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# Factors Associated With Physical Activity in Hospitalized Patients With Dementia

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## Abstract

Older adults continue to spend little time engaged in physical activity when hospitalized. The purpose of this study was to (a) describe activity among hospitalized older adults with dementia and (b) identify the association between specific factors (gender, ambulation independence, comorbidities, race, and hospital setting) and their physical activity. This descriptive study utilized baseline data on the first 79 participants from the Function Focused Care for Acute Care using the Evidence Integration Triangle. Multiple linear regression models were run using accelerometry data from the first full day of hospitalization. The participants spent an average of 83.7% of their time being sedentary. Male gender, ambulation independence, and hospital setting (the hospital in which the patient was admitted) were associated with greater activity. This study reports on the limited time spent in activity for older adults with dementia when hospitalized and highlights patient profiles that are particularly vulnerable to sedentary behavior in the hospital setting.

### Keywords

accelerometry; older adults; hospitalization

Hospitalization can be a “devastating” event for older adults (Guilcher et al., 2021; Hoenig & Rubenstein, 1991). Not only do older adults experience setbacks arising from their acute illness, but they can also experience physical deconditioning that persists in the postacute period (Falvey et al., 2015; Guilcher et al., 2021; Hoenig & Rubenstein, 1991; Pedersen et al., 2013). Hospital-associated deconditioning occurs when immobility during a hospital stay creates a loss of muscle mass and significant functional decline (Hvid et al., 1985; Smith et al., 2020; Zisberg & Gur-Yaish, 2017; Zisberg et al., 2015). Older adults spend an average of 83%–86% of their hospital stay being sedentary, and only a median of 5.5 min ambulating (Brown et al., 2009; Callen et al., 2004; Fleiner et al., 2016). The deconditioning that arises from this immobility increases the length of hospital stays and increases the susceptibility of patients to hospital-acquired infections or other complications, such as delirium or falls (Admi et al., 2015; Covinsky et al., 2003; Gill et al., 2004; Mudge et al., 2010). The lack of

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physical activity in hospitals directly threatens the environment of healing that hospitals aim to provide.

## Benefits and Barriers to Physical Activity for Hospitalized Older Adults With Dementia

The World Health Organization defines physical activity as “any bodily movement produced by skeletal muscles that requires energy expenditure” (Caspersen et al., 1985; World Health Organization, 2020). In the hospital, physical activity generally refers to all activities that exceed lying in bed (Caspersen et al., 1985; World Health Organization, 2020). Physical activity is particularly beneficial for hospitalized older adults, as it can decrease the risk of falling (Burton et al., 2015; Chen et al., 2020; Fisher, Galloway, et al., 2011; Lee et al., 2016; Resnick & Boltz, 2019), prevent episodes of delirium (Avenda et al., 2016; Boltz et al., 2015; Haley et al., 2019; Kamel et al., 2003), decrease the length of a hospital stay, and prevent future hospitalizations (Hunter et al., 2014; Kuzmik et al., 2021; Resnick & Boltz, 2019).

Unfortunately, older adults with dementia experience multiple compounding barriers to physical activity when hospitalized (Kröpelin et al., 2013; Taylor et al., 2014; Zisberg et al., 2016). Clinical staff who provide care to hospitalized patients with dementia might justify their patient’s lack of activity as a way to protect their safety, believing that limiting activity will decrease fall risk (Kröpelin et al., 2013). Other factors that might prevent physical activity among hospitalized older adults with dementia include the use of tethers, such as continuous pulse oximetry, intravenous infusions, or urinary catheters, and psychological factors, such as depression or agitation that can coexist with dementia (Kröpelin et al., 2013; Taylor et al., 2014). Barriers to physical activity have been further complicated or impacted by the COVID-19 pandemic and include limited out-of-room activity, nursing staff shortages, and visitor restrictions (Danesh et al., 2021; Hugelius et al., 2021).

