Hospital in Motion, a multidimensional implementation project to improve patients’ physical behaviour during hospitalization, a study protocol

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Abstract

Background: Despite the evidence of the adverse consequences of immobility during hospitalization, patients spend most of the time in bed. While physical activity is a modifiable factor which can prevent in-hospital functional decline, bed rest is deep rooted in the hospital culture. To attack this, a multidimensional approach is needed. Therefore, Hospital in Motion, a multidimensional implementation project, was designed to improve physical behaviour during hospitalization.

Methods: The Hospital in Motion study will be implemented within two specialism (cardiology and oncology) in a Dutch University Medical Centre. Per ward, multidisciplinary teams are composed and follow a step-by-step multidimensional implementation approach which includes the development and implementation of tailored action plans with multiple interventions to stimulate physical activity in daily care. The aim of this study is to investigate the effectiveness of Hospital in Motion on physical behaviour, measured with the behavioural mapping method, one year after start of the project. A pre-post observational study is used to evaluate the effectiveness, including 80 patients per time point per specialism. In addition, the process evaluation will be measured per ward, with a caregivers survey, patient statements and semi-structured interviews with patients and caregivers.

Conclusion: This study will provide information about both the effectiveness of the Hospital in Motion project on physical behaviour as in the procedures of an implementation process aimed to incorporate physical activity in usual care. These insights will be useful for others interested in changing physical behaviour during hospitalization.


Keywords Hospitalization, physical behaviour, mobility, interdisciplinary care, implementation
**Background**

More than 2 million patients are admitted to Dutch hospitals yearly, with a mean admission time of 7 days (1). Although hospital admissions are necessary to diagnose or treat patients for health issues, hospital admissions also have downsides. Diverse studies show that hospitalized patients spend most of the time lying in bed, while in the last 20 years a growing body of evidence is established showing the adverse consequences of bed rest (2, 3). Restricted physical activity and immobilization can increase hospital related complications (3, 4). Many studies have proven that inactivity is associated with reduced muscle mass and strength (5,6). In addition, bed rest results in an increased risk of diverse medical complications (7-9). Early mobilization and higher levels of physical activity during hospitalization have proven to decrease the risk of complications and length of stay (10). Moreover, lower levels of physical activity are associated with a functional decline and new disability in activities of daily living after discharge (3, 4, 11-14). This functional decline is labelled as hospitalization-associated-disability (HAD) and HADs have profound implications for patients since it lead to long-term care in nursing homes, readmissions and even death (13). Literature characterizes HADs as both preventable and iatrogenic, and as a direct result from the actions of a health care provider or institution. HADs can therefore be considered as collateral damage of the treatment in a hospital in which health care professionals and policy makers have a responsibility in resolving this problem (15).

Nevertheless, patients are reflexively put into pyjamas, transferred into bed (16) and spend less than 6% of the day active (2-4, 11). Lack of knowledge and time is often mentioned by caregivers as a barrier to promote physical activity. This lack of time results in nurses prioritizing their medical tasks above assisting with mobilisation and stimulating physical activity with patients’ ability to perform their own ADL tasks (17, 18). Studies targeting sedentary behaviour during hospitalization have shown that physical activity is a modifiable factor which can prevent in-hospital functional decline (10, 19-21). These studies mostly focused on single interventions while sedentary behaviour is deep rooted in the hospital
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culture. A multidimensional project focussing on environment, caregivers and patients, using multiple interventions, may possibly be even more effective (22). However, projects to improve physical behaviour focusing on the whole system, integrating physical activity in all levels of daily hospital care, are not common (20). Therefore, Hospital in Motion, a multidimensional project to improve patients’ physical behaviour during hospitalization, has been developed.

The primary objective of the current study is to investigate the effectiveness of Hospital in Motion on physical behaviour, within the specialism oncology and cardiology.

Secondary objectives are to investigate the effectiveness on length of hospital stay and immobility-related complications of patients during hospitalization and to monitor the implementation process, evaluating factors influencing the implementation.

