JOURNAL of AGING and LONG-TERM CARE
www.agingandlongtermcare.com

ISSN 2619-9017 | E-ISSN 2618-6535

ORIGINAL RESEARCH

2018, 1(2), 65-72
doi: 10.5505/jaltc.2018.52724

Effect of a Sit-To-Stand Activity on Mobility Outcomes Among Canadian Continuing Care Residents with and Without Dementia

Susan E. Slaughter[1] & Carla Ickert[1] C. Allyson Jones[2] Jeffrey A. Bakal[3]

Abstract

The demand for continuing care facilities to support older adults in Canada is expected to increase. Currently, access to rehabilitation and recreation services is limited among this group of older adults. Identifying simple mobility interventions implemented by usual care staff may be a cost-effective way to maintain or improve mobility among older adults in continuing care. This study evaluated the effectiveness of a mobility activity, the sit-to-stand activity, on mobility outcomes of long-term care and supportive living residents with and without dementia. Fifteen supportive living facilities and eight long-term care facilities participated. Eligible residents were aged ≥ 65 years, medically stable and able to stand up from a chair. Facility healthcare aide staff received training on the sit-to-stand activity by study educators and were asked to complete the activity with participating residents four times daily. Staff documented completion of the activity on flowsheets. Two mobility outcomes, time to complete first sit-to-stand and number of sit-to-stand repetitions completed in 30-seconds, were measured by research assistants at the beginning and end of the trial for all participants. Demographic information, including age, sex, and dementia diagnosis, was gathered from health records. Data were analyzed using receiver operating characteristic curves and logistic regression. Across all 296 residents, mean time to complete the first sit-to-stand at baseline was 5.58 seconds (SD = 4.20) and the final mean time was 4.63 (SD = 3.71) seconds ($p < .001$). Dementia did not show a significant effect in likelihood of losing repetitions ($p = .12$) or time ($p = .12$). Residents in supportive living facilities were approximately half as likely as their long-term care counterparts to gain two or more seconds on their time for the first sit-to-stand (adjusted odds ratio = 0.48; 95% CI: 0.26-0.88, $p = .02$). The sit-to-stand activity is a low-cost, simple mobility intervention that may improve mobility of older adults in continuing care.

Key Practitioners Message

- Older adults in Canadian continuing settings have limited access to rehabilitation and recreation therapies
- Usual care staff may be able to implement mobility activities to sustain resident mobility, which is essential for quality of life and lowering care costs
- A simple mobility intervention, the sit-to-stand activity, can be implemented by usual care staff and may help frail older adults maintain mobility
- The mobility of both residents with and without dementia can benefit from the sit-to-stand activity

Introduction

The number of people age 65 and older is rapidly increasing in Canada, with the most pronounced increase occurring among the oldest old, aged 80 and over (Statistics Canada, 2013). This older segment of the population is one of the heaviest healthcare users in Canada and will drive an increase in need for access to continuing care facilities (CIHI, 2017a). Currently, 93% of residents in continuing care are over the age of 65, with the residents' average age of 84 years (CIHI, 2017b). Many of these residents have both physical and cognitive impairment; 62% of residents have a di-

Correspondence: Susan E. Slaughter, Edmonton Clinic Health Academy11405 - 87 Ave, Edmonton Alberta, T6G1C9, CANADA.
e-mail: susan.slaughter@ualberta.ca

Authors: [1] University of Alberta, Faculty of Nursing, [2] University of Alberta, Faculty of Rehabilitation Medicine, [3] University of Alberta, Faculty of Medicine and Dentistry

Received: 8 October 2018 | Accepted: 17 November 2018| Published Online: 18 November 2018

National Association of Social and Applied Gerontology

agnosis of dementia and 34% are dependent or totally dependent in their activities of daily living (CIHI, 2017b). Given the complex medical and chronic conditions in this population, maintaining physical capacity is key to mitigating the strain on the health system (Fries et al., 1994).