### Theoretical Framework for Understanding Physical Activity

According to the social-ecological model (Mcleroy et al., 1988; Stokols, 1996), intrapersonal, interpersonal, environmental, and policy factors interact to influence the physical activity of an older adult. The intrapersonal level includes biological and personal factors of older adults that impact their likelihood of physical activity, such as age and gender. Next, the interpersonal level includes the interactions between older adults and others that impact their likelihood of physical activity (e.g., encouragement by a care partner, nurse, or physical therapist to get out of bed and ambulate). Environmental-level factors include whether the setting facilitates safe physical activity, such as access to safe and uncluttered areas to walk, appropriate assistive devices, and/or age-appropriate weights. Last, the policy level includes broad factors that create a climate conducive for physical activity, such as facility recommendations that require patients to get out of bed daily, or regulations allowing patients to walk to diagnostic tests as able (van Alphen et al., 2016). In this study, we used the social-ecological model to guide the examination of such factors and their association with the physical activity of older adults with dementia in the hospital setting.

### Previous Research and Gap

Previous research indicates that the factors associated with sedentary behavior during a hospital stay include worse cognitive impairment, worse physical function, longer length of stay, advanced age, male gender, Black race, presence of delirium, mobility impairment before admission, sleep medication, low caloric intake, hospital environmental safety concerns, comorbidities, and history of falls (Boltz et al., 2010, 2011, 2021; Evensen et al., 2017; Fisher, Goodwin, et al., 2011; Izawa et al., 2015; Kosma & Cardinal, 2016; Pedersen et al., 2013; Zisberg & Syn-hershko, 2016). These associations might occur due to a variety of factors such as socialized norms (e.g., gender); structural and personal racism (e.g., Black race; Boltz et al., 2021; Izawa et al., 2015; Kosma & Cardinal, 2016); or the policies, staffing, and culture of a hospital (e.g., hospital environment; Chase et al., 2018; Zisberg et al., 2011). With few exceptions (Evensen et al., 2017; Kuzmik et al., 2021), most studies supporting the association of these factors and hospital physical activity did not specifically focus on hospitalized older adults who have a cognitive impairment, and all were conducted prior to the COVID-19 pandemic. Older adults with dementia might demonstrate different physical activity patterns in the hospital compared with their peers, given the conditions that coexist with dementia described above, such as depression and agitation, as well as other neuropsychiatric symptoms, such as pacing, repetitive actions, apathy, and sleep disturbances. Additionally, because of measurement challenges, such as overreporting from subjective survey reports, recommendations have been made to utilize objective measurement instruments such as actigraphy in the analysis of physical activity among older adults, especially those with cognitive impairment (Chase et al., 2018; Fjeldsoe et al., 2013; Watts et al., 2013). Given the aforementioned research gaps, research is needed to objectively examine the physical activity of older hospitalized patients with dementia following the impact of the COVID-19 pandemic and the factors associated with their physical activity.

### Study Purpose

Building off prior empirical studies and utilizing the social-ecological model, the purpose of this study was to gain a better understanding of physical activity among older hospitalized patients with dementia following the impact of the COVID-19 pandemic by (a) describing activity among this group and (b) identifying the factors associated with their physical activity. We hypothesized that male gender, fewer comorbidities, greater ambulation independence at admission, White race, and hospital setting would be associated with more physical activity during the first full day of a hospitalization. Understanding the factors that influence physical activity in hospitalized patients with dementia can help identify patients who should be targeted for physical activity interventions, determine the major barriers to physical activity for these individuals, and aid in the implementation of interventions to increase their physical activity and prevent hospital-associated deconditioning.

## Methods

### Design

This was a descriptive study using baseline data from an ongoing study entitled Function Focused Care for Acute Care Using the Evidence Integration Triangle (FFC-AC-EIT;

ClinicalTrialas.gov Identifier: NCT04235374). This study was approved by the University of Maryland Baltimore Institutional Review Board. The focus of FFC-AC-EIT was to help the staff engage patients with cognitive impairment in physical activity during all care interactions and subsequently optimize their patients' function.

