.52]), role perception (beta coefficient: 0.27 [95% CI: 0.13–0.41]), planning (beta coefficient: 0.20 [95% CI: 0.07–0.34]) and action control (beta coefficient 0.47 [95% CI: 0.34–0.61]) were associated with HCP-reported behaviour. The results were similar in the sensitivity analysis adjusting for age and sex. The HCP full model was better than model 1, explaining 20.0% more of the variance (p value for delta R^2 <0.001).

Table 1:
Patient and healthcare professional characteristics and distribution of HAPA and non-HAPA variables.

		Patients (n = 198) *	HCPs (n = 142)
Characteristic			
Age (years), mean (SD)		74 (7.6)	32 (8.6)
Female, n (%)		74 (37.0%)	107 (75.4%)
Hospital, n (%)	Bern University Hospital	86 (43.0%)	79 (55.6%)
	Tiefenau Hospital Bern	41 (20.5%)	23 (16.2%)
	Fribourg Cantonal Hospital	71 (35.5%)	40 (28.2%)
Education (maximum level reached), n (%)			NA
	Elementary school	28 (14.0%)	
	Apprenticeship	115 (57.5%)	
	High school	12 (6.0%)	
	College	41 (20.5%)	
Duration of hospitalisation (days), mean (SD)		7.3 (5.4)	NA
Life-space assessment score, mean (SD) **		75.7 (34.5)	NA
Working group, n (%)		NA	
	Physician		61 (43.0%)
	Nursing staff		59 (41.5%)
	Physiotherapist		22 (15.5%)
HAPA variables, mean (SD) ***			
Intention		4.3 (0.9)	4.4 (0.8)
Behaviour		3.9 (1.2)	3.8 (0.9)
Self-efficacy		3.7 (0.7)	3.5 (0.8)
Outcome expectancies		3.9 (0.5)	4.5 (0.5)
Risk perception		3.9 (0.8)	4.4 (0.7)
Action control		3.9 (1.0)	3.9 (0.9)
Planning		NA	3.4 (0.9)
Non-HAPA variables, mean (SD) ***			
Factual knowledge		3.6 (0.8)	4.1 (0.5)
Action knowledge		4.0 (0.9)	4.0 (0.9)
Role perception		3.9 (1.0)	4.2 (0.8)
Fear		1.8 (1.2)	2.2 (0.6)
Organisation-environment		3.3 (0.9)	2.8 (1.0)

HAPA: Health Action Process Approach; NA: not applicable; SD: standard deviation.

* Two patients did not complete the questions on baseline characteristics, hence these data are available for 198/200 (99%) of the patients.

** According to the University of Alabama at Birmingham Study of Aging Life-Space Assessment. The score ranges from 0 (never left the bedroom in the past 4 weeks) to 120 (went out of town without personal or walking assistance daily in the past 4 weeks).

*** HAPA and non-HAPA variables were rated on a 5-point Likert scale (1 = disagree, 2 = rather disagree, 3 = neutral, 4 = rather agree, 5 = agree).

Table 2:
Unadjusted hierarchical regression models for predicting patient and HCP intention regarding patient mobility. Results from the hierarchical regression analysis, presented as beta coefficients with 95% confidence intervals. 142 patients had data variables for the models. Significant results are highlighted in bold. The outcome (intention) was defined as "I intend to move as much as possible during a future hospitalisation" for the patients and "I want to ensure that my patients move as much as possible during hospitalisation" for the HCPs. R^2 is the amount of the variance explained by the model (0.00 representing 0%, 1.00 representing 100%). The delta R^2 (increment between two models) refers to the amount of the variance additionally explained with the additional variables. Results were similar in a sensitivity analysis adjusted for age and sex.

