Original Research

The Effectiveness of Hospital in Motion, a Multidimensional Implementation Project to Improve Patients' Movement Behavior During Hospitalization

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Objective. Hospital in Motion is a multidimensional implementation project aiming to improve movement behavior during hospitalization. The purpose of this study was to investigate the effectiveness of Hospital in Motion on movement behavior.

Methods. This prospective study used a pre-implementation and post-implementation design. Hospital in Motion was conducted at 4 wards of an academic hospital in the Netherlands. In each ward, multidisciplinary teams followed a 10-month step-by-step approach, including the development and implementation of a ward-specific action plan with multiple interventions to improve movement behavior. Inpatient movement behavior was assessed before the start of the project and 1 year later using a behavioral mapping method in which patients were observed between 9:00 am and 4:00 pm. The primary outcome was the percentage of time spent lying down. In addition, sitting and moving, immobility-related complications, length of stay, discharge destination home, discharge destination rehabilitation setting, mortality, and 30-day readmissions were investigated. Differences between pre-implementation and post-implementation conditions were analyzed using the chi-square test for dichotomized variables, the Mann Whitney test for non-normal distributed data, or independent samples *t* test for normally distributed data.

Results. Patient observations demonstrated that the primary outcome, the time spent lying down, changed from 60.1% to 52.2%. For secondary outcomes, the time spent sitting increased from 31.6% to 38.3%, and discharges to a rehabilitation setting reduced from 6 (4.4%) to 1 (0.7%). No statistical differences were found in the other secondary outcome measures.

Conclusion. The implementation of the multidimensional project Hospital in Motion was associated with patients who were hospitalized spending less time lying in bed and with a reduced number of discharges to a rehabilitation setting.

Impact. Inpatient movement behavior can be influenced by multidimensional interventions. Programs implementing interventions that specifically focus on improving time spent moving, in addition to decreasing time spent lying, are recommended.

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Although there is extensive literature describing the detrimental effects of immobility, bedrest and inactivity are still deeply rooted in the hospital culture[1]; hospitalized patients spend 49% to 98% of their time in bed.[2–6] Immobility during hospital stay is associated with complications such as pneumonia, urinary tract infection, deep venous thrombosis, and pressure ulcers, which can result in prolonged hospital stays, more readmissions, higher mortality, and increased hospital costs.[7–9] In addition, lower levels of physical activity lead to functional decline and new disabilities in activities of daily living after discharge.[10–13] This functional decline is labeled as hospitalization-associated disability, which leads to long-term care in nursing homes, readmissions, or even death.[12–14]

Promoting inpatient mobilization can be challenging since the traditional hospital culture seems to discourage patients to be physically active.[15–17] Care is usually organized around the inactivating hospital bed, with food and drinks supplied within reach. In addition, patients often feel dependent on health care providers (HCPs) for instructions and manual support in mobilizing, even when they are able to move independently. This feeling of dependency on HCPs might be a result of nurses automatically supporting patients in washing, clothing, and eating.[17] Together, this has resulted in a culture where many patients are spending most of the time in bed. Recent studies targeting inactivity during hospitalization demonstrated that mobilization and physical activity is a modifiable factor that can prevent in-hospital functional decline.[2,18,19] Most of these studies investigated the effect of single interventions on patients' physical function or medical outcomes instead of on movement behavior itself, which is a crucial first step in the pathway towards improving patient outcomes. The evaluation of movement behavior is important to provide useful information about the successful and unsuccessful elements of interventions.

However, sedentary behavior is deeply rooted in the hospital culture. To overcome this culture and create more sustainable changes, there is a need for effective interventions that integrate physical activity in usual tailored care.[17,20–23] Multi-component interventions are preferred above single interventions as they have proven to be more effective.[24] Additionally, in line with the social ecological model, multidimensional interventions focusing on the patients, on HCPs, and on the built environment may be more effective.[20,21,24,25] Programs or studies aiming to improve movement behavior focusing on the whole system, by implementing multidisciplinary and multi-component interventions tailored to local context, are still rare. Existing multi-component studies mainly focused on elderly[21–23] or focused only on HCPs.[21–23] Since our aim is to implement physical activity throughout the hospital within current daily care procedures, Hospital in Motion, a multidimensional and multidisciplinary implementation project, was developed. The purpose of this study was to investigate the effectiveness of the Hospital in Motion project on inpatients' movement behavior. Furthermore, we assessed the effectiveness on length of hospital stay, discharge destination home, discharge destination rehabilitation setting, 30-day readmission, mortality, and immobility-related complications of patients during hospitalization.