Methods

In November 2015 project Hospital in Motion started at the University Medical Centre Utrecht (UMC Utrecht). Hospital in Motion is a complex multidimensional project primarily designed to improve physical behaviour during hospital stay, defined as a decrease in patients sedentary behaviour (lying in bed) and increase in physical activity (i.e. standing, walking and exercising). This project follows two approaches. The first approach focusses on creating hospital-wide awareness of the high amount of sedentary behaviour during hospital stay and the known associated adverse effects, and the necessity to incorporate physical activity in usual care. The second approach includes the development and implementation of tailored action plans for each clinical ward. This study investigates the effectiveness of the implementation of the tailored action plan and evaluates the implementation process within two medical specialism.

Setting

This study will be conducted within the specialism cardiology and the specialism oncology of the University Medical Centre Utrecht, the Netherlands. Per specialism, a tailored action plan will be implemented at 2 wards; cardio-thoracic-surgery and general cardiology, and medical
oncology and haematology. The study protocol was assessed and approved by the medical ethics committee (METC) of the UMC Utrecht (study protocol number 16-250). Verbally informed consent was obtained from all patients.

**Study design**

An observational study with a pre-post design will be used to evaluate the effectiveness of the Hospital in Motion study on physical behaviour. Additionally, the implementation process will be evaluated by using a qualitative approach. Data will be collected before and after implementation. The duration of the implementation project is planned for 10 months, starting in January 2018 (fig. 1).

**Implementation approach and intervention**

Hospital in Motion will be implemented following the step-by-step model of Grol and Wensing (fig. 2) (23). Step 1 to 3 include the development of proposal for change, analysis of actual performance and problem analysis. Step 4 includes the selection of strategies and measures to change practise, which will be developed by a multidisciplinary project team, which will be formed per ward and will define tailored goals suitable for their ward. During step 5, an action plan, existing of multiple interventions, will be developed, tested and executed at each ward. This plan will consists of 6 general topics;

1. **Education;** Education is an important cornerstone of increasing awareness on the importance of and options for physical activity, and dangers of bedrest (18, 24).
2. **Physical activity as part of usual care;** For successful implementation, physical activity needs to be incorporated in usual care and all caregivers with direct patient contact need to be involved (18, 25).
3. **Involving third parties;** Involving the social environment (i.e. family, friends or volunteers) to improve a patients’ physical behaviour (26, 27).
4. **Stimulating environment;** Currently hospital wards are not stimulating environments for physical activity (28). Changes in the environment are conditional for stimulating physical activity.
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5. *Mobilization milestones;* Daily mobilization goals are successful in increasing walking distance, ADL activities and number of mobilization moments out of bed (10, 29).

6. *Technology support;* Increasingly technological applications are available to support, stimulate and measure physical activity (30).

**Outcome evaluation**

At each specialism 80 patients will be included during a period of 2 months (40 patients per ward). Each patient, on a random weekday of their stay, admitted on the specific ward is eligible to participate in this study.

**Primary outcome**

Physical behaviour will be measured with the behavioural mapping method (31) and will be assessed before and after the implementation period (fig. 1). Patients will be observed in fixed order, every 10 minutes for 1 minute. During this minute, the patients’ location, position, activity and contact will be registered (31). A maximum of 8 patients per ward per day can be observed and observations take place from 9 am until 4 pm.

In this study physical behaviour is defined as the percentage of the total observed time that a patient spent in a specific position. A distinction will be made between lying in bed, sitting (bedside or chair) and physical activity (standing, transferring, walking, cycling).

**Secondary outcomes**

Secondary outcomes are length of stay (LOS) and the incidence of immobility-related complications (i.e. pneumonia, aspiration, chest infection, pulmonary embolism, deep-vein thrombosis, urinary tract infection and pressure sores) (32). These outcomes will be retrospectively retrieved out of the electronic patient file.

**Patients characteristics**
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Demographic characteristics that will be documented are gender, age, admission reason, specialism, the presence of mobilization tools (i.e. rollator, walker, crutches or stick), catheter (yes/no), infusion (yes/no) and main limitations during physical activity (e.g. pain, exhausting). In addition, the health perception and physical functioning of patients will be assessed.

Subjective Believed Health Questionnaire is a valid measurement to obtain the health perception, defined as “individual’s experience of physical and mental functioning while living his life the way he wants to, within the actual constraints and limitations of individual existence” (33). The questionnaire exists of eight questions; question one and two focused on the subjective health, scored on a ladder-type scale form 0-10. Question three to eight focused on perceived control and acceptance, scored between 1 (completely disagree) and 7 (totally agree) (34).