Patients	**Model 1**	**Model 2**
Factual knowledge	0.18 (0.02; 0.33)	**0.14 (0.01; 0.26)**
Action knowledge	0.15 (–0.02; 0.32)	0.02 (–0.12; 0.16)
Role perception	**0.21 (0.07; 0.35)**	0.15 (–0.01; 0.30)
Fear	0.02 (–0.08; 0.12)	0.02 (–0.07; 0.12)
Organisation-environment	0.00 (–0.11; 0.14)	–0.02 (–0.13; 0.08)
Self-efficacy	NA	0.24 (–0.01; 0.50)
Outcome expectancies	NA	**0.43 (0.19; 0.67)**
Risk perception	NA	**0.26 (0.04; 0.49)**
R^2 (p value)	*0.14 (<0.001)*	*0.35 (<0.001)*
Delta R^2 model 2 – model 1 (p value)	*0.21 (<0.001)*	
Healthcare professionals	**Model 1**	**Model 2**
Factual knowledge	**0.38 (0.11; 0.66)**	0.11 (–0.16; 0.38)
Action knowledge	**0.21 (0.02; 0.39)**	**0.17 (0.03; 0.30)**
Role perception	**0.20 (0.02; 0.35)**	0.07 (–0.09; 0.24)
Fear	0.14 (–0.08; 0.30)	0.17 (–0.01; 0.34)
Organisation-environment	0.01 (–0.10; 0.13)	0.04 (–0.05; 0.14)
Self-efficacy	NA	**0.21 (0.01; 0.40)**
Outcome expectancies	NA	**0.41 (0.14; 0.70)**
Risk perception	NA	**0.24 (0.11; 0.37)**
R^2 (p value)	*0.30 (<0.001)*	*0.51 (<0.001)*
Delta R^2 model 2 – model 1 (p value)	*0.21 (<0.001)*	

NA: not applicable (i.e. variable not included in the model); R^2: R-squared.

Table 3:
Unadjusted hierarchical regression models predicting patient and HCP behaviour regarding patient mobility. Results from the hierarchical regression analysis, presented as beta coefficients with 95% confidence intervals. 138 patients had complete data for models 1–4 and 128 patients for model 5. Significant results are highlighted in bold. The outcome (behaviour) was defined as "I moved as much as possible during hospitalisation" for the patients and "I ensured that my patients moved as much as possible during hospitalisation" for the HCPs. R^2 is the amount of the variance explained by the model (0.00 representing 0%, 1.00 representing 100%). The delta R^2 (increment between two models) refers to the amount of the variance additionally explained with the additional variables. Results were similar in a sensitivity analysis adjusted for age and sex.

Patients	**Model 1**	**Model 2**			
Action knowledge	**0.57 (0.37; 0.77)**	**0.37 (0.14; 0.60)**			
Fear	–0.10 (–0.27; 0.06)	–0.06 (–0.21; 0.08)			
Organisation-environment	–0.07 (–0.26; 0.11)	–0.11 (–0.32; 0.09)			
Action control	NA	0.42 (0.25; 0.60)			
R^2 (p value)	*0.23 (<0.001)*	*0.32 (<0.001)*			
Delta R^2 model 2 – model 1 (p value)	*0.09 (0.009)*				
Healthcare professionals	**Model 1***	**Model 2* ****	**Model 3** *****	**Model 4**	**Model 5**
Factual knowledge	**0.45 (0.13; 0.76)**	**0.40 (0.07; 0.72)**	**0.38 (0.0504; 0.70)**	**0.33 (0.02; 0.65)**	**0.26 (0.00; 0.52)**
Action knowledge	0.12 (–0.04; 0.27)	0.09 (–0.06; 0.25)	0.05 (–0.10; 0.22)	0.06 (–0.09; 0.21)	0.01 (–0.12; 0.15)
Role perception	**0.48 (0.32; 0.64)**	**0.45 (0.28; 0.61)**	**0.43 (0.27; 0.59)**	**0.40 (0.24; 0.56)**	**0.27 (0.13; 0.41)**
Fear	–0.02 (–0.22; 0.17)	–0.01 (–0.19; 0.20)	–0.03 (–0.23; 0.17)	–0.03 (–0.22; 0.19)	0.14 (–0.03; 0.30)
Organisation-environment	0.08 (–0.04; 0.21)	0.09 (–0.04; 0.21)	0.08 (–0.04; 0.21)	0.07 (–0.05; 0.26)	0.06 (–0.05; 0.16)
Self-efficacy	NA	**0.24 (0.05; 0.43)**	**0.19 (0.00; 0.39)**	0.05 (–0.15; 0.26)	–0.04 (–0.22; 0.14)
Outcome expectancies	NA	–0.04 (–0.34; 0.25)	–0.14 (–0.42; 0.18)	–0.10 (–0.38; 0.19)	–0.06 (–0.30; 0.19)
Risk perception	NA	0.00 (–0.20; 0.20)	–0.05 (–0.26; 0.15)	0.00 (–0.20; 0.20)	0.03 (–0.14; 0.20)
Intention	NA	NA	**0.21 (0.00; 0.42)**	0.16 (–0.04; 0.37)	0.02 (–0.17; 0.21)
Planning	NA	NA	NA	**0.25 (0.10; 0.40)**	**0.20 (0.07; 0.34)**
Action control	NA	NA	NA	NA	**0.47 (0.34; 0.61)**
R^2 (p value)	*0.45 (<0.001)*	*0.47 (<0.001)*	*0.49 (<0.001)*	*0.53 (<0.001)*	*0.65 (<0.001)*
Delta R^2 model 5 – model 1 (p value)	*0.20 (<0.001)*				