Methods

Study Design

A pre-post design was used to evaluate the effectiveness of Hospital in Motion. The project started in January 2018 and ended 10 months later (November 2018). Baseline measurements were performed 2 months before the start of the project and the post-implementation measurement 1 year later in November and December 2018. For more detailed information about the design and timeline, we refer readers to our published study protocol.[26]

Setting

This study was conducted within 4 participating wards of the University Medical Center Utrecht, the Netherlands: cardiology, cardiothoracic surgery, medical oncology, and hematology. The study protocol was assessed and approved by the local Medical Ethics Committee (study protocol number 16–250). Verbal informed consent was obtained from all included participants.

Study Population

Patients admitted to 1 of the 4 participating wards were eligible to be included for the evaluation of Hospital in Motion. Exclusion criteria were cognitive impairments like delirium (defined as an acute disorder of attention and cognition, estimated by the medical and nursing staff) and language restrictions making a patient unable to provide informed consent. In addition, patients receiving terminal care were excluded. The day before the observations, P.B., L.M.M.v.D., or K.V. discussed with the coordinating nurse of the ward which of the admitted patients were eligible to participate. Eligible patients were asked in random order and inclusion stopped when 8 patients wanted to participate or when no more eligible patients were available.[26]

Hospital in Motion

Hospital in Motion is a multidisciplinary and multidimensional implementation project designed to improve patients' movement behavior during hospitalization. Per ward, a multidisciplinary project team was formed, including a project manager (L.M.M.v.D. or P.B., both PhD students and physical therapists), a unit-manager, physical therapist(s), nurse(s), and physician(s). The Implementation of Change Model, developed by Grol and Wensing (27), was followed. This model is developed especially for the implementation of change in clinical practices and contains 7 steps. Steps 1 to 3 include the development of proposal for change,

analysis of actual performance, and problem analysis. During these steps, on each ward patient opinion about perceived promotion to be physically active was assessed using short statements, surveys were performed among HCPs, and in-depth interviews were performed with HCPs and patients. Furthermore, the baseline measurement of the movement behavior of patients was performed. Step 4 of the model includes the selection of strategies and measures to change practice, and step 5 focuses on the development, testing, and execution of the implementation plan. During steps 4 and 5, each project team identified multiple interventions to be implemented to stimulate inpatient physical activity in usual care and developed an action plan with these interventions for their ward. Interventions focused on 3 levels of the social ecological model, a conceptual framework depicting spheres of influence over human behavior, namely individual, interpersonal, and organizational.[25] In 2016 and 2017, a pilot study was performed on the geriatric department. Preliminary results and gained experiences during this pilot formed the 6 topics for the action plan, focusing on patients, HCPs, and environment: education of staff and patients, physical activity as part of daily usual care, involvement of third parties such as family members or volunteers, creation of a stimulating environment and mobilization milestones, and technology support. Steps 6 and 7 contain the integration of changes in routine care and the evaluation of the implementation plan. In these steps, the patient statements and the survey among HCPs were repeated. Furthermore, the follow-up measurement of the movement behavior of patients was performed, and in-depth interviews were performed with HCPs from within and outside the project team. For more detailed information about the interventions and the followed approach, see Supplementary Appendices 1 and 2 and our published study protocol.[26]

Patient Involvement

In this study, patients were involved in the development and implementation of the interventions (action plan). Before the start of the project, patients' opinions were investigated using semi-structured interviews. At the end of the implementation period, patients were interviewed for the process evaluation.[26]

Outcome Evaluation

Patient characteristics. Demographic and clinical characteristics including the use of a walking aid (ie, rollator, walker, crutches, or stick) and urine catheter were recorded. In addition, physical functioning was assessed using the Activity Measure for Post-Acute Care Basic Mobility "6-Clicks" (AM-PAC) and by measuring handgrip strength. The AM-PAC includes 6 items: turning over in bed, sitting down on and standing up from a chair with arms, moving from lying on one's back to sitting on the side of the bed, moving to and from a bed to a chair, walking in a hospital room, and climbing 3–5 steps with a railing. All activities were scored on a scale of 1 (unable to do/total assistance required) to 4 (no assistance required). The sum of the scores ranges from 6 (indicating total assistance or "cannot do at all") to 24 (indicating completely independent functioning). The AM-PAC demonstrated to be reliable and valid for assessing patients' basic mobility in acute care settings.[28,29] Handgrip strength was measured to get insight into the overall muscle strength and level of physical function. Handgrip strength was measured with the Jamar hydraulic hand dynamometer, which is an easily accessible tool with excellent psychometric characteristics.[30–31]

