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ORIGINAL ARTICLE

Barriers to and solutions for improving physical activity in adults during hospital stay: a mixed-methods study among healthcare professionals

Sven J. G. Geelen[a], Boukje M. Giele[a], Raoul H. H. Engelbert[a,b], Sandra de Moree[c], Cindy Veenhof[d,e], Frans Nollet[a], Fenna van Nes[b] and Marike van der Schaaf[a,b]

[a]Department of Rehabilitation Medicine, Amsterdam UMC, Amsterdam Movement Sciences, University of Amsterdam, Amsterdam, The Netherlands; [b]Center of Expertise Urban Vitality, Faculty of Health, Amsterdam University of Applied Sciences, Amsterdam, the Netherlands; [c]Department of Medical Psychology, Amsterdam UMC, University of Amsterdam, Amsterdam, The Netherlands; [d]Physical Therapy Research, Department of Rehabilitation, Physical Therapy Sciences & Sports, University Medical Center Utrecht, Utrecht University, Utrecht, The Netherlands; [e]Expertise Center Healthy Urban Living, Research Group Innovation of Human Movement Care, University of Applied Sciences Utrecht, Utrecht, The Netherlands

ABSTRACT

Purpose: To identify healthcare professionals' perspectives on key barriers to improving physical activity in hospitalized adult patients, and to identify solutions to overcome these barriers.

Methods: We used an explanatory sequential mixed-methods study design in a Dutch university hospital. A survey exploring 39 potential barriers was completed by 15 physicians/physician assistants, 106 nurses, four nursing assistants, and four physical therapists working on surgery, internal medicine, and cardiology wards. Next, three in-depth semi-structured focus groups – comprising 30 healthcare professionals – discussed the survey findings to identify key barriers and solutions. Focus group discussions were analyzed using thematic analysis.

Results: Five themes were identified that described both the key barriers and the solutions to overcome these barriers. Healthcare professionals proposed several solutions, including clarifying the definition of physical activity, empowering patients to take responsibility for physical activity, giving physical therapists or physicians a prominent role in encouraging physical activity, and changing the hospital ward to entice patients to become physically active.

Conclusions: Healthcare professionals need clear guidelines, roles, and responsibilities when it comes to physical activity. They also need personalized interventions that empower patients in physical activity. Finally, hospital wards should be designed and furnished so that patients are encouraged to be active.

➤ IMPLICATIONS FOR REHABILITATION

- Many healthcare professionals want to sustainably improve physical activity in hospitalized adults.
- For this they need clear guidelines that not only define physical activity, but also describe the roles and responsibilities of all members of the medical team.
- Healthcare professionals need interventions that help to empower patients to take an active role in physical activity during hospital stay.
- Hospital wards should be designed and furnished so that patients are encouraged to be physically active.

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Mobility; physical activity; hospital; barrier; solution; adults

Introduction

Over one-third of hospitalized patients experience hospitalization-associated disability, defined as the loss of the ability to perform one or more activities of daily living independently due to hospital admission [1–4]. Hospitalization-associated disabilities (HADs) have been associated with a prolonged length of stay, increased risk of long-term institutionalization, and increased mortality [5–7]. Given the increasing number of patients being admitted to a hospital in the Netherlands [8], addressing HADs is becoming increasingly crucial.

HADs are known to be associated with low physical activity levels during hospital stay [9,10]. And interventions aiming to increase physical activity during hospital stay have proven to be effective in preventing HADs [11–13]. Nevertheless, physical activity levels during hospital stay remain low and patients continue to spend most of the time lying in bed or sitting [14,15].

To sustainably improve physical activity in hospitalized patients, a thorough understanding of the behavior of the healthcare professionals involved in medical and nursing care is needed [16,17]. Healthcare professionals report that while they are willing

CONTACT Sven J. G. Geelen s.j.geelen@amsterdamumc.nl Department of Rehabilitation Medicine, Amsterdam UMC, Amsterdam Movement Sciences, Meibergdreef 9, Amsterdam, 1105AZ, The Netherlands

Supplemental data for this article can be accessed here.

to improve physical activity in hospitalized patients, they also encounter multiple barriers, including insufficient knowledge, tools, physician's orders, and time [18–22]. The authors of a recent study in a Dutch university hospital proposed that the entire team involved in routine medical and nursing care should be responsible for prioritizing and improving physical activity in hospitalized patients [20].

When it comes to identifying key barriers to physical activity in clinical practice, such involvement of the team is limited by current methods of data collection. The limitations of surveys and individual interviews are that they may fail to include the priorities, group norms and cultural values of the team [23]. If healthcare professionals' perspectives are instead discussed in focus groups, we may be better able to identify the key barriers encountered in clinical practice by all members of the team rather just a select few. And we may also be able to identify collectively the solutions to overcome these key barriers.

To our knowledge, no studies have investigated these key barriers and solutions by discussing the perspectives of healthcare professionals in focus group discussions. Therefore, we conducted a mixed methods research study in which we first inventory the healthcare professionals' perspectives on improving physical activity in hospitalized patients. Thereafter, we discussed these perspectives in focus groups to identify key barriers and solutions. The research questions of this study were: What do the healthcare professionals working at a university hospital consider to be the key barriers to improving physical activity in adults during hospital stay? And what solutions will help them to overcome these barriers?

Materials and methods

Study design

This study used an explanatory sequential mixed methods study design. In this type of study, quantitative data is collected and analyzed first, followed by the collection and analysis of qualitative data. The qualitative phase builds directly on the results of the quantitative phase, allowing a more robust analysis and help to gain a better understanding of the problem [24]. In phase 1, we used a quantitative survey to identify factors that healthcare professionals perceived as important barriers to improving physical activity in hospitalized patients. In phase 2, we used in-depth qualitative focus group discussions to further explore these barriers and to collectively identify solutions that might help to overcome the key barriers. A certified Medical Research Ethics Committee approved the study protocol [W19_216 # 19.261]. All surveys were anonymized, and all focus group participants gave written informed consent to participate in the study. This study was reported according to the Good Reporting on a Mixed Methods Study (GRAMMS) criteria as proposed by O'Cathain, Murphy, and Nicholl [25] (Supplementary Material S1).

Context and study population

This study was conducted between March 2018 to June 2019 at a 1002-bed university hospital (Amsterdam University Medical Center (UMC), location Academic Medical Center) in Amsterdam, the Netherlands within five wards: two 29-bed gastrointestinal- and oncology surgery wards, one 29-bed internal medicine hematology ward, one 29-bed internal medicine infectious diseases ward, and one 29-bed cardiology ward. The staff on each hospital ward was comprised of approximately 35 nurses who performed their duties in shifts (day, evening, night), 2–5 physicians or physician assistants dedicated to daily care, and one physical therapist. The healthcare professionals participating in this study met the following criteria: (1) they were employed as a physician, physician assistant, nurse, nursing assistant, or physical therapist (for at least 70% of full-time equivalent); and (2) were working on one of the following wards: gastrointestinal- and oncology surgery, internal medicine hematology, internal medicine infectious diseases, or cardiology.

Phase 1 – using surveys to identify important barriers

Data collection

To our knowledge, no surveys were available in the literature to assess all of the factors that might be perceived by healthcare professionals as a barrier to improving physical activity in hospitalized patients. We therefore developed a survey using the 38-item pilot checklist described by Huijg et al. [26], which is based on the Theoretical Domains Framework and aims to identify the most important barriers and enablers to the implementation of physical activity interventions [26–28]. The final version of the survey consisted of 39 items (Supplementary Material S2), and a detailed description of this survey's development can be found in Supplementary Material S3. A 5-point Likert response scale was used for all survey items with the following options: 1, strongly agree; 2, agree; 3, neutral; 4, disagree; 5, strongly disagree. Items were randomly alternated between positive and negative wordings to avoid response bias. Items with higher average scores indicate the barriers considered by healthcare professionals to be the most important when it comes to improving physical activity, while items with lower average scores indicate the barriers they consider the least important.

Recruitment

This survey was distributed digitally via an online survey system (Limesurvey GmbH., Hamburg, Germany) among all eligible healthcare professionals at each hospital ward. All eligible healthcare professionals were asked to complete the survey independently. Paper versions were also distributed to increase the response rate. Reminders were sent three times by e-mail, and healthcare professionals were reminded three times during staff meetings.

Data analysis

Quantitative data was analyzed using IBM-SPSS Statistics version 25 (IBM Corp, Armon, New York). Descriptive statistics of the study sample were expressed as means and standard deviations. Before analyzing the 39-item survey, the scoring order of negatively formulated items (questions 8, 9, 11, 13, 25, 28, 29, 30, 31, and 35) was reversed. After analyzing the survey, all items were listed in descending order (from most to least considered to be a barrier) with the scores expressed as mean and standard deviation (SD).

Integration – using the survey findings to build focus group topic guides

Methodological integration occurred by using the findings of phase 1 to build the topic guide for the focus group discussions of phase 2 [29]. The ten items with the highest average scores (i.e., indicating the most important barriers) were incorporated as main topics in the semi-structured focus group topic guides. Also, to facilitate the focus group discussion and validate the survey findings, at least three items with the lowest average scores (i.e.,

indicating the least important barriers) were incorporated in the semi-structured focus group topic guides.

Phase 2 – using focus groups to discuss these important barriers

Recruitment

Because most healthcare professionals work in shifts, a combination of a "convenience" and a "purposive" sampling approach was used to assemble a heterogeneous group of participants with respect to age, working experience, and profession, as recommended by Holloway and Wheeler [23]. To facilitate effective discussions [23], each focus group consisted of 7–12 participants including at least one physician/physician assistant and at least six nurses/nursing assistants.

Data collection

One focus group was held for both surgery wards, one for both internal medicine wards and one for the cardiology hospital ward. To facilitate in-depth discussions, each focus group was moderated by a quality advisor (BMG) and a medical psychologist (SdM). In all focus group discussions, privacy was ensured, and the moderators experienced no limitations in terms of creating a cordial discussion atmosphere. The maximal amount of time used was 60 min, and each focus group was fully audiotaped.

Data analysis

Qualitative data was analyzed using MAXQDA Analytics Plus 2020 (VERBI Software, 2018, Berlin, Germany). The first author (SJGG) fully transcribed and checked all group discussions and notes. This was followed by a thematic analysis according to the methods of Braun and Clarke [30]. In detail, two authors (SJGG, BMG) assigned initial codes using all of the data from the first two focus groups. Next, both authors collectively developed a preliminary codebook and used the codebook to code the third focus group. The preliminary themes and the codebook were further discussed by both authors and finalized within three consensus meetings attended by a varying composition of the following participants: two nurses, a physician assistant, a physical therapist (SJGG), a quality advisor (BMG), three senior researchers (RHHE, FvN, MvdS), and a medical psychologist (SdM). These analyses resulted in five themes based upon the data of all three focus groups together. The Dutch quotes and codes were translated into English and checked by a native speaker in line with recommendations of Van Nes et al. [31].

Trustworthiness

We enhanced the credibility of our findings in several ways. Firstly, we wanted to make sure that the focus group participants were given the opportunity to have in-depth discussions. Each focus group was therefore moderated by a quality advisor who was also a physical therapist (BMG), and by a medical psychologist (SdM), neither of whom had a professional or social relationship with any of the participants. Secondly, two authors (SJGG, BMG) coded the data independently, and multiple consensus meetings were held to discuss the codes and preliminary themes. Thirdly, we used member checking of synthesized analyzed data to explore whether results have resonance with the participants' perspectives [32]. Finally, we kept track of all methodological and analytical decisions during the study by maintaining an audit trail and writing methodological memos.

Results

Participant characteristics

Survey participants

In total, 15 physicians/physician assistants, 106 nurses, four nursing assistants, and four physical therapists completed the survey. Their median working experience was 5 years (interquartile range [IQR] 2–14.5) (Table 1).

Focus group participants

The three focus groups were made up of thirty healthcare professionals (surgery wards $n = 7$, internal medicine wards $n = 13$, cardiology ward $n = 10$) (Table 2). Each focus group consisted of 1 physician or physician assistant, and 6–11 nurses. A nursing assistant also participated in the internal medicine focus group. No physical therapists participated in the focus groups. Overall, 87% was female and the median working experience was 5 years (IQR 2–12). The duration of the focus group discussions ranged between 47 and 60 min.

Phase 1 – the most and least important barriers from an individual perspective

The ten items considered the most important barriers for each hospital ward, and the three items considered the least important barriers are shown in Table 3. Of the ten items most considered as being a barrier, four items emerged on all five hospital wards: item 11 "If I improve the physical activity levels of hospitalized patients, this will lead to a lack of time for other tasks/things I have to do", item 13 "Other work tasks/things I need to do interfere with my intention to improve the physical activity levels of

Table 1. Descriptive data of survey participants.

		Surgery ward #1 $N = 24$	Surgery ward #2 $N = 33$	Hematology ward $N = 23$	Infectious diseases ward $N = 26$	Cardiology ward $N = 26$
Profession (*n*,%)	Physician	1 (4.2)	4 (12.1)	1 (4.2)	4 (15.4)	2 (7.7)
	Physician assistant	1 (4.2)	1 (3)	1 (4.2)	0 (0)	0 (0)
	Nurse	19 (79.2)	25 (75.8)	22 (91.7)	19 (73.1)	21 (80.8)
	Nursing assistant	1 (4.2)	1 (3)	0 (0)	2 (7.7)	0 (0)
	Physical therapist	1 (4.2)	1 (3)	0 (0)	0 (0)	2 (7.7)
Age (*n*,%)	18–25 years	9 (37.5)	7 (21.2)	6 (25)	9 (34.6)	9 (34.6)
	26–35 years	10 (41.7)	17 (51.5)	5 (20.8)	8 (30.8)	11 (42.3)
	36–45 years	1 (4.2)	2 (6.1)	4 (16.7)	3 (11.5)	2 (7.7)
	46–55 years	3 (12.5)	3 (9.1)	4 (16.7)	3 (11.5)	2 (7.7)
	55+ years	1 (4.2)	4 (12.1)	4 (16.7)	3 (11.5)	2 (7.7)
	Missing	0 (0)	0 (0)	1 (4.2)	0 (0)	0 (0)
Working experience (median, IQR)		4.5 (2–9)	5 (2–15)	15 (2–24)	4.5 (1–8.5)	2.5 (1–6.5)

N: number; IQR: interquartile range.

Table 2. Descriptive data of focus group participants.

Participant No.	Focus group No.	Hospital ward	Profession	Age (years)	Gender	Experience as a healthcare professional (years)
1	1	Surgery ward #1	Physician assistant	26–35	Female	2
2	1	Surgery ward #2	Nurse	46–55	Female	29
3	1	Surgery ward #2	Nurse	26–35	Female	5
4	1	Surgery ward #2	Nurse	55+	Female	26
5	1	Surgery ward #1	Nurse	18–25	Female	1
6	1	Surgery ward #1	Nurse	26–35	Female	10
7	1	Surgery ward #1	Nurse	26–35	Female	1
8	2	Infectious diseases ward	Nursing assistant	55+	Male	10
9	2	Hematology ward	Nurse	46–55	Male	16
10	2	Infectious diseases ward	Nurse	18–25	Female	1.5
11	2	Hematology ward	Nurse	55+	Female	39
12	2	Infectious diseases ward	Nurse	26–35	Female	7
13	2	Hematology ward	Nurse	18–25	Female	0.5
14	2	Hematology ward	Physician	26–35	Male	9
15	2	Hematology ward	Nurse	26–35	Female	6
16	2	Infectious diseases ward	Nurse	36–45	Female	12
17	2	Infectious diseases ward	Nurse	26–35	Female	12
18	2	Hematology ward	Nurse	46–55	Female	26.5
19	2	Infectious diseases ward	Nurse	26–35	Female	5
20	2	Hematology ward	Nurse	18–25	Female	0.5
21	3	Cardiology ward	Nurse	26–35	Female	1
22	3	Cardiology ward	Nurse	26–35	Female	10
23	3	Cardiology ward	Nurse	55+	Female	23
24	3	Cardiology ward	Nurse	26–35	Female	4
25	3	Cardiology ward	Nurse	18–25	Female	4
26	3	Cardiology ward	Nurse	26–35	Female	4
27	3	Cardiology ward	Nurse	18–25	Female	2
28	3	Cardiology ward	Nurse	18–25	Female	2
29	3	Cardiology ward	Nurse	18–25	Male	1
30	3	Cardiology ward	Physician	26–35	Female	1

Table 3. The ten items considered the most and the three items considered the least as barriers, categorized per hospital ward.

	Surgery ward #1 $N = 24$		Surgery ward #2 $N = 33$		Hematology ward $N = 23$		Infectious Diseases ward $N = 26$		Cardiology ward $N = 26$	
Order*	Question	Mean (SD)	Question	Mean (SD)	Question	Mean (SD)	Question	Mean (SD)	Question	Mean (SD)
1st	**13**	**3.26 (0.62)**	**20**	**3.50 (0.95)**	**13**	**3.61 (0.89)**	**13**	**3.83 (0.76)**	**13**	**3.72 (0.79)**
2nd	**20**	**3.26 (0.96)**	**13**	**3.45 (1.09)**	28	3.50 (1.10)	**20**	**3.76 (0.60)**	**11**	**3.64 (0.91)**
3rd	27	3.13 (0.80)	**31**	**3.40 (0.98)**	**20**	**3.48 (0.73)**	**31**	**3.68 (0.80)**	**31**	**3.58 (0.76)**
4th	**31**	**3.13 (0.99)**	28	3.30 (1.21)	**11**	**3.48 (0.85)**	30	3.50 (0.81)	36	3.54 (0.93)
5th	25	2.96 (0.91)	**11**	**3.30 (1.02)**	38	3.22 (1.17)	28	3.40 (0.91)	38	3.54 (0.93)
6th	**11**	**2.96 (1.02)**	25	3.24 (0.94)	**31**	**3.12 (0.87)**	23	3.40 (0.76)	23	3.46 (0.90)
7th	24	2.92 (0.97)	27	3.21 (0.89)	36	3.09 (1.16)	38	3.35 (0.78)	30	3.46 (0.95)
8th	15	2.83 (0.92)	24	3.06 (0.90)	30	3.04 (1.02)	**11**	**3.35 (0.89)**	**20**	**3.42 (0.76)**
9th	8	2.74 (0.96)	36	2.97 (1.05)	23	3.00 (0.98)	15	3.29 (0.69)	24	3.42 (0.86)
10th	26	2.63 (0.82)	15	2.94 (0.98)	37	2.96 (0.96)	24	3.24 (0.97)	28	3.42 (0.95)
…	…	…	…	…	…	…	…	…	…	…
37th	7	1.42 (0.58)	12	2.59 (0.52)	19	1.46 (0.59)	7	1.83 (0.72)	7	1.58 (0.70)
38th	12	1.38 (0.58)	7	2.55 (0.50)	7	1.46 (0.51)	14	1.79 (0.51)	19	1.54 (0.51)
39th	16	1.13 (0.34)	16	1.12 (0.33)	16	1.08 (0.28)	16	1.35 (0.49)	16	1.23 (0.43)

* = items ordered from most considered as barrier to least considered as barrier; N = number; **bold** = relevant determinant on all five hospital wards; 7 = "If I improve the physical activity levels of hospitalized patients, this will lead to improved physical performance in these hospitalized patients"; 8 = "If I improve the physical activity levels of hospitalized patients, I will risk physical injury"; 11 = "If I improve the physical activity levels of hospitalized patients, this will lead to a lack of time for other tasks/things I have to do"; 12 = "I am motivated to improve the physical activity levels of hospitalized patients"; 13 = "Other work tasks/things I need to do interfere with improving the physical activity levels in hospitalized patients"; 15 = "All information and materials that are necessary to improve the physical activity levels in hospitalized patients are available"; 16 = "Improving the physical activity levels in hospitalized patients gives me a lot of benefits"; 19 = "The effects of improving the physical activity levels in hospitalized patients are clearly visible to me (e.g. participants' motivation, behavior, health)"; 20 = "I have sufficient time to improve the physical activity levels in hospitalized patients"; 23 = "On my hospital ward, formal arrangements are made with regard to improving the physical activity levels in hospitalized patients (i.e. policy, work plans)"; 24 = "On my hospital ward, there are sufficient facilities to improve the physical activity levels in hospitalized patients (e.g. equipment, material, space)"; 25 = "On my hospital ward, other changes interfere with improving the physical activity levels in hospitalized patients (e.g. reorganizations, cutbacks, the introduction of other innovations)"; 27 = "In general, hospitalized patients are motivated to improve their physical activity levels during hospital admission"; 28 = "In general, increased medical complexity of my patient influences my motivation to improve the physical activity level during hospital admission"; 30 = "I would like to have training to improve physical activity levels in hospitalized patients"; 31 = "I would like to have more assistance to improve physical activity levels in hospitalized patients"; 36 = "I have clear plans of how I will improve the physical activity levels in hospitalized patients"; 37 = "I check regularly whether I am doing everything necessary to improve the physical activity levels in hospitalized patients"; 38 = "I have clear plans of how I will improve the physical activity levels in hospitalized patients when I encounter barriers (e.g. lack of time, participants are not motivated)".

hospitalized patients", item 20 "I have sufficient time to improve the physical activity levels in hospitalized patients" and item 31 "I would like to have more assistance to improve physical activity levels in hospitalized patients". Two items were considered the least important barriers on all five hospital wards: item 16 "Improving the physical activity level in hospitalized patients gives me a lot of benefits" and item 7 "If I improve the physical activity level of hospitalized patients, this will lead to improved physical performance in these hospitalized patients". All other items appeared to vary between hospital wards.

Integration – using the survey findings to develop focus group topic guides

Using the quantitative survey findings, three topic guides were developed (Table 4). Each topic guide was derived from phase 1 and incorporated 10 items considered to be the most important barriers and at least three items considered to be the least important barriers. These topic guides allowed for clarification of the barriers most likely to be key to improving physical activity in hospitalized patients and thus informed the focus group moderators (BMG and SdM) in directing the sequence and coverage of the topics under study.

Phase 2 – key barriers and solutions to overcome these keys barriers

Five themes were identified that describe both the key barriers to improving physical activity in hospitalized patients and the solutions healthcare professionals perceive as possibly helping them overcome these barriers: (1) differences in how healthcare professionals define physical activity; (2) the extent to which patients have freedom of choice; (3) role expectations within the multidisciplinary team; (4) the importance of patients' characteristics and

Table 4. Topic guides.

General introduction including informed consent procedures.

Definition of physical activity during focus groups:
For the purpose of this study, physical activity is defined as any bodily movement of the patient that requires energy expenditure. This refers to all activities in which the patient does not sit still, lie still or sleep.

General prompts used during focus groups:
- Do you recognize […]?
- What does the organization already offer as a solution for […]?
- What else can the organization offer?
- How do you get that impression?
- From your perspective, what could help?
- Do you recognize yourself in […]?
- What is your view on […]?
- How do you explain […]?
- What support would you like to experience?
- Which effects are visible to you?
- Does […] influence your behavior?
- What need is there for […]?
- What information and resources are missing?
- How do you get that impression?
- What would help you?

Topic guide surgery wards	*Topic guide internal medicine wards*	*Topic guide cardiology ward*
The following items were used to elicit an in-depth focus group discussion:	The following items were used to elicit an in-depth focus group discussion:	The following items were used to elicit an in-depth focus group discussion:
[Most perceived to be an important barrier]	[Most perceived to be an important barrier]	[Most perceived to be an important barrier]
Domain: Motivation & Goals Item 13: "Other work tasks/things I need to do interfere with improving the physical activity levels in hospitalized patients."	Domain:Motivation & Goals Item 13: "Other work tasks/things I need to do interfere with improving the physical activity levels in hospitalized patients."	Domain: Motivation & Goals Item 13: "Other work tasks/things I need to do interfere with improving the physical activity levels in hospitalized patients."
Domain: Beliefs about consequences: Item 8: "If I improve the physical activity levels of hospitalized patients, I will risk physical injury." Item 11: "If I improve the physical activity levels of hospitalized patients, this will lead to a lack of time for other tasks/things I have to do."	Domain: Beliefs about consequences Item 11: "If I improve the physical activity levels of hospitalized patients, this will lead to a lack of time for other tasks/things I have to do."	Domain: Beliefs about consequences Item 11: "If I improve the physical activity levels of hospitalized patients, this will lead to a lack of time for other tasks/things I have to do."
Domain: Environmental context and resources Item 20: "I have sufficient time to improve the physical activity levels in hospitalized patients." Item 27: "In general, hospitalized patients are motivated to improve their physical activity levels during hospital admission." Item 31: "I would like to have more assistance to improve physical activity levels in hospitalized patients." Item 24: "On my hospital ward, there are sufficient facilities to improve the physical activity levels in hospitalized patients (e.g. equipment, material, space)." Item 25: "On my hospital ward, other changes	Domain: Environmental context and resources Item 20: "I have sufficient time to improve the physical activity levels in hospitalized patients." Item 23: "On my hospital ward, formal arrangements are made with regard to improving the physical activity levels in hospitalized patients (i.e. policy, work plans)." Item 25: "On my hospital ward, other changes interfere with improving the physical activity levels in hospitalized patients (e.g. reorganizations, cutbacks, the introduction of other innovations)." Item 28: "In general, increased medical complexity of my patient influences my	Domain: Environmental context and resources Item 31: "I would like to have more assistance to improve physical activity levels in hospitalized patients." Item 38: "I have clear plans of how I will improve the physical activity levels in hospitalized patients when I encounter barriers (e.g. lack of time, participants are not motivated)." Item 23: "On my hospital ward, formal arrangements are made with regard to improving the physical activity levels in hospitalized patients (i.e. policy, work plans)." Item 30: " I would like to have training to improve physical activity levels in hospitalized

(*continued*)

Table 4. Continued.

General introduction including informed consent procedures.		
interfere with improving the physical activity levels in hospitalized patients (e.g. reorganizations, cutbacks, the introduction of other innovations)." Item 15: "All information and materials that are necessary to improve the physical activity levels in hospitalized patients are available." Item 28: "In general, increased medical complexity of my patient influences my motivation to improve the physical activity levels during hospital admission."	motivation to improve the physical activity levels during hospital admission." Item 31: "I would like to have more assistance to improve physical activity levels in hospitalized patients." Item 30: "I would like to have training to improve physical activity levels in hospitalized patients."	patients." Item 20: "I have sufficient time to improve the physical activity levels in hospitalized patients." Item 24: "On my hospital ward, there are sufficient facilities to improve the physical activity levels in hospitalized patients (e.g. equipment, material, space)." Item 28: "In general, increased medical complexity of my patient influences my motivation to improve the physical activity level during hospital admission."
	Domain: Behavioral regulation Item 37: "I have clear plans of how I will improve the physical activity levels in hospitalized patients when I encounter barriers (e.g. lack of time, participants are not motivated)."	Domain: Behavioral regulation Item 36: "I have clear plans of how I will improve the physical activity levels in hospitalized patients"
[Least perceived to be an important barrier] Item 16: "Improving the physical activity levels in hospitalized patients gives me a lot of benefits." Item 12: "I am motivated to improve the physical activity levels of hospitalized patients" Item 7: "If I improve the physical activity levels of hospitalized patients, this will lead to improved physical performance in these hospitalized patients."	[Least likely perceived to be an important barrier] Item 16: "Improving the physical activity levels in hospitalized patients gives me a lot of benefits." Item 7: "If I improve the physical activity levels of hospitalized patients, this will lead to improved physical performance in these hospitalized patients." Item 14: "I can easily remember what I need to do to improve physical activity levels in hospitalized patients." Item 19: "The effects of improving the physical activity levels in hospitalized patients are clearly visible to me (e.g. participants' motivation, behavior, health)."	[Least likely perceived to be an important barrier] Item 16: "Improving the physical activity levels in hospitalized patients gives me a lot of benefits." Item 19: "The effects of improving the physical activity levels in hospitalized patients are clearly visible to me (e.g., participants' motivation, behavior, health)." Item 7: "If I improve the physical activity levels of hospitalized patients, this will lead to improved physical performance in these hospitalized patients."

expectations; and (5) the hospital bed as a centerpiece. All five themes were raised in each focus group, regardless of the type of hospital ward.

Theme 1: differences in how healthcare professionals define physical activity

Even though healthcare professionals perceived physical activity as being important, each healthcare professional defined "physical activity/inactivity" differently. The healthcare professionals described how this variation in defining physical activity makes it difficult for them to estimate the extent to which they should improve physical activity in hospitalized patients. They also indicated that they perceived this variation not only across different hospital wards but also between different healthcare professionals working with the same patient population within a single hospital ward. They also noted that defining physical activity is even more difficult in patients who are not motivated or who are "sick" in their opinion. This is exemplified by the following two comments:

> Sitting in the chair is a start, but it's not enough; I wouldn't consider sitting passively in a chair as physical activity. (Participant 2)

> … We've transferred someone with the electric hoist out of bed. That's already mobilizing to us. (Participant 17)

During the focus group discussions, the healthcare professionals indicated that they often used the pre-admission living situation to estimate the extent to which they should improve a patient's physical activity. But they also indicated that this was insufficient and that it would be more helpful if they received help in three key areas: knowledge about the relationship between physical activity and positive health outcomes; the formulation of specific goals; and education from physical therapists to help clarify the definition of physical activity. The following quote exemplifies the formulation of specific goals:

> What I think can help is; if you have a clear goal; for example: "This patient is supposed to be able to walk to the toilet himself because then he can go home." But the specification of a goal like this is often lacking … (Participant 16)

Theme 2: the extent to which patients have freedom of choice

Healthcare professionals reported varying perspectives on the extent to which patients may decide to be physically inactive. On the one hand, healthcare professionals indicated that they believe patients should adhere to the healthcare professionals' physical activity recommendations. After all, physical activity is part of the treatment if they want to recover as quickly as possible and prevent complications. On the other hand, healthcare professionals indicated that they believe physical activity is part of self-responsibility and self-management. Patients themselves should therefore decide whether they are physically active or inactive. Healthcare professionals described how this difference in perspective is perceived as a key barrier because it leads to uncertainty among healthcare professionals and to contradictory messages towards patients. In the following comment a healthcare professional exemplifies how healthcare professionals might deliver their physical activity recommendations:

> Like this morning, "it's a part of the package coming to the hospital, it's now time to sit in the chair. or at least stand briefly next to the bed." (Participant 29)

All healthcare professionals agreed that the immediate solution would be for patients to take more responsibility for themselves in terms of physical activity and – if that is not possible – for them to be at least more intrinsically motivated to be physically active. Various interventions that would help patients understand their responsibility regarding physical activity during hospital stay were specifically proposed. Providing the patient with more insight is an example given by a healthcare professional:

> … that's is what I always try to do; to really tell people what they can do themselves to speed up the whole process and help it go more smoothly; "The solution is to get out of bed and to move around. You can do that yourself." (Participant 4)

Theme 3: role expectations within the multidisciplinary team

The perceived barriers and solutions also seemed to depend on the extent to which each healthcare professional perceived improving physical activity to be their responsibility, and which responsibilities they attributed to other healthcare professionals. For example, nurses indicated that they are the most suitable professionals when it comes to improving the patient's physical activity. Every nurse feels responsible for the patient's general well-being, including promoting basic mobility and independent activities of daily living. However, nurses also indicated that if the patient's physical activity levels need improving, they cannot be the only one responsible because they are also responsible for other important tasks. The solutions they proposed included allowing more time for the nurses to invest in this particular task or giving the responsibility for this task to other health professionals. The perceived lack of time to improve the patient's physical activity level is exemplified in the following comment:

> As a nurse you've got more and more things to do, not just nursing tasks. And then on top of all that you also get the responsibility of improving someone's physical activity levels! (Participant 9)

Due to their knowledge, skills, time, and expertise, physical therapists were considered by nurses and physicians/physician assistants to be the best healthcare professional responsible for improving physical activity in hospitalized patients. Therefore, the focus groups agreed that it is essential for physical therapists to play a more prominent role on hospital wards. Furthermore, while physicians emphasized that the primary responsibility lies with nurses and physical therapists, they indicated that physicians themselves could contribute by using their regular conversations with patients to also motivate them to be physically active. The following comment exemplifies a physician's efforts to improve the patient's physical activity level:

> I immediately tell the patient during my first conversation after admission: "we expect you get out of bed immediately after the operation." One time I'll tell the patient "at least three times a day"; another time I'll tell the patient something else. It depends on how the patient responds. (Participant 1)

Theme 4: the importance of patients' characteristics and expectations

Healthcare professionals reported that some of the barriers they perceive also depend to a great extent on the patient's background (i.e., lifestyle, pre-existing physical activity levels, age, and culture). Healthcare professionals also signaled that these barriers depend on whether the patient expects to be physically active during hospital stay. Healthcare professionals thereby specifically stated that it is undesirable that patients typically associate hospital stay with "wearing pajamas" and "lying in bed". In the following comment a healthcare professional describes how particular patients might be more active than others due to their background:

> Those patients who are affected by cancer; they were always so sporty and after an operation, they will be again . they understand what to do. But you also have a large group of patients that have never been physically active at all. (Participant 4)

Healthcare professionals indicated that it is essential that the patient's background and expectations are taken into account when determining which solutions to use. Multiple solutions were suggested, such as repeatedly giving them advice about being physically active, making physical activity as easy as possible, mentioning the possible complications due to physical inactivity, helping the patient have positive experiences concerning physical activity, involving family members and visitors, and, for patients undergoing surgery, by providing sufficient information beforehand. The role family members could take is exemplified in the following comment:

> What I sometimes do, when I can't seem to motivate someone, I ask the family of the patient for help. We've noticed on this hospital ward that the family has a big influence on the patient; for example, during my evening shifts; I encourage the family to take my patient with them. off the hospital ward. (Participant 10)

Theme 5: the hospital bed as a centerpiece

Healthcare professionals reported that another important reason for physical inactivity is that the hospital bed is a centerpiece during hospital stay (e.g., food and drinks are placed at the bedside, medication is brought to the patient, and the television is within reach). Healthcare professionals indicated that the lack of an activating hospital environment which encourages physical activity adds to the patient's expectation that getting out of bed may not be necessary at all. This is exemplified in the following comment:

> No, when the room is organized around the bed, and everything is within reach . and the television is also free; which means it's available for everyone; then it's incredibly tempting for people to stay in their beds. (Participant 2)

Moreover, healthcare professionals indicated that the lack of sufficient, adequate equipment needed to support physical activity limits both the patient's physical activity and the healthcare professional's efforts to improve the patient's physical activity. How healthcare professionals perceive malfunctioning equipment is exemplified in the following comment:

> Recently we noticed that we needed to "steal" walkers from other rooms or we only had walkers with broken brakes; (Laughter) Yeah; We laugh about that, but it's really pretty dire. (Participant 25)

Healthcare professionals mentioned numerous possibilities for attracting and inviting patients to get out of bed, or to make it easier for patients to be out of bed, such as clean, spacious hospital rooms, attractive shared rooms (e.g., comfortable patient lounge), rooms specifically dedicated to physical activity and regularly organized activities. They also mentioned that sufficient and adequate equipment (e.g., IV poles with handles, walkers, electric hoists) on each hospital ward would be a possible solution for them to encourage patients to get out of bed, and would enable patients to be physically active independently. A healthcare professional's own perspective of the hospital ward's surrounding is exemplified in the following two comments:

> And maybe if we made our patient lounge more appealing; that it's also lovely to sit there with other patients and; now it's just depressing; yeah sorry. (Participant 2)

> But also a kind of exercise room or something; for people who can walk themselves. (Participant 22)

Discussion

This mixed-methods study at a Dutch university hospital explored healthcare professionals' perspectives on the key barriers to improving physical activity in adult patients during hospital stay, and on the solutions to help overcome these barriers. Five themes

were identified: (1) the differences in how healthcare professionals define physical activity; (2) the extent to which patients have freedom of choice; (3) the role expectations within the multidisciplinary team; (4) the importance of patients' characteristics and expectations; and (5) the hospital bed as a centerpiece. These five themes were identified regardless of the type of hospital ward. Examples of the solutions healthcare professionals suggested included the following: clarifying what is defined as physical activity, empowering patients to take responsibility for physical activity, giving both physical therapists and physicians a more prominent role, and changing the hospital ward such that it encourages patients to be physically active.

Our findings suggest that healthcare professionals define physical activity in different ways and that this is a key barrier to improving physical activity in adult patients during hospital stay. Variations in the definition of physical activity are also found in scientific research, where frequently used terms for physical activity during hospital stay are "mobility" [21,22,33,34], "physical function" [35], "exercise" [36], "ambulating" [19,37] and the words "physical activity" itself [20,38]. The ways in which healthcare professionals define physical activity also seem to differ from the ways that patients describe physical activity [38]. Previous research highlights that the barriers perceived by healthcare professionals and patients probably depend on the internal standards, values, and conceptualization used for physical activity [39]. The results of the current study suggest that two solutions to help overcome this barrier are clarifying what is defined as physical activity on a hospital ward, and formulating specific goals in terms of the amount of physical activity expected of a patient.

In our study, healthcare professionals indicated that solutions can also lie in patients themselves taking the responsibility for achieving sufficient physical activity during their hospital stay. The healthcare professionals emphasized this by indicating that interventions are needed that help patients understand their responsibility regarding in-hospital physical activity. Such interventions that empower patients to take a more active role in physical activity during hospital stay have been described in the Early Recovery After Surgery (ERAS) program [40]. In addition, a collaborative investigation into contentious areas of healthcare from Luxembourg found that patient empowerment requires the to (1) understand their role, (2) have sufficient knowledge, (3) have sufficient skills, and (4) be in a facilitating environment [41]. Taken together, this suggests that interventions that help patients understand their responsibility regarding physical activity – as mentioned in our findings – are not the only interventions needed to effectively empower patients to take responsibility for physical activity in clinical practice.

Our findings also suggest that a key barrier to improving physical activity in hospitalized patients is nurses' workload: a high workload means they cannot take on tasks to improve physical activity, and therefore attribute these tasks to other healthcare professionals. This finding is in line with previous research, that has found that nurses often perceive the particular task of improving physical activity as time-consuming, while they are also responsible for many other tasks [20,35,37]. Consequently, perceiving a task as time-consuming may often cause healthcare professionals to neglect it [42]. Previous studies have shown that increased awareness and understanding of physical activity among nurses often results in improved levels of physical activity [20]. In addition to that, our results emphasize that to improve physical activity sustainably, it is not only nurses who should be aware of the importance of physical activity: all healthcare professionals need to feel responsible and be involved in future interventions. For instance, the studies of Hoyer [16], Mudge [17], and Zisberg [34] demonstrate that all members of the multidisciplinary team can and should be involved in the development and implementation of new interventions aimed at improving physical activity. Therefore, we recommend teams involved in routine care to discuss each healthcare professional's role in improving physical activity and involve all healthcare professionals in the development of future interventions.

Finally, our findings indicate that a key barrier to improving physical activity is related to context, including the patient's characteristics, the patient's expectations, and the hospital environment. This is in line with the results of several previous studies on this topic [20,37,38]. Even though the main priority during a hospital stay will always be medical treatment, our study emphasizes that context-related barriers must be addressed in order to improve physical activity during hospital stay in a sustainable manner.

Strengths and limitations

This study's first strength is the inclusion of healthcare professionals from surgery, hematology, infectious diseases, and cardiology hospital wards. Including such a variety of healthcare professionals allowed for the inclusion of different perspectives on physical activity in a hospital setting. A second strength is the use of a survey before conducting the focus groups, as this ensured consideration of the perspectives of healthcare professionals working on these different hospital wards. Third, basing this survey on the Theoretical Domains Framework ensured that the focus group discussions considered all potential barriers to improving physical activity. Finally, the multidisciplinary involvement of researchers, physical therapists, nurses, senior researchers, physicians, a quality advisor, and a medical psychologist in both the development of the survey and the analysis of the focus group data ensured that the data was analyzed from all possible angles of a team.

Some study limitations also need to be addressed. Even though we did not aim for full saturation, we believe sufficient saturation was reached, consistent with the chosen thematic analysis approach [43]. Secondly, only one physicians/physician assistants and no physical therapists participated in the focus group discussions. Because physical inactivity during hospital stay occurs in all age and patient groups [15], we focused on discussing the key barriers and solutions with healthcare professionals involved in routine care of all hospitalized patients. However, it may have been beneficial to include more perspectives of physicians, physician assistants and physical therapists on this topic. Thirdly, all participants had the Dutch nationality and worked at the Amsterdam UMC location Academic Medical Center, which might affect the generalizability of our results. However, we assume that our results will also apply to non-university hospitals. In a previous study, Hoyer et al. investigated barriers to early mobility of hospitalized general medicine patients and found the same overall barriers in different hospitals [22]. Fourth, the perspectives of patients and their visitors were not included. These groups may have provided additional valuable information regarding the key barriers and solutions. For the interpretation of the results of this study, it should be realized that key barriers and solutions as perceived by healthcare professionals are investigated. To optimally translate our proposed solutions into interventions, involvement of patients and their visitors is of additional value.

Conclusions

Based on our findings, healthcare professionals need clear guidelines, roles, and responsibilities when it comes to improving physical activity in hospitalized patients. Healthcare professionals also need tools that help to empower patients to take an active role in physical activity. Furthermore, hospital wards should be designed and furnished so that patients are encouraged to be active. A possible next step towards adopting physical activity as a priority in clinical practice would be to translate the solutions suggested in this study into feasible interventions in collaboration with patients, healthcare professionals, team leaders, and hospital managers. Future research is needed on effectiveness of these interventions and the dose-response relationship between physical activity and the prevention of HADS. More research is also needed to understand how healthcare professionals can empower patients to take an active role in physical activity during hospital stay. Finally, our findings imply that more insight is needed to identify the changes in the hospital environment that can help to increase the patient's level of physical activity.

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ORCID

Sven J. G. Geelen http://orcid.org/0000-0001-9443-8211
Boukje M. Giele http://orcid.org/0000-0003-1412-0188
Raoul H. H. Engelbert http://orcid.org/0000-0002-6923-8696
Cindy Veenhof http://orcid.org/0000-0003-0970-2896
Frans Nollet http://orcid.org/0000-0002-2847-9995
Marike van der Schaaf http://orcid.org/0000-0001-7272-4698

Data availability statement

Due to privacy legislation, the data set associated with this paper is not available.

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