NA: not applicable (i.e. variable not included in the model); R^2: R-squared.

* p value for delta R^2 model 2 – model 1: 0.10

** p value for delta R^2 model 3 – model 2: 0.049

*** p value for delta R^2 model 4 – model 3: 0.001

**** p value for delta R^2 model 5 – model 4: 0.41

Discussion

In this theory-driven analysis, we assessed potential determinants of patient- and HCP-reported intentions and behaviours related to mobility of older patients during an acute hospitalisation in a medical ward. Action knowledge and action control seemed key factors of patient behaviour, and factual knowledge, role perception, planning and action control of HCP behaviour. The several identified potential drivers of mobility-related intentions and behaviours provide useful information for the development of future interventions for increasing the mobility of older hospitalised patients, to ensure that these interventions successfully lead to behaviour change in clinical practice.

Fear, which has previously been identified as a barrier to patient mobility [18], was not significantly associated with patient- and HCP-reported intention or behaviour. Of note, fear was rated rather low in this study, so that the findings might not apply to patients and HCPs with a higher level of fear. While about one third of older people develop a fear of falling, even without experiencing a fall [32, 33], and reducing fear is important in general to improve HCP and patient well-being and HCP work motivation [34, 35], further study is warranted to determine whether reducing fear of fall/injury can improve behaviours related to mobility of older hospitalised patients.

Factual knowledge was associated with patient-reported intention and HCP-reported behaviour, and action knowledge with patient-reported behaviour and HCP-reported intention. Previous interventions to increase mobility have targeted knowledge in several ways. While some studies focused on factual knowledge (e.g. education about the importance of patient mobility) [10, 36], other studies addressed action knowledge as well [11, 13, 37]. Concordant with implementation science theories, our findings suggest that future interventions should target not only factual knowledge (i.e. “what to do”), but also action knowledge (i.e. “how to do it”). This could include information on where, when and how to move, for example with walking itineraries or exercises, or a goal-setting process with concrete daily mobility objectives, which was effective in previous studies [11, 13, 37]. Furthermore, we found an association between perceiving patient mobility as a part of HCP work tasks (i.e. role perception) and HCP-reported behaviour. Ensuring that patient mobility is taught as a main work task in healthcare professional studies and training might help to improve healthcare professional role perception and thus how they ensure patients move as much as possible during their hospitalisation.

Self-efficacy, outcome expectancies and risk perception were associated with HCP-reported intention, while planning and action control were associated with their behaviour. Several possibilities exist to target those aspects that seem important to improve HCP behaviour related to patient mobility. First, implementing practical training could help to improve self-efficacy, including self-confidence. Second, discussions between HCPs about their outcome expectancies and risk perception could help adjust or correct them, notably reduce misbeliefs. For example, the misbelief that letting patients lie for a few days will not significantly impact their outcomes, or that fostering mobility increases the risk of falls. Finally, developing practical guidelines and algorithms about patient mobility for HCPs could contribute to improve planning and action control.