In 2016, only 34% of residents in Canadian continuing care received physical therapy, 14% received recreational therapy while only 5% received occupational therapy (CIHI, 2017b). In Alberta, only 21% of residents received physical therapy, 31% received recreational therapy and 19% received occupational therapy (CIHI, 2017b). Physical therapists and occupational therapists are not employed on site in Albertan supportive living settings, and physical therapists or occupational therapists make up only 0.7% of the staffing total for long-term care homes (CIHI, 2013). In contrast, 51% of the staffing total in long-term care is unregulated healthcare professionals such as healthcare aides (HCAs) (CIHI, 2013). Given the limited capacity of allied health professionals such as physical and occupational therapists, and the large numbers of continuing care residents not receiving therapeutic services, developing mobility interventions that can be implemented by other staff in continuing care settings is a promising mechanism to improve the functional abilities of frail continuing care residents. HCAs, who provide direct care, spend more time with residents in continuing care settings than any other healthcare professional (Estabrooks, Squires, Carleton, Cummings, & Norton, 2015) and are therefore uniquely situated to support the functional independence and mobility of residents.

Although moderate-to-vigorous levels of physical activity is typically recommended for older adults (PHAC, 2012), low levels of physical activity have been shown to improve functional abilities in older adults (Roberts, Phillips, Cooper, Gray, & Allan, 2017). Even for frail older adults, physical activity has been demonstrated to improve balance and performance of activities of daily living compared to usual care (Chou, Hwang, & Wu, 2012). The sit-to-stand activity, where older adults repeatedly stand up and sit down from a chair, has been shown to slow functional decline and improve mobility in frail long-term care residents with dementia (Slaughter et al., 2015). This activity, implemented by HCAs, is a practical intervention that requires minimal additional training, no additional equipment and is low cost to implement. It is not known if the benefits of the sit-to-stand activity on resident mobility are also seen in older adults without dementia or in other forms of continuing care such as supportive living. This study examined the effect of the sit-to-stand activity delivered by HCAs on mobility outcomes, specifically the ability to transfer, of long-term care and supportive living residents with and without dementia.

Methods

This study was conducted as part of a Hybrid Type III cluster randomized controlled trial (Blinded), which evaluated the effect of varying frequencies and intensities of reminder implementation strategies while also evaluating the effect of the sit-to-stand activity on continuing care resident outcomes (Blinded). This report focuses on the mobility outcomes of continuing care residents.

Recruitment

Fifteen supportive living facilities and 8 long-term care homes from BLINDED were recruited for participation in the Sustaining Transfers through Affordable Research Translation (START) trial. All facilities agreed to introduce the sit-to-stand activity as part of expected care practice for HCAs. Eligible residents were over the age of 65 years at randomization, were medically stable, were able to stand up from a chair, and resided on a participating unit. Additionally, for residents in supportive living facilities, they were only eligible to participate if they had been assessed by a case manager as requiring a minimum level of care assistance established through admission guidelines (AHS, 2010). Recruitment of residents was ongoing throughout the trial to ensure sufficient participants. Unit managers, case managers or delegates approached eligible residents or their authorized representatives used a script to request permission to provide their contact information to the research team. Unit managers, case managers or delegates confirmed the cognitive status of residents. A research assistant then fol-

lowed up with each resident or representative to explain the study in more detail and obtain written informed consent. Assent of residents with cognitive impairment was assessed by their willingness to complete the outcome measures at the beginning and end of the trial. Given the duration of the trial, decision-making capacity was re-confirmed with unit managers, case managers or their delegates prior to the second data-collection point for all residents who started without a previous diagnosis of dementia, to verify that they were still able to consent to collection of endpoint measures. Three residents had been subsequently diagnosed with dementia; consent forms from their authorized decision makers were sought to gather endpoint measures. Two consented while the third declined. Ethics approval was received from the Health Research Ethics Board at the BLINDED university.

There were slightly more were female participants with dementia (69.6%, n = 133) compared to females without dementia (61.0%, n = 64, p = .08). Table-1 includes the age characteristics of resident participants. Those with dementia were slightly older (M = 84.5 years, SD = 7.5, n = 191) compared to participants without dementia (M = 82.70 years, SD = 8.32, n = 105, p = .06).

