Spaced Retrieval, Errorless Learning and Vanishing Cues in Retraining Sit-to-Stand in People Living with Dementia

Author

Dolecka, Urszula E

Published

2016

Thesis Type

Thesis (Masters)

School

School of Allied Health

DOI

10.25904/1912/612

Spaced Retrieval, Errorless Learning and Vanishing Cues in Retraining Sit-to-Stand in People Living with Dementia

Urszula E Dolecka

Bachelor of Physiotherapy (University of Queensland)

Master of Rehabilitation (Poland)

School of Allied Health Sciences

Griffith Health

Griffith University

Submitted in fulfilment of the requirements for the degree of

Master of Philosophy

15 September 2015

Abstract

Inability to stand up independently has significant consequences for older adults and people living with dementia and can lead to dependency and institutionalisation. Physiotherapists frequently retrain sit-to-stand (STS) during rehabilitation, addressing underlying impairments, and teaching STS strategies with the aim of making the task easier (Carr & Shepherd, 2010, pp. 77-92). These strategies comprise sliding forward, moving the feet backwards, leaning forward and pushing through the armrests (Janssen, et al., 2002). However, there is limited empirical evidence regarding which STS strategies are actually used by older adults and people living with dementia when standing up unconstrained from a standard chair with or without a table in front.

During therapy sessions physiotherapists use verbal instructions and feedback that are often ambiguous and extensive (Parry, 2005b; Talvitie & Reunanen, 2002). Providing extensive verbal instructions appears to be counterproductive when working with people living with dementia as they respond better to short, action based commands (Christenson, et al., 2011). People living with dementia have memory problems that have a detrimental effect on learning. However, as the decline in declarative memory occurs, implicit memory is preserved much longer and can be used in task retraining (Grandmaison & Simard, 2003; Hopper, 2003). Practicing over increasing time intervals (spaced retrieval) (Camp, et al., 1996), without errors (errorless learning) (Clare & Jones, 2008), using cues in a structured manner (vanishing cues) (Haslam, et al., 2010), and written instructions (Bouergeois, et al., 2003; Curtin, 2011) have been demonstrated as beneficial for learning in people living with dementia but have not been broadly used in physiotherapy (Creighton, et al., 2013; White, et al., 2014).
The research program for the thesis comprised two studies. The first observational study examined STS strategies used by older adults and people living with dementia standing up from a standard chair with and without a table in front. In the second study a single case experimental design with multiple baselines across concurrent subjects was employed and involved four participants randomly allocated to baseline length (Tate, et al., 2008). The aim of this research was to explore the feasibility and utility of a STS training protocol based on spaced retrieval, errorless learning and vanishing cues principles supported by an instruction sheet and a command repeated verbatim in people living with dementia.

The primary measure used in both studies was the assessment of STS, specifically, the number, type and sequence of STS strategies, determined from digitally recorded video clips. An independent assessor rated the randomised video clips using an observation based STS

assessment tool developed for the study. Inter- and intra-tester reliability of the assessment tool was also established.

Findings from the first study indicated that older adults and people living with dementia adopted a similar starting position when standing up from the standard chair. People living with dementia used more strategies than older adults; in particular, pushing through the armrests and moving feet backwards when there was no table in front. The presence of a table did not affect STS performance of older adults. Leaning forward was the most commonly used strategy, followed by pushing through the armrests and moving feet backwards. Sliding forward was the least used strategy (four out of 120 trails).

In the second study participants with dementia were able to learn STS strategies when provided with an instruction sheet and the command repeated verbatim. The effect of training on STS performance when assessed without the instruction sheet varied. Two participants with more advanced cognitive decline who learnt slower during the training sessions were able to incorporate STS strategies previously not used. All participants were able to respond to the commands given by a person not involved in the study but were more likely to perform all STS strategies when the instruction sheet and the training command were provided. The training protocol was practical to implement in a residential care facility and acceptable for people living with dementia.

In summary, these studies found there are some differences in STS strategies used by older adults and people living with dementia and that a table in front may alter how people with dementia stand up. STS training based on spaced retrieval, errorless learning and vanishing cues principles supported by an instruction sheet and the command repeated verbatim can assist with STS retraining in people living with dementia but the effect of the training may be limited when STS is performed without the instruction sheet.

Statement of originality

This work has not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

Urszula E Dolecka

Table of Contents

List of Figures

List of Tables

List of Abbreviations

10 MWT	10 meters walk test
AD	Alzheimer's disease
ACE-R	Addenbrooke's Cognitive Examination – Revised
ADL	Activities of daily living
B (1-7)	Baselines (1-7)
BOS	Base of support
CDR	Clinical Dementia Rating Scale
COG	Centre of gravity
DEMMI	de Morton Mobility Index
DG	Dementia Group
DRS	Dementia Rating Scale
EL	Errorless learning
F	Female
FB	Feet backwards
FIM	Functional Independence Measure
LF	Leaning forward
M	Male
M (1-4)	Maintenance (1-4)
MMSE	Mini Mental State Examination
MSQ	Mental Status Questionnaire
N-DG	Non-Dementia Group
P (1-4)	Participant (1-4)
PA	Push up through the arms
PK	Push up through the knees
RoBINT Scale	Risk of Bias in N-of-1 Trails Scale
SCED	Single case experimental design
SR	Spaced retrieval
SCh	Standard chair
SCh-PSU	Sit-to-stand from the standard chair to the command "Please stand up"
SCh-WDY	Sit-to-stand from the standard chair to the command "What do you have to do to stand up, tell me and show me?"
T (1-8)	Training session (1-8)
SF	Sliding forward

SMMSE	Standardised Mini Mental State Examination
STS	Sit-to-stand
VC	Vanishing cues
WCh	Wheelchair
WCh-PSU	Sit-to-stand from the wheelchair to the command “Please stand up”

List of Appendices

Statement of contributions by others to the thesis as a whole

Professor Suzanne Kuys (primary advisor) and Associate Professor Tamara Ownsworth (associate advisor) made substantial input into the program of studies and the preparation of the thesis, specifically, assisted with the concept design of the study, data analysis, provided advice on data presentation, and critical revision of the thesis.

Urszula Dolecka (student) was a primary investigator involved at all levels of the study, including the concept, literature review, study design, recruitment of participants, data collection and analysis, interpretation of findings, and writing the thesis.

Statement of contributions to co-authored work contained in the thesis

Included in this thesis is a paper in Chapter 3 which is co-authored with Professor Suzanne Kuys and Associate Professor Tamara Ownsworth. Detailed contribution to the co-authored paper is outlined at the front of the relevant chapter. The bibliographic details for the paper including all authors, are:

Dolecka, U. E., Ownsworth, T. Kuys, S. S. (2015). Comparison of sit-to-stand strategies used by older adults and people living with dementia. *Archives of Gerontology and Geriatrics, 60*(3): 528-534.

The copyright of the paper was transferred to Elsevier as a part of journal publishing agreement but the authors retained the right to: share their article for personal use, internal institutional use and scholarly sharing purposes, with a DOI link to the version of record on Science Direct (and with the Creative Commons CC-BY-NC- ND license for author manuscript versions); retain patent, trademark and other intellectual property rights (including raw research data); proper attribution and credit for the published work.

Appropriate acknowledgements of those who contributed to the research but did not qualify as authors are included in Acknowledgments.

___________________________________ (Date) 15.09 2015

Student: Urszula Dolecka

___________________________________ (Date) 15.09 2015

Supervisor: Professor Suzanne Kuys

___________________________________ (Date) 15.09 2015

Associate Supervisor: Associate Professor Tamara Ownsworth

Published works by the author incorporated into the thesis

Dolecka, U. E., Ownsworth, T., Kuys, S. (2015). Comparison of sit-to-stand strategies used by older adults and people living with dementia*. Archives of Gerontology and Geriatrics, 60*(3): 528-534. Incorporated as Chapter 3.

Dolecka, U. E., Kuys, S., Ownsworth, T. (2014). Comparison of sit-to-stand strategies used by older adults and people living with dementia. *Australian Journal of Dementia Care, 3*(5):30-31 (Abstract)

Presentations by the author relevant to the thesis but not forming part of it

"Comparison of sit-to-stand strategies used by older adults and people living with dementia" National Dementia Research Forum. Sydney, September 2014 (Poster)

"Consistency of performance of people with dementia during cognitive and functional tasks". Gold Coast Health and Medical Research Conference. Gold Coast, November, 2013 (Poster)

"Strategies used to stand up: comparisons between older people with and without dementia". Australian Physiotherapy Association National Conference. Melbourne, October 2013

Acknowledgements

Foremost, my deepest appreciations go to people and their families who agreed to participate in the studies. Without their willingness to help, this thesis would not have been possible.

I would like to express my sincere gratitude to my supervisors, Professor Suzanne Kuys and Associate Professor Tamara Ownsworth, for their guidance. As a primary supervisor, Professor Suzanne Kuys provided me with support at every step of my journey, relentlessly editing my work and helping me to refocus. I could not imagine having a better supervisor. Associate Professor Tamara Ownsworth provided me with a very valuable methodological support and assisted with revision of the thesis.

Every journey has a beginning and I can trace my journey to my grandmother. Without her presence in my life I might never have become interested in gerontology. Even as a child I was aware that her walking was changing as she was getting older. I can still remember her first fall and I can see my mother following the same path. But, as my grandma used to say, only lucky people become old.

Then, I met another significant person on my journey, Mrs Karchesia. I could never get tired of listening to old war stories repeated over and over again. She was funny and fearless, had a contagious laughter and a rare zest for life. At the same time, she was extremely organised. She kept a journal on her desk, just beside a phone. In this journal she recorded all the important things that were happening in her life. On the desk was also a medication book that she had made herself. She would tick off every pill she took, to the amusement of her GP, who tried to give her a Webster pack. After Mrs Karchesia had two heart surgeries, her memory was affected and this was the time when her routines and habits became so useful. My last conversation with her was over the phone when she was 94 years old. She said to me: “Hold on, what’s your name?”, then she referred to her book and told me when and what we discussed last time I had phone her. I am sure that during our last conversation she was taking notes.