Outcome expectancies and risk perception were associated with patient-reported intention, and action control with patient-reported behaviour. These three parameters seem accessible to change. Discussions between HCPs and patients might help identify patient expectations and potential misbeliefs. A common misbelief is that one should rest in bed to recover, likely related to hospital set-up and organisation (beds available all day long, bedside visits, …) [18]. While the latter cannot be easily modified, it is nevertheless quite feasible to address patient misbeliefs about outcome expectancies and risk perception. Including their relatives in the process might also be important in preventing them from spreading these misbeliefs. Finally, action control might be improved by providing patients with tools to set and monitor goals, such as a mobility diary, and by discussing these goals and progress regularly with the patients. In the future, interactive technology measuring mobility (e.g. smartphone apps, smart watches), might also help elderly patients monitor their mobility and progress.

Limitations and strengths

This study has several strengths. First, we conducted the survey with both patients and HCPs and included the main healthcare professional categories involved in patient mobility at hospital (nurses/nursing assistants, physicians, physiotherapists). Second, the sample was large enough to provide a 7% margin of error with a confidence level of 95%. Third, we assessed and analysed not only variables identified in previous studies on patient mobility, but also variables of the HAPA model, allowing a theory-driven assessment of mobility behaviours. Fourth, we conducted the survey in three hospitals of different sizes and cultural/language regions, increasing result generalisability. Fifth, we studied a broad patient population, not limiting the study to specific health conditions.

We must acknowledge several limitations. First, only patients and HCPs who agreed to answer the survey were included, so that the results might not be generalisable to all patients and HCPs. This is, however, a limitation of any such study. Second, recruitment by the heads of nursing might have introduced a selection bias. To reduce this risk, they were asked to provide a sample of HCPs of various ages, years of experience and qualification degrees. Furthermore, selection was conducted by several different people, because there is one head of nursing on each ward (and not only one in each hospital), which might have helped reduce selection bias. Third, the subsamples of HCPs were too small to assess for differences across professions (physicians, nurses/nursing assistants, physiotherapists). Nevertheless, the majority of our sample were physicians and nurses/nursing assistants, whose behaviour change is most likely to help modify practices, and are thus most important to assess. In the setting we studied, fostering mobility is indeed considered a main task of physiotherapists, but not of physicians and nurses/nursing assistants. However, this might be different in other settings. Fourth, patients who were wheelchair-bound before hospitalisation and those with cognitive impairment were excluded. While it is important that wheelchair-bound patients continue to be able to transfer themselves for

example from wheelchair to bed, such patients most frequently are already hardly moving independently before hospitalisation, and likely represent a different patient collective that should be studied separately. Whereas mobility is very important for cognitively impaired patients, asking them to answer questions about a past hospitalisation would likely not have yielded reliable answers. Fifth, the study used a cross-sectional design with, for patients, self-reporting, which does not rule out an information bias, without repeat measurements and with assessment of past behaviour. This did not allow us to assess the HAPA model completely, nor to study a temporal sequence, nor to assess intraindividual correlations, nor to measure patient mobility objectively. However, while mobility can be measured objectively, most other variables that we assessed cannot (e.g. the intention to move). Of note, patient perception of mobility during hospitalisation might also have been different if it had been studied during hospitalisation. Sixth, several items that could confound or mediate the associations (such as functional ability, use of a walking aid or hospitalisation diagnosis) were not collected. However, we were interested in studying mechanisms of intention and behaviour that can be targeted through an intervention, and thus did not focus on or adjust for specific health conditions or functional ability, which would have limited result generalisability. Finally, the study was conducted in Switzerland only, so results might not be generalisable to other countries with different healthcare systems.

Conclusion and clinical implications

This study assessing determinants of patient- and HCP-reported intentions and behaviours identified several potential drivers of patient and HCP behaviour related to mobility of older hospitalised medical patients, which can be addressed through specific interventions. The findings of this study can inform the development of behaviour change interventions to help successfully implement practice modifications, in order to improve mobility of older patients hospitalised on an acute medical ward and, in turn, their outcomes.

