Feasibility of Measuring Physical Activity Using Accelerometry in Hospitalized and Community-Living Older People with Cognitive Impairment

Loevezijn, Ariane A. van; Cameron, Ian D; Kurrle, Susan E; Bodegom, David van

Sheryl Zimmerman, PhD
School of Social Work, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina

Kimberly Ward, BA
David Reed, PhD
Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina

Robert Rodriguez, BA
School of Medicine, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina

Christine E. Kistler, MD, MASc
Department of Family Medicine, Cecil G. Sheps Center for Health Services Research, School of Medicine, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina

ACKNOWLEDGMENTS

This manuscript was presented as a poster at the John B. Graham Student Research Day at the University of North Carolina at Chapel Hill School of Medicine on January 17, 2013, and on May 3–4, 2013, at the American Geriatrics Society annual conference at the Presidential poster session and student poster session.

Conflict of Interest: The editor in chief has reviewed the conflict of interest checklist provided by the authors and has determined that the authors have no financial or any other kind of personal conflicts with this paper. Dr. Kistler was supported by Award K12 HS19468–01 from the Agency for Healthcare Research and Quality awarded to the University of North Carolina (UNC) Mentored Career Development Program in Comparative Effectiveness Research and by the UNC Lineberger Comprehensive Cancer Center. This research also was supported by the National Center for Research Resources and the National Center for Advancing Translational Sciences, National Institutes of Health, through Grant KL2TR000084. It was conducted as one of the Collaborative Studies in Long-Term Care through the Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill.

Author Contributions: Kathryn Moore and Christine Kistler had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Kistler, Lewis, Zimmerman. Acquisition of data: Moore, Ward, Rodriguez, Kistler. Analysis and interpretation of data: Moore, Lewis, Zimmerman, Reed, Kistler. Drafting of the manuscript: Moore, Lewis, Zimmerman, Kistler. Critical revision of the manuscript for important intellectual content: Moore, Lewis, Zimmerman, Reed, Ward, Rodriguez, Kistler. Statistical analysis: Reed, Kistler. Obtained funding: Moore, Kistler. Administrative, technical, and material support: Ward.

Sponsor's Role: The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

REFERENCES

1. Preventive US. Services Task Force. Screening for colorectal cancer: U.S. Preventive Services Task Force recommendation statement. Ann Intern Med 2008;149:627–637.
2. Walter LC, Covinsky KE. Cancer screening in elderly patients: A framework for individualized decision making. JAMA 2001;285:2750–2756.
3. Bellizzi KM, Breslau ES, Burness A et al. Prevalence of cancer screening in older, racially diverse adults: Still screening after all these years. Arch Intern Med 2011;171:2031–2037.
4. Kistler CE, Kirby KA, Lee D et al. Long-term outcomes following positive fecal occult blood test results in older adults: Benefits and burdens. Arch Intern Med 2011;171:1344–1351.
5. Schonberg MA, Leveille SG, Marcantonio ER. Preventive health care among older women: Missed opportunities and poor targeting. Am J Med 2008;121:974–981.
6. Katz JN, Chang LC, Sangha O et al. Can comorbidity be measured by questionnaire rather than medical record review? Med Care 1996;34: 73–84.
7. Walter LC, Lindquist K, Nugent S et al. Impact of age and comorbidity on colorectal cancer screening among older veterans. Ann Intern Med 2009;150:465.
8. Carlson CM, Kirby KA, Casadei MA et al. Lack of follow-up after fecal occult blood testing in older adults: Inappropriate screening or failure to follow up? Arch Intern Med 2011;171:249–256.

FEASIBILITY OF MEASURING PHYSICAL ACTIVITY USING ACCELEROMETRY IN HOSPITALIZED AND COMMUNITY-LIVING OLDER PEOPLE WITH COGNITIVE IMPAIRMENT

To the Editor: Physical activity has clear benefits for older people, including older people with cognitive impairment.[1–4] Precise, valid, reliable measurements of physical activity are required for research purposes.[5] Accelerometry is increasingly being used as a method of quantifying physical activity. The current study was designed to assess the feasibility of using an accelerometer (activPAL; PALtechnologies Ltd, Glasgow, UK) in older people with cognitive impairment in hospital and community settings. Two groups of participants were recruited. The first was from a hospital rehabilitation ward in Sydney, Australia. The second was from community-living older people in the Hornsby Ku-ring-gai region of Sydney, Australia. A Mini-Mental State Examination score of <25 was defined as cognitive impairment. In the rehabilitation ward sample, participants were recovering from significant injury or illness with the aim of improving functioning and returning to community. Each group wore the device on their thigh for at least 7 days (Figure 1). The device was wrapped in the finger of a latex glove for waterproofing and affixed to the thigh using a transparent dressing and left in place for a number of days. This attachment provided 2 to 7 days of continuous use, allowing the wearer to shower without removing the device. Participants were asked to wear the accelerometer for 2 weeks. The device recorded the amount of time in minutes per hour spent sitting or lying, the number of sit-to-stand movements, time spent standing, time spent stepping, and the metabolic equivalents of the physical behavior (METS). The device has been validated for use in an elderly population.[6–8] Data were extracted from the device to a spreadsheet and manually coded for each parameter. The relevant health research ethics committee approved the study.

Figure 1. Device in place on the right thigh of a study participant.

Table 1. Participant Characteristics and Device Use

Characteristics and Feasibility	Hospital Rehabilitation, n = 24	Community Living, n = 21
Participant characteristic		
Female, n (%)	13 (54)	9 (43)
Age, mean ± SD	86 ± 5	82 ± 7
Mini-Mental State Examination score, mean ± SD	20 ± 5	21 ± 4
EuroQol 5D score, mean ± SD	9 ± 2	6 ± 3
Short Physical Performance Battery score, mean ± SD	4 ± 3	6 ± 3
Device Use		
Participants who completed study, n (%)	18 (75)	20 (95)
Upright time in minutes per day, mean ± SD	87 ± 39	353 ± 115
Walking time in minutes per day, mean ± SD	15 ± 10	62 ± 34
Number of steps per day, mean ± SD	921 ± 678	4,653 ± 2,756

SD = Standard Deviation.

Table 1 shows characteristics and device use for the study. There were 24 cognitively impaired participants in the hospital rehabilitation group (54% female, mean age 86) and 21 cognitively impaired participants in the community group (43% female, mean age 82). Eighteen of 24 participants (75%) in the hospital group and 20 of 21 (95%) in the community group completed the study. Two accelerometers had to be rebooted because they did not seem to operate according to function. Failure of the two devices did not lead to major loss of data. There is significant data processing time required for data checking and summarizing, estimated as 2 minutes per day of measured activity downloaded from the device. In this study, approximately 30 minutes of data processing was required to calculate mean activity scores for 2 weeks of recorded data per participant.

This pilot study shows that it is feasible to measure physical activity using accelerometry in older people with cognitive impairment in hospital and community settings. To the authors' knowledge, this is the first study to confirm this with this type of device. This is consistent with previous observations in another study using a different accelerometer worn on the arm (Sense Wear; Body Media, Pittsburgh, PA).[9] The results recorded in the current study in cognitively impaired older people are comparable with those of other studies using pedometers and accelerometers to assess physical activity in older people.[8–10] It is feasible to measure physical activity using an accelerometer in cognitively impaired older people, but these conclusions may not be generalizable to people with severe cognitive impairment, who may not tolerate the device. For people who tolerate the device, the recordings were successful, but significant time is required to extract and summarize the data, which will limit the use of the current device to research settings.

Ariane A. van Loevezijn, MSc
Leyden Academy on Vitality and Ageing, Leiden the Netherlands

Ian D. Cameron, MB, BS, PhD
Rehabilitation Studies Unit, University of Sydney, Sydney Australia

Susan E. Kurrle, MB, BS, PhD
Curran Ageing Research Unit, Hornsby Ku-ring-gai Hospital, Hornsby, Australia

David van Bodegom, MD, PhD
Leyden Academy on Vitality and Ageing, Leiden the Netherlands
Department of Gerontology and Geriatrics, Leiden University Medical Centre, Leiden, the Netherlands

ACKNOWLEDGMENTS

Conflict of Interest: This project was funded by the Curran Ageing Research Unit. The authors have no financial involvement or interest in the activPAL device. A.A. van Loevezijn was granted a scholarship, "DOO internationaliserings beurs," by the Leiden University Medical Center. The scholarship is intended for students doing part of their medical training abroad.

Author Contributions: All authors contributed to the study concept and design, preparation of manuscript and analysis and interpretation of data. van Loevezijn: data collection.

Sponsor's Role: The sponsor had no role in the design, methods, subject recruitment, data collection or analysis, or preparation of the paper.

REFERENCES

1. Manini TM, Pahor M. Physical activity and maintaining physical function in older adults. Br J Sports Med 2009;43:28–31.

2. Batty GD. Physical activity and coronary heart disease in older adults. A systematic review of epidemiological studies. Eur J Public Health 2002;12:171–176.
3. Liu CK, Fielding RA. Exercise as an intervention for frailty. Clin Geriatr Med 2011;27:101–110.
4. Angevaren M, Aufdemkampe G, Verhaar HJ et al. Physical activity and enhanced fitness to improve cognitive function in older people without known cognitive impairment. Cochrane Database Syst Rev 2008: CD005381.
5. Forbes D, Forbes S, Morgan DG et al. Physical activity programs for persons with dementia. Cochrane Database Syst Rev 2008:CD006489.
6. Grant PM, Dall PM, Mitchell SL et al. Activity-monitor accuracy in measuring step number and cadence in community-dwelling older adults. J Aging Phys Act 2008;16:201–214.
7. Mutrie N, Doolin O, Fitzsimons CF et al. Increasing older adults' walking through primary care: Results of a pilot randomized controlled trial. Fam Pract 2012;29:633–642.
8. Lord S, Chastin SF, McInnes L et al. Exploring patterns of daily physical and sedentary behaviour in community-dwelling older adults. Age Ageing 2011;40:205–210.
9. Erickson KI, Barr LL, Weinstein AM et al. Measuring physical activity using accelerometry in a community sample with dementia. J Am Geriatr Soc 2013;61:158–159.
10. Bohannon RW. Number of pedometer-assessed steps taken per day by adults: A descriptive meta-analysis. Phys Ther 2007;87:1642–1650.

MOBILE GERIATRIC TEAM ADVICE: EFFECT ON LENGTH OF HOSPITAL STAY IN OLDER ADULTS

To the Editor: Older adults have longer length of hospital stay (LHS) in medical acute care units than younger individuals.[1,2] Early intervention of a mobile geriatric team (MGT) combining a brief geriatric assessment (BGA) and subsequent standardized advice reduces the LHS of older adults hospitalized after an admission to the emergency department (ED).[3] It has recently been reported that MGT geriatric advice (medical advice for the diagnosis and treatment of polymorbid older adults) but not gerontological advice combining geriatric and social (organization of home-help services) advice was associated with early discharge from the ED.[4] Because LHS is longer in medical acute care units than in the ED, which allows more time to implement adapted gerontological advice, it was hypothesized that MGT gerontological advice would be associated with shorter LHS in older adults. The aim of this study was to determine whether MGT gerontological advice was associated with shorter LHS of older adults hospitalized in nongeriatric acute care medical units through the ED than of controls who did not receive gerontological advice.

Between February and June 2011, 106 older adults (mean age 85.2 ± 5.0; 70.8% female) who visited the ED of Angers University Hospital were prospectively included in this cohort study. Inclusion criteria were aged 75 and older and admission to the ED. Participants were divided into three groups based on MGT advice (geriatric, gerontological, or no advice). All participants were matched for age, sex, and reason for admission to the ED to improve comparability between those that the MGT did and did

Table 1. Baseline Characteristics of Older Adults Categorized According to the Nature of Advice Provided by a Mobile Geriatric Team, and Multiple Cox Regression Models Showing the Association Between the Length of Hospital Stay (Dependent Variable) and the Nature of Mobile Geriatric Team Advice (Independent Variable) Adjusted on Baseline Clinical Characteristics (n = 106)

	Mobile Geriatric Team Advice, n (%)				Fully Adjusted Cox Regression	
Characteristic	None, n = 58	Geriatric, n = 16	Gerontological, n = 32	*P*-Value[a]	Hazard Ratio (95% Confidence Interval)	*P*-Value
Mobile geriatric team intervention (reference none)						
Brief geriatric assessment with geriatric advice					1.26 (0.64–2.46)	.50
Brief geriatric assessment with gerontological advice					1.98 (1.10–3.58)	.02
Aged ≥85	31 (53.4)	10 (62.5)	22 (68.8)	.35	0.60 (0.36–1.00)	.05
Male	20 (34.5)	6 (37.5)	5 (15.6)	.12	1.35 (0.70–2.60)	.36
≥5 drugs taken daily	40 (76.9)	12 (75.0)	28 (87.5)	.43	1.08 (0.55–2.13)	.82
No use of formal or informal home services	9 (15.5)	4 (25.0)	4 (12.5)	.53	1.24 (0.61–2.51)	.55
History of falls in previous 6 months	19 (52.8)	8 (50.0)	23 (76.7)	.08	1.01 (0.50–2.02)	.98
Temporal disorientation	16 (27.6)	5 (31.3)	8 (25.0)	.90	1.50 (0.83–2.73)	.18
Living at home	47 (81.0)	12 (75.0)	24 (75.0)	.75	0.62 (0.35–1.11)	.11
Reason for admission to emergency department						
Acute organ failure[b]	18 (31.0)	3 (18.8)	6 (18.8)	.35	Reference	
Gait or balance disorders	16 (27.6)	5 (31.3)	16 (50.0)	.10	1.16 (0.54–2.51)	.70
Neuropsychiatric disorders[c]	2 (3.4)	2 (12.5)	3 (9.4)	.33	0.88 (0.28–2.75)	.83
Social-related conditions	8 (13.8)	2 (12.5)	4 (12.5)	.98	0.66 (0.28–1.60)	.36
Other	14 (24.1)	4 (25)	3 (9.4)	.21	0.92 (0.42–2.00)	.84

[a]Between-group comparison based on chi-square test.
[b]Congestive heart failure, chronic lung disease, chronic kidney disease, or cirrhosis.
[c]Delirium, dementia, or mental behavioral disorder.