


Impact of COVID-19 Stay-At-Home Restrictions on Falls in One Community of High-Risk Older Adults

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Abstract

Aim: To examine the relationship between falls among high-risk older adults at one Program of All-Inclusive Care for the Elderly (PACE) and the COVID-19 closure of its Day Health Center (DHC), which provides participants with social and rehabilitative services and contributes to their weekly physical activity. **Methods:** Self-reported falls during the 3 months before the DHC's closure ("pre-COVID-19") were compared in number and in character to falls during its closure ("COVID-19"). **Results:** One thirty five participants were enrolled during the entire 6-month period; 37% ($n = 50$) fell during this time. These participants experienced fewer falls during COVID-19 (mean = 0.64) than they did pre-COVID-19 (mean = 1.24, $p = .0003$). **Conclusions:** In this population of high-risk, community-dwelling older adults, an abrupt reduction in activity levels may have reduced falls. Physical activity has been shown to both increase and protect against falls in older adults. The long-term consequences of a comparably prolonged period of inactivity merit further study.

Keywords

falls, frailty, physical activity, COVID-19

Introduction

Stay-at-home orders prompted by COVID-19 decreased levels of physical activity worldwide ("The Impact Of Coronavirus On Global Activity - Fitbit Blog," 2020). In older adults at increased risk for deconditioning, prolonged reductions in activity levels may adversely affect health and functional outcomes. Developing an understanding of the multifold ways that physical inactivity associated with COVID-19 has and will impact the health of older adults is critical (Roschel et al., 2020).

The Program of All-Inclusive Care for the Elderly (PACE) is a long-term care model in the United States that allows high-risk older adults to continue living in the community ("Program of All-Inclusive Care for the Elderly (PACE)," n.d.). Because nursing home (NH) eligibility is a prerequisite for PACE enrollment, participants tend to be more physically or cognitively impaired than their community-dwelling peers. Program of All-Inclusive Care for the Elderly's use of capitated financing over a fee-for-service model allows care teams to prioritize the holistic and long-term well-being of their participants. Day Health Centers (DHC) at PACE provide participants with a continuum of services including a midday meal, social activities, and rehabilitative services (including physical and occupational therapy). The commute to and from the DHC and its occupational and physical

therapy services provide PACE participants—who attend the DHC on average 2–3 days per week—with much of their weekly physical activity. In March 2020, state-by-state mandates due to the COVID-19 pandemic forced the widespread closure of adult day care centers, including in Maryland where this study took place (Hogan, 2020). Because visits to the DHC might be considered a proxy for weekly physical activity for much of the PACE population, the DHC's abrupt closure during COVID-19 provided a window into the potential risks and benefits of physical activity in this population.

In this context, studying falls is appropriate. Falls are the leading cause of injury and death from injury among older Americans and have a well-documented impact on well-being (Bergen et al., 2016; Chang et al., 2010; Stenhagen et al., 2014; "The National Institute on Aging: Strategic Directions for

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Table 1. Characteristics of the Study Population (SD = standard deviation, * $p < .05$).