## Sample and Settings

Hospitals were eligible to participate in the study if they (a) had at least one unit dedicated to general medical patients; (b) identified two registered nurses to be champions (one for day and one for evening shifts); (c) enabled staff to access email and websites via a phone, tablet, or computer; and (d) did not have a geriatric program (e.g., Acute Care for Elders, Hospital for Elder Life Program/HELP) on the study units. Patients were eligible to participate if they were (a) 65 years of age or older; (b) admitted onto a medical unit for any medical diagnosis; and (c) screened positive for dementia based on a score of ≤20 on the Saint Louis University Mental Status Examination (Shwartz et al., 2019), a score of >2 on the AD8 Dementia Screening Interview (Galvin et al., 2005), a score of 0.5 to 2.0 on the Clinical Dementia Rating Scale (O'Bryant et al., 2008), and a score of ≥9 on the Functional Activities Questionnaire (Pfeffer et al., 1982). Patients were excluded if they (a) were enrolled in hospice, (b) were already on the unit for more than 48 hr, (c) did not have a family member/caregiver to contact, (d) anticipated having surgery, (e) had a major acute psychiatric disorder or significant neurological condition associated with cognition other than dementia, or (f) were COVID-19 positive. Patients with dementia could self-consent if they passed an evaluation, which assessed their capability to sign consent (Resnick et al., 2007). If the patient did not pass the evaluation, we obtained assent from the patient to contact their legally authorized representative, who then went through the consent process. Across six hospitals and two states (Maryland and Pennsylvania), a total of 1,609 patients (67% of all screened) were approached for study involvement, and 112 patients (7% of approached) consented and were enrolled in the FFC-AC-EIT study. Because of early patient discharge or the patient refusing to wear the MotionWatch8, we were only able to obtain a full 24 hr of activity monitoring during the first full day of hospital admission for 79 of these patients. Thus, the sample size for this study was 79 participants.

## Procedure

Trained and blinded evaluators obtained data on the enrolled patients through actigraphy, chart review, observation of the patients, and reports from the patients' care partners and staff during the patient's hospital stay.

## Measures

The major outcome variable of time spent in (sedentary, light, moderate, and vigorous) physical activity was based on 24 hr of MotionWatch8 data collected on patients during the first full day of hospitalization. Time spent in physical activity was treated as a continuous variable. We determined that the first full day of hospitalization, the first midnight through midnight spent at the hospital, would best provide a representative snapshot of the participants' hospital activity prior to the patient receiving the activity intervention. The MotionWatch8 is an activity-monitoring device that contains an accelerometer that measures limb movement and provides an approximation of seconds of whole-body physical activity.

The device was set in 60-s "epochs" of time and was placed on the participants' wrist. Activity levels were based on previously established set rates for older adults, including sedentary, light, moderate, and vigorous levels of physical activity (Landry et al., 2015). Specifically, these levels were set at less than or equal to 178 counts per min for sedentary activity, between 179 and 561 counts per min for light activity, between 563 and 1,019 counts per min for moderate-level activity, and greater than or equal to 1,020 counts per min for vigorous-level activity (Landry et al., 2015). Feasibility, construct validity, and predictive validity of the MotionWatch8 have been established in hospitalized persons with dementia (Kuzmik et al., 2021; Landry et al., 2015).

The measured factors associated with physical activity included gender, race, comorbidities, ambulation independence, and hospital setting. Gender and race were obtained through self-report and coded as nominal variables. Comorbidities were measured using the Charlson Comorbidity Index (Resnick et al., 2007), which is a summary measure of the total number of comorbidities. Higher scores on the Charlson Comorbidity Index indicate a greater number of comorbidities (Quan et al., 2011). Evaluators completed the Charlson Comorbidity Index through chart review. Ambulation independence was measured through nurse report of their patient's independence in walking 50 yards, which was a single item from the Barthel Index (Mahoney & Bathel, 1965). Scores included 1, *easy/no device; 2, with difficulty or uses device; 3, some help*; and 4, *dependent*. Both the Charlson Comorbidity Index and Barthel Index have demonstrated strong validity through prior studies (Collin et al., 1988; Mahoney & Bathel, 1965; Quan et al., 2011). Last, the hospital setting variable was coded as a nominal value designating the hospital (1–6) in which the patient received care. See Table 1 for a description of the hospitals.

### Data Analysis

We performed descriptive analysis to evaluate central tendency and outliers. We then used multiple linear regressions to examine the association of the predictor variables (e.g., gender, race, comorbidities, ambulation independence, and hospital setting) with time spent in different intensities of physical activity. Given that only four older adults performed any vigorous activity, we decided to group vigorous and moderate activity together into one model. Thus, we performed three separate multiple linear regression models to determine the association of the predictor variables for each level of physical activity (vigorous/moderate activity, light activity, and sedentary behavior). There was no evidence of multicollinearity among the predictor variables, with all variance inflation factors less than 5. We set a $p$ value significance level of ≤ .05 and used SPSS (version 25) to conduct all analyses.