Availability of data and material

The datasets analysed during the current study and the codes used for analysis are available from the corresponding author upon reasonable request. No specific library or package was used for the analyses.

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Potential competing interests

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflict of interest related to the content of this manuscript was disclosed.

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Appendix

Table S1. HAPA items of the survey for patients and HCPs.

VARIABLES	PATIENTS	HEALTHCARE PROFESSIONALS
Self-efficacy *Cronbach's α* (patients): 0.82 *Cronbach's α* (HCPs): 0.92	I am sure that I can move as much as possible during a hospital stay, even if it becomes sometimes hard.	I am sure that I can ensure that my patients move as much as possible, even if it is sometimes difficult (for example because of lack of time).
	I am sure that I can move as much as possible during a hospital stay, even if I have to request a lot of support from the healthcare providers.	I am sure that I can ensure that my patients move as much as possible.
	I am sure that I can move as much as possible during a hospital stay, even if I have to boost myself.	I am sure that I can ensure that my patients move as much as possible, even if I must think carefully when I manage to do so during my work day.
	I am sure that I can move as much as possible during a hospital stay, even if I do not immediately notice positive changes.	I am sure that I can ensure that my patients move as much as possible, even if I have to give myself a push.
	I am sure that I can move as much as possible during a hospital stay, even if I would prefer doing something else.	I am sure that I can ensure that my patients move as much as possible, even if once I do not feel sure (=competent).
	I am sure that I can move as much as possible during a hospital stay, even if my complaints/pain are a barrier.	After starting to ensure that my patients move as much as possible, I am confident that I will continue to manage to do so.
	I am sure that I can move as much as possible during a hospital stay, even if I have to overcome myself each time.	I am sure that I can ensure over the long term that my patients move as much as possible, even if I do not immediately notice progress by my patients.
	I am sure that I can move as much as possible during a hospital stay, even if I have little visits and exams do not let me much time available.	I am sure that I can ensure over the long term that my patients move as much as possible, even if I sometimes feel sorry for my patients when they suffer during mobilization.
	I am sure that I can move as much as possible during a hospital stay, even if I gave up several times.	I am sure that I ensure over the long term that my patients move as much as possible, even if I would actually prefer to do something else.
		I am sure that I can ensure over the long term that my patients move as much as possible, even if I have to adapt my priorities / work organization.
		I am sure that I can ensure over the long term that my patients move as much as possible, even if I have to overcome myself each time.
		I am sure that I can ensure over the long term that my patients move as much as possible, even if this increases my workload.
		I am confident that I can once again ensure that my patients move as much as possible n, if I once did not manage to do so (for example because of lack of time).

		I am confident that I can again ensure that my patients move as much as possible, even if some day I do not have time.
		I am confident that I can again ensure that my patients move as much as possible, even if once I cannot pick myself up.
		I am confident that I can again ensure that my patients move as much as possible, even if several times I did not manage to do so (for example because of lack of time).
Outcome expectancies *Cronbach's α* (patients): 0.67 *Cronbach's α* (HCPs): 0.76	If I move as much as possible during a hospital stay, I do something good for my health.	If I ensure that my patients move as much as possible, I do something good for my patients' health.
	If I move as much as possible during a hospital stay, it always requires self-discipline.	If I ensure that my patients move as much as possible, it has positive effects on psychical health of patients.
	If I move as much as possible during a hospital stay, it makes me self-confident.	If I ensure that my patients move as much as possible, my patients can go back to their everyday independent life.
	If I move as much as possible during a hospital stay, it impacts positively my mental state.	If I ensure that my patients move as much as possible, I am satisfied with my work.
	If I move as much as possible during a hospital stay, I always have to make a big effort.	
	If I move as much as possible during a hospital stay, I am a burden for the healthcare providers.	
	If I move as much as possible during a hospital stay, I feel better afterwards.	
	If I move as much as possible during a hospital stay, I can leave hospital earlier.	
Risk perception *Cronbach's α* (patients): 0.79 *Cronbach's α* (HCPs): 0.73	I believe that my health will worsen if I do not move as much as possible during a hospital stay.	I believe that the health status of my patients can worsen if I do not ensure that they move as much as possible.
	I believe that I will stay longer at hospital if I do not move as much as possible during hospitalization.	I believe that my patients must stay longer at hospital if I do not ensure that they move as much as possible.
	I believe that I will become dependent on other people / institutions / walking aids to do my activities of daily living if I do not move as much as possible during hospitalization.	I believe that my patients will become more dependent in their everyday activities if I do not ensure that they move as much as possible.
Intention	I intend to move as much as possible during a future hospitalization.	I want to ensure during the next 3 months that my patients move as much as possible during their hospitalization.
Planning *Cronbach's α* (HCPs): 0.92	NA	I have already concretely planned, when (during my work day) I will ensure that my patients move.
		I have already concretely planned, how I will ensure that my patients move.
		I have already concretely planned, where I will ensure that my patients move.