Characteristics	Total ($n = 135$)	No Fall in Last 6 Months ($n = 85$)	1 or Multiple Fall(s) in Last 6 Months($n = 50$)	p -Value in Chi-Squared for Categorical Variables
Age, mean (SD), years	76 (11)	77 (11)	76 (10)	.61
Sex (%)				
Female	100 (74%)	68 (80%)	32 (64%)	.041*
Male	35 (26%)	17 (20%)	18 (36%)	
Race (%)				
African American/Black	93 (69%)	60 (71%)	33 (66%)	.68
White	38 (28%)	22 (26%)	16 (32%)	
Other	4 (3%)	3 (3%)	1 (2%)	
Ethnicity (%)				
Hispanic or Latino	3 (2%)	2 (2%)	1 (2%)	.89
Not Hispanic or Latino	132 (98%)	83 (98%)	49 (98%)	
BMI (%)				
<18.5	2 (1%)	1 (1%)	1 (2%)	.41
18.5–24.9	44 (33%)	24 (28%)	20 (40%)	
25–29.9	33 (24%)	24 (28%)	9 (18%)	
>30	56 (41%)	36 (42%)	20 (40%)	
Antidepressants (%)				
Yes	60 (44%)	34 (40%)	26 (52%)	.17
No	75 (56%)	51 (60%)	24 (48%)	
Antipsychotics (%)				
Yes	18 (13%)	13 (15%)	5 (10%)	.38
No	117 (87%)	72 (85%)	45 (90%)	
Diagnosed with COVID-19 (%)				
Yes (%)	14 (10%)	8 (9%)	6 (12%)	.63
No (%)	121 (90%)	77 (91%)	44 (88%)	
Living Situation				
ALF	21 (16%)	11 (13%)	10 (20%)	.66
NH	8 (6%)	6 (7%)	2 (4%)	
Home Alone	37 (27%)	24 (28%)	13 (26%)	
Home with Relative(s)/Spouse/ Caregiver	69 (51%)	44 (52%)	25 (50%)	
Days/Week attending DHC, mean (SD) (range = 0–5)	2.5 (1.2)	2.5 (1.2)	2.4 (1.3)	.81
Berg balance Scale Score, mean (SD) (range = 0–56)	31 (16)	33 (16)	29 (14)	.15
Ambulatory assistive device (%)				
None	23 (17%)	16 (19%)	7 (14%)	.87
Cane	20 (15%)	12 (14%)	8 (16%)	
Rolling walker/rollator	68 (50%)	43 (51%)	25 (50%)	
Non-ambulatory	24 (18%)	14 (16%)	10 (20%)	

Research, 2020–2025,” n.d.). The relationship between falls and physical activity is complex; while providing protective benefits, physical activity—particularly walking—can simultaneously increase risk for a fall event (Brodie et al., 2017; Gregg et al., 2000).

The COVID-19 pandemic reduced the likelihood that PACE participants left their homes and likely resulted in reduced levels of physical activity, creating conditions that allowed us to examine the efficacy of the status quo in the PACE program’s efforts to prevent falls while maintaining the strength and mobility of their patient population. The primary

aim of this study was to examine the association of the mandated closure of the DHC at one PACE site during COVID-19 on falls among PACE participants.

Methods

COVID-19 Context

The COVID-19 pandemic was declared a national emergency by the United States government on March 13th, 2020 (“Proclamation on declaring a national emergency concerning the novel Coronavirus disease (COVID-19) outbreak,” n.d.).

Stay-at-home orders and non-essential business closures were made at the discretion of each state's government. In Maryland, the location of the PACE site where this study was conducted, adult day care centers were ordered to close on March 17th, 2020 (Hogan, 2020). Soon afterward, daily activities were severely restricted by the closure of non-essential businesses and stay-at-home orders. This was especially true for older adults, who were urged by government guidelines to remain home as much as possible, due to the absence of a COVID-19 vaccine.

We compared falls at one PACE site in Maryland during the 3 months before its DHC's closure on March 17th, 2020 ("pre-COVID-19") to falls during the 3 months following its closure ("COVID-19"). The context described above remained relevant for the 6-month length of the study period.

Study Population

All individuals in the study were enrolled participants in Hopkins ElderPlus, a PACE site in Baltimore, Maryland (Table 1). Only participants enrolled during both time periods being compared (specified below) were included. Any participant who experienced one or more fall(s) across the two time periods being compared are referred to as "fallers."

Data Collection

Falls at Hopkins ElderPlus are reported to a staff member either by the participant themselves, a family member, a caregiver, or a staff member at the assisted living facility (ALF) or NH where the participant is living. Program reporting guidelines define a fall as, "a sudden, unintentional, descent of the body to either the floor/ground, or another object" ("PACE Quality Monitoring & Reporting Guidance," 2018). The details of each fall—including its time, date, location, precipitating activity, harm, and injury—are entered into a log at the program's daily team meeting.