Mobility training

Full-time, part-time and casual HCAs at all 23 facilities attended 20-minute training sessions on the sit-to-stand activity. Three hundred, sixty-one training sessions were attended by 582 dayshifts and 448 evening shift HCA staff. The 15-minute training sessions, conducted by START study educators, used adult learning principles and interactive techniques to introduce the HCA staff to the sit-to-stand activity including discussing resident safety, discussing the benefits of maintaining mobility in old age, describing how to document the new activity on documentation flowsheets, and problem-solving anticipated challenges. HCAs were asked to complete the sit-to-stand activity with participating residents twice during dayshift and twice during the evening shift, a total of 4 occasions per day.

Measures

HCAs were trained to record completion of the sit-to-stand activity on monthly documentation flowsheets that were integrated into the residents' health record. HCAs would record the number of repetitions of the sit-to-stand activity completed by each resident on each occasion of the activity. A target number, based on the resident's assessed capacity at baseline, was included on each flowsheet for guidance. If a resident refused to complete the activity, the HCA would note the refusal. If a resident was unavailable, due to hospitalization or absence from the site for other reasons, the HCA would note the resident was unavailable. Flowsheets were collected monthly from each site. Resident mobility was measured at two-time points: at baseline, when residents were recruited

Table-1. Resident Characteristics

	Dementia Diagnosis (N = 191)		No Dementia (N=105)	
	Mean (*SD*)		Mean (*SD*)	
Variable	Time 1	Time 2	Time 1	Time 2
Age	84.46 (7.51)	-	82.70 (8.32)	-
Time to 1st STS	5.92 (4.48)	4.90 (3.82)	4.96 (3.58)	4.16 (3.48)
STS in 30 Seconds	5.33 (3.06)	5.20 (3.24)	5.82 (3.15)	6.55 (3.55)
Exposure				
Days between first and last outcome measure	331.5 (162.9)		314 (172.5)	
Intensity				
Repetitions standardized against residents baseline abilities (range 0- ∞)	1.73 (1.47)		1.67 (1.86)	

Note: *SD* = Standard deviation, STS = Sit-to-stand

into the trial, and at the end of the trial. As residents were recruited throughout the trial, the duration between the first and last point varied by the resident. Research assistants measured resident mobility using the 30-second sit-to-stand test (Jones, Rikli, & Beam, 1999; McCarthy, Horvat, Holtsberg, & Wisenbaker, 2004) and the time to complete one sit-to-stand test (Bohannon, 1995). At baseline, research assistants abstracted demographic information from the residents' health record including; age, sex and presence or absence of a dementia diagnosis.

Predictor variables

Residents began and completed their participation in the study at different times; therefore, the dates for the first and last sit-to-stand were individualized as the start and end date for the participation of each resident. Given the residents' varied number of occasions and capacity to repeat the sit-to-stand, the daily flowsheet data were converted into two standardized measures that highlight different elements in the sit-to-stand activities: (1) The variable Exposure to the sit-to-stand activity was calculated for each resident as the number of days between their first and last mobility measurement. (2) The variable Intensity was computed for each resident based on the number of repetitions they completed during their first sit-to-stand test. The repetitions completed on each occasion were thus standardized against the resident's first sit-to-stand test so that a resident who has demonstrated the capability to do more repetitions would need to do more at each occasion to achieve higher intensity.

Outcome variables

The primary purpose of this study was to improve resident mobility. Mobility outcomes were measured using the time for the first sit-to-stand and the number of sit-to-stands completed in 30 seconds. A resident was considered to have gained time if their time for the first sit-to-stand score was two or more seconds slower during the final assessment compared to their baseline, suggesting worsening mobility. A resident was considered to have lost repetitions if their number of sit-to-stands in thirty seconds score was at least two repetitions fewer at their final assessment, compared to their baseline, suggesting worsening mobility.

Analysis

Residents were grouped into two cohorts based on the presence or absence of a dementia diagnosis. Baseline characteristics of the residents were summarized as means and standard deviations (SDs), or counts and percentages as appropriate. Residents with dementia were compared to residents without dementia first by comparing both their mean time for the first sit-to-stand and number of sit-to-stand repetitions completed in 30 seconds.