Movement behavior. Movement behavior was assessed 2 months before and after implementation using the behavioral mapping method.[26,32,33] Behavioral mapping is a structured method where participants are intermittently observed at set intervals. It has a good to excellent inter-rater reliability, and analyses showed that the level of agreement with accelerometers was strong for identifying physical activity.[2,31,32] For this study, a maximum of 8 patients per ward per day were observed on a random weekday. The observations took place from 9 am until 4 pm, in a fixed order every 10 minutes, for 1 minute. During this minute, the patients' location, body position, daily activity, and direct contact were noted. Patients could be included in the observations more than once during the same hospital admission because the observations are a reflection of the patient population at that moment. For this study, movement behavior was defined as the percentage of the total observed time that a patient spent in a specific body position. A distinction was made between lying (in bed), sitting (bedside or chair), and moving (standing, transferring, walking, and cycling).[26,33] The percentage of time spent lying in bed was studied as primary outcome. Sitting and moving were included as secondary outcomes.[26] The physical function measurements (AM-PAC and handgrip strength) and the observations (behavioral mapping) were performed following a strict protocol by trained physiotherapy students who were not involved during the implementation phase.

Medical outcomes. Furthermore, length of stay, discharge destination home, discharge destination rehabilitation setting, mortality, 30-day readmission rate, and the incidence of immobility-related complications (ie, pneumonia, pulmonary embolism, deep-venous thrombosis, urinary tract infection, and pressure sores)[34] were included as secondary outcomes. Data on these outcomes were retrospectively retrieved from the electronic patient files by data managers and a trained independent research assistant of the patients who were included for the observations.

Table 1.
Characteristics of Observed Patients[a]

Characteristics	Baseline	Post-implementation	P[b]
Age (y), mean (SD)	60.6 (15.8)	58.3 (16.3)	.356
Male, n (%)	109 (63.7%)	114 (69.9%)	.230
Surgery, n (%)	59 (35.5%)	51 (31.5%)	.436
Physical Functioning (AM-PAC 6-click BM), mean (SD)	22.2 (4.1)	22.4 (3.1)	.245
Mobilizing independently in room, n (%)[c]	143 (83.6%)	127 (77.9%)	.185
Handgrip strength (kg), mean (SD)	28.5 (12.1)	30.1 (12.5)	.280
Mobilizing without walking aid, n (%)	130 (76.9%)	134 (82.7%)	.394
Urinary catheter, n (%)	8 (4.7%)	7 (4.5%)	.915

[a]AM-PAC = Activity Measure for Post-Acute Care
[b]Significant $P < .05$.
[c]AM-PAC-BM 1 to 5 without assistance required.

Sample Size and Data Analyses

The calculation of the required sample size was based on a statistical power of 80%, a P value of .05, and a decrease of 15% of the time lying in bed.[2,26] This calculation gave a sample size of at least 74 patient observations for both the baseline period and the post-implementation period.[26] All continuous variables were tested for normality with the Kolmogorov–Smirnov test. Patient characteristics were described using descriptive statistics and tested with the chi-square test, Mann Whitney test, or independent samples t test, where appropriate. For the movement behavior data, first, the time spent per category of movement behavior (ie, lying, sitting, and moving) was calculated per participant. Second, the percentage of observed time in a specific category was calculated per participant. Subsequently, for both periods (baseline and post-implementation), the mean percentages of observed time per category of movement behavior were calculated. Differences in movement behavior and medical outcomes between the 2 periods were tested using the chi-square test, Mann Whitney test, or the independent samples t test, where appropriate. In addition to overall analyses, we stratified per ward.[26] Statistical analyses were conducted using IBM SPSS statistics software.[25]

Results

A total of 171 patient observations on 138 patients were performed during the baseline period. After the implementation period, 163 patient observations on 150 patients were performed. Characteristics of the total study population are presented in Table 1. The majority of the participants were male, with a mean age of 59.5 years (16.1 SD). Around 80% of the patients were able to transfer to chair and walk without assistance. There were no significant differences observed in the characteristics of the population before and after implementation ($P > .05$). Baseline characteristics and context per ward are demonstrated in Table 2.

Throughout the implementation period diverse interventions were developed. In total, 15 interventions were implemented within the actions plans. See Table 3 for an overview of the final delivered interventions per ward. A detailed description of these interventions can be found in Supplementary Appendix 2.