Demographic data, as well as body mass index (BMI), living situation, use of ambulatory assistive device, COVID-19 diagnosis, and Berg Balance Scale (BBS) score (Berg et al., 1992), was gathered from the electronic health record. Monthly reports on antidepressant and antipsychotic medications were gathered. Our study was reviewed by the Institutional Review Board (IRB), who determined that this study qualified as a quality improvement project to guide appropriate use of the DHC for certain subgroups of the PACE population and would only utilize retrospective data. Therefore, participants did not provide informed consent.

Measures

The primary independent variable was the time of the fall event (which fell into either the "pre-COVID-19" or "COVID-19" time period, as specified above). The primary outcome measure was the fall rate, calculated as the number

of falls in a given time period divided by the number of adults participating in the program in that time period. We also examined the proportion of adults having any (one or more) falls during a given time period. Secondary outcome measures included the location of fall, activity during fall, and harm level and injury associated with fall. Covariates included age, sex, race, ethnicity, BMI, antidepressant use, antipsychotic use, COVID-19 diagnosis, living situation, days per week attendance at the DHC, BBS score, and use of an ambulatory assistive device.

Statistical Analyses

To examine the relationship between falls and time period, we used paired, two-tailed t-tests assuming equal variance for continuous variables. To examine the relationship between fall location and activity and time period, we used chi-squared tests in conjunction with post hoc analysis of residuals to determine which categories were contributing to the significant chi-squared statistics. Univariate Poisson regressions of patient characteristics were used to evaluate falls pre-COVID-19, falls during COVID-19 and a reduction in falls across time periods. A p -value $< .05$ was considered significant. Analyses were performed using Stata version 15.

Results

Patient Characteristics

A total of 135 participants were enrolled at Hopkins ElderPlus and were included in our review (Table 1). The mean age of participants was 76 years, 74% were female, and 69% were African American/Black. 50 participants (37%) met criteria for the comparison. Participants who had at least one fall in the 6 months ("fallers") were more likely to be female as compared to participants who had no falls in the 6 months ("non-fallers"). There were no other differences between fallers and non-fallers.

Fall Outcomes

Pre-COVID-19 and COVID-19 Falls. There were 94 falls during the study period; 62 total falls reported pre-COVID-19 and 32 total falls reported during COVID-19 (Table 2). Fallers experienced fewer falls during COVID-19 (mean = 0.64) than they did pre-COVID-19 (mean = 1.24, $p = .0003$) (Figure 1). Among fallers, a higher proportion experienced zero falls during COVID-19 (56%) than those who experienced zero falls pre-COVID-19 (16%, $p = .0002$).

Falls by Location and Activity. We further evaluated falls by location and activity (Table 2). Falls pre-COVID-19 and falls during COVID-19 differed as to the proportion of falls that occurred at home, at the DHC, in transportation, or in the community ($p = .053$) (Figure 1). More falls took place in the

Table 2. Characteristics of Falls during Pre-COVID-19 versus COVID-19 (SD = standard deviation, †chi-squared for categorical variables, ‡paired t-test, * $p < .05$).

	Falls During the 6-Month Study Period (n = 94)	Falls During the 3 Months of Pre-COVID-19 (n = 62)	Falls During the 3 Months During COVID-19 (n = 32)	p-Value
Total number of fallers	50	42	22	
Average number of falls per faller (mean, SD)	1.9 (1.4)	1.5 (0.8)	1.5 (0.9)	
Location of fall (%)†				.053
DHC	8 (9%)	8 (13%)	N/A	
Transportation	2 (2%)	2 (3%)	N/A	
Home	77 (82%)	46 (74%)	31 (97%)	
Community	7 (7%)	6 (10%)	1 (3%)	
Activity during fall (%)‡				.012*
Reaching	5 (5%)	1 (2%)	4 (13%)	
Sitting	11 (12%)	10 (16%)	1 (3%)	
Standing	7 (7%)	3 (5%)	4 (13%)	
Transfer	27 (29%)	15 (24%)	12 (38%)	
Walking	29 (31%)	24 (39%)	5 (16%)	
Found on ground/Unknown	15 (16%)	9 (15%)	6 (19%)	
Harm score (%)‡				.20
3	47 (50%)	40 (51%)	17 (53%)	
4	23 (24%)	20 (25%)	8 (25%)	
5	22 (23%)	17 (22%)	7 (22%)	
6	2 (2%)	2 (3%)	2 (6%)	
Injury (%)‡				.21
Injury	50 (53%)	31 (50%)	19 (59%)	
No injury	44 (47%)	31 (50%)	13 (41%)	