To compare the levels of exposures and intensity in relation to the two mobility outcomes, the change in the time for the first sit-to-stand was graphically explored through two true positive rate receiver operating characteristic (ROC) curves. These curves allow the identification of an approximate threshold at which the resident cohort achieved, for example at least a 75% success rate in maintaining or improving function cohort achieved, for example at least a 75% success rate in maintaining or improving function.

In order to examine the association between the daily sit-to-stand activity and the sit-to-stand test performance, a series of logistic regression models was created controlling for age, sex, dementia status, and type and size of facility to examine the effects of the derived variables on the likelihood of losing function between the baseline and final outcome measurement. All possible subsets variable selection was used to identify the most relevant covariates of each. Results are reported using adjusted odds ratios (OR). All analyses were completed in R version 3.4.3 (Vienna Austria).

Results

Of the 344 patients who participated in the BLINDED trial, those with both a baseline and final mobility measure were included in the analyses (n = 296). Median exposure (days between baseline and final outcome measurement) was 378 days (Interquartile range = 123-481 days, min = 21 days, max = 511 days). Across all residents, mean time to complete the first sit-to-stand at baseline was 5.58 seconds (SD = 4.20) and the final mean time was 4.63 seconds (SD = 3.71), demonstrating a small improvement in average first sit-to-stand ($p < .001$). Across all residents, mean number of sit-to-stands completed at baseline was 5.50 sit-to-stands (SD = 3.06) and the final test was 5.68 sit-to-stands (SD = 3.41).

The figures show the ROC curves for the outcome of maintaining or improving mobility as measured by time for the first sit-to-stand. Figure-1 suggests that residents who were able to do at least 2.5 times their initial number of repetitions of the sit-to-stand maneuver per day with HCAs had an 85% probability of being successful in preserving or increasing mobility as measured by the research assistants using the time for the first sit-to-stand measurement.

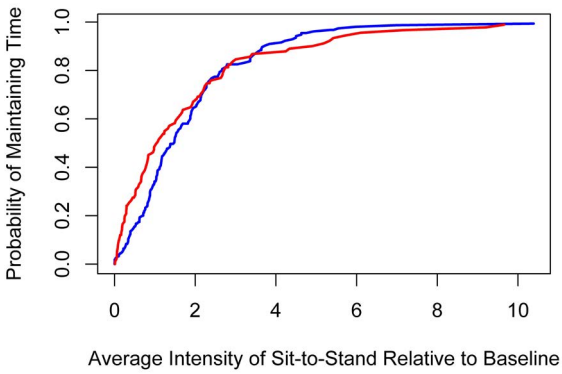

Figure-1. Maintaining time to first sit-to-stand dementia (blue) vs not (red) by intensity

Figure-2 suggests that residents who completed the activity for less than 100 days were only 20% likely to preserve or improve mobility. In contrast, those who completed the activity for more than 400 days, had a 60% probability of being successful in preserving or increasing mobility as measured by the time for the first sit-to-stand measurement.

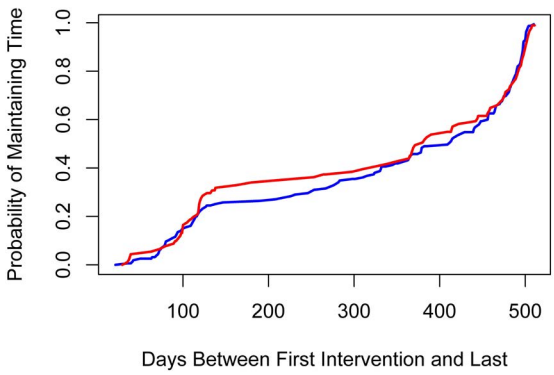

Figure-2. Maintaining time to first sit-to-stand dementia (blue) vs not (red) by exposure

A series of multivariable logistic models was examined which demonstrated the components of the intervention statistically controlled by age, sex and dementia status. Residents with dementia were 1.72 times more likely (95% CI: 0.88-3.34, p = .12) to gain at least two seconds from baseline in their time for the first sit-to-stand compared to those without dementia, representing a slower chair-stand time and thus loss of mobility Intensity, defined previously as the number of sit-to-stand repetitions completed relative to the residents baseline ability, was associated with a ~35% reduction (adjusted OR = 0.64; 95% CI: 0.45-0.91, p = .01) in the risk of gaining time. Thus, the more intense a resident completed the sit-to-stand activity relative to their baseline score, the more a resident was protected against risk of slower completion of the test at the end of the study. Similarly, residents in a long-term care facility were