		I have already concretely planned, how often I will ensure that my patients move.
		I have already concretely planned, with whom I will ensure that my patients move.
		I have already concretely planned, how I will ensure that my patients move, even if once I do not feel enough competent.
		I have already concretely planned, how I will ensure that my patients move, even if several times I did not manage to do so (for example because of lack of time).
		I have already concretely planned, how I will ensure that my patients move when the workload is high.
		I have already concretely planned, how I will ensure that my patients move, even if once something acute happens in-between.
Action control[a] *Cronbach's α* (patients): 0.83 *Cronbach's α* (HCPs): 0.86	I kept in mind my intention to move during my hospitalization.	I kept in mind my intention to ensure that my patients move.
	During my hospitalization, I paid attention (thought) to move as much as I intended to.	I paid close attention (thought) to as I had planned to ensure that my patients move.
	During my hospitalization, I did anything (behavior) to move as I intended to.	I did everything (behavior) as I had planned to ensure that my patients move.
Behavior *Cronbach's α* (patients): 0.87 *Cronbach's α* (HCPs): 0.83	I moved every day during my hospitalization.	I ensured that my patients move during hospitalization.[b]
	I moved every day as much as possible during my hospitalization.	I ensured every day that my patients move during hospitalization.[b]
		I ensured as much as possible that my patients move during hospitalization.[b]
		I ensured every day as much as possible that my patients move during hospitalization.[b]

Abbreviations: HCP, healthcare professional; NA, not applicable (not collected).
Legend: For items in the past, patients were asked to think about their last hospitalization on a medical ward. For items related to the future / long term, participants were asked to think about the next 3 months. Negatively formulated items are highlighted in grey boxes. They were recoded so that all items of a same variable were positively coded (1=less optimal, 5=best).
[a] Additional answer possible: "I had no intention". [b] Additional answer possible: "Not applicable".

Table S2. Non-HAPA items of the survey for patients and HCPs.

NON-HAPA VARIABLES	PATIENTS	HEALTHCARE PROFESSIONALS
Factual knowledge *Cronbach's α* (patients): 0.16 *Cronbach's α* (HCPs): 0.60	I know the consequences of low movement during hospitalization.	I know the movement capacities of my patients (= what they are able to do with / without help).
	During a hospital stay, medication or other treatments are more important than moving.	I know the consequences of low patient movement during a hospitalization.
		I know the contraindications and indications to mobilize my patients.
		Patients who were inactive or dependent in their activities of daily living before admission do not need to move during their hospitalization.
		It is more important to prevent falls during mobilization than to encourage patient movement.
		Other work tasks are more important than patients' mobilization.
		Mobilization of patients is part of their treatment.
Action knowledge *Cronbach's α* (patients): 0.89	I knew how to handle medical devices (for example urinary catheter, infusion) when I wanted to move.	I know how to advise my patients regarding movement at hospital.
	I knew whether I was allowed to move.	
	I knew when I was allowed to move.	
	I knew where I could move.	
	I knew who to ask to get support to move.	
Role perception	I am self-responsible to move during a hospitalization.	Ensuring my patients move is part of my work tasks.
Fear *Cronbach's α* (HCPs): 0.60	Fear (for example of hurting myself or of not finding the way back) was a barrier to move.	I fear that my patients fall / hurt themselves during mobilization.
		I fear consequences if my patients hurt themselves during mobilization.
		I fear complications that could happen to my patients because of lack of movement.
		I fear to hurt myself when I mobilize my patients.
Organization / environnement *Cronbach's α* (patients): 0.51 *Cronbach's α* (HCPs): 0.58	Healthcare providers did **not** have time to help me move.	On my department / unit, it is clear, who is responsible for patients' mobilization.
	I received a timetable of my exams / visits.	On my department / unit, patients' mobilization is standardized (algorithms, schemes, responsibilities, …).
	Lack of sitting / resting spots was a barrier to move.	