Throughout my journey I have met many other people who had memory problems and were diagnosed with dementia. I have seen how devastating memory problems can be for a person and their family. Often I felt powerless as a therapist, but at the same time I couldn’t get out of my mind a conviction that there must be a way of overcoming these memory problems and achieving better results during therapy.

Finally, I met Cecile Prescott, an occupational therapist. Cecile was instrumental in pointing me in a direction totally unknown to me. As a result, I attended a workshop provided by Dr Cameron Camp and found out more about innovative dementia care. The workshop was fascinating and provided me with many answers, but also generated even more questions.

The workshop with Dr Camp was probably the moment that I started to think about this research project. However, it was a couple of years before I met Professor Suzanne Kuys, who made the project possible. She kept my vivid mind on the right track, bringing me always down to earth with her very practical questions, for which many times I did not have answers. This is when Associate Professor Tamara Ownsworth agreed to join us. She asked more questions that I could not answer and steered the project in a different direction, the world of single case methodology.

There are also other exceptional people who helped with the project: Professor Paul Varghese from the Princess Alexandra Hospital and staff at Masonic Care Queensland made data collection for the second study possible; Nikki Lehtonen and Sharyn Furze, physiotherapists, who agreed to watch hundreds of video clips and did not protest when I asked them to do it again; and most importantly, Kathy Grudzinskas and Cherie Hearn, Physiotherapy Directors at Princess Alexandra Hospital because without their approval and support I would never have been able to start or finish this project. I will always appreciate their willingness to approve my leave from work, whenever I needed, even if the notice was short.

Finally, nothing would be possible without the most important person in my life – Tomasz, the most supportive husband in the world. Without his encouragement, willingness (and abilities) to solve any computer problems I had and his quiet acceptance of all domestic responsibilities, I would never have reached this point.

This work was supported by Queensland Health in a form of a Health Practitioner Research Scheme Grant (AH0071, HPRGS2010) and Allied Health Thesis Assistance Scheme.

Chapter 1 Introduction

Sit-to-stand (STS) is an important functional task that may be performed over 100 times a day by healthy older adults living in the community (Grant, Dall, & Kerr, 2011). An inability to stand up independently has been indicated as a contributing factor to institutionalisation (Dehail et al., 2007; Gaugler, Duval, Anderson, & Kane, 2007; Schultz, Alexander, & Ashton-Miller, 1992) and dependency on caregiver assistance post-stroke, particularly when associated with cognitive decline (Perry, Marchetti, Wagner, & Wilton, 2006). Assisting with STS and transfers are recognised as high physical loads that often lead to injuries among nursing staff (Engkvist, 2004, 2008; Vieira, Kumar, Coury, & Narayan, 2006). Therefore, improving a persons' participation in the STS task and subsequently transfers may help decrease the physical load and amount of physical assistance required to complete the task.

STS difficulties, among other activities of daily living (ADL), are reported to occur following an acute illness and subsequent hospitalisation (Covinsky et al., 2003; Zisberg et al., 2011). Development of generalised weakness and deconditioning often underlay the functional deterioration (Gillis & MacDonald, 2005) that is likely to be more pronounced in the presence of cognitive decline as seen in dementia (Pedone et al., 2005; Sands et al., 2002). As a result, difficulty standing up may be experienced when the previously used strategy is no longer effective. Furthermore, a person may not be able to adapt their strategies to their current level of function or to challenges posed by the sitting surface that can be lower than usual.

STS performance can be made easier through the use of strategies (Janssen, Bussmann, & Stam, 2002) such as using a chair with a higher seat (Alexander, Gross, Medell, & Hofmeyer, 2001; Alexander, Koester, & Grunawalt, 1996; Demura & Yamada, 2007; Hughes, Myers, & Schenkman, 1996; Mazza, Benvenuti, Bimbi, & Stanhope, 2004; Schenkman, Riley, & Pieper, 1996), sitting on the edge of the chair (Barreca, Sigouin.C.S., Lambert, & Ansley, 2004; Hughes, Weiner, Schenkman, Long, & Studenski, 1994; Nuzik, Lamb, VanSant, & Hirt, 1986), placing feet behind the knee line (Akram & McIlroy, 2011; Khemlani, Carr, & Crosbie, 1999; Schenkman, Berger, Riley, Mann, & Hodge, 1990; Schultz et al., 1992; Shepherd & Koh, 1996), leaning forward (Alexander et al., 1996; Hughes et al., 1994; Nuzik et al., 1986; Shepherd & Gentile, 1994), and pushing through the armrests to stand up (Etnyre & Thomas, 2007; Schultz et al., 1992). However, there is little information on which strategies are actually used by older adults when standing up from a standard chair or by people living with dementia and whether these strategies are used in any preferred sequence. Additionally, no evidence was found regarding whether having a table in front, a common scenario in everyday activities, alters STS strategies.

When assessing STS ability in clinical practice, among other assessments, physiotherapists typically observe STS strategies (Carr & Shepherd, 2010, pp. 77-92). There is no structured method of assessing the STS task, the strategies used or the sequence in which the components of the task are completed when performed naturally. Reliability of kinematic sit-to-stand assessment using video-goniometer has been established (Jeng, Schenkman, Riley, & Lin, 1990). However, there is no evidence on the reliability of physiotherapists in their ability to observe STS strategies and the sequence these are used.

During STS retraining physiotherapists may address physical limitations (e.g. muscle weakness) but also teach the specific STS strategies (sliding forward, feet backwards, leaning forward, and pushing through the armrests) that can make the task easier. In addition to movement facilitation and demonstration, physiotherapists provide instructions and verbal feedback such as knowledge of results and performance (Carr & Shepherd, 2010, pp. 37-42; May, 2003). Typically, these instructions are verbal (May, 2003; Parry, 2004; Parry, 2005a, 2005b; Talvitie, 2000; Talvitie & Reunanen, 2002) and extensive (Talvitie, 2000), with physiotherapists having been shown to talk twice as much as patients in a session (Roberts & Bucksey, 2007). This style of communication may be detrimental for people living with dementia who have decreased working memory (Bayles & Kim, 2003) and impaired language comprehension (Christenson, Buchanan, Houlihan, & Wanzek, 2011; Weirather, 2010).

Difficulties following instructions together with memory problems can lead to the misconception that people living with dementia are unable to learn new skills and improve in functional tasks. This misconception has been perceived as a barrier to rehabilitation (Thomas, 2005). There is increasing evidence that people living with dementia, despite a decline in cognition can learn motor skills (van Halteren-van Tilborg, Scherder, & Hulstijn, 2007) and more complex functional tasks (de Werd, Boelen, Rikkert, & Kessels, 2013; Hunter, Ward, & Camp, 2011; Josephsson et al., 1993; Lekeu, Wojtasik, Van der Linden, & Salmon, 2002; van Tilborg, Kessels, & Hulstijn, 2011; Zanetti et al., 1997; Zanetti et al., 2001). The ability to learn motor skills and functional tasks has been attributed to components of memory that are preserved in people living with dementia.

Memory is a complex phenomenon but it can be classified as declarative or explicit (e.g. facts and events) and implicit or non-declarative (e.g. skills and habits) (Squire & Wixted, 2011). Explicit memory is most severely affected in people living with dementia and deficits occur quite early in the development of the disease whereas implicit memory is preserved for longer (Hopper, 2003). As a result, people living with dementia are not able to use effectively explicit memory when learning a new functional task and depend mainly on implicit memory. Learning using implicit memory has specific characteristics. It occurs through repetitive practice even if the person does not remember the practice (Brush & Camp, 1998; Clare & Jones, 2008; Vidoni & Boyd, 2007) and errors need to be eliminated from the practice, otherwise the errors will be reinforced (Clare & Jones, 2008; de Werd et al., 2013; Donaghey, McMillan, & O'Neill, 2010). It has been suggested that training methods (Grandmaison & Simard, 2003; Hopper et al., 2013), which target implicit memory such as spaced retrieval (Creighton, van der Ploeg, & O'Connor, 2013), error free learning (errorless learning) (Clare & Jones, 2008; Middleton & Schwartz, 2012) and specific cueing methods (vanishing cues) (Haslam, Moss, & Hodder, 2010) may play an important role in the rehabilitation of people living with dementia.

Spaced retrieval refers to the practice of recalling information over increasing periods of time (Bier, Provencher, et al., 2008; Bourgeois et al., 2003; Brush & Camp, 1998; Camp, Foss, O'Hanlon, & Stevens, 1996; Cherry, Hawley, Jackson, & Boudreaux, 2009; Cherry & Simmons-D'Gerolamo, 2005) and has been successfully used in people with Alzheimer's disease and other dementias (Brush & Camp, 1998). When using spaced retrieval, information is presented, and the person is asked to immediately recall it. After a correct recall, the person is then asked to recall the same piece of information after a delay (e.g. 30 sec time interval). For every successful recall the time interval is increased, often doubled. After an incorrect response, the time- interval is decreased to the previous successful level.

Errorless learning (Clare & Jones, 2008; Middleton & Schwartz, 2012) has been used with vanishing cues (Haslam et al., 2010; Kessels & de Haan, 2003) as well as spaced retrieval (Haslam, Hodder, & Yates, 2011; Thivierge, Jean, & Simard, 2014). Ensuring that the practice or recall of information is always correct and the person living with dementia does not make a mistake underpins errorless learning. Vanishing cues (the provision of increasing and decreasing cues depending on performance), particularly when combined with errorless learning, has been shown to be useful for learning new information and skills in people living with dementia (Haslam et al., 2010). However, the use of these techniques in retraining mobility tasks such as the sequence of STS strategies has not been reported in the reviewed studies.

People living with dementia often retain skills acquired early in life, e.g. ability to read (Benigas & Bourgeois, 2011; Vuorinen, Laine, & Rinne, 2000). The ability to read can enable the use of written signs or instructions as external memory aids during rehabilitation. Using written instructions can reduce cognitive load (Bayles & Kim, 2003) and assist with preventing errors during the practice, therefore is likely to support implicit learning.