Table-2. Logistic Regression Models

Outcome: Lost Time	Adjusted Odds Ratio	95% CI	p
Dementia	1.72	0.88-3.34	.12
Intensity	0.84	0.67-1.07	.17
Supportive Living	0.48	0.26-0.88	.02
Outcome: Lost Repetitions	Adjusted Odds Ratio	95% CI	p
Dementia	1.91	(0.74-4.94)	.12
Intensity	0.64	(0.45-0.91)	.01
Supportive Living	1.65	(0.77-3.58)	.21

Note-1: All models adjusted for age and sex
Note-2: CI = Confidence interval

approximately twice as likely as their supportive living counterparts to gain at least 2 seconds from their baseline sit-to-stand time (adjusted OR = 2.08; 95% CI: 1.14-3.84, p = .02). Dementia displayed trend evidence of being associated with a likelihood of losing time and repetitions (p = .12 for both).

Discussion

The sit-to-stand activity is a simple, feasible intervention designed to improve mobility and function of frail older adults. This study built on previous work (Slaughter et al., 2015) exploring the impact of the sit-to-stand activity on mobility. The overall change in mobility scores from baseline was examined, as well as the impact of the duration of exposure and intensity on the likelihood of losing mobility over time. Consistent results were demonstrated from the previous trial, with benefits of the sit-to-stand activity demonstrated among both residents with and without dementia. Increases in the intensity of a resident's sit-to-stand repetitions, relative to their baseline ability, was associated with a reduced risk of losing time in the mobility test, with most benefit observed between 2 and 3 times the baseline repetitions.

Research demonstrating the benefits of physical activity for older adults is increasing. Reviews have identified activity as essential to healthy aging among older adults (Bauman, Merom, Bull, Buchner, & Singh, 2016). More specifically, benefits of activity interventions targeted at older adults considered pre-frail have been documented, including reducing falls and improving mobility (de Labra, Guimaraes-Pinheiro, Maseda, Lorenzo, & Millan-Calenti, 2015). Many participants in this study would be considered pre-frail, as residents in continuing care settings (Fried et al., 2001; Carpenter, Hastie, Morris, Fries, & Ankri, 2006; Slaughter, Eliasziw, Morgan, & Drummond, 2010) and the demonstrated benefits of the sit-to-stand in reducing lost mobility add to the growing literature for this group.

This study found no significant difference between odds of lost time or odds of lost repetitions of the sit-to-stand activity between those with dementia and those without dementia, although the odds ratio trends suggested that residents with dementia were more likely to worsen. The ROC curves also demonstrated similar effects between those with and without dementia. Although the physical decline is an expected outcome of dementia (Auyeung et al., 2008) it is also an expected outcome of transition to and residence in a continuing care facility (Levy et al., 2016), which may suggest why non-significant differences were found.

Residents completing the sit-to-stand activity with high intensity were less likely to lose repetitions in the mobility test compared to those completing the activity with low intensity. Completing more repetitions of the sit-to-stand activity within a single occasion may have been more physically demanding for residents and resulted in improved mobility. This is consistent with research on strength training in older adults. For example, in their meta-analysis of resistance training in older adults, Steib, Schoene, and Pfeifer (2010) found a dose-response relationship between training intensity and maximal muscle strength, with high intensities producing the largest benefits for older adults. These results are echoed in other systematic reviews (Liu & Latham, 2011; Patterson, Jones & Rice, 2007) which have found that higher intensity strength exercise among older adults improves functional ability, such as standing up from a chair, in addition to muscle strength.