Abbreviations: HCP, healthcare professional; NA, not applicable (not collected).
Legend: For items in the past, patients were asked to think about their last hospitalization on a medical ward. For items related to the future / long term, participants were asked to think about the next 3 months. Negatively items that are highlighted in grey boxes were recoded so that all items of a same variable were positively coded (1=less optimal, 5=best).

Table S3. Correlation matrix for patients.

	Intention	Behavior	Factual knowledge	Action knowledge	Role perception	Fear	Organization - environment	Self-efficacy	Outcome expectancies	Risk perception
Behavior	0.27[b]									
Factual knowledge	0.23[c]	0.14								
Action knowledge	0.22[c]	0.47[a]	0.18							
Role perception	0.29[a]	0.29[a]	0.16	0.20[c]						
Fear	-0.08	-0.20[c]	-0.04	-0.24[c]	-0.22[c]					
Organization - environment	0.12	0.15[d]	0.13	0.41[a]	0.16[d]	-0.12				
Self-efficacy	0.38[a]	0.19[c]	-0.05	0.22[c]	0.22[c]	0.01	0.18[d]			
Outcome expectancies	0.37[a]	0.39[c]	0.20[c]	0.30[a]	0.13	-0.28[b]	0.17[c]	0.16[d]		
Risk perception	0.46[a]	0.21[c]	0.17[d]	0.16[d]	0.25[b]	0.03	0.05	**0.51**[a]	0.20[c]	
Action control	0.36[a]	0.48[a]	0.12	0.36[a]	0.22[b]	-0.10	0.27[b]	0.23[c]	0.39[a]	0.26[b]

Legend: Correlations higher than 0.50 are highlighted in bold. P-value for the statistical significance of the correlations: [a] p<0.0001; [b] p<0.001; [c] p<0.01; [d] p<0.05.

Table S4. Correlation matrix for HCPs.

	Intention	Behavior	Factual knowledge	Action knowledge	Role perception	Fear	Organization - environment	Self-efficacy	Outcome expectancies	Risk perception	Planning
Behavior	0.47[a]										
Factual knowledge	0.40[a]	0.50[a]									
Action knowledge	0.44[a]	0.44[a]	0.51[a]								
Role perception	0.42[a]	**0.60**[a]	0.43[a]	0.44[a]							
Fear	-0.03	-0.15	-0.29[c]	-0.19[d]	-0.09						
Organization - environment	0.06	0.14	0.10	0.11	0.03	-0.07					
Self-efficacy	0.47[a]	0.43[a]	0.35[b]	0.33[b]	0.36[a]	-0.20[d]	-0.00				
Outcome expectancies	**0.58**[a]	0.33[b]	0.42[a]	0.29[b]	0.39[a]	-0.10	0.03	0.42[a]			
Risk perception	0.47[a]	0.21[d]	0.32[b]	0.22[c]	0.25[c]	-0.15	-0.12	0.29[b]	0.50[a]		
Planning	0.33[a]	0.49[a]	0.28[c]	0.26[c]	0.32[b]	-0.12	0.06	**0.52**[a]	0.21[d]	0.06	
Action control	0.40[a]	0.70[a]	0.37[b]	0.29[b]	0.46[a]	-0.27[c]	0.07	0.40[a]	0.29[b]	0.18[d]	0.42[a]

Legend: Correlations higher than 0.50 are highlighted in bold. P-value for the statistical significance of the correlations: [a] p<0.0001; [b] p<0.001; [c] p<0.01; [d] p<0.05.