Considering the functional importance of STS (Dehail et al., 2007; Janssen et al., 2002; Schultz et al., 1992), this task was chosen for this program of research. People living with dementia who were able to independently stand up were purposefully selected for the STS retraining used in this research. This permitted the observation of usual STS strategies prior to the commencement of the training and to minimise confounders such as decreased physical abilities.

Overall, the aim of this research program was to investigate the use of spaced retrieval, errorless learning and vanishing cues to retrain STS strategies in people living with dementia. Firstly, STS strategies used by healthy older adults and people living with dementia were determined and a STS assessment tool developed. Subsequently, a detailed protocol of STS retraining using spaced retrieval, errorless learning and vanishing cues supported by an instruction sheet was developed and implemented using a single-case experimental design with multiple baseline lengths allocated to four older adults living with dementia.

This thesis comprises five chapters. Chapter 1 introduces the research program. Chapter 2 presents the background and scoping literature review and consists of six sections. The first section (2.1) introduces the chapter, the second section (2.2) presents STS in older adults and people living with dementia, Section 2.3 explores memory and learning, including learning of basic motor skills in people living with dementia, and methods that can be used to support learning. Section 2.4 presents a scoping review of studies retraining functional tasks in people living with dementia. The last two sections of Chapter 2 are “Summary” (2.5) and “Research aims” (2.6). The next two chapters, Chapter 3 and 4, outline the two studies incorporated into this program of research: comparison of STS strategies used by older adults and people living with dementia (Study 1) and STS retraining using spaced retrieval, errorless learning and vanishing cues in people living with dementia (Study 2). The last chapter (Chapter 5) summarises the research findings and includes a general discussion, implications for clinical practice as well as indicates areas for future research.

Chapter 2 Background and scoping review

2.1. Introduction

People living with dementia have memory problems that increase as dementia progresses (Lucas, 2005). However, memory loss is not uniform. For example, a person with dementia may gradually lose the ability to remember the names of their children or spouse, or what happened a few minutes ago. But, memory of emotions can be still triggered and new habits can be formed.

The risk of developing functional problems increases in the presence of underlying cognitive decline as seen in dementia(Auyeung et al., 2008; Pedone et al., 2005). Older adults frequently experience problems with functional tasks such as STS following an acute illness and hospitalisation (Covinsky et al., 2003; Sands et al., 2002). Physiotherapists routinely retrain STS strategies in older adults and people living with dementia during rehabilitation. However, retraining functional tasks in people living with dementia may pose specific challenges related to memory problems and difficulties with following instructions.

There is growing evidence that by using specific training methods such as cognitive rehabilitation methods, learning new information and improving skills is possible in people living with dementia (Clare, 2012; De Vreese, Neri, Fioravanti, Belloi, & Zanetti, 2001; Grandmaison & Simard, 2003; Hopper et al., 2013), even if they are not able to recall who was teaching them or that learning was taking place. However, there is limited evidence on the use of these methods in retraining functional tasks, in particular, standing up, in people living with dementia in physiotherapy.

This chapter commences with background information on the STS task in the context of difficulties older adults and people living with dementia experience with this task and strategies that can be used to make standing up easier. As people living with dementia experience memory problems and learning difficulties, information regarding specific memory and learning deficits will be explored, particularly with regard to learning motor skills. Methods that can support learning in people living with dementia will also be described. A scoping review is then presented of studies involving functional tasks retraining in people living with dementia. The chapter will conclude with summary and detailed aims of this program of research.

2.2. Sit-to-stand in older adults and people living with dementia

Decline in functional abilities, that include STS and transfers, is common in older adults living in the community (Takata et al., 2013), residential care facilities (Sabol et al., 2011), and in those admitted to acute hospitals (Covinsky et al., 2003; Sands et al., 2002). STS difficulties can have far reaching consequences for the older adult such as being associated with a risk of falling (Yamada & Demura, 2009; Yamada, Demura, & Takahashi, 2013), and increased need for caregiver assistance (Perry et al., 2006). Additionally, an increased length of hospital stay (up to 45%) has been shown for older adults who cannot stand up within 24 hours of admission to acute hospital from a chair without using their arms (Fisher, Ottenbacher, Goodwin, & Ostir, 2009).

STS difficulties increase with age (Ikeda, Schenkman, O' Riley, & Hodge, 1991; Mourey, Grishin, d'Athis, Pozzo, & Stapley, 2000; Wheeler, Woodward, Ucovich, Perry, & Walker, 1985) and can be amplified by parameters associated with the sitting surface. The sitting surface may be challenging for older adults when it is too low (Burdett, Habasevich, Pisciotta, & Simon, 1985; Demura & Yamada, 2007; Mazza et al., 2004), or when the seat or backrest is tilted backwards (Alexander et al., 1996; Wheeler et al., 1985). The absence or low position of armrests can have a further detrimental effect on STS performance, increasing the demands on lower limbs and challenging stability (Wheeler et al., 1985).

In addition to individual physical limitations and challenges faced due to the parameters of the sitting surface; the ability of older adults to stand up may be further impacted by cognitive decline. Age-related cognitive decline is believed to occur before or concurrently with worsening physical abilities (Atkinson et al., 2010; Black & Rush, 2002). Particularly, the decline in global and executive cognitive function has been identified as a strong predictor of physical deterioration in activities of daily living (Atkinson et al., 2007) that among other activities, include the STS task. Older adults depend more than young adults on cognitive monitoring to ensure successful motor performance even during simple tasks (Heuninckx, Wenderoth, Debaere, Peeters, & Swinnen, 2005); activating more brain areas than young adults (Heuninckx et al., 2005; Heuninckx, Wenderoth, & Swinnen, 2008; Mattay et al., 2002). It is thought that this increased brain area activation enhances attention, sensory processing and inter-sensory integration which most likely compensate or counteract the age-related changes in brain function (Heuninckx et al., 2008).

Cognitive and functional decline in people living with dementia appear to be more severe than that seen during the natural ageing process (Auyeung et al., 2008). In people living with dementia, decline in both domains are strongly interrelated (Atkinson et al., 2007; Black &

Rush, 2002; Rosano et al., 2005). Therefore, it is likely that concurrent decline in cognition and functional abilities can lead to more pronounced STS difficulties in people living with dementia than in older adults without cognitive decline.

Most of the evidence relating to STS problems experienced by people living with dementia is derived from research reporting manual handling and communication issues during transfers. Difficulties with standing have been reported in institutionalised older adults with moderate and severe Alzheimer's disease (Tappen, Roach, Buchner, Barry, & Edelstein, 1997). Many individuals were observed who had physical problems with rising from a chair but who also experienced difficulty understanding and following the commands to stand up (Tappen et al., 1997). Similar problems with following instructions were confirmed by a study investigating nurses' strain when assisting with transfers of people with dementia (Wangblad, Ekblad, Wijk, & Ivanoff, 2009). Nurses working in residential care facilities reported that misunderstandings during transfers, not the weight of a person were the biggest source of perceived difficulties (Wangblad et al., 2009). Additionally, nursing staff described the experience during transfers of people living with dementia as a reciprocal struggle (constantly challenging from physical and communication point of view) (Thunborg, Von Heideken Wagert, Soderlund, & Gotell, 2012). It is not uncommon, that when being assisted with standing up, people living with dementia grab or hold onto a chair and/or push back into it, making every day cares difficult (Varnam, 2011). People living with dementia were also reported to have difficulties with STS when the task required adaptation and problem solving; for example, when the sitting surface was changed (Finlay, Bayles, Rosen, & Milling, 1983).

STS difficulties experienced by older adults and people living with dementia are likely to be multifactorial and may relate to their current health status, type of sitting surface as well as their cognitive and functional abilities. Understanding the biomechanical aspects of STS as well as STS strategies that can make the task easier, underpins the rehabilitation approach used by physiotherapists when retraining STS. These methods and strategies will be described in the next sections.

2.2.1. Sit-to-stand in older adults

To be able to stand up from a stable sitting position a person needs to bring the centre of gravity over the base of support through the execution of horizontal and vertical body movements, while at the same time controlling balance (Fujimoto & Chou, 2012; Gross, Stevenson, Charette, Pyka, & Marcus, 1998; Mathiyakom, McNitt-Gray, Requejo, & Costa, 2005; Mourey et al., 2000). In rehabilitation, the STS task is often seen as comprising four phases (Bennett & Karnes, 1998, p. 188; Schenkman et al., 1990):

- Flexion momentum (also known as pre-extension) when the trunk moves forward;
- Momentum transfer, when horizontal momentum is transferred into vertical motion and the thighs lose contact with the seat (seat off or early lift),
- Extension, when the trunk and lower limbs joints extend and a person achieves a vertical posture, and
- Stabilisation phase, when a person needs to maintain balance in standing, that is, to keep the now much higher located centre of gravity over a significantly reduced base of support, in comparison to the initial sitting position.

Standing up from a sitting position can be achieved by using several methods: a vertical rise, when the initial movement is directed more upwards than horizontally; momentum transfer, when a strong horizontal momentum is generated to be transferred into vertical momentum; and the stabilisation method (not to be confused with stabilisation phase described above), that brings the centre of gravity over the base of support through increased leaning forward achieved by the trunk and hip flexion (Scarborough, McGibbon, & Krebs, 2007). Each of these methods is explored below.

2.2.1.1. The vertical rise method

The vertical rise method can be seen as physically demanding due to the centre of gravity remaining behind the base of support during the majority of the task (Mourey et al., 2000; Scarborough et al., 2007). This method of standing up requires strong activation of leg extensors (Scarborough et al., 2007). As a result, the vertical rise method may not be favoured by older adults, particularly when standing up from a lower chair as this requires considerable muscle strength (Hughes & Schenkman, 1996). However, it has been suggested that vertical rise is used by older adults who are afraid of falling and may perceive the horizontal trunk movement (leaning forward) as a threat to stability (Mourey et al., 2000). Fear of falling in particular, was suggested as the reason why older adults keep the centre of gravity posteriorly to the base of support (Mourey, Grishin, d'Athis, Pozzo, & Stapley, 2000; Scarborough, Mc Gibbon, & Krebs, 2007), and consequently, may also fail to stand up (Riley, 1997).