During the baseline period, patients were lying in bed 60.1% (28.9 SD) of the time between 9 am and 4 pm. This percentage decreased after implementation to 52.2% (28.6 SD) ($P = .010$). The percentage sitting increased from 31.6% (25.5 SD) to 38.3% (25.3 SD) ($P = .012$). The percentage moving did not significantly improve after implementation; it changed from 8.3% (7.8 SD) to 9.6% (7.9 SD) ($P = .308$) (Tab. 4).

Analyses per ward show comparable changes in percentages lying, sitting, and moving after implementation (Tab. 5). The time moving increased most on the cardiothoracic surgery ward from 8.2% to 12.7% of the day ($P = .019$), which is in contrast to the medical oncology ward, where the percentage moving decreased from 8.4% to 5.4% ($P = .022$).

Concerning the medical outcomes, the number patients who were discharged to a rehabilitation center significantly decreased from 6 (4.4%) to 1 (0.7%) ($P = .044$). No statistical differences were found in the other secondary outcome measures (Tab. 6).

Discussion

In summary, the multidimensional and multidisciplinary Hospital in Motion project was associated with an overall decline in the time spent lying in bed (−7.9%). Additionally, the time spent sitting up (+6.7%) increased, and the number of patients discharged to a rehabilitation center decreased.

Table 2.
Characteristics and Baseline Context Per Ward[a]

Characteristics	Cardiology	Cardiothoracic Surgery	Medical Oncology	Hematology
Population	Medical	Surgical	Medical	Medical
Number of admission places	32	22	14	20
Baseline characteristics of included patients	N = 41	N = 45	N = 42	N = 43
Length of Stay; mean (SD)	14 (14)	15 (15)	8 (6)	32 (24)
Age; mean (SD)	64 (16)	60 (16)	60 (16)	58 (15)
AM-PAC score; mean (SD)	23 (2)	22 (4)	21 (6)	23 (3)
Mobilizing independently in room;%[b]	88%	82%	79%	93%
Baseline statements patients[c]	N = 40	N = 41	N = 36	N = 42
I find the environment stimulating *(% agrees or strongly agrees)*	30%	44%	33%	21%
I received information about the importance of mobilization and physical activity during hospitalization *(% agrees or strongly agrees)*	60%	66%	50%	74%
The nurse stimulated me to be physically activity *(% agrees or strongly agrees)*	50%	76%	61%	67%
Baseline surveys HCPs (nurses & physicians)	N = 28	N = 24	N = 13	N = 20
In what percentage of the new admissions do you provide information about the importance of physical activity during hospitalization to your patients?	39%	75%	55%	56%
Mobilization of my patients is high on my priority list, also during busy days. *(rank from 0 to 10)*	4	7	6	6
I am willing to actively involve myself in promoting mobilization and physical activity of patients. *(rank from 0 to 10)*	7	8	8	7
Project team	Project manager (LvD) Nurses (N = 2) Physical therapist Cardiologist Unit manager	Project manager (LvD) Nurses (N = 2) Physical therapist Unit manager	Project manager (PB) Nurses (N = 2) Physical therapist Unit manager	Project manager (PB) Nurses (N = 2) Physical therapist Unit manager

[a] AM-PAC, Activity Measure for Post-Acute Care; HCP, health care provider.
[b] AMPAC-BM 1 to 5 without assistance required.
[c] Based on a 5-point Likert scale from totally not agree to totally agree.

An important strength of the Hospital in Motion study is the use of a ward-specific, multidisciplinary, and multidimensional approach.[26] Since patient populations and daily care processes can differ greatly per ward, implementation projects need to be tailored per ward to fulfil specific requirements. Changing the culture regarding physical activity requires fundamental changes to current thinking and practice to patient mobility within the whole organization, including all disciplines.[20] Therefore, the project teams were multidisciplinary, including physical therapists, nurses, physicians, and unit managers. Single initiatives might not be enough to ensure success for change in behavior or for creating sustainable and continual improvement of processes.[20,21] Integrating physical activity in usual care by multidimensional approaches, including interventions aiming at several social ecological levels are more likely to be successful.[17,21,25] Another strength of this study is the primary outcome of movement behavior, measured with the behavioral mapping method, as improving movement behavior is the crucial step in the pathway towards improving patient outcomes. This provided insight into the actual physical activity level of patients as well as insight into the context in which the physical activity or bedrest takes place. This enables detailed evaluation of movement behavior and provides insight in ward-specific opportunities to develop targeted interventions.[26] A limitation of this study is the pre-post design to evaluate the action plan, whereby external factors that may have influenced the outcomes of Hospital in Motion could not