## Results

Our sample consisted of the first 79 participants of the FFC-AC-EIT intervention study. The 79 participants had a mean age of 82.86 years old, 63.3% identified as female, and 64.6% identified as White (Table 2). The average score on the Saint Louis University Mental Status Examination was 6.75 (a score of 0–19 or 0–20 indicates dementia, depending on high school education). The most common reasons for admission were infection (24%); change in cognition (13%); and fall, weakness, or syncope (11%). During the first full day of

hospitalization, the participants spent an average of 1 min (*SD* = 6 min) in vigorous activity, 9 min (*SD* = 24 min) in moderate activity, 223 min (*SD* = 189 min) in light activity, and 1,205 min (*SD* = 206 min) in sedentary behavior. Thus, within a 24-hr period, this sample spent an average of 0.07% of their time in vigorous activity, 0.63% of their time in moderate activity, 15.5% of their time in light activity, and 83.7% of their time being sedentary.

Among hospitalized older adults with dementia, we found that male gender, ambulation independence, and hospital setting were associated with physical activity (Table 3). In particular, we found that male gender was associated with more time in light activity ($b = -8{,}482.46$, $p = .003$), whereas female gender was associated with more time in sedentary behavior ($b = 9{,}136.59$, $p = .003$). For instance, on average, female participants demonstrated approximately 152 additional sedentary minutes within the 24-hr hospitalization period, compared with male participants. We found that ambulation *independence* was associated with more time in light activity ($b = -2{,}916.90$, $p = .04$), whereas greater ambulation *dependence* was associated with more time in sedentary behavior ($b = 3{,}107.74$, $p = .04$). For example, a 1-point increase in ambulation dependence was associated with an additional 52 sedentary minutes within the 24-hr hospitalization period. Last, we also found that the hospital in which the patients were admitted was associated with their activity levels. For instance, participants in the reference hospital had approximately 24 more minutes on average of combined vigorous and moderate activity, compared with participants in Hospital 6. Overall, the combined factors (gender, ambulation independence, comorbidities, race, and hospital setting) explained 18% of the variance for vigorous and moderate activity, 25% of the variance for light activity, and 26% of the variance for sedentary behavior.

## Discussion

This study found that participants spent 83.7% of their first full day of hospitalization being sedentary. This finding suggests that this population of older adults with dementia is spending a considerable amount of time being sedentary when hospitalized, at levels similar to their peers without dementia (Brown et al., 2009; Callen et al., 2004; Fleiner et al., 2016). Large amounts of sedentary time in the hospital is concerning because it is associated with hospital-associated deconditioning and greater hospital-based complications (Admi et al., 2015; Brown et al., 2009; Callen et al., 2004; Covinsky et al., 2003; Fleiner et al., 2016; Gill et al., 2004; Hvid et al., 1985; Mudge et al., 2010; Smith et al., 2020; Zisberg & Gur-Yaish, 2017; Zisberg et al., 2015). As previously mentioned, the COVID-19 pandemic might have increased barriers to physical activity among older adult patients with dementia due to staffing shortages and visitor restrictions (Danesh et al., 2021; Hugelius et al., 2021). Although hospital clinical staff might prioritize immediate tasks such as patient toileting or medication administration, it is well established that hospital patients who perform more activities have better long-term outcomes (Kim et al., 2020; Nuzum et al., 2020; Tan et al., 2017). This study highlights the need for initiatives that engage hospitalized older adults in physical activity and promote their mobility (Agency for Healthcare Research and Quality, 2021; American Academy of Nursing, 2021; Fisher et al., 2016; Sari, 2010).

We found that two “intrapersonal” factors of the social-ecological model (male gender, ambulation independence) were associated with the physical activity of hospitalized older adults with dementia. The association of better physical function with greater physical activity among hospitalized older adults with dementia corroborates previous research findings (Evensen et al., 2017; Kuzmik et al., 2021), while the association between male gender and more physical activity provides clarity to previous inconsistent research findings (Kuzmik et al., 2021; Zisberg & Syn-hershko, 2016).

This study also found that patient physical activity levels vary by hospital; thus, the hospital in which the patient is admitted can contribute to their physical activity level. This finding mirrors the social-ecological model, which suggests that broad “environmental” factors can create a climate conducive or not conducive for physical activity. While determining the cause of differences in patient physical activity by hospital is not within the scope of this paper, explanations could include differences in hospital policies that require patients to get out of bed daily or differences in nurse/physical therapist staffing and deployment (e.g., competing patient demands), staff perception that physical activity increases the risk of falls, and equipment availability (e.g., chairs, gait belts; Cooper et al., 2021; Jamshidi et al., 2020; Johnson et al., 2021; Rosbergen et al., 2022; Scheerman et al., 2020). From our data, we did not qualitatively observe differences in trends of physical activity by hospital characteristics such as urban versus suburban or size (Table 1). Future research should test specific hospital environmental factors and their association with differences in patient physical activity.

The examined factors for the vigorous/moderate activity, light activity, and sedentary behavior models only explained 18%, 25%, and 26% of the variance, respectively. Additional factors that may help explain the physical activity of hospitalized patients with dementia not examined in this study include the use of psychotropic medications, nurse motivation, and patient self-efficacy. For instance, nurses may or may not feel motivated to encourage their patients to maintain physical activity in the hospital, even when they are met with resistance by the patients (Cooper et al., 2021; Koenders et al., 2020; Meesters et al., 2019; Scheerman et al., 2020). In particular, nurse managers, who are known to play a critical role in promoting the uptake of evidence-based practice, often do not prioritize mobility as a nursing activity and clinical outcome (Doherty-King & Bowers, 2011). Similarly, an older adult’s sense of self-efficacy, or the belief in their capacity to perform physical activity, can facilitate or hinder their levels of physical activity in the hospital (Schutzer & Graves, 2004; Spiteri et al., 2019). Last, a larger sample size would have provided more variance for the time spent in physical activity.

## Limitations and Strengths

The major limitations of this descriptive study are the sample size and data limitations from the use of secondary data. This sample size consisted of 79 older adults across six hospitals in only two states. As the participant information was pulled from an activity intervention study, we were limited to using data from the first 48 hr of the patient’s hospital admission, prior to the patient receiving the activity intervention. It is possible that patients vary in physical activity depending on how many days they have spent in the hospital. Additionally, due to the examination of physical activity and the associated factors at one point in time,

the associations do not prove correlation. Researchers might consider assessing physical activity during the pandemic, compared with before the pandemic, by evaluating different time points, such as matching patients by demographics and setting.

Despite these limitations, this study has many strengths. Considering that one in four hospitalized older adults has dementia (Fogg et al., 2018), the study of hospitalized older adults with dementia is meaningful. This study's sample of participants reflected the demographics of older adults with dementia in gender, age, and race, as dementia is more prevalent for female Americans and Black Americans (Aging, 2020; Assocation, 2021). This research highlights patient profiles that are particularly vulnerable to sedentary behavior in the hospital setting, such as female older adults with dementia and older adults with ambulation dependence. Physical activity interventionists in the acute care setting, both clinical and research based, might consider focusing their activity interventions (e.g., physical therapy referrals, encouraging ambulation) on this population.

## Conclusion

This study reports on the physical activity of hospitalized older adults with dementia in the postpandemic environment, finding that participants spent 83.7% of their time being sedentary. Male gender and greater ambulation independence were associated with greater activity. Furthermore, the hospital in which the patients were admitted was associated with their activity levels. The findings from this study support a need to continue to focus on approaches to increase physical activity for older patients with dementia and to particularly focus on those who are female and not independent in ambulation.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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**Table 1**

Hospital Characteristics

| | Suburban vs. urban | Hospital size | Number of patients from hospital included in this study |
|---|---|---|---|
| Hospital 1 | Urban | Medium | 24 (30.4%) |
| Hospital 2 | Urban | Large | 10 (12.7%) |
| Hospital 3 | Suburban | Medium | 9 (11.4%) |
| Hospital 4 | Suburban | Medium | 9 (11.4%) |
| Hospital 5 | Urban | Medium | 18 (22.8%) |
| Hospital 6 | Suburban | Large | 9 (11.45) |

*Note*. Small hospital < 100 beds; medium hospital= 100–499 beds; large hospital > 500 beds.

**Table 2**

Participant Characteristics

| Characteristics | Total *N* | Mean (*SD*) | *n* (%) |
|---|---|---|---|
| Age | 79 | 82.86 (7.69) | |
| SLUMS | 79 | 6.75 (5.50) | |
| Base comorbidities | 78 | 2.37 (1.54) | |
| Baseline Barthel index | 78 | 63.04 (26.94) | |
| Gender | 79 | | |
| Women | | | 50 (63.3%) |
| Men | | | 29 (36.7%) |
| Race/ethnicity | 79 | | |
| White | | | 51 (64.6%) |
| Black or African American | | | 24 (30.4%) |
| Asian | | | 4 (5.1%) |
| Education, *n* (%) | 79 | | |
| <High school | | | 16 (20.3%) |
| High school | | | 35 (44.3%) |
| >High school | | | 28 (35.6%) |
| Ambulation independence, *n* (%) | | | |
| Easy/no device | | | 4 (5.1%) |
| With difficulty/uses device | | | 19 (24.1%) |
| Some help | | | 14 (17.7%) |
| Dependent | | | 42 (53.2%) |

*Note*. SLUMS = St. Louis University Mental Status Exam.

## Table 3

Factors Associated With Vigorous/Moderate Activity, Light Activity, and Sedentary Behavior ($N = 77$)

| Factor | Beta (*SE*) | *p* |
|---|---|---|
| Vigorous and moderate activity, $R^2 = .18$ | | |
| Gender (reference: Male) | | |
| Female | −654.13 (431.71) | .13 |
| Ambulation independence | −190.84 (214.13) | .38 |
| Comorbidities | −7.57 (138.78) | .96 |
| Race (reference: White race) | | |
| Black race | 687.48 (598.48) | .26 |
| Asian race | 1,611.86 (894.34) | .08 |
| Hospital setting (reference: Hospital setting 1) | | |
| Hospital setting 2 | −1,074.66 (879.95) | .23 |
| Hospital setting 3 | −1,550.60 (772.94) | .05* |
| Hospital setting 4 | −445.16 (677.47) | .51 |
| Hospital setting 5 | −1,043.67 (567.73) | .07 |
| Hospital setting 6 | −1,456.84 (684.39) | .04* |
| Light activity, $R^2 = .25$ | | |
| Gender (reference: Male) | | |
| Female | −8,482.46 (2,747.26) | .003* |
| Ambulation independence | −2,916.90 (1,362.67) | .04* |
| Comorbidities | 329.30 (883.18) | .71 |
| Race (reference: White race) | | |
| Black race | 2,257.54 (3,808.57) | .56 |
| Asian race | 2,293.58 (5,691.35) | .69 |
| Hospital setting (reference: Hospital setting 1) | | |
| Hospital setting 2 | −9,965.56 (5,599.79) | .08 |
| Hospital setting 3 | −12,493.96 (4,918.76) | .01* |
| Hospital setting 4 | −4,550.32 (4,311.27) | .30 |
| Hospital setting 5 | −7,045.70 (3,612.88) | .06 |
| Hospital setting 6 | −8,002.82 (4,355.26) | .07 |
| Sedentary behavior, $R^2 = .26$ | | |
| Gender (reference: Male) | | |
| Female | 9,136.59 (2,972.73) | .003* |
| Ambulation independence | 3,107.74 (1,474.50) | .04* |
| Comorbidities | −321.73 (955.66) | .74 |
| Race (reference: White race) | | |
| Black race | −2,945.01 (4,121.14) | .48 |
| Asian race | −3,905.44 (6,158.43) | .53 |
| Hospital setting (reference: Hospital setting 1) | | |
| Hospital setting 2 | 11,040.22 (6,059.36) | .07 |
| Hospital setting 3 | 14,044.56 (5,322.44) | .01* |

| Factor | Beta (*SE*) | *p* |
|---|---|---|
| Hospital setting 4 | 4,995.48 (4,665.09) | .29 |
| Hospital setting 5 | 8,089.36 (3,909.38) | .04* |
| Hospital setting 6 | 9,459.66 (4,712.69) | .05* |

*Note*. Units = seconds.