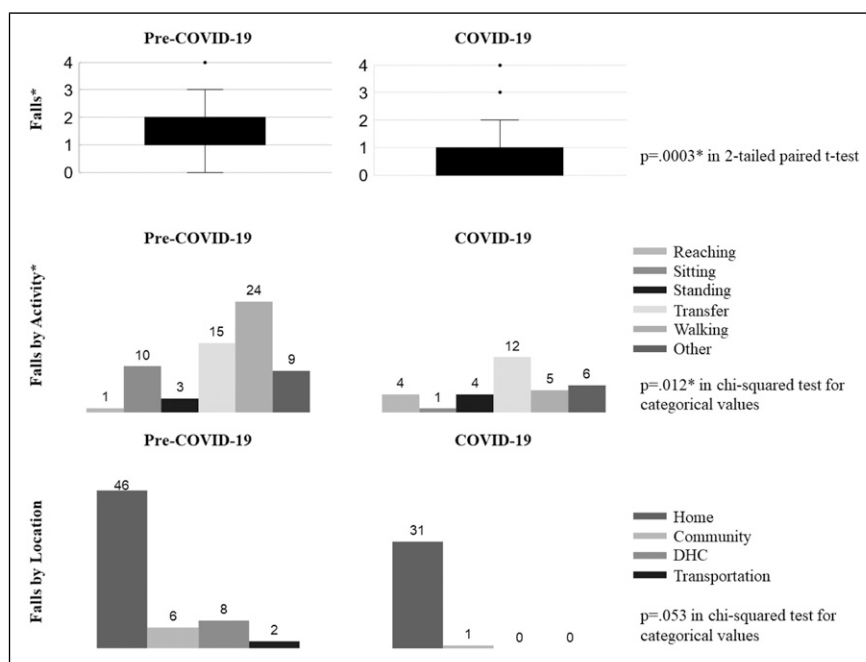


Figure 1. Pre-COVID-19 and COVID-19 comparison of overall falls per participant, falls by location, and falls by activity (* $p < .05$).

home during COVID-19 (84%) than did falls pre-COVID-19 (51%). Falls while walking decreased from 39% of falls pre-COVID-19 to 16% of falls during COVID-19, disproportionate to the overall reduction in falls.

Falls by Harm Score. There was no difference in harm score per fall or fall-related injuries when comparing falls pre-COVID-19 and during COVID-19.

Falls and Patient Characteristics. Among patient characteristics, only living home alone was found to be associated with the number of pre-COVID-19 falls ($p = .038$). No patient characteristics were found to be associated with number of COVID-19 falls or to be associated with a reduction in falls across the time periods.

Discussion

Our findings suggest that the conditions during the early months of COVID-19 were associated with lower numbers of reported falls among PACE enrollees. Stay-at-home orders and business closures, including the closure of the Hopkins ElderPlus DHC, reduced the number of settings that were possible to visit during these months. The restrictions decreased opportunities for walking and kept participants in the home, which may have carried fewer fall-risks than other settings.

Visits to the DHC make up a significant portion of many participants' weekly physical activity. Prior to the DHC's COVID-19 closure, participants attended the DHC an average of 2–3 days per week. For ambulatory participants, each visit includes walking the 150 feet between the transportation van and the DHC, plus a variable distance from the participant's home to the transportation van. Furthermore, occupational and physical therapy is incorporated into a day at the DHC for many participants. Whether or not participants compensated for the restricted opportunities for physical activity outside of the home with alternate exercise modalities is unknown. Determining causality between the DHC's closure and the observed reduction in falls is not possible from our data. We note that the number of days per week a participant spends at the DHC was not associated with a reduction in falls across the time periods. This lack of an association could suggest that attending the DHC more frequently does not increase one's risk of falling as compared to staying home. Alternatively, the reasons for attending the DHC a certain amount per week vary between participants, which may have obscured an association between DHC days and fall risk.

Fear of hospital settings during COVID-19 may have prompted heightened caution in the home that contributed to the reduction in falls. In March 2020, a widespread decrease in hospital admissions was observed, thought to have been driven by fear of exposure to the virus (Huynh, 2020). The well-publicized impact of the virus on older adults is likely to

have exaggerated this phenomenon in the PACE population (CDC, 2020).

The strengths of the study stem from two attributes of the PACE model. First, the capitated payment model and emphasis on care coordination incentivize the careful tracking of falls, doing so allows for individualized care planning and the observation of clinic-wide trends for quality improvement. Second, the centrality of the DHC in its care model puts PACE in a better position than other outpatient geriatric care settings to understand the ways in which participants' daily activities changed during the COVID-19 closure.

The most important limitation of this study is the possibility of underreporting during COVID-19. The reduced number of in-person healthcare interactions prevented staff members from observing visible changes in participants that may have prompted a fall report under normal circumstances. However, weekly wellness calls from PACE social workers provided participants with a facilitated opportunity to report a fall during COVID-19. Furthermore, given participants' familiarity with fall reporting at PACE, there is reason to believe that self-reporting did not decline.

These findings shed light on the complex relationship between physical activity and falls in older adults; while we know that lack of activity can accelerate sarcopenia and increase fall risk (Bell et al., 2016; Breen et al., 2013), walking itself has also been shown to exaggerate fall risk (Brodie et al., 2017; Sherrington et al., 2020). While not simple, the direction of the relationship between physical activity and fall risk depends on the functional status of the older adult. One study, for example, isolated four older adult risk groups through device monitoring of daily walking patterns; they observed that both the most active ("the Athletic") risk group and the least active ("the Restrained") risk group had low fall rates (Brodie et al., 2017). The groups with high fall rates were ("the Impaired")—people with gait impairments that led to physical deconditioning and falls—and "the Active," who were healthier and more active than the Impaired, but were exposed to more places and situations where falls could occur (Brodie et al., 2017). Using this framework may help to understand our findings among PACE participants. External factors related to COVID-19 may have shifted previous "Active" individuals into the "Restrained" risk group; in other words, people fell less because there were fewer opportunities to do so.

What is not visible from our data is the longer-term consequences of a COVID-19-related decline in activity. In a survey conducted in January 2021, one third of American older adults reported reduced activity levels since the start of the pandemic (Hoffman et al., 2021). Associated with the reduced activity was a two to threefold worsening of self-reported physical function as well as increased risk of falls and fear of falling (Hoffman et al., 2021). These findings suggest a tipping point—perhaps not yet reached by the time of our study—at which a step count reduction leads to muscle loss, physical deconditioning, and falls.

Furthermore, if the restrictive conditions of COVID-19 did indeed bring about a temporarily safer environment for the PACE population, quality of life represents an unmeasured tradeoff. Social distancing measures related to COVID-19 have already been associated with significant decreases in self-perceived mental health and vitality among older adults (Almeida et al., 2021). The DHC and other community settings provide many participants with important social interaction. Increased day center use at PACE programs has also been linked to reduced hospital admissions (Temkin-Greener et al., 2008). While this study provides a snapshot of one short-term beneficial health outcome caused by the conditions of COVID-19, the long-term consequences of a comparably prolonged period of inactivity merit further study.

Care planning for populations of highly disabled older adults should emphasize strength training (Ganz & Latham, 2020), cognizant of the potential fall risk posed by walking. Furthermore, upon returning to in-person services, long-term care settings should be aware of a potential decline in strength in this older adult population; heightened caution to protect against falls during this time of transition is warranted.

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Declaration of Conflicting Interests

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IRB Approval

This study was approved by the Johns Hopkins IRB, IRB approval number: 00256352.

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