Table 3.
Overview of Implemented Interventions per Ward, Displayed per Topic of the Action Plan[a]

Intervention	Cardiology	Cardiothoracic Surgery	Medical Oncology	Hematology
Education				
Patient information brochure	X	X	X	X
Patient information poster	X	X	X	
Education to staff	X	X	X	X
Pre-admission information		X		X
Physical activity as part of usual care				
Joint lunch for patients (in living room)	X	X	X	X
Eating out of bed	X	X	X	X
Exercise guides and 7-min workout videos with exercises (lying, sitting, and standing)	X		X	X
Stimulating environment				
Improving the patient living room	X	X		
Exercise material and walking aids available	X	X		
QR-code walking route	X	X	X	X
Department map with all facilities	X	X	X	X
Involving third parties				
Stimulating visitors to go walking or do the exercises from the guides with the patient			X	X
Mobility icons	X			
Mobilization milestones and technology				
Daily activity schedule per patient		X		
Highest level of mobility card per patient			X	

[a] X = this intervention was implemented.

Table 4.
Differences in Movement Behavior Pre- and Post-Implementation

Movement Behavior	Baseline (N = 171)	Post-implementation (N = 163)	*P*
Percentage lying, mean (SD)	60.1 (28.9)	52.2 (28.6)	.010[a]
Percentage sitting, mean (SD)	31.6 (25.5)	38.3 (25.3)	.012[a]
Percentage moving, mean (SD)	8.3 (7.8)	9.6 (7.9)	.308

[a] Significant $P < .05$.

be ruled out. In addition, this study investigated the effect of implementing an action plan with multiple interventions, resulting in the understanding that only statements can be made about the impact of the entire action plan and not the individual interventions. A limitation concerning the behavior mapping method is the fact that the behavior of patients or HCPs may have been influenced by the observers' presence during the day. However, a recent study shows a high level of agreement between the behavioral mapping method and an accelerometer.[33]

Studies improving movement behavior in usual care, by implementing multidisciplinary and multi-component

Table 5.
Differences in Movement Behavior Per Ward

Ward	Baseline	Post-implementation	Δ	*P*
Cardiology; mean (SD)	N = 41	N = 39		
Percentage lying	51.0 (29.6)	41.6 (24.1)	9	.136
Percentage sitting	38.9 (24.8)	45.9 (20.8)	7	.146
Percentage moving	10.2 (9.8)	12.4 (10.1)	2	.335
Cardiothoracic surgery; mean (SD)	N = 45	N = 40		
Percentage lying	54.5 (29.7)	46.7 (21.2)	8	.208
Percentage sitting	37.3 (26.4)	40.7 (18.9)	3	.484
Percentage moving	8.2 (7.8)	12.7 (9.2)	5	.019[a]
Medical oncology; mean (SD)	N = 42	N = 43		
Percentage lying	69.3 (24.8)	62.0 (30.2)	7	.349
Percentage sitting	22.3 (21.0)	32.6 (28.1)	10	.096
Percentage moving	8.4 (7.0)	5.4 (6.8)	−3	.022[a]
Hematology; mean (SD)	N = 43	N = 41		
Percentage lying	65.5 (28.1)	57.2 (33.1)	9	.336
Percentage sitting	27.9 (26.6)	34.7 (29.7)	7	.418
Percentage moving	6.6 (6.3)	8.1 (6.7)	2	.268

[a]Significant $P < .05$.

Table 6.
Differences in Medical Outcome Before and After Hospital in Motion

Characteristics	Baseline (N = 136)	Post-Implementation (N = 146)	*P*
Patients with 1 or more immobility-related complication(s) total, N (%)	24 (17.6)	16 (11.0)	.108
Length of stay, in days, mean (SD)	16.9 (17.6)	15.8 (13.6)	.727
Mortality during hospital stay, N (%)	4 (3.0)	1 (0.7)	.149
Discharged to rehabilitation setting, N (%)	6 (4.4)	1 (0.7)	.043[a]
Discharged home, N (%)	108 (80.0)	126 (86.3)	.157
Readmission within 30 days, N (%)	21 (15.6)	20 (13.7)	.660

[a]Significant $P < .05$.

interventions tailored to local context, are still rare. To our knowledge, 1 previous study investigated the effect of multi-component interventions on movement behavior itself.[2] Van de Port et al [2] investigated the implementation of multi-component interventions at a neurology department to increase physical activity of stroke patients and also used the behavioral mapping method. After implementing a daily therapy group, a brochure with exercises, and HCP education, patients spent less time lying (−20%). Additionally, 3 previous studies implemented multi-component interventions to promote physical activity and found positive results on physical and medical outcomes.[21–23] Their implementation models are comparable with the Implementation of Change Model used in this study.[27] However, these programs focused mainly on elderly, whereas low mobility during hospitalization is of all ages. In addition, Liu et al[23] implemented interventions only focusing on HCPs. The study of Mudge et al[22] contained interventions using newly contracted and paid staff, instead of changing current usual care, which was 1 of our main aims for creating sustainable and continual improvement. In addition to the diverse approaches used, it is not possible to compare their effect sizes with our study due to the differences in outcome measures.

Before the start of the project, the mean percentage of lying in bed was 60%, which is consistent with previous observational studies reporting percentages of lying in bed from 49% to 70% of the daytime.[2,3,6] After the implementation, the percentage of lying was reduced to 52%, and the time sitting increased from 32% to 38%, which means patients on average spent 33 minutes more out of bed between 9 am and 4 pm. The percentage moving did not increase significantly. Based on these results, it cannot be stated that patients moved from sedentary (<1.5 Metabolic Equivalent of Task [METs]) to physical active (>1.5 METs).[35] However, it is also clinically relevant to decrease the time spent lying in bed as research shows that this can decrease complications.[35–38] Currently, no data are known about how much change of time spent in bed is clinically relevant. However, we did not achieve the 15% reduction of time lying in bed, which we aimed for a priori as we found a decrease of 8% in time lying in bed. Although, the clinical relevance of this decrease is unclear, these results may be a promising first step in changing the hospital culture regarding movement behavior.

The decreases in time spent lying were comparable at the 4 included wards (range 7.3%–9.4%). Remarkably, the time spent moving only increased at the cardiothoracic surgery ward, from 8.2% to 12.7%. This was the only surgical ward included in this study and the majority of admissions were elective. One of the intervention's characteristics for this ward was that information was sent home to all patients about the importance of and schedule for mobilization after the operation before their admission. Therefore, patients might have been prepared better at getting physically active during their hospital stay. The highest percentage of lying in bed is found at the medical oncology ward (before and after the project), and the time spent moving decreased at this ward after implementation. Reasons for this are unclear.

We have chosen to identify 6 topics a priori in which interventions could be created by the project teams. Although the aim of Hospital in Motion was to form tailored action plans per ward, the final 4 action plans included very similar interventions, which might have been the result of the predefined topics. However, the final interventions might not be equally implemented and effective at all 4 wards. Most interventions within the action plans primarily focused on emphasizing the importance of getting out of bed instead of getting more physically active. This might explain our finding that patients did not move more after the implementation but mostly exchanged time lying for time sitting up. To provide more insight into the reach, adaptations, and impact of the implemented interventions within the action plans, the successful and unsuccessful elements of the implementation approach of Hospital in Motion and the maintenance in daily care, a process evaluation is crucial. Therefore, a detailed process evaluation was performed per ward alongside the effectiveness measurements, following the Medical Research Council guidance of Moore et al.[26–39] Aspects like the reach and adoption per intervention, and barriers and facilitators during the implementation were evaluated. The results of the process evaluation will be reported in 2 separate studies. These results will hopefully help others to develop and implement effective interventions to improve inpatient physical activity. Since this is one of the first studies showing the results of multi-component interventions on movement behavior on different wards of a hospital, more studies are needed investigating interventions designed to change movement behavior during hospitalization. We recommend that future studies investigate interventions that specifically focus on improving time spent moving by patients in addition to decreasing time spent lying and sitting.

Clinical Message

- The time spent lying by patients can be decreased by implementing a multidimensional action plan.
- An in-depth process evaluation is needed to give more insight in the successful and unsuccessful elements of Hospital in Motion.

Author Contributions

Concept/idea/research design: L.M.M. van Delft, P. Bor, K. Valkenet, C. Veenhof
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Ethics Approval

This study was approved by the Medical Ethics Committee (protocol: 16–250) of the University Medical Center Utrecht.

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Disclosure

The authors completed the ICMJE Form for Disclosure of Potential Conflicts of Interest and reported no conflicts of interest.

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