2.2.1.2. The momentum transfer method

The momentum transfer method is recognised as the most efficient STS method (Hughes & Schenkman, 1996; Papa & Cappozzo, 2000). The initial acceleration in the momentum transfer method can assist with standing up by bringing the centre of gravity closer and faster over the base of support, shortening the duration of the task (Fujimoto & Chou, 2012; Shepherd & Gentile, 1994). However, when standing up, the initial horizontal and upward movement of the trunk needs to be terminated to prevent a fall if the uncontrolled forward movement continued beyond the base of support (Riley, 1997). Controlling the forward momentum can be difficult for older adults (Pai, Naughton, Chang, & Rogers, 1994). Although challenging from a balance point of view, an exaggerated momentum transfer is occasionally observed in clinical practice. Some older adults when attempting standing up may perform several forward trunk movements (hip and trunk flexions) before transferring the generated momentum into a vertical rise. It is possible, that older adults perform these multiple hip and trunk flexions to gradually build the momentum and/or to test limits of stability prior to the momentum transfer.

2.2.1.3. The stabilisation method

The stabilisation method involves exaggerated hip and trunk flexion; bringing the centre of gravity closer to the base of support formed by the feet. Although, this method results in a longer duration of the task (Scarborough et al., 2007), it favours stability during the task which appears to be more important for older adults than the speed of movement (Mourey et al., 2000; Mourey, Pozzo, Rouhier-Marcer, & Didier, 1998; Schenkman et al., 1996). Stability demands are believed to be the critical factor prolonging STS duration in older adults (Demirbuken, Algun, Tekin, & Ilcin, 2011; Hughes & Schenkman, 1996) and consequently, resulting in a slower speed of standing up in comparison to younger adults (Fujimoto & Chou, 2012; Hughes & Schenkman, 1996; Papa & Cappozzo, 2000).

Of these methods, the stabilisation method appears to be preferred by older adults when standing up (Hughes et al., 1994; Schenkman et al., 1996). This has been attributed to age related balance problems and increased reliance on visual feedback (Demirbuken et al., 2011; Mourey et al., 2000; Mourey et al., 1998). It has been suggested that balance problems in older adults during standing up are amplified by reduced ability to use visual feedback (Ikeda et al., 1991; Mourey et al., 2000; Mourey et al., 1998; Tully, Fotoohabadi, & Galea, 2005). Decreased ability of older adults to extend the cervical and thoracic spine (looking at the floor) during the initial phase of standing up (from the start of trunk flexion to early extension) was implicated as one of the reason for the decreased visual feedback (Ikeda et al., 1991; Kuo, Tully, & Galea, 2010).

2.2.2. Sit-to-stand in people living with dementia

Only one study was found that has investigated STS performance from a kinematic point of view in people living with dementia (Manckoundia, Mourey, Pfitzenmeyer, & Papaxanthis, 2006). Twelve elderly participants, six females with confirmed dementia (Alzheimer's disease, Mini Mental State Examination scores between 16 and 23, mean age 81 SD = 3.5 years) and a control group of six older adults including three female participants (mean age 79 SD = 3.5 years) without cognitive problems participated in the study. The kinematic analysis involved two cameras, positioned to record from the sagittal plane, with body markers placed on the shoulders, iliac spine, femoral trochanter, knee, lateral malleolus, heel and fifth metatarsal (Manckoundia et al., 2006). The STS parameters analysed included movement duration, shoulder path amplitude, shoulder path curvature, and shoulder tangential velocity profiles. Participants were required to start in a seated position on a chair without armrests, have their arms crossed on the chest to eliminate use of arms and to allow visibility of markers, the trunk was in vertical alignment with the knees flexed to 100 degrees, and the ankles were pre-positioned to ten degrees of dorsiflexion. All participants completed three practice trials before completing STS five times (Manckoundia et al., 2006).

Participants with dementia completed the task in a similar manner to older adults in relation to peak velocity profiles and had a shorter duration of standing up compared to sitting down (Manckoundia et al., 2006). However, participants with dementia moved their shoulders less forward in the horizontal plane (leaning forward) when standing up and sitting down in comparison to the control group (Manckoundia et al., 2006). The authors suggested that as a result of decreasing the forward movement of the shoulders, people living with dementia had to use greater lower limb extensor muscle force to stand up than the older adults and therefore had decreased ability to perform the task efficiently due to difficulties with planning and adjusting the STS strategies in response to the environment (Manckoundia et al., 2006). Care, however, must be taken when interpreting these findings (Manckoundia et al., 2006). Participants were constrained in their starting position, were seated in a chair that did not contain armrests and had to keep their arms crossed on their chest when standing up and sitting down. Therefore, it is unknown if differences in the shoulder path curvature between older adults and people with dementia would still be present if STS performance was unconstrained. Considering the STS differences observed by Manckoundia et al. (2006), it is possible that people living with dementia differ in their use of other strategies recognised as assisting with standing up such as sliding forward to the edge of the chair, positioning feet backwards and pushing up through the armrests.

2.2.3. Sit-to-stand strategies that can make standing up easier

There are several ways available to physiotherapists to make the STS task easier. These can target the physical deficits of the person, modify the environment, or optimise the efficiency of the task performance (Carr & Shepherd, 2010, pp. 77-92). The ability to balance as well as having adequate muscle strength are important factors in achieving successful STS (Akram & McIlroy, 2011; Lord, Murray, Chapman, Munro, & Tiedemann, 2002; Riley, Krebs, & Popat, 1997). These are often impaired in older adults, therefore are routinely addressed during rehabilitation. Using a chair with a higher seat or having the hips and knees positioned to at least 90 degrees before attempting standing are some of the available environmental modifications (Alexander et al., 2001; Alexander et al., 1996; Demura & Yamada, 2007; Hughes et al., 1996; Mazza et al., 2004; Schenkman et al., 1996).

Physiotherapists may teach STS strategies that can make standing up easier even when STS is performed from a challenging sitting surface such as a lower or tilted backwards seat. These STS strategies involve: sliding or scooting forward to sit on the edge of the chair (Barreca et al., 2004; Hughes et al., 1994; Nuzik et al., 1986), moving the feet backwards behind the knee line (Akram & McIlroy, 2011; Khemlani et al., 1999; Schenkman et al., 1990; Schultz et al., 1992; Shepherd & Koh, 1996), leaning forward (Alexander et al., 1996; Hughes et al., 1994; Nuzik et al., 1986; Shepherd & Gentile, 1994), and pushing through the armrests (Etnyre & Thomas, 2007; Schultz et al., 1992) up into standing position. These strategies contribute to better stability and decrease demands on muscle strength by helping to bring the centre of gravity closer (over) the base of support (Figure 1). The average distance that the centre of gravity

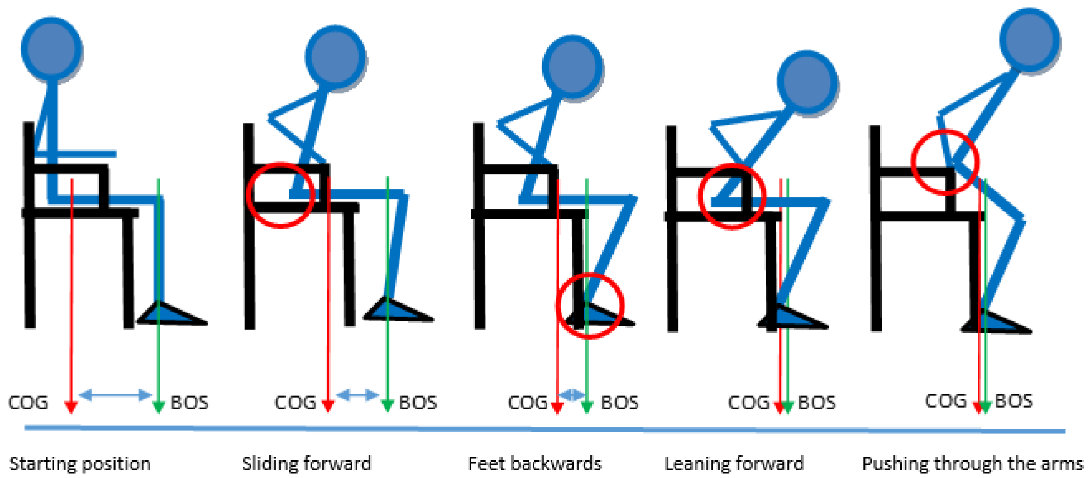


Figure 1 Strategies that can bring the centre of gravity over the base of support
Abbreviations: COG, Centre of gravity; BOS, Base of support

needs to be brought forward is approximately 25 cm to the heels and 33 cm to the ankles (Schultz et al., 1992). In the sections below each STS strategy will be discussed in more detail.

2.2.3.1. Sliding forward

The sliding forward strategy involves moving the buttocks to the edge of the chair. This strategy helps to decrease the distance between the centre of gravity and the base of support (Barreca et al., 2004; Hughes et al., 1994; Nuzik et al., 1986). Sliding forward may be required when the chair is too high for a person to reach their feet to the floor, to compensate for inadequate space under the sitting surface for the feet, or to make standing up easier from a chair with a deep or tilted seat. The sliding forward strategy, together with feet backwards and leaning forward strategies, improves stability during standing up (Hughes et al., 1994).

2.2.3.2. Feet backwards

Placing the feet backwards with the shanks of the lower legs in less than 90 degrees (Gillette, Stevermer, Raina, & Derrick, 2005; Khemlani et al., 1999; Schultz et al., 1992; Shepherd & Gentile, 1994) is another strategy to move the centre of gravity forward, closer to the point of application of ground reaction forces (Kawagoe, Tajima, & Chosa, 2000). By using this strategy the centre of gravity can be brought approximately 14 cm closer to the base of support (Schultz 1992) and can reduce demands on the knee and ankle extensors (Hughes et al., 1994). This can be a useful strategy for older adults as moving the feet backwards appears to result in a greater forward movement of the centre of gravity over the base of support compared to leaning forward (8.1 cm) (Schultz 1992). However, to be able to use this strategy sufficient space is required under the seat for the feet (Kawagoe et al., 2000; Khemlani et al., 1999).