Given the limited resources available for therapeutic services, simple functional activities like the sit-to-stand activity that can be completed by unregulated care staff such as HCAs are ideal opportunities to support the mobility of residents in continuing care environments. Our research team has reported the acceptability and feasibility of the sit-to-stand activity elsewhere (Kagwa, Bostrom, Ickert, & Slaughter, 2017). In brief, HCA staff are generally accepting of the activity if appropriate supports are in place, for example, leadership commitment, and if residents are willing and interested in participating (Kagwa et al., 2017). Time limitations and workload challenges were common barriers to completing the sit-to-stand activity, but HCA staff demonstrated creativity in developing strategies to support the integration of the sit-to-stand activity into daily care practice (Kagwa et al., 2017).

Limitations

This study has some limitations. Conducting mobility assessments with older adults with cognitive impairment can be challenging. These participants can have difficulty following instructions or repeating the chair-stand test for a full 30-seconds, leading to measurement error. Both the time to 1st sit-to-stand and the total number of sit-to-stands completed in 30-seconds were included to reduce reliance on a single measure that required residents' sustained focus. Reliance on HCAs' documentation of completing the sit-to-stand activity with residents on monthly documentation flowsheets is a limitation. To optimize adoption of the activity by the HCAs and to mitigate the risk of inaccurate documentation, informal and formal information sessions with HCAs were conducted during the first four months of the study (BLINDED).

Conclusion

The sit-to-stand activity is a simple, feasible mobility intervention that can be implemented by usual care staff in continuing care facilities to support the mobility of frail older adults. Both residents with and without dementia can benefit from this activity, which reduces their likelihood of losing mobility over time.

References

AHS (Alberta Health Services) (2010). *Admission guidelines for publically funded continuing care living options*. Retrieved from https://www.albertahealthservices.ca/assets/info/seniors/if-sen-living-option-guidelines.pdf

Auyeung, T., Kwok T., Lee, J., Leung, P., Leung, J., & Woo, J. (2008). Functional decline in cognitive impairment: The relationship between physical and cognitive function. *Neuroepidemiology, 31*, 167-173. [Crossref]

Bauman, A., Merom, D., Bull, R., Buchner, D., & Singh, F. (2016). Updating the evidence for physical activity: Summative reviews of the epidemiological evidence, prevalence, and interventions to promote "Active Aging". *The Gerontologist, 56*(S2), S268-S280.[Crossref]

Bohannon R. (1995) Sit-to-stand test for measuring performance of lower extremity muscles. *Perceptual and Motor Skills, 80*,163-166. [Crossref]

Carpenter, G. I., Hastie, C. L., Morris, J. N., Fries, B. E., & Ankri, J. (2006). Measuring change in activities of daily living in nursing home residents with moderate to severe cognitive impairment. *BMC Geriatrics, 6, 7*. [Crossref]

CIHI (Canadian Institute of Health Information) (2017a). *Seniors in transition: Exploring pathways across the care continuum*. Ottawa, ON.

CIHI (Canadian Institute of Health Information) (2017b). *CCRS Profile of Residents in Continuing Care Facilities 2016-2017*. Retrieved from https://www.cihi.ca/en/quick-stats

CIHI (Canadian Institute of Health Information) (2013). *Residential Long-Term Care Financial Data Tables 2013*. Retrieved from https://www.cihi.ca/en/quick-stats

Chou, C., Hwang, C., & Wu, Y. (2012). Effect of exercise on physical function, daily living activities, and quality of life in the frail older adults: A meta-analysis. *Archives of Physical Medicine and Rehabilitation, 93, 237*-244. [Crossref]

de Labra, C., Guimaraes-Pinheiro, C., Maseda, A., Lorenzo, T., & Millan-Calenti, J. (2015). Effects of physical exercise interventions in frail older adults: A systematic review of randomized controlled trials. *BMC Geriatrics, 15,* 154. [Crossref]

Douglas, N. F., Campbell, W. N., & Hinckley, J. J. (2015). Implementation science: Buzzword or game changer? *Journal of Speech, Language, and Hearing Research, 58,* S1827-S1836. [Crossref]

Estabrooks, C., Squires, J., Carleton, H., Cummings, G., & Norton, P. (2015). Who is looking after Mom and Dad? Unregulated workers in Canadian long-term care homes. *Canadian Journal on Aging, 34*(1), 47-59. [Crossref]

Fried, L., Tangen, C., Walston, J., Newman, A., Hirsch, C., Gottdiener, J., … McBurnie, M. A. (2001). Frailty in older adults: Evidence for a phenotype. *Journal of Gerontology: Medical Sciences, 56A*(3), M146-M156. [Crossref]

Fries, B., Schneider, D., Foley, W., Gavazzi, M., Burke, R., & Cornelius, E. (1994). Refining a case-mix measure for nursing homes: Resource utilization groups (RUG-III). *Medical Care, 32*(7), 668-685.

