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Exploring in-hospital mobility practices for geriatric patients: insights from a mixed-method study

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Abstract

Background It is well-established that mobility is very limited among older hospitalized patients and associated with several negative outcomes. Therefore, this mixed-methods study aimed to quantify 24-hour mobility levels in acutely admitted older adults and simultaneously explore clinical practice with regards to mobilization and mobility through an ethnographic field study.

Methods Over a 6-week period, hospital mobility was assessed in 44 geriatric patients by SENS motion® activity sensors that the patients wore continuously for 24 h a day during their hospitalization. An ethnographic field study was conducted alongside the cohort study. It included participant observation on the ward and situated conversations with staff, patients, and relatives 2–3 times a week for 4–5 h at different times of the day. The observations were noted in field notes. Activity data were aggregated into a per day measure based on the mean of all available days for a given patient. Also, the per day measures were stratified by walking dependency (walking with or without a walking aid). The field notes were analyzed through a thematic analysis.

Results During hospitalization, the patients spent most of their time (22.8 h/per day) in sedentary behavior and only 1.2 h/per day in uptime (walking and standing), including 43 min walking, and took less than 1200 steps daily. The field study revealed that most staff consider mobilization and mobility important tasks. However, mobilizing patients to a chair and performing functional level assessments are prioritized over patient mobility. Also, the patients' perceived mobility opportunities are limited by the physical environment (e.g., congested hallways) and lack of purposeful activities to engage in.

Conclusions This study found low levels of mobility in geriatric inpatients during hospitalization. While mobility is considered important, mobilization to a chair and functional assessments are prioritized over patient mobility, which becomes dependent on the patient's own initiative. Therefore, environmental adjustment, enhanced interprofessional collaboration, and targeted strategies for integrating mobility into daily care practices are warranted to enhance in-hospital mobility. ClincalTrials.Gov identifier NCT06421246.

Keywords 24-hour mobility, Hospitalization, Geriatric patients, Ethnography, Mixed methods

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Background

It is well-established that mobility is very limited among older hospitalized patients (aged 65 years and older) [1–8]. Limited in-hospital mobility is associated with several negative outcomes, including readmission, mortality, and decline in functional capacity [4, 9–12]. An in-hospital decline in functional capacity or ability to perform activities of daily living (ADL) is also known as hospital-associated disability (HAD) [13].

Among older adults (aged 65 years and older) who are acutely hospitalized, 30–41% are discharged with HAD [4, 6, 11] - possibly caused by low mobility during hospitalization. There is no consensus on the exact number of steps needed per day to prevent HAD. A study by Agmon and colleagues [14] has proposed 900 steps per day as a possible critical limit for increased risk of HAD, while a recent study by Pavon et al. [4] showed that patients who developed HAD walked an average of 1186 steps per day as opposed to 1808 steps for those who did not develop HAD.

In a qualitative interview study from our hospital, Stefánsdóttir and colleagues found that older hospitalized patients wish to increase their in-hospital mobility to reduce the negative consequences of inactivity, regain independence in daily activities and return to their everyday lives [15]. The discrepancy between patients' wishes for in-hospital mobility and their actual mobility levels, could indicate a lack of focus on promoting mobility in the hospital-setting - perhaps due to a clinical culture where no healthcare professionals "own" this responsibility [16, 17]. Thus, it is important to gain knowledge on perspectives towards in-hospital mobility and how this relates to mobility levels to provide new solutions to facilitate mobility during hospitalization [18, 19].

Therefore, the aim of this mixed-methods study was to quantitatively assess 24-hour mobility levels in acutely admitted older adults at the Geriatric Department of Copenhagen University Hospital, Hvidovre, using sensor technology. Additionally, the study sought to explore the clinical practice of mobilization and mobility, and staff and patient perspectives on mobilization and mobility through an ethnographic field study, to understand how these factors may influence patient mobility levels during hospitalization.

Methods

Study design

This study used a convergent parallel mixed method cohort study design, where the quantitative and qualitative data were collected simultaneously and analysed separately before integration [20]. Over a 6-week period, hospital mobility among geriatric patients was assessed quantitatively, while a concurrent qualitative field study explored the practices, challenges, and opportunities for mobility within the Geriatric Department. The qualitative component focused on how patients are encouraged, or feel encouraged to stand, walk, and engage in mobility during hospitalization. By integrating these methods, we aimed to supplement previous literature that have focused on either quantitative or qualitative dimensions. The mixed-method approach allowed a comprehensive understanding of in-hospital mobility by combining quantitative analyses of mobility patterns with qualitative insights into healthcare professionals' and patients' actions, experiences, and perspectives. The reporting of the study follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) [21] and the Standards for Reporting Qualitative Research (SRQR) [22] statements.

Setting

The study was conducted from May 2024 to July 2024 in the Geriatric Department of Copenhagen University Hospital, Hvidovre (CUHH). CUHH has 685 beds and admits 95.000 patients each year (in 2021) [23]. The Geriatric Department has 19 beds and 37 staff members consisting of nurses ($n = 18$), certified nursing assistants ($n = 6$), physiotherapist ($n = 1$) and physicians with responsibility in the department ($n = 12$). Additionally, physiotherapists and occupational therapists could be called for from a centrally located physio- and occupational therapy department when needed.

Cohort study

Participants

The study participants included 44 geriatric patients who were recruited daily from Monday to Friday. All admitted patients in the Geriatric Department were screened for eligibility by their medical records and were considered eligible if they were: (1) aged ≥ 65 years; and (2) able to walk one step with or without assistance from another person or walking aid. The exclusion criteria were: (1) terminally ill with a probable life expectancy of less than 30 days, based on clinical judgment; (2) in isolation; (3) in delirium at the time of inclusion; or (4) unable to consent to participate in the trial based on clinical judgment. Additionally, patients who were expected to be discharged within 24 h of inclusion were excluded (too little time for movement-sensor data-collection).