AM-PAC: The Activity Measure for Post-Acute Care (AM-PAC) is a validated measurement instrument based on the activity limitation domain of the International Classification of Functioning, Disability and Health (ICF). In this study the AM-PAC “6-Clicks” measures of basic mobility and daily activity in acute care will be used. These short forms have shown to be valid for assessing patients' activity limitations in acute care settings (35).

Hand Dynamometer: The hand-grip test will be measured with the Jamar hydraulic hand dynamometer, which is an isometric, hydraulic and easily accessible tool with excellent test-retest reliability (r>0.80) and inter-rater reliability (r=0.98) (36).

30-s CST: The 30 seconds chair stand test (30-s CST) is a reliable and valid measurement method for lower extremity strength assessment and a good indicator for a person’s level of physical function (37).

Sample size calculation
For the sample size calculation, unpublished observation data from the UMC Utrecht in 2016 is used, in which 80 patients were observed hospital-wide. This data demonstrated that patients spend 56.01% of the time lying in bed, with a standard deviation of 32.53. Based on earlier studies, after the implementation of a multiple intervention, a decrease of 15% of the time spent in bed is expected to be feasible (19). Sample size calculations, including a power of 80% and p-value of 0.05, resulted in a sample size of 74 patients at each specialism.

**Process evaluation**

To monitor the implementation process and evaluate factors influencing the implementation of complex interventions, a process evaluation is advised. In this study, the framework of the MRC guideline 2008 is followed to guide the process evaluation (38). The three key functions of this framework include implementation, mechanisms of impact and context. Implementation contains the goals and interventions that have been delivered by the project, including the adaptations, dose and reach, and how this delivery is achieved. The mechanisms of impact include the response (of caregivers and patients) to the interventions, the mediators and all unexpected pathways and consequences. Context includes all other factors that may affect the implementation, interventions and outcomes, such as barriers (e.g. openness to changes, motivation, workload, money) and facilitators (38). For the process evaluation of the Hospital in Motion study on the different wards, a caregivers survey, patient statements and semi-structured interviews with patients and caregivers are developed, which contain items of the three key functions of process evaluation. The caregivers survey and patients statements will be conducted before and after the implementation period. The semi-structured interviews will be conducted at the end of the implementation period (fig. 3).

**Caregivers survey:** The caregivers survey contains questions focusing on the willingness to change and motivation of the caregivers. In addition, it investigates the adoption of the six topics of the action plan in daily care. A score between 0 and 100 is given on a scale
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Consisting of a percentage or not agree / fully agree. The survey will be sent to all caregivers of the wards before and after the implementation period.

**Patient statements:** The level of encouragement patients perceived care providers and the environment to be physically active in the past two days, will be investigated using 6 statements with a 5-point scale. The statements include received stimulation for physical activity from care providers and the physical environment. This patient questionnaire will be performed before and after the implementation period. After the implementation, the statements will be supplemented with goal specific questions, to investigate the success of the implementation of multiple ward specific interventions.

**Semi-structured interviews with patients and caregivers:** After the implementation, semi-structured interviews with both patients and caregivers will be undertaken. The interviews will be guided with a topic list, based on the three key functions of process evaluation as described before (38).

**Statistical analysis**

Statistical analyses will be performed separately for each specialism. All statistics will be done in IBM SPSS Statistics software. All outcome variables will be tested on normality with the Kolmogorov-Smirnov test. Patients characteristics will be described using descriptive statistics and tested with the Chi Square test, Mann Whitney test or independent-samples t-test.

The primary outcome physical behaviour is defined as the percentages of the total observed time that a patient spent lying, sitting and active. The different scores between the pre- and post-measurement will be analysed with ANCOVA, whereby the covariate(s) include baseline variables which may differ between the specialisms. If data is not normally distributed, log transformation will be executed before testing.
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The process evaluation will be based on the caregivers survey, patients statements and semi-structured interviews. For both the caregivers survey and the patients statements, analysis will be executed per question and tests will be performed on the different outcomes before and after implementation. Categorical data will be analysed using Chi Square test and continuous data by using the Mann Whitney test or independent-sample t-test. To correct for multiple testing a post hoc multiple comparison test will be performed. Semi-structured interviews will be recorded with audio-recording and transcribed. Data analysis will follow three steps; coding, categorizing and selecting theme’s, which will be performed in NVivo.