2.2.3.3. Leaning forward

Leaning forward is achieved by trunk and hip flexion, resulting in the upper body and shoulders moving forward. The role of leaning forward differs, depending on the preferred method of standing (Scarborough et al., 2007). This strategy can be used to generate momentum or to improve stability during standing up (Hughes et al., 1994). Increased leaning forward can change the order in which joints complete the extension phase of the STS task from knees, hips and ankles to hips, knees and ankles (Shepherd & Gentile, 1994). Leaning forward is commonly used during the STS task although differing degrees of hip flexion are required depending on the chair and strategy used to stand up. For example, leaning forward increases when standing up is challenged by lowering the seat or when lower limb weakness is present (Shepherd & Gentile, 1994).

2.2.3.4. Pushing through the arms

Pushing through the arms can assist with both the vertical and horizontal movement of the body when standing up (Schultz et al., 1992). Pushing through the arms when rising vertically (with less leaning forward) may decrease the physical demands on the lower limbs but balance may be challenged at the time of seat off as the centre of gravity may not be sufficiently forward over the base of support (Schultz et al., 1992).

Pushing through the arms horizontally may help to control trunk flexion (leaning forward) and contribute to stability required during STS (Leung & Chang, 2009). This has been suggested to assist to stabilise the body position at the time of seat off by bringing the centre of gravity forward (Leung & Chang, 2009; Schultz et al., 1992).

2.2.4. Type, number and sequence of strategies

The majority of evidence available on strategies used during STS is derived from studies where standing up was constrained by seating surfaces or the body position. For example, the seating surface (chair used) was without armrests (Hughes et al., 1994; Mourey et al., 1998; Schenkman et al., 1990; Shepherd & Gentile, 1994) or purposefully made low (Alexander et al., 1996; Burdett et al., 1985; Demura & Yamada, 2007; Mazza et al., 2004). In some studies, participants were required to keep their arms crossed on their chest when standing up (Demura & Yamada, 2007; Yamada & Demura, 2009) or had the starting position of feet (Akram & McIlroy, 2011; Khemlani et al., 1999) or buttocks predetermined (Hughes et al., 1994; Nuzik et al., 1986; Schenkman et al., 1990). Although, these studies provide valuable insight into biomechanical aspects of standing up, there is limited evidence on the STS strategies (sliding forward, feet backwards, leaning forward and pushing through the arms) that are preferred and actually used by older adults or people living with dementia.

The frequency of use of STS strategies by older adults and people living with dementia when standing up from a standard chair naturally without any constraints is not known. Older adults have self-reported that they avoid sitting on some household surfaces (e.g. low chairs) for fear of not being able to stand up (Bohannon 2003). Additionally, if seated, older adults have indicated they typically pushed up through chair armrests, were sliding forward (scooting forward), and leaning forward to be able to stand up (Bohannon & Corrigan, 2003). However, older adults have not been observed for their choice of STS strategies during unconstrained standing up and it is not known if these strategies are used simultaneously, or in a particular sequence.

In everyday living, older adults and people living with dementia may need to stand up with a table in front (for example after a meal) or with a walker in front. The effect of having a table in front on the STS strategies has also not been previously investigated. Interestingly, young adults generated higher horizontal momentum when standing up with bar in front in comparison to an empty space in front (Pai & Lee, 1994). It is possible that having a table in front may similarly influence the STS strategies used by older adults, but this requires investigation.

2.3. Learning in people living with dementia

Dementia is the leading single cause of disability for Australians over 65 years and has become a major health and economic challenge (Access Economics, 2009). People living with dementia have a higher risk of functional decline and developing problems with activities of daily living, including STS, than older adults without cognitive problems (Auyeung et al., 2008; Sands et al., 2002; Sauvaget, Yamada, Fujiwara, Sasaki, & Mimori, 2002).

In the past, memory and learning impairments, inherent to dementia were used to support a view that people with dementia were unable to learn; and therefore, unable to benefit from rehabilitation (Hopper, 2003; Thomas, 2005; Yu, Evans, & Sullivan-Marx, 2005). With increasing understanding of human memory, evidence is now available that memory deficits in dementia do not involve all memory systems and memory that is spared can be used in the learning and rehabilitation process (Clare, 2012; van Halteren-van Tilborg et al., 2007).

Retraining functional tasks such as STS is a core component of the physiotherapy profession but only a few studies were identified that involved teaching people living with dementia skills that relate to STS task (Creighton, Davison, van der Ploeg, Camp, & O'Connor, 2014; Hunter et al., 2011; White, Ford, Brown, Peel, & Triebel, 2014). Understanding the role of cognition in rehabilitation and the best therapy approaches for populations who present with cognitive impairment are recent emerging directions in physiotherapy research (Fisher, Morton, & Lang, 2014). Therefore, this background section will explore memory systems, memory and learning, and in particular, the learning of basic motor skills, in people living with dementia. Methods that have been used in neuropsychology to support memory and task retraining in people living with dementia will be explored with the aim to investigate possible application into STS retraining.

2.3.1. Memory systems

There are various models of memory classification (Henke, 2010). The most often described model is based on the role of consciousness in memory formation and retrieval. This model divides memory into declarative and non-declarative systems (Henke, 2010; Squire & Wixted, 2011; Squire & Zola-Morgan, 1991). The other commonly used model of classification is based on the cognitive processes involved in memory formation. This model classifies memory as working memory (previously known as short memory) and long-term memory, with its subsystem known as remote memory (Jeneson & Squire, 2012; Squire, 2009).

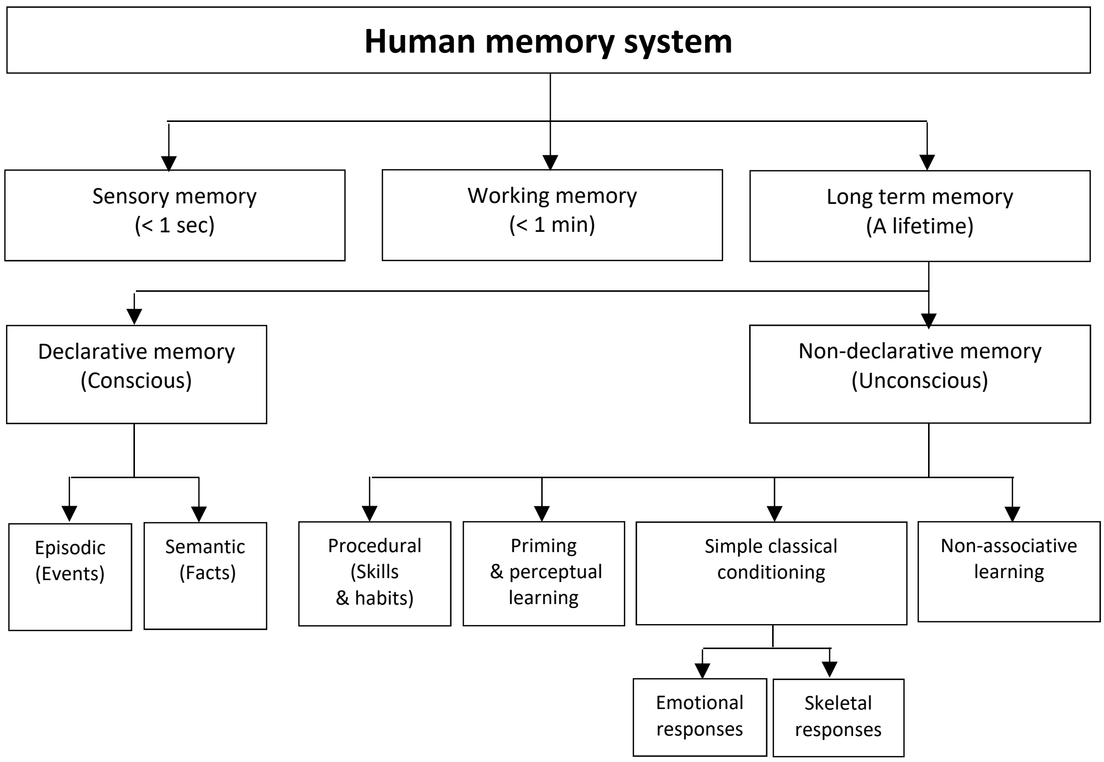


Figure 2 Human memory system
The diagram compiled using information from Jeneson and Squire (2012) and Squire and Zola-Morgan (1991, p. 1381)

Declarative and non-declarative memory systems (Figure 2) are recognised as subsystems of long term memory (Bayley & Squire, 2003; Henke, 2010; Squire, 2009). Differences exist between these two long-term memory systems in what type and how information is learnt, how and where information is stored and is recalled (Squire & Wixted, 2011; Squire & Zola-Morgan, 1991).

Declarative memory relates to events or episodes (episodic memory) and facts or knowledge about the world (semantic memory). This type of memory can be stated or verbalised (Lucas, 2005; Squire & Wixted, 2011) and its acquisition involves brain structures such as the medial temporal lobe and diencephalon (Lucas, 2005; Squire & Wixted, 2011; Wixted & Squire, 2011). Formation of declarative memory occurs through explicit learning that can be seen as a process that involves an awareness of the learning and a conscious recall process. This type of learning is focused on the facts, concepts and steps of the task (Squire & Wixted, 2011; Voss & Paller, 2008).