Jones, C. J., Rikli, R. E., & Beam, W. C. (1999). A 30s chair-stand test as a measure of lower body strength in community-residing older adults. *Research Quarterly for Exercise and Sport, 70*, 113-117. [Crossref]

Kagwa, S., Bostrom, A-M., Ickert, C., & Slaughter, S. (2017). Optimising mobility through the sit-to-stand activity for older people living in residential care facilities: A qualitative interview study of healthcare aide experiences. *International Journal of Older People Nursing, 13*, e12169. [Crossref]

Levy, C. R., Zargoush, M., Williams, A. E., Williams, A. R., Giang, P., Wojtusiak, J., … Alemi, F. (2016). Sequence of functional loss and recovery in nursing homes. *Gerontologist, 56*(1), 52-61. [Crossref]

Liu, C.-J., & Latham, N. (2011). Can progressive resistance strength training reduce physical disability in older adults? A meta-analysis study. *Disability and Rehabilitation, 33*(2), 87-97. [Crossref]

McCarthy, E. K., Horvat, M. A., Holtsberg, P. A., & Wisenbaker, J. M. (2004). Repeated chair stands as a measure of lower limb strength in sexagenarian women. *Journal of Gerontology: Medical Sciences, 59*A, 1207-1212. [Crossref]

Paterson, D. H., Jones, G. R., & Rice, C. L. (2007). Ageing and physical activity: Evidence to develop exercise recommendations for older adults. *Canadian Journal of Public Health, 98*(Suppl. 2), S69-S108. [Crossref]

PHAC (Public Health Agency of Canada) (2012). Physical activity tips for older adults (65 years and older). Retrieved from https://www. canada.ca/en/public-health/services/health-promotion/healthy-living/physical-activity/physical-activity-tips-older-adults-65-years-older.html

Roberts, C. E., Phillips, L. H., Cooper, C. L., Gray, S., & Allan, J. L. (2017). Effect of different types of physical activity on activities of daily living in older adults: Systematic review and meta-analysis. *Journal of Aging and Physical Activity, 25,* 653-670. [Crossref]

Slaughter, S. E., Eliasziw, M., Morgan, D., & Drummond, N. (2010). Incidence and predictors of excess disability in walking among nursing home residents with middle-stage dementia: A prospective cohort study. *International Psychogeriatrics, 23*(1), 54-64. [Crossref]

Slaughter, S. E., Estabrooks, C. A., Jones, C. A., Wagg, A. S., & Eliasziw, M. (2013). Sustaining Transfers through Affordable Research Translation (START): study protocol to assess knowledge translation interventions in continuing care settings. *Trials, 14,* 355. [Crossref]

Slaughter, S. E., Wagg, A., Jones, A., Schopflocher, D., Ickert, C., Bampton, E., … Estabrooks, C. (2015). Mobility of Vulnerable Elders (MOVE) study: Effect of the sit-to-stand activity on mobility, function and quality of life. *Journal of the American Medical Directors Association, 16*(2), 138-143. [Crossref]

Statistics Canada (2013). Population Projections for Canada (2013 to 2063), Provinces and Territories (2013) to 2038. Retrieved from http://www.statcan.gc.ca/pub/91-520-x/91-520-x2014001-eng.pdf

Steib, S., Schoene, D., & Pfeifer, K. (2010). Dose-response relationship of resistance training in older adults: A meta-analysis. *Medicine and Science in Sport and Exercise, 42*(5), 902-914. [Crossref]

Tworek, K., Ickert, C., Bakal, J., Eliasziw, M., Wagg, A. S., Jones, C. A., & Slaughter, S. (in press). Examining the impact of knowledge translation interventions on uptake of evidence-base practices by care aides in continuing care. *Worldviews on Evidence-Based Nursing*.