Discussion

Despite the evidence about the consequences of low levels of physical activity, patients spend most of the day in bed, which may lead to a functional decline and new disability in activities of daily living after discharge (2,3). Previous studies demonstrated that increased amounts of physical activity during hospitalization may prevent this functional decline (39). Three recent studies implemented a single-intervention to improve physical activity during hospital stays. The first study implemented the John Hopkins Level of Mobility Scale, which demonstrated an improved level of mobility on a general medicine unit (10). The second study implemented enforced mobilisation in patients following gastrointestinal cancer surgery and found a reduced number of postoperative pulmonary complications (21). The third study is a large-scale study whereby the implementation of three goals (1. mobilisation within 24 hour, 2. mobilisation three times a day and 3. progressive and scaled mobility) has shown to improve the frequency of mobilization out of bed with 10 percent (40). In conclusion, physical activity seems to be a modifiable factor during hospital stay.

However, to integrate physical activity in usual care, it is suggested that the approach should be multidimensional, with multiple interventions focussing on the whole system (17). One previous study, the study of Mudge et al. (2015), evaluated a multidimensional approach using multiple interventions, with implementing the Eat Walk Engage program.
This program showed a reduced LOS (20). The Hospital in Motion study has the strength that it contains ward tailored multiple interventions, developed by a multidisciplinary project team. In addition, it is one of the first known large projects using a multidimensional approach, focusing on the physical environment, caregivers and patients, instead of only one element, to improve physical behaviour during hospitalization.

Another major difference with previous studies is the primary outcome of the Hospital in Motion study. The outcome evaluation of previous studies included mostly hospital outcomes (e.g. LOS, remissions and mortality) or only the highest level of mobilization (10, 20, 21, 40). Hereby the actual amount of physical activity during a hospital day remains unclear. To get more information about patients’ physical behaviour during hospitalization, the primary outcome is defined as the percentage of the total observed time that a patient spent in bed, sitting and spend active. This provides insight in the actual performance of patients during usual care and gives insight in the ward specific culture (i.e. eating position, daily schedule and opportunities to improve physical activity). In addition, this is a direct outcome measure which is intended to change by the project in comparison with LOS and complications.

Diverse factors could influence the success of the implementation of Hospital in Motion. The action plan is a multidimensional package of interventions aimed to improve physical behaviour. It contains multiple interventions aimed at incorporating physical activity in usual care procedures, targeting the whole care system. This strength is a challenge at the same time because its complexity. Many factors may affect the implementation process, such as the functioning of the project team, motivation of the caregivers, willingness to change, the wards financial situation, time and workload. Therefore, monitoring the implementation of the Hospital in Motion project is important. The process evaluation will give insight in the change of usual care and success and failure factors of the implementation process. Using semi-structured interviews, a caregivers survey and patients statements, the ward specific success and impeding factors will be investigated after the
implementation period. Hereby, the study also provides information about how to implement a multidimensional project with multiple interventions like Hospital in Motion.

**Trial status**

This trial is currently recruiting participants until the end of December 2018. The first participant was enrolled on October 2017.

**Additional file**

**Abbreviations**

HAD: hospitalization-associated-disability; ADL: activities of daily living; UMC Utrecht: University Medical Centre Utrecht; METC: medical ethics committee; LOS: length of hospital stay; AM-PAC: Activity Measure for Post-Acute Care; ICF: International Classification of Functioning, Disability and Health; 30-sec CST; 30 seconds chair stand test
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Ethical approval and consent to participate
The study protocol was assessed and approved by the medical ethics committee (METC) of the UMC Utrecht (study protocol number 16-250). Verbally informed consent was obtained from all patients.

Consent for publication
Not applicable

Availability of data and material
The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interest
The authors declare that they have no competing interests

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Authors’ contributions
PB and LvD declare to be equally contributing authors, whereas both make equally contribution to the protocol. PB, LvD, KV and CV designed the framework and methodology. PB and LvD developed the research protocol and drafted the manuscript. KV and CV critically revised the manuscript and approved the final version.

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Declaration of Conflicting Interest
The Author(s) declare(s) that there is no conflict of interest
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