Non-declarative memory refers to a distinctive group of other memory systems which supports learning that cannot be declared or stated. These include skills and habits, simple classical conditioning, priming and perceptual learning, and non-associative learning (habituation and sensitization) (Squire & Wixted, 2011; Squire & Zola-Morgan, 1991). The brain structures involved in non-declarative memory acquisition comprise the cerebellum, basal ganglia and sensorimotor areas of the cortex located in the frontal lobes (Squire, 2009; Vidoni & Boyd, 2007). In contrast to declarative memory, non-declarative memory cannot be verbalised because it stores information that cannot be declared (Lucas, 2005). Non-declarative memory is acquired through implicit learning; that is, it is acquired without awareness, through practice and experience, and cannot be consciously recalled. Implicit learning is also known as procedural learning because of its relation to procedural knowledge or "skills-based information, where what has been learned is embedded in the acquired procedure" (Squire & Wixted, 2011, p. 266).

Various cognitive processes are involved in formation of memory, one of them being working memory. The frontal lobe, specifically prefrontal cortex, has been identified as a brain area necessary for the function of working memory (Squire, 2009) . Working memory enables a person to hold and manipulate information for a short period of time with an aim to "select and implement goal-directed behaviour, to exercise what are termed executive functions" (Squire, 2009, p. 12714). Working memory has been recognised as a main contributor to the formation of consciously acquired declarative memory (Squire & Zola-Morgan, 1991). However, there is an increasing recognition that working memory can also be unconscious or implicit (Henke, 2010).

2.3.2. Memory and learning in dementia

Alzheimer's disease and vascular dementia are the most commonly known types of dementias with acknowledged overlapping pathology, often leading to a diagnosis of mixed dementia (Jellinger & Attems, 2007; Kalaria, 2002). It is has been postulated that factors causing these dementias have synergistic relations with each other (Jellinger & Attems, 2007). Alzheimer's disease and vascular dementia also share similar patterns of memory problems (Kalaria, 2002; Livner, Laukka, Karlsson, & Backman, 2009).

Memory systems are not equally affected by dementia. It is generally believed that declarative memory and explicit learning decline as dementia progresses, whereas the non-declarative memory system and implicit (procedural) learning are preserved over longer periods (Camp et al., 1996; Clare, 2012; De Vreese et al., 2001; Harrison, Son, Kim, & Whall, 2007; Hopper, 2003; Kuzis et al., 1999; Lucas, 2005; Nestor, Fryer, & Hodges, 2006). Pathological changes related to dementia in the frontal lobe particularly in the area of prefrontal cortex have also detrimental effect on cognitive processes such as working memory (Baddeley, Bressi, Della Sala, Logie, & Spinnler, 1991) .

2.3.2.1. Declarative memory and explicit learning in dementia

The inability to form declarative memories is one of the early signs of dementia, particularly of Alzheimer's disease (Gold & Budson, 2008; Hopper, 2003; Nestor et al., 2006). Episodic memory is typically affected first with the initial loss usually relating to recent events, but in the later stages of the disease, long term and remote memories can also become impaired (Camp et al., 1996; Graham, Emery, & Hodges, 2004; Nestor et al., 2006). The loss of episodic memory has the most detrimental effects on functioning (Gold & Budson, 2008).

It is believed that declarative memory is acquired through cognitive processes such as working memory (Belleville, Chertkow, & Gauthier, 2007). This type of memory, particularly in the area of attention control, starts to deteriorate in the early stages of dementia, leading to difficulties with formation of declarative memories (Belleville et al., 2007). To hold and manipulate information in working memory, information needs to be declared or verbalised aloud or internally, e.g. via a phonological loop (Atabati, Jahangiri, & Mokhber, 2011; Bayles, 2003). It is believed that since these processes involve language which is also affected in Alzheimer's disease (Blair, Marczinski, Davis-Faroque, & Kertesz, 2007), manipulation and rehearsal may be further restricted contributing to problems with memory formation and learning (Atabati et al., 2011; Peters et al., 2009).

Deterioration of declarative memory and coexisting language problems have a detrimental impact on communication, particularly on the ability to follow instructions and commands (Christenson et al., 2011; Tappen et al., 1997; Wangblad et al., 2009; Weirather, 2010). These difficulties have been acknowledged and explored in psychology, speech pathology, occupational therapy and nursing professions but not to the same extent by physiotherapists (Rönnberg, 1999; Staples, 2006). There is no empirical evidence on how physiotherapists perceive these limitations and how they communicate with people living with dementia during therapy. During usual physiotherapy sessions with other groups of patients, communication is mostly verbal (May, 2003; Parry, 2004; Parry, 2005a, 2005b; Talvitie & Reunanen, 2002), with physiotherapists often doing twice as much talking as their patients (Roberts & Bucksey, 2007). With verbal instructions being frequent and often extensive during physiotherapy sessions (Talvitie, 2000) it is not known how physiotherapists communicate and instruct when working with people living with dementia but it is reasonable to suggest it is likely to be similar.

When complex or long verbal commands are provided, this may exceed the capacity of working memory (Bayles, 2003) and a person with dementia may appear uncooperative during therapy. This lack of engagement can have major consequences. It may be alleged that a person with dementia is unable to participate and benefit from therapy, and therefore may be at risk of being denied access to rehabilitation. It is reasonable to suggest, that participation in therapy and overall outcomes could improve, if instructional methods reflected the communication needs of this population.

Difficulties with following instructions may be addressed by providing short and simple commands (Small & Gutman, 2002; Smith et al., 2011; Wilson, Rochon, Mihailidis, & Leonard, 2012). People living with dementia respond better when "alpha" rather than "beta" questions and commands are used by health care workers (Christenson et al., 2011). Alpha questions and commands involve short, clear expressions in the form of action phrases which require specific verbal or motor responses. In contrast, beta questions and commands involve ambiguous, indirect, often interrupted expressions (Christenson et al., 2011). For example, if asking a person living with dementia to stand up, an alpha command would be "stand up", "slide forward". A beta command would be something like "up we go, "come here".

People living with dementia also appear to respond better to instructions that are consistent and repetitive; for example, repeated verbatim every time a particular task is performed (Weirather, 2010). Repeating commands verbatim facilitates the formation of an association between the command and the expected response (Bier, Provencher, et al., 2008; Bird & Kinsella, 1996; Camp et al., 1996). However, repeating commands verbatim is only beneficial when the command is understood by a person with dementia (Small & Gutman, 2002). When the command is not understood, paraphrasing rather than verbatim repeating is recommended (Wilson et al., 2012).

It is reasonable to assume, that considering the impact of declarative memory problems on the ability to follow commands or instructions in people living with dementia, physiotherapists need to be aware of the specific communication needs when retraining functional tasks, including STS. It appears that people living with dementia would benefit from instructions and commands being clear and concise, provided as an action phrase, rather than as an ambiguous or interrupted task description (Christenson et al., 2011) and repeated verbatim (Bier, Provencher, et al., 2008; Camp et al., 1996; Small & Gutman, 2002; Weirather, 2010).

2.3.2.2. Non-declarative memory and implicit learning in dementia

In contrast to the deterioration in declarative memory and explicit learning caused by Alzheimer's disease, non-declarative memory and implicit or procedural learning appear to be relatively spared due to the preserved function in subcortical brain areas (Clare, 2012; Harrison et al., 2007; Kuzis et al., 1999). The preservation of non-declarative memory and implicit learning however, is not uniform and appears to depend on the severity of dementia (Harrison et al., 2007). In addition to disease progression, vascular pathology may have an additional detrimental effect on non-declarative memory and implicit learning. Ischemic lesions have been shown to increase the severity of cognitive problems in people living with dementia, particularly when the vascular pathology involves the basal ganglia and white matter (Iadecola, 2010).

Preservation of non-declarative (implicit) memory in dementia has been demonstrated in most domains of this memory type, including motor skills (Dick et al., 2001; Dick, Andel, et al., 2000; Dick, Hsieh, Bricker, & Dick-Meuhlke, 2003; Dick, Hsieh, Dick-Meuhlke, Davis, & Cotman, 2000; Dick, Nielson, Beth, Shankle, & Cotman, 1995; Dick et al., 1996; Hirono et al., 1997; van Tilborg et al., 2011), habits (Eldridge, Masterman, & Knowlton, 2002), and perceptual repetition priming (Verfaellie, Keane, & Johnson, 2000). Retraining STS is the focus of this research program, therefore the learning of basic motor skills will be explored further.

2.3.3. Learning basic motor skills in dementia

According to motor learning theory, learning motor skills is believed to involve three stages; cognitive, associative and autonomous (Fitts & Posner, 1967). Cognitive stage involves the development of the plan of steps required to perform the skill as well as conscious control and monitoring. In the associative stage, the steps form a sequence that is practiced with ongoing feedback and the movement becomes more consistent. By the third, the most advanced stage, the skill becomes automatic.

Learning motor skills has been reported as possible in dementia due to non-declarative memory and implicit learning being preserved even in later stages of the disease (van

Halteren-van Tilborg et al., 2007). People living with dementia are able to learn basic motor skills through practice and achieve similar improvements to older adults without cognitive decline (Dick et al., 1995; Dick et al., 1996). Basic motor skills learning in people living with dementia will be discussed in the context of types of motor skills and practice undertaken during the training, number of repetitions required, role of visual feedback, retention of skills, and ability of people living with dementia to transfer the learnt skills to another context (generalisation).

2.3.3.1. Type of basic motor skills

Fine as well as gross motor skills learning have been investigated in people living with dementia. Learning of fine motor skills investigated include tracing a path in a maze (Kuzis et al., 1999; Taylor, 1998), a rotor pursuit task where participants held a stylus in one hand aiming to maintain contact with a spot on a rotating disc (Dick et al., 2001; Dick et al., 2003; Dick et al., 1995), a serial reaction time task and pattern learning task (van Tilborg & Hulstijn, 2010), tracing an inverted shape viewed in a mirror (Rouleau, Salmon, & Vrbancic, 2002), rapid aiming arm movements (Yan & Dick, 2006) and turning a knob that controlled the height of a column on a computer screen (Rice, Fertig, Maitra, & Miller, 2008). Learning of gross movement skills investigated have included a bean bag tossing activity (Dick, Andel, et al., 2000; Dick, Hsieh, et al., 2000; Dick et al., 1996) and hitting a tennis ball with a small racket (Andel, 2000).