The inclusion process began within 48 h of admission. Eligible patients received verbal and written information and were offered 24 h to consider participation. Written informed consent was obtained from both the patient and the investigator before assessments commenced.

Descriptive data and outcome variables

Within the initial 48 h of admission to the ward, a baseline assessment was performed by the primary

investigator (LKJ). Additional demographic characteristics were collected based on patient medical records. Following the baseline assessment, the participants were consulted daily until discharge by the primary investigator (LKJ).

Mobility

Mobility was objectively measured using wearable sensors, SENS motion® (SENS) (SENS Innovation Aps). The primary investigator applied sensors to all participants and instructed them to wear the sensor continuously for 24 h a day during the entire hospitalization. To avoid half-day measurements, the sensors were applied during the morning, and a valid day was defined as from 12 am to 12 am the following day. 2.5 SENS motion® (SENS), a waterproof activity sensor (45 × 23 × 5 mm, 6 g), was placed in a small allergy-friendly patch and attached approximately 15 cm above the patella, lateral on the right thigh. SENS motion® is a triaxial sensor which samples at 12 Hz and registers the orientation and acceleration of the leg. It connects wirelessly via Bluetooth to a smartphone application, transmitting the recorded data to the application every 10 min, when the smartphone is nearby. The raw data are then transferred from the smartphone to a web server. An algorithm developed by SENS Innovation processes the recorded acceleration data and classifies mobility into nine different activity classifications: (1) no data, (2) lying/sitting rest, (3) lying/sitting movements, (4) standing, (5) sporadic walking, (6) walking, (7) moderate intensity, (8) high intensity, and (9) cycling. For this study, we only used activity classifications 1–6, since we were primarily interested in mobility in the form of ambulation, and we defined four outcomes based on these classifications. (1) Number of steps– was defined as the total count of steps taken, (2) Walking time– was calculated by summing the duration of activity classifications 5–6, (3) Up-time– was calculated as the sum of time spent in activity classifications 4–6 and (4) Sedentary time– was calculated by summing the duration of activity classifications 2–3. Additionally, number of steps was dichotomized as </>= 900, as this has previously been identified as a possible critical limit for increased risk of HAD [14]. The SENS motion® has moderate reliability for both walking ($ICC_{2.1}$ 0.66) and steps ($ICC_{2.1}$ 0.72) in this population [24]. Participants were consulted daily to ensure proper sensor placement and to obtain data via the smartphone application. Upon discharge, participants had the sensor removed.

Baseline characteristics

Baseline characteristics collected through the medical records included sex, age, civil status, place of residence, admission diagnosis, walking ability prior to hospitalization and falls history. Characteristics assessed through the baseline assessment included (1) pre-admission mobility, (2) Activities of Daily Living, (3) cognition, (4) frailty, (5) basic mobility, and (6) mobility status, as described below:

1) Pre-admission mobility: The New Mobility Score (NMS) was used to assess functional independency two weeks prior to hospitalization [25]. The NMS evaluates the ability to perform indoor walking, outdoor walking, and shopping, with a possible total score of 9 (fully independent). Each activity was rated between 0 and 3, as either; unable (0); with personal assistance (1); with an aid (2); or with no difficulty and no aid [3, 25]; The Danish version of the Life Space Assessment (LSA) [26], a validated tool [27], was used to assess the participants' life space mobility one month prior to hospitalization [26, 27]. The LSA consist of five levels ranging from the patient's bedroom to beyond their town. For each level, participants were asked how often they travelled to that area (≥ once a week = 1 points, 1–3 times a week = 2 points, 4–6 times a week = 3 points or daily = 4 points), and whether they required assistance (independently = 2 points, assistive device = 1.5 points, or personal assistance = 1 point). The score ranges from 0 to 120, where a score of 120 represents the highest level of functional mobility and independence [26, 27].

2) Activities of Daily Living: The Katz Index of Activities of Daily Living (KATZ) was used to measure participants functional independence with activities of daily living (ADL) in six basic activities: bathing, dressing, using the toilet, getting in and out of the bed, controlling the bladder and bowels and eating. The score ranges from 0 to 6, where a score of 6 represents dependence in all ADLs, and a score of 0 represents independence in all activities [28, 29].

3) Cognition: The Orientation Memory Concentration Test (OMC) was used to evaluate the cognitive status of the participant at the time of enrolment [30]. The OMC test has previously been validated in in older inpatients [31]. The OMC is a six-item test, with a total possible score of 28 points. Patients were rated as having either; no or negligible cognitive impairment (25–27 points); mild impairment (18–25 points); moderate impairment (8–17 points); or severe impairment (0–7 points) [30].

4) Frailty: The Clinical Frailty Scale (CFS) is a 9-point scale that measures the functional level and frailty of older adults. It ranges from "Very Fit" to "Living with Mild Frailty" and finally to "Terminally Ill, Approaching End of Life" [32]. The CFS was used to evaluate the presence of frailty prior to hospitalization, with a score ≥ 5 indicated the presence of frailty [32].

5) Basic mobility: The Cumulated Ambulation Scale (CAS), a valid predictor of hospitalisation, discharge status and short-term mortality [33], was used to measure basic mobility during the hospital stay. The scale

evaluates the patient's independence in getting in and out of bed, sit-to-stand from a chair and walking. Each activity is scored on a 3-point scale based on their performance as either; unable (0); with guidance/support (1); or independently (2), resulting in a total CAS score between 0 and 6 [33].

6) Mobility status: John Hopkins Highest Level of Mobility Scale (JH-HLM scale) was used to assess mobility during hospitalization [34]. The JH-HLM measures 8 mobility milestones: (1) only lying, (2) bed activities, (3) sit at edge of the bed, (4) transfer to chair, (5) standing for ≥1 min, &) walking 10 + steps, 7) walking 25 + feet and 8) walking 250 + feet; The 4-meter gait speed test was employed to measure habitual gait speed from a standing start position [35, 36]. Before the assessment, a 4-meter distance was marked in the ward corridor. Participants were instructed to walk at their normal pace and continue past the measured line. The assessor recorded the time it took for each participant to walk the 4 m. The test was repeated twice, and the fastest trial was used.

Sample size

As the aim of the study is descriptive, there is no hypothesis to test, so the sample size was estimated pragmatically. We included for 6 weeks from 15/05/2024 to 28/06/2024. Based on previous experience with inclusion rates at the hospital, we estimated that we would be able to include a minimum of 30 patients. We expected this to be sufficient to give insight into the mobility of the patients.

Statistical analyses

Statistical analyses were conducted using R 4.3.2 (R Foundation for Statistical Computing, Vienna, Austria) and SAS Enterprise Guide 8.4 (SAS Institute Inc.). Measures for mobility were first summarized within each day. To be representative of a day, measurements for more than 20 of the 24 h had to be available. If this was not the case, the day's measurement was excluded. Outcomes were then further aggregated into a per day measure, defined as the mean of all available days for the given patient, presented as minutes per day for walking, uptime and sedentary time and as mean steps per day for steps within each patient. Additionally, uptime and steps measurements were summarized within each hour, with only on hours with at least 59.5 min of available measures included. Results are expressed as medians with interquartile ranges (IQR) for continuous variables or as number of participants with percentage for categorical variables. Also, the per day measures were stratified by walking dependency (walking with or without a walking aid).

Ethnographic field study

The field study was conducted alongside the cohort study allowing the two methods to inform and complement each other. It included participant observation on the ward and situated conversations [37] with staff, patients, and to a lesser extent, relatives. Field work is about acquiring knowledge about how certain actions are automatically promoted or inhibited in a particular context [38]. This approach is based on a complexity-sensitive perspective analyzing patterns, disruptions and connections [39]. This is an interactionist analytical strategy emphasizing that action and perspectives are understood as more than individual choices or cognitive processes–they are shaped in their socio-material context.

The field work was conducted by an ethnographer, with a background in nursing and anthropology, and who has worked the past 12 years in hospital ethnographic research. While she was familiar with hospital practice, she was new to the geriatric ward setting. Hammersley and Atkinson [37] describe the possible ethnographic participant positions during field work ranging from 'full participant' to 'full observer'. In this study, the ethnographer predominantly observed activities and conversations, but also engaged in some, adopting both the 'observing participant' and 'participating observer' positions [40]. Field work took place over a month from May to June. The ethnographer was in the department 2–3 times a week for about 4–5 h at the time at different times of the day (morning, afternoon, evening) to reflect the practice of mobility. During participant observations she jotted notes, and afterwards elaborated and wrote thorough field notes including experiences, conversations, thoughts, and reflections [41]. The field notes were analyzed through a thematic analysis inspired by Terry et al. [42] by the ethnographer. The first step was to read all the material to gain an overall understanding and familiarization. Next, the data were semantically coded with a focus on interaction and contextual factors. These codes were then organized into themes that reflected patterns on how mobility is understood and reflected and practiced clinically. The codes were presented and discussed with the research group in a consensus meeting. Throughout the process, the themes were iteratively refined through repeated readings of the data, paying particular attention to how healthcare professionals and patients navigate regarding mobility in the specific context and considering the underlying causes of clinical practice related to mobility.

Ethical considerations

The study was pre-registered at ClinicalTrials.Gov (NCT06421246) and approved by the Scientific Ethics Committees for the Capital Region of Denmark (F-24023831) and the Danish Data Protection Agency

(p-2024-15948) prior to inclusion of the first participant, and the study was performed in agreement with the Helsinki declaration. All participants provided a written informed consent before inclusion. Due to the non-invasive observational character of this study, patients with signs of cognitive impairment could also sign the consent form. For patients who did not understand the information, we sought written consent from a next of kin/guardian. The field study was approved by the ward management, and the staff was informed through multiple meetings at which the study was presented. These meetings provided an opportunity to outline the study's focus on mobilization and mobility practices as part of the complex everyday context and for staff to ask questions, ensuring transparency and facilitating informed participation. We hung up posters in the ward containing a short description of the study, as well as a picture of the researchers (the ethnographer and the research assistant who included patients for the quantitative study). Whenever the ethnographer approached staff or patients, she introduced herself, explained the purpose of the field study, and asked if they were willing to share their experiences.

Table 1 Baseline characteristics of patients

Baseline variables	*N*	Overall
Demographic characteristics		
Age (years)	44	82 (78;85.5)
Sex (female, %)	44	24 (54.5%)
Length of stay (no. days)		4 (3;7.25)
Living alone (number, %)	44	32 (72.7%)
Civil status	43	
Divorced		5 (11.6%)
Married		12 (27.9%)
Unmarried		7 (16.3%)
Widower		19 (44.2%)
Admission diagnosis	44	
Pulmonary		5 (11.4%)
Cardiovascular		5 (11.4%)
Neurological		7 (15.9%)
Infection		5 (11.4%)
Fall		14 (31.8%)
Other		8 (18.2%)
Habitual functional level		
Walking (dependent, %)	44	29 (65.9%)
Use of walking aid	29	
Furniture		4 (13.8%)
Rollator		17 (58.6%)
Scooter		1 (3.5%)
Stick		6 (20.7%)
Other		1 (3.5%)
NMS (score)	34	7 (5;9)
Falls within previous year (yes, %)	43	30 (69.8%)
Falls no.	29	2 (1;3)
LSA (score)	30	44.5 (39;58)
CFS (score)	43	4 (3;5)
Current functional level		
OMC (score)	30	19 (18;22)
KATZ (score)	31	4 (2;6)
CAS (score)	44	6 (5.5;6)
JH-HLM (score)	43	8 (7;8)
4-meter gait speed test (m/s)	25	0.55 (0.4;0.7)

Results are expressed as median (interquartile range) for continuous variables and as number of participants (percentage) for categorical variables. Abbreviations: NMS: The New Mobility Score; LSA: The Life Space Assessment; CFS: The Clinical Frailty Scale; OMC: The Orientation Memory Concentration Test; KATZ: The Katz Index of Activity of Daily Living; CAS: The Cumulated Ambulation Scale; JH-HLM: John Hopkins Highest Level of Mobility Scale

Results

Descriptive characteristics

The total number of potentially eligible patients during the 6-week inclusion period was 127. They represented all patients admitted to the ward during the study period. All 127 were assessed for eligibility. Thirty-five were excluded based on the initial in, - and exclusion criteria. 92 patients were invited to participate, of those 50 patients accepted to participate in the study. Six patients were excluded due to loss of their sensors and/or having less than 20 h of valid sensor data. The baseline characteristics of the 44 participants are described in Table 1. The participants had a median age of 82 years (IQR: 78:85.5), 54.5% were women, 72.7% were living alone and 44.2% were widowers. Prior to hospitalization, the majority required a walking aid (65.9%) and had fallen within the previous years (69.8%) with a median of 2 falls (IQR: 1:3). The median length of stay was 4 days (IQR: 3:7.25), and 31.8% were admitted to the hospital with fall or fall tendency. Their NMS was 7 (IQR: 5:9), reflecting good pre-admission functional independence [43], their LSA was 44.5 (IQR: 39:58), reflecting restricted functional mobility [44] and they had a CFS of 4 (3:5), reflecting mild frailty prior to hospitalization. At baseline, their OMC score was 19 (IQR: 18:22), reflecting mild cognitive impairment [30], their KATZ was 4 (IQR: 2:6), and their JH-HLM was 8 (IQR: 7:8), reflecting good mobility during hospitalization [34]. The patients' CAS was 6 (IQR: 5.5.:6), reflecting independence in getting in and out of bed, sit-to-stand and walking [33], and their walking speed was 0.55 m/s (IQR: 0.40:0.7).

Mobility

The per day mobility data for the participants are shown in Table 2. The participants wore the sensors for a median of 3 days (IQR: 1:5) during hospitalization. For all participants, the median number of steps taken per day was 1185 (IQR: 741:1804), the median time per day spent walking was 41 (IQR: 25:57) minutes and the median of uptime per day was 73 (IQR: 43:120) minutes. For sedentary behavior (lying and sitting time), the median time

Table 2 Per day mobility data

	Overall	Walking - independent	Walking - dependent
N	44	15	29
Walking (min/day)	41 (IQR 25;57)	43 (IQR 36;98)	36 (IQR 23;55)
Steps (per day)	1185 (IQR 741;1804)	1469 (IQR 1040;3508)	1082 (IQR 529;1271)
Uptime (min/day)	73 (IQR 43;120)	82 (IQR 60;143)	70 (IQR 37;109)
Sedentary time (min/day)	1367 (IQR 1320;1397)	1358 (IQR 1297;1380)	1370 (IQR 1331;1403)
Steps (per day) > = 900	32 (72.7%)	13 (86.7%)	19 (65.5%)

Results are expressed as median (interquartile range) for continuous variables and as number of participants (percentage) for categorical variables. Walking independent and walking dependent refer to patients who walk without or with a walking aid

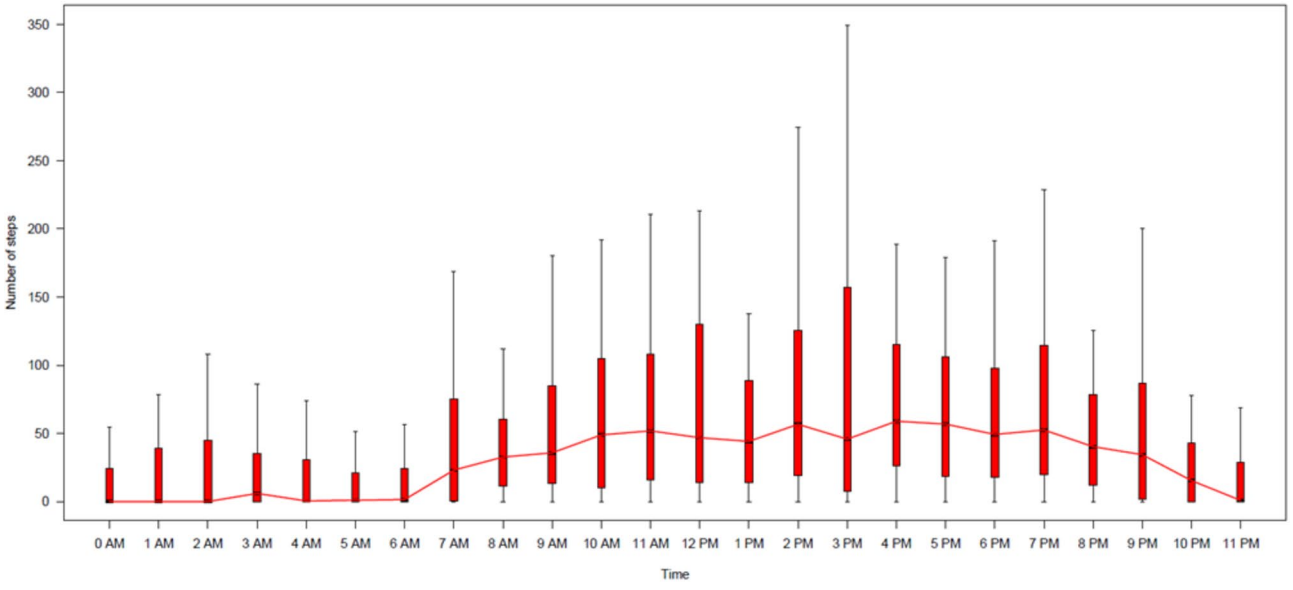

Fig. 1 Distribution of steps throughout a 24-hour period. *Note: Mean steps per hour across patients*

per day was 1367 (IQR: 1320:1397) minutes. 72.7% of patients had a number of steps per day of 900 or more. When stratified by walking dependency, walking independent patients showed better performance.

The distribution of steps and uptime throughout the day are presented in Figs. 1 and 2. The figures illustrate the mobility distribution from 0 AM to 11 PM. The median number of steps and uptime remained relatively constant with no notable variation between 8 AM and 7 PM. However, a greater variation in the number of steps was observed between 2 and 3 PM (Fig. 1), and a similar increase in variation was observed in uptime between 3 and 7 PM (Fig. 2).

Mobility practices in the geriatric ward: challenges and opportunities for promoting mobility

Engagements with mobilization and mobility dependent on patient potentialOverall, mobilization was recognized as a high priority in the ward. Nursing professionals prioritized getting patients out of bed and into a chair during their shifts and especially at mealtimes, also emphasizing patient mobility in the form of walking to the toilet or to sit in the hallway. A nurse professional expressed how she sees the task: "*mobilization is part of the treatment here, so it's important, but we don't force anyone*." This quote illustrates that for the healthcare professionals the task involves concepts such as autonomy and self-determination on the one hand, and knowledge about health consequences on the other.

When patients were admitted to the ward, their functional level was assessed by a physiotherapist to determine their current functional level in relation to their habitual level. Based on the assessment, a rehabilitation plan was developed. In some cases, physiotherapeutic rehabilitation or training was initiated during hospitalization. However, the frequency and nature of these sessions varied depending on available physiotherapeutic resources and the potential for improvement. Upon discharge, a new assessment was conducted, and the rehabilitation plan was reassessed and adjusted if necessary. From these healthcare professional practices, the focus seemed to be on those who had gotten worse or had an obvious potential for improvement as this field note expresses:

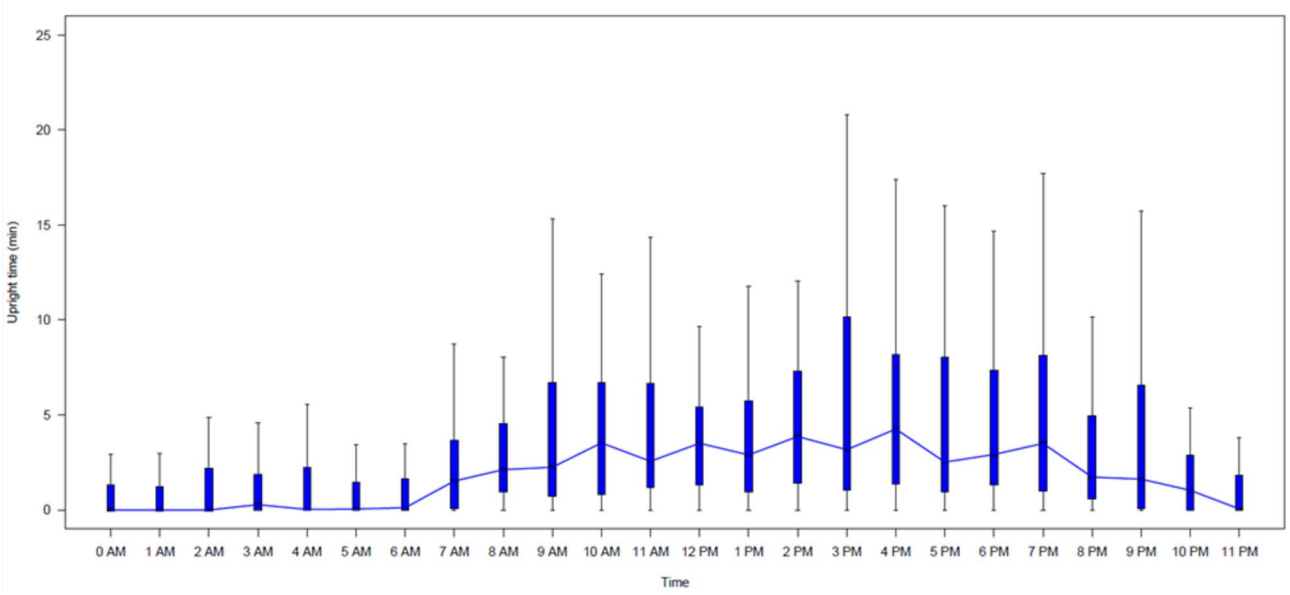

Fig. 2 Distribution of uptime throughout a 24-hour period. *Note: Mean minutes of uptime per hour across patients*

> *I ask the physiotherapist how they assess whether the patient is relevant to them. The therapist explains that she typically reviews the patient's journal entries from the past six months to evaluate their functional level over that period. "This patient for example, she's had three rehabilitation plans in the last six months and there's been no change, so it probably wouldn't make sense to give her a new one. And she mobilizes herself" (Field notes).*

This focus on assessment and rehabilitative potential may leave patients who are self-reliant when it comes to mobilization in charge of their own mobility, it makes mobility dependent on the patient's own initiative and their understanding of the situation and reduces emphasis on the patient's maintenance potential.

The interdisciplinarity of mobilization and mobility

The interdisciplinary healthcare team of nursing professionals, therapists, and physicians frequently discussed mobilization and mobility. However, these discussions primarily focused on assessing the level of mobilization and mobility as a question of whether the patient could walk independently or needed assistive devices or/and other kinds of support. This encompassed questions like *"Does the patient require full assistance for mobilization?" (Field notes) "Does the level of mobilization/mobility differ from the habitual level?" (Field notes)* as this script from the fieldnotes illustrates:

> *At the 9 o'clock conference: nurses, physicians, a physical therapist, and an occupational therapist attend. There seems to be some illness today among both physicians and nursing staff. Additionally, the physicians have had to assist in another department. All patients are reviewed very meticulously. Occasionally, the senior physician asks:" how is the patient mobilized", and the nurse responds on whether the patient can get up and move around on their own, or what kind of help or support is needed. Sometimes, the physical therapist adds information about whether they have assessed the patient. (Field notes)*

The question of mobilization and mobility was therefore more of a diagnostic and prognostic nature, to order suitable aids, plan discharge and home care rather than on developing strategies for enhancing mobility during hospitalization. There was a significant focus on patients who had experienced functional decline leading up to or during hospitalization. Conversely, less attention was given to maintaining mobility in patients who were not initially admitted for functional decline. Occasionally, what was referred to as the 'bed-loving' patients was discussed at the morning conference. These were patients who, with or without assistance, could get out of bed, but whom the staff experienced as reluctant to do so.

> *When asked about mobilization by the doctor, the nurse describes the patient as "very bed-loving". The doctor points out that it is important that he gets up, especially when eating, because his general nutritional status is poor, and it seems like he has just given up on everything. "He doesn't really want to do anything", the nurses explain and they are a little unsure about how much he is able to do, or*

how much he just doesn't want to do. A little later in the conference regarding another patient, the doctor says, "he needs to be pulled out of that bed." Again, the nursing staff expresses uncertainty about how, but the doctor says, "I don't think he needs to be asked, he needs to be told that he does." (Field notes).

When this experienced patient-reluctance was combined with the healthcare professionals' concerns about how the patients' condition might be affected if pushing them to hard, mobilization and mobility emerged as a difficult pedagogical task for both the nursing staff and the physiotherapists - one that involved situational challenges and ethical considerations about autonomy and paternalism for the individual healthcare worker to solve.

Environmental constraints

The physical environment of the ward played a crucial role for the healthcare professionals' experiences of shaping mobilization and mobility opportunities. The healthcare professionals experienced that their ability to encourage mobility was limited by the availability of places for patients to walk or how patients perceived the purpose of the activity. Hallways were often congested, and there were few accessible areas where patients could walk to engage in meaningful activities as expressed in this field note:

A lady who can walk by herself, but who is a little insecure because of her situation with dizziness and fainting episodes, says that she is mostly in her room watching-, reading- or talking on the phone. She explains that she goes to bed around nine o'clock, a little tired but also because there's nothing to do (Field notes).

This lack of designated spaces for mobility and activity discouraged both patients and healthcare professionals from prioritizing physical activity as expressed by this physician:

There is nothing in these settings that motivate them; there's nowhere to sit here, and there isn't really any space in those alcoves — for example, there's a bed there right now. We isolate them in the rooms here.

Uncertainty, hesitancy, and unavailability

Both patients and healthcare professionals exhibited hesitancy regarding mobilization and mobility. The healthcare professionals were reluctant to encourage movement if they were uncertain about their ability to help or if they did not know if someone else could help. This is illustrated by a filed note based on a nurse assistant that explains her morning routine:

She may not have time to help everyone get dressed and washed before breakfast but helps those who can get up in a chair or on the edge of the bed. But whether getting a patient in the chair depends on whether it's a patient who can sit for more than 20 min. If they can only sit for a short time, she doesn't necessarily get them up, because she doesn't have time to help them back after such a short time. It must be someone who can sit for a few hours (Field notes).

Most patients were hesitant to leave the ward unless accompanied by staff or family even when they were physically capable of doing so. Some patients were deliberately discouraged from leaving the ward because they might not find their way back, so the door to the outside was sometimes shielded. Patients mostly remained in their rooms, making themselves available to staff and seemed uncertain about what they were allowed to do or what they were able to do based on their condition and the ward routines. A nurse reflected on this patients' reticence as a consequence of their situation in which they are also trying to adapt to the ward:

The patients who are here are weary of life and are institutionalized, so they make room for us.

This uncertainty or hesitancy extended to family members, who might also be unsure of their role in supporting mobility. Involvement of family members was perceived as a valuable resource for encouraging patient mobility. However, their involvement was not systematically integrated into mobilization and mobility practices. Many of the patients reported various barriers to mobility, including dizziness, weakness, tiredness, and fear of falling. These perceptions contributed to their reluctance to engage in mobility as illustrated in this field note:

She doesn't dare go to the terrace because there is a step and it's hot; she's afraid of feeling unwell and dizzy (Field notes).

Additionally, patients often felt there was nowhere to go or nothing to do in the hallway. The experience of congestion in the ward further diminished the appeal of using the space for socialization or mobilization and mobility. The next quote illustrates the interplay between being dependent on help and the limitations– or possibilities– offered by the physical environment.

"It's not so good for me. I feel overlooked and ignored. I went to the bathroom this morning and had breakfast in my room (explaining her activities). I've

walked out into the hallway with my walker, I did that myself, but there's nothing to do here".

Patient dependency and self-initiated mobilization and mobility

Despite the presence of self-service carts for drinks, patients often had these items brought to them. This dependency reduced opportunities for spontaneous movement. However, staff had to keep an eye on how much fluid each patient received and try to motivate them to drink, which meant that they would often bring the patients their drinks. Some patients did engage in self-initiated mobility, particularly during quieter periods in the afternoon or evening. At these periods, there were fewer people and less activity in the narrow hallways. These patients expressed a desire to walk - several said *"you have to keep moving" (Field notes).* This notion of having to "keep moving" was part of an everyday practiced routine to stay mobile, why these patients on their own took initiative to walk back and forth in the hallway during hospitalization just for the purpose of exercise. Others mostly remained in their rooms, and when found sitting in the hallway it was often because they sought respite from their room environment or expressed frustration about inactivity. This was more an expression of restlessness than a movement or exercise strategy as this field note illustrates:

The man in bed 2 comes out of the door with his walker. He looks towards the alcove, but there's a patient sitting at a table with her daughter across from him and a doctor kneeling beside them. They are talking about how things are going. He pulls a chair slightly out from the alcove and sits down. He sits a bit behind the pillar, sticking his head out and looking down the hallway. D walks past and says, "I'll come and get you, take a little walk." He stays seated. Another nurse professional walks by and says, slightly surprised, "You made it out here." A physician comes over, kneels beside him, and they discuss his symptoms and align on the plan; they want him to stay over the weekend. She says she'd like to examine him back in the room. "I just got out here," he replies. "I can help you out here afterward, and then I can also see you walk," she offers. "I can damn well walk out here myself, there were just so many people in the room, I couldn't stand it," he says, as if that were the reason why he came out to sit in the hallway (Field notes).

This next field note indicates an experience of both uncertainty, dependency but also 'exercise-initiative'. It also serves as an example of 'the geriatric patient' and illustrates other conditions in the hospital that might restrict patients from moving beyond their room:

I had a long conversation with Y. She looks better today, although she complains about an upset stomach and shares with me what happened in the room. I think about the man at the table next to hers; this is the kind of information about other people that one might prefer to be shielded from or not involved in. This could lead to refusing to sit here again or avoiding the area altogether. I tell her that the last time I saw her, she was sitting here in a wheelchair, but today she was walking with a walker (I noticed this when I arrived). She explains that she usually walks with a walker but feels a bit unsure now and prefers to walk with a staff member because she is afraid of falling. She has fallen several times before and broken her leg and arm. She shows me her arm, where the elbow appears somewhat deformed. She expresses a desire to practice walking—she usually does this, she says, pointing down the long hallway. It's unclear whether she means here at the hospital, at the nursing home, or if she is referring to her sessions with the physiotherapist (Field notes).

In addition to illustrating the patient problem of wanting more mobility but needing help that was not necessarily available, the fieldnote also illustrates how the materiality of the hospital was filled with dilemmas. On the one hand, patients could feel lonely and isolated in their rooms, but on the other hand, both the room and the corridor could be experienced as settings where you are involuntarily and uncomfortably subjected to intimate and confidential information about your fellow patients. This could mean retreating to your bed, the only space that would offer a minimal sense of privacy where you would have some control over what happens in and around it.

The mobilization and mobility practices within the geriatric ward highlight both the prioritization and the challenges of promoting mobility during hospitalization. While there was a clear recognition of the importance of mobilization and mobility, systemic and environmental barriers, as well as uncertainties among patients and staff shaped mobilization and mobility practices.

Discussion of convergent findings

In this mixed-method study, 24-hour mobility levels among acutely admitted older adults were quantified using sensor technology during hospitalization. Concurrently, mobility practice and staff and patient perspectives on mobility were explored through qualitative ethnographic fieldwork to understand how these factors may influence patient mobility during their hospital stay.

The main quantitative findings revealed that during hospitalization, the patients spent most of their time (22.8 h/per day) in sedentary behavior and only 1.2 h/per day in uptime (walking and standing), including 43 min walking and took less than 1200 steps daily. The main findings from the qualitative ethnographic fieldwork revealed that (1) while most staff consider mobilization/mobility an important task, mobilizing patients to a chair and performing functional level assessments are prioritized, and (2) perceived mobility opportunities are limited by the physical environment (e.g., congested hallways) and lack of purposeful activities to engage in (why walk if not to do something or be with others).

The levels of in-hospital mobility measured in the study are slightly higher than the levels reported in general medical wards [1–4, 6] and geriatric inpatients [8, 45]. Nevertheless, the level of mobility should still be a cause for concern as it corresponds to the level reported by Pavon et al. [4] in hospitalized older adults who were discharged with new hospital-acquired disability. Also, a recent review of studies conducted in acute-care settings for medical and geriatric inpatients reported that patients spent 89–99% of their day in sedentary behavior, with uptime durations ranging from 66 to 117 min per day [46]. These studies and the present study highlight the substantial inactivity among older hospitalized adults. The interdisciplinary healthcare group at the Geriatric Department in the present study is aware of the importance of mobility and the consequences of insufficient mobilization. There is a strong interdisciplinary focus on mobilization - specifically on clarifying how patients are mobilized and on assessing their functional level and rehabilitative potential and less on ensuring daily patient mobility. Nursing professionals are focused on ensuring that patients are mobilized to a chair during each shift, while the physiotherapists walk with patients, who can do so, if the patient needs an evaluation of their functional level. Other factors that may contribute to the low levels of mobility observed in the study include environmental constraints. The staff experience challenges in encouraging mobility due to limited space for walking and lack of a meaningful purpose of mobility beyond the act itself (e.g., a destination to walk to or an activity to take part in). The only option they currently experience to have, is directing patients to the hallway, which they perceive as a limiting factor. As a result, patients often stay in their rooms, which further contributes to sedentary behavior. From the qualitative data, we found that the healthcare professionals find it challenging to increase patient mobility when they experience being unable to accompany the patients. This may be more pronounced in patients who require a walking aid, which most of the patients in the present study did (66%). The need for walking aids during hospitalization has previously been associated with reduced mobility levels [1, 12]. The potential limitation in mobility associated with walking aids was illustrated in the present study by walking dependent patients having lower performance on all outcomes compared to walking independent patients. Even so, most of both walking dependent and independent patients exceeded the threshold of 900 steps per day [14], which has previously been identified as a possible critical limit for increased risk of HAD. Interestingly, the step counts in our study were higher than the 728 steps (IQR: 176:2089) reported by Jawad et al. [3], despite only 30% of the patients in their study using a walking aid compared to 66% in our study.

However, factors beyond the use of walking aids, such as overall functional level and department-specific mobilization practices, may also influence the mobility levels. Nevertheless, patients in the present study had a relatively good functional level both prior to and during hospitalization, enabling them to be mobile. For example, the NMS was 7 (5:9), indicating good pre-admission functional independence while the CAS was 6 (5.5:6), indicating independence in basic mobility at the time of inclusion. Although the patients were able to move independently, they spent most of their time during hospitalization being sedentary behavior. This may be due to the fact that in the Geriatric Department the overall focus seems to be primarily on patients who have experienced a decline in functional level, patients with a rehabilitation potential, rather than on patients who are self-reliant as patients with a maintenance potential.

Another factor that may be causing the lack of mobility promotion during hospitalization relates to responsibility. The interprofessional staff perceive themselves as having clearly defined professional responsibilities related to mobilization. However, daily routine ambulation, and the maintenance of mobility do not appear to fall within any specific professional domain. Furthermore, physiotherapists and nursing staff often face the challenge of encouraging patients to engage in activities that they do not wish to engage in. This presents a difficult pedagogical task that calls for interprofessional reflection and support. The poem of Charles Osgood illustrates responsibility, which captures the essence of shared but unclaimed duties: *"There was an important job to be done and Everybody was sure that Somebody would do it. Anybody could have done it, but Nobody did it. Somebody got angry about that because it was Everybody's job. Everybody thought Anybody could do it, but Nobody realized that Everybody couldn't do it. It ended up that Everybody blamed Somebody when Nobody did what Anybody could have."* In the clinical setting, where mobility promotion is acknowledged as important but lacks clear ownership, it could be due to a clinical culture where no one "owns" this responsibility [16].

Many of the patients reported various barriers to mobility, including dizziness, weakness, tiredness, and fear of falling. The patients are older and mildly frail, where minor imbalances in their systems and daily routines can create significant bodily insecurity. Although the patients' CAS scores indicated that they were capable of independent mobility, they may still be reluctant to engage in mobility on their own. This suggests that the patients require motivation and support from healthcare staff to engage in mobility during hospitalization. Staff encouragement is particularly important. As Stefándóttir et al. reported [15], support and motivation from healthcare providers and relatives are key factors for patients to stay physically active during hospitalization. Moreover, patients' different ways of assigning meaning to mobility and physical activity during hospitalization, their condition, and their experience with mobility and physical activity challenges staff in the pedagogical task of encouraging and creating opportunities for movement.

Tackling the abovementioned issues through systematic environmental enhancements, structural and organizational adjustments, engagement of relatives, clear communication of mobilization and mobility expectations, strengthened interprofessional collaboration, and targeted strategies for situational pedagogical challenges in mobilization and mobility may promote a more cohesive approach. This, in turn, can improve the integration of mobilization and mobility practices into daily clinical routines and help prevent functional decline during hospitalization.

Strengths and limitations

The study has several notable strengths. Firstly, the study used a mixed method design allowing for a comprehensive understanding of mobility in geriatric patients. Secondly, we used sensors to objectively measure 24-h mobility throughout hospitalization, which has previously been described as a valid method for quantifying mobility in older adults [47]. We measured patients as many days as possible during hospitalization. For the analysis of the data, we only included patient-days with more than 20 h of valid data, to avoid skewed days in the analysis. Furthermore, we chose the 20-hour cutoff to be sure to keep data from the last day before discharge, on which most patients did not have 24 h of measurement. This is important, as hospitalized patients are typically more active towards discharge [3, 6] and excluding these data may have led to an underestimation of their activity level. Thirdly, the study included patients with cognitive disorders, a group often excluded from similar studies. This population is highly relevant to the current study, as older patients frequently present with cognitive challenges. The fact that we have previously found hospitalized older adults with cognitive impairments to be less active than their non-impaired peers [1, 48] highlight the importance of including these patients to get a more comprehensive understanding on in-hospital mobility. The inclusion of these patients enhances the generalizability of our findings and ensures that they better reflect clinical practice, although this generalizability was still limited by our decision to exclude patients with delirium and those in isolation.

The study also had some limitations worth mentioning. Firstly, the study was conducted in a single university hospital, which may limit generalizability. Secondly, we presented the median activity across the entire hospitalization, thereby not accounting for day-to-day variation. This may result in overlooking potential changes in activity levels over time, such as increased activity before discharge [3, 6]. Also, we only included mobility related to the lower extremities, which means that we did not capture a complete overview of the patients' whole-body mobility. Thirdly, we were not able to measure all included patients throughout their entire hospitalization. The reasons for lack of measurements were removal of sensors by patients or staff and/or postponement of planned discharge after removal of the sensors. Additionally, missing data at baseline resulted in fewer than 44 participants participating in all tests. This occurred because some patients opted to only wear the sensor and did not want to participate in the baseline assessment.

Conclusion

In this mixed-method study, we found that older geriatric inpatients spent most of their in-hospital time in sedentary behavior and take less than 1200 steps daily. While mobility is considered important by most staff, mobilization to a chair and functional assessments are prioritized over patient mobility, which becomes dependent on the patient's own initiative. However, the patients' perceived mobility opportunities are limited by the physical environment and lack of purposeful activities to engage in. Therefore, systematic environmental adjustments, strengthened interprofessional collaboration with clearly defined responsibilities, and targeted strategies integrating mobility into daily clinical routines are warranted to enhance in-hospital mobility.

Abbreviations

HAD	Hospital-associated disability
NMS	New Mobility Score
LSA	The Life Space Assessment
CFS	The Clinical Frailty Scale
OMC	The Orientation Memory Concentration Test
KATZ	The Katz Index of Activity of Daily Living
CAS	The Cumulated Ambulation Scale
JH-HLM	John Hopkins Highest Level of Mobility Scale
IQR	Interquartile range

Author contributions
Conceptualization: MMP, JWK, TB; Methodology: MMP, JWK, TB, LKJ, BSP, TSL, BRN. Validation: LKJ, MMP, BSP; Formal analysis: MMP, BSP, LKJ, TK, TSL; Investigation: LKJ, TSL; Data curation: LKJ, MMP, BSP, TSL, TK; Writing– original draft: LKJ, TSL, MMP. Writing– Review and Editing: All authors; Visualization: TK; Supervision: MMP, JWK; Project Administration: BSP, MMP, JWK, TSL, BRN; Funding Acquisition: MMP, LKJ, TB, JWK.

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Data availability
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The study was approved by the Scientific Ethics Committees for the Capital Region of Denmark (F-24023831) and the study was performed in agreement with the Declaration of Helsinki. All participants provided written informed consent before inclusion. The study was approved by the Scientific Ethics Committees for the Capital Region of Denmark (F-24023831) and the Danish Data Protection Agency (p-2024-15948).

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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