Regardless of whether fine or gross motor skills are being trained, these studies indicate that people living with dementia are able to learn. Interestingly, people living with dementia had a similar rate of improvement in learning fine and gross motor skills to healthy older adults, regardless of the severity of dementia (Dick et al., 2003; Dick et al., 1995; Dick et al., 1996). However, in comparison to older adults, the same skills were performed slower or with less accuracy by people living with dementia (Yan & Dick, 2006).

2.3.3.2. Type of practice

Generally, people living with dementia appear to benefit from constant practice, which has been defined as “invariant repetition of the movement pattern rather than variations of the skill to be acquired” (Dick, Hsieh, et al., 2000, p. 472). It appears that random or variable practice hinders their learning outcomes (Dick et al., 1996). For example, people living with dementia practiced a rotary task at four speeds presented in either a random order or in a block of one speed at a time (Dick, Hsieh, et al., 2000). No learning was demonstrated following the random practice with a small benefit demonstrated following the blocked practice (Dick, Hsieh, et al., 2000). This was in contrast to healthy older adults who learnt regardless of the practice type and in fact, demonstrated better learning when the practice was random (Dick et al., 2003). Similarly, people with Alzheimer's disease have demonstrated reduced accuracy in a bean bag tossing task when the distance the bean bag had to be tossed was changed (Dick, Hsieh, et al., 2000; Dick et al., 1996) or when different types of tossing movements were introduced (Dick, Andel, et al., 2000).

2.3.3.3. Number of repetitions

Generally, it is believed that learning a motor skill relies on repetitive practice, with better performance associated with higher numbers of repetitions (Luft & Buitrago, 2005). Certainly, this appears to be the case in people following stroke (Wolf, Blanton, Baer, Breshears, & Butler, 2002) or brain injury (Kimberley, Samargia, Moore, Shakya, & Lang, 2010). However, when a rotary pursuit motor task was trained, people with Alzheimer's disease achieved maximum learning after 40 repetitions and additional practice did not improve the performance (Dick et al., 1995). This finding has to be interpreted with caution. Firstly, the reported number of repetitions required to learn the skill is likely to be task specific (Dayan & Cohen, 2011), and therefore may not apply to other motor tasks. Secondly, the authors (Dick et al., 1995) were not able to exclude a possibility of fatigue as a limiting factor of further learning.

2.3.3.4. Visual feedback

The role of visual feedback appears to be also important for people living with dementia during motor skills learning. When learning to perform tasks such as rotor pursuit skills, people living with dementia depended on visual feedback more than older adults without cognitive decline (Dick et al., 2001). The visual feedback provided instant information about errors. However, other forms of feedback may not be as beneficial for learning new tasks in people living with dementia. Older adults living with dementia who were provided with knowledge of their results every third trial when practicing a task of turning a knob to match the height of column presented on a computer screen demonstrated a greater learning effect compared to being provided with feedback after every trial (Rice et al., 2008).

2.3.3.5. Retention

Motor skill learning studies provide evidence that people living with dementia can retain learnt motor skills over time. Retention of basic motor skills was demonstrated in rotor pursuit task (Dick et al., 1995) and tossing tasks (Dick et al., 1996). In both studies, people living with dementia, similarly to older adults, retained their skills one month following the completion of the training period. However, when different practice conditions were tested (Dick et al., 1996), people living with dementia maintained their performance better following constant, rather than random or blocked practice.

2.3.3.6. Transfer (generalisation)

The overarching aim of learning a motor skill is to be able to transfer or generalise the skill. Transferring skills occurs when one learnt skill can benefit a different activity or when it can be utilised in different conditions (Seidler, 2007). In people living with dementia (mainly Alzheimer's disease), some evidence of skill transfer has been demonstrated using a task of tossing a bean bag (Dick, Hsieh, et al., 2000). People living with dementia were able to benefit from previous practice when the bean bag was made heavier but not when the target or distance were changed. However, the skill transfer occurred directly after practice and only to a skill that was highly similar to the skill being trained (Dick et al., 2003; Dick, Hsieh, et al., 2000).

In summary, it appears that motor skill learning in people living with dementia is possible due to preserved implicit memory. However, the type of practice undertaken appears to be important. The practice needs to be constant and visual feedback needs to be available. Retention of basic motor skills is possible but transfer of skills may be impaired and limited to a skill that is closely related or has a high level of similarity. Although people living with dementia appear to have a similar rate of learning of motor skills as older adults, the speed and coordination of movement is usually poorer prior to as well as following the practice.

2.3.4. Methods supporting learning in dementia

It is likely that during acquisition of motor skills both explicit and implicit learning occur simultaneously (Vidoni & Boyd, 2007), particularly, when learning a complex task involving a number of steps that need to be completed in a sequence (Ghilardi, Moisello, Silvestri, Ghez, & Krakauer, 2009). Considering that the declarative memory system (particularly episodic memory) and explicit learning are compromised in people living with dementia (Graham et al., 2004), learning sequence based tasks may be difficult. Therefore, additional methods to support learning may be required to overcome these challenges.

Methods supporting learning in dementia are used with the aim to improve function, compensate for declarative memory problems and to facilitate implicit learning (De Vreese et al., 2001; Grandmaison & Simard, 2003; Hopper et al., 2013). These methods include the use of a specific training schedule (e.g. spaced retrieval), practicing without errors (errorless learning) or using different methods of delivering instructions and commands (vanishing cues, verbal commands, written instructions with steps of a task, modelling). The role of actual practice of the tasks (that is, a subject performed task approach) in learning new skills has also been reported as beneficial. Each of these methods supporting learning will be explained in more detail below but it has to be noted that these can be used in various combination.

2.3.4.1. Spaced retrieval

Spaced retrieval refers to a training method that supports learning through recalling and retrieving information over increasingly longer periods of time (increasing time intervals). The use of spaced retrieval in people living with dementia is attributed to Dr Cameron Camp who pioneered this method of training in this population (Creighton et al., 2013; Oren, Willerton, & Small, 2014). Recent reviews of research on the use of spaced retrieval (Creighton et al., 2013; Hochhalter, Overmier, Gasper, Bakke, & Holub, 2005; Hopper et al., 2005; Oren et al., 2014) support the claim that using spaced retrieval in people living with dementia can assist with learning new information and skills. It is believed that this method supports learning in dementia by tapping into the non-declarative memory system which does not require awareness of the learning process (Camp et al., 1996).

Spaced retrieval has been used successfully for people with Alzheimer's disease (Camp et al., 1996; Cherry et al., 2009; Cherry & Simmons-D'Gerolamo, 2005; Cherry, Walvoord, & Hawley, 2010; Hawley & Cherry, 2004), as well as those with vascular and mixed dementias (Brush & Camp, 1998). Tasks learnt included among many others, accessing external memory aids (written information) in response to a cue that was presented as a precise question (e.g. what do you do when…?) (Bier, Provencher, et al., 2008; Bird & Kinsella, 1996; Bourgeois et al., 2003; Camp et al., 1996), recalling everyday objects (Cherry & Simmons-D'Gerolamo, 2005), face and name associations (Hawley & Cherry, 2004; Hopper, Drefs, Bayles, Tomoeda, & Dinu, 2010), and specifically learning functional tasks such as eating (Lin, Huang, Su, Tsai, & Wu, 2010; Wu, Lin, Su, & Wu, 2014; Wu, Lin, Wu, Lin, & Liu, 2014), and using a mobile phone (Lekeu et al., 2002).

Specific principles underpin spaced retrieval. These include the use of a consistent training command (often presented as a question), usually increasing and doubling the time intervals after correct recall of information, correction of errors followed by immediate recall with return to a previous successful interval, and overlearning when progress is difficult to make (Brush & Camp, 1998). The inclusion of a spaced retrieval test (Brush & Camp, 1998; Camp et al., 1996) has been proposed with the aim to identify people who are more likely to benefit from this method of training. A test of reading ability, particularly when written responses are to be used has been also recommended (Bourgeois et al., 2003; Brush & Camp, 1998).

Training commands

The use of consistent and specific training commands and instructions are recommended to be used in the spaced retrieval method (Brush & Camp, 1998; Camp et al., 1996). Training commands usually are in form of a question that requires a very specific answer. For example, a question, “What do you have to do when you leave the house?” is followed by a specific answer, “I need to lock the door” and action. It is possible that the use of a short and consistent command that requires a prescribed response decreases the ambiguity of communication with people who have dementia and facilitate implicit learning as in stimulus-response conditioning (Hopper et al., 2005).

Time intervals

Once the specific response to the training phrase has been correctly repeated, a period of time, also called a time interval, is allowed to elapse before the information has to be recalled. In spaced retrieval, after every successful recall the time interval increases but, if an incorrect response is provided, the time interval decreases (Figure 3).

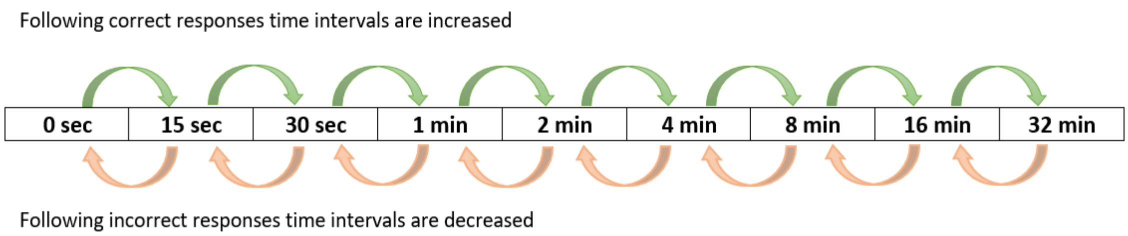


Figure 3 Spaced retrieval time intervals

Time intervals for recall are usually doubled and may follow the pattern proposed by Brush and Camp (1998) and Camp et al. (1996); immediate recall of the training phrase followed by another recall 15 then 30 seconds later and followed by one, two, four, eight, sixteen, and thirty two minute time intervals. However, it has been acknowledged that maintaining a strict interval pattern may not be possible in real training and that intervals may have to be modified according to the task being practiced and a person’s performance (Camp et al., 1996). Different schedules for time intervals have been also investigated (Hochhalter, Bakke, Holub, &

Overmier, 2004; Hochhalter et al., 2005; Hopper et al., 2010). However, the schedule based on doubling time intervals following a correct response appears to be the most commonly used.

Correction of errors

Prevention or immediate correction of errors during practice is one of the main principles underlying spaced retrieval. The flow chart (Figure 4) represents the spaced retrieval training pathway when correct or incorrect responses are provided.

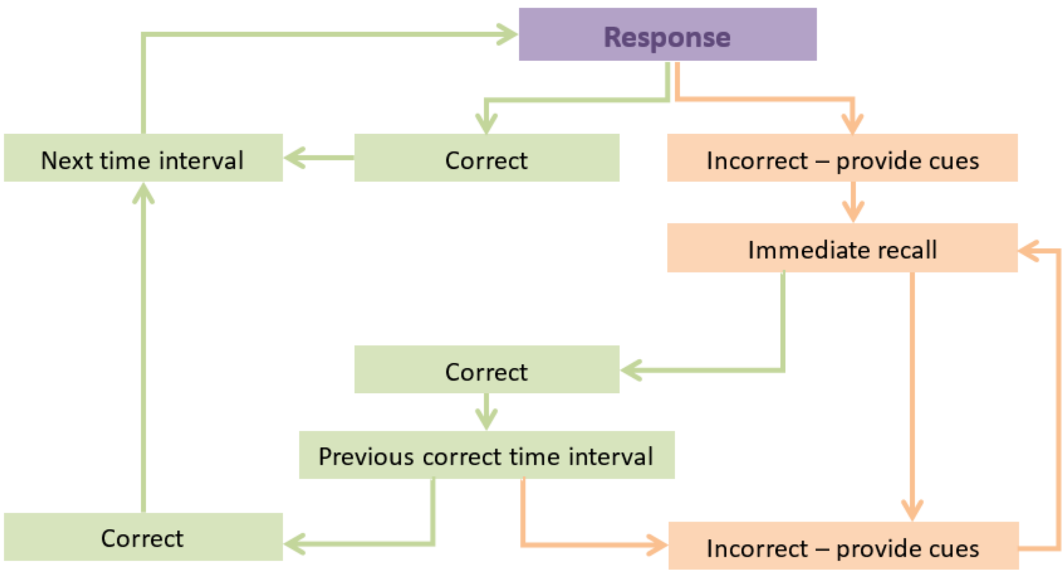


Figure 4 Spaced retrieval pathway for correct and incorrect responses

When hesitation to provide a response or an incorrect recall is observed, a correct answer is provided by the trainer and the person is asked immediately to make another response or recall (Brush & Camp, 1998; Camp et al., 1996). If that recall was successful, that is, it was correct, the next recall takes place after a time interval equal to the previous successful attempt. Prevention and correction of errors in spaced retrieval is believed to support errorless learning that will be described later.

Overlearning

Generally, overlearning refers to overtraining of the task after the task has been mastered (Driskell, Willis, & Copper, 1992). In a spaced retrieval context, overlearning is an additional practice that may be provided when progress in training cannot be made; that is, when a person cannot move to the next time interval. When this happens, repeated practice may be provided. The practice may be repeated using the previous time interval that resulted in successful recall. This may need to be followed by a more gradual increase in time intervals rather than usual twofold expanding of the time (Brush & Camp, 1998). The use of the more gradual time intervals is believed to be helpful with passing a problematic time interval. Brush and Camp (1998) indicated that, if a person is unable to progress in six sessions with overlearning, the person may not be suitable for spaced retrieval.

Screening test for spaced retrieval

Not all people living with dementia are suitable for spaced retrieval and a screening test can be used to identify those most likely to benefit. This involves recalling specific information over short time intervals (Brush & Camp, 1998). For example, a person with dementia may be given a photograph of a man and be told his name. Then, the person is asked to immediately recall the name, for example, "This is Peter Smith. What's his name?" If the correct answer was provided, the question may be repeated 10 seconds and, if successful, after 20 seconds delay. According to the test, a person has no more than three attempts at each of the intervals, although, the test may be repeated later (Brush & Camp, 1998).

Reading test

People living with dementia are usually able to read simple sentences, if they were able to read prior to the onset of dementia (Benigas & Bourgeois, 2011; Bourgeois et al., 2003; Vuorinen et al., 2000). Establishing that a person with dementia can read allows for the use of an external memory aid, such as a card with a written response or steps of a task printed on it to be used during spaced retrieval practice (Bourgeois et al., 2003; Brush & Camp, 1998). In addition, the reading test also helps with the identification of the font size that is most appropriate for someone's visual acuity. A simple printed text in a decreasing font size, starting with the largest at the top of a page, may be used. Considering the decline in contrast perception in dementia (Valenti, 2010), using high contrast such black print on white paper has been recommended.

Use of spaced retrieval with other methods

Spaced retrieval is often used in conjunction with other methods that support learning in people with dementia. Commonly, spaced retrieval has been used in combination with errorless learning (Haslam et al., 2011; Thivierge et al., 2014; Thivierge, Simard, Jean, & Grandmaison, 2008) and structured or graded cueing also known as vanishing cues in a small number of studies (Bier, Provencher, et al., 2008; Neely, Vikstrom, & Josephsson, 2009). Errorless learning and instruction methods will be discussed in the next sections.

2.3.4.2. Errorless learning

Errorless learning aims to eliminate errors in the performance of whatever is being learnt in order to prevent the incorrect performance being practiced and ultimately encoded (Clare & Jones, 2008). This is believed to be a superior training method in people living with dementia than a trial and error approach (Clare, Willson, Breen, & Hodges, 1999; Clare et al., 2000; Kessels & Hensken, 2009; Provencher, Bier, Audet, & Gagnon, 2008). Errorless learning has been used in conjunction with other methods, e.g. spaced retrieval, vanishing cues, prompting, or task modelling. However, it can also be seen as a primary training method in the rehabilitation of people with memory problems, including dementia (de Werd et al., 2013).

It has been postulated that errorless learning can be used effectively only when retraining tasks that meet specific criteria. Specifically, tasks must have only one cognitive domain and a single behaviour component or it is able to be broken down into components; responses should be prescriptive, and not flexible; the task should require attention to the responses and no other aspects of the task; and a person should be physically able to perform the task (Clare & Jones, 2008).

To minimise or eliminate errors in learning for people living with dementia various strategies have been used. These include dividing tasks into smaller components, adequately modelling tasks, preventing guessing, correcting errors, and decreasing cues and prompts in a careful and systematic manner (Clare & Jones, 2008). Errors, particularly related to incorrect guessing can be corrected immediately or prevented by providing cues, prompts and external memory aids. These can be later faded or diminished as a person masters the task (Clare & Jones, 2008; Clare et al., 1999; Clare et al., 2000).

In dementia, errorless learning has been often used in memory rehabilitation (Clare & Jones, 2008) including face-name associations (Clare et al., 1999; Kessels & de Haan, 2003), learning personal information as well as using external memory aids (Clare et al., 1999; Clare et al., 2000). This approach to training has been also used in rehabilitation of everyday tasks in people living with dementia.

2.3.4.3. Instruction methods

In addition to providing short, concise and action based commands and instructions there are other methods that can assist a person living with dementia to complete or learn the task. These methods involve cueing and prompting that can be increased or reduced depending on performance, external memory aids in the form of written signs or instructions and implicit modelling. It has to be mentioned that recent developments in assistive technologies and virtual communication could be used in delivering instructions during functional tasks retraining or during activities of daily living (Seelye, Schmitter-Edgecombe, Das, & Cook, 2012). However, discussing the use of technology is beyond the scope of this thesis.

Cues and prompts

Cueing (providing hints) and prompting (leading though steps of a task) are often used to assist a person living with dementia to achieve the desired response during rehabilitation. Cueing and prompting are believed to support the declarative memory system (Clare, 2012) and generally may involve four types; visual, verbal, gestural, and physical signals. Cueing and prompting may be very structured and provided in an ascending (accumulating, increasing) or descending (decreasing, vanishing) manner.

Vanishing cues refers to the process of reducing cues as a person learns the expected response (Haslam et al., 2010; Kessels & de Haan, 2003). This method of cueing has been reported as superior to ascending cueing because of its potential to tap into the non-declarative memory system (Hunkin & Parkin, 1995). Generally, it is believed that using vanishing cues alone is not particularly beneficial for people living with dementia (Bourgeois et al., 2003; Kessels & de Haan, 2003). Better outcomes have been reported when vanishing cues were used in combination with errorless learning (Clare et al., 1999; Clare et al., 2000; Haslam et al., 2010).

External memory aids

External memory aids can be very useful in facilitating learning for people with dementia (Bourgeois et al., 2003). External memory aids such as a sign that points to the location of objects have been used in the retraining of ADLs (Josephsson et al., 1993). An instruction sheet containing a list of steps to be completed to use a mobile phone has also successfully been used with people living with dementia (Lekeu et al., 2002). Both studies reported positive learning outcomes. In the first study one participant was able to decrease his dependency on external signs (Josephsson et al., 1993) and in the second study (Lekeu et al., 2002), participants learnt to use a mobile phone by independently consulting the list of steps.

However, for a person to use the external memory aid independently in the task, referring to the memory aid needs to be incorporated into the training. The use of the external memory aid may be trained by methods that support episodic memory, for example, spaced retrieval (Bourgeois et al., 2003). Procedural memory systems can also be used to support the inclusion of an external memory aid. An example of this might be the inclusion of a movement such as turning a page with written instructions (Lekeu et al., 2002) of the task being learnt. The use of memory aids can be faded; however, fading may not always be possible, particularly if tasks are complex and have multiple steps to complete (Camp et al., 1996; Curtin, 2011; Lekeu et al., 2002).

Modelling

Modelling is a specific form of providing instructions. It involves demonstration of a task usually without verbal instructions being provided and has been used in motor retraining (Carr & Shepherd, 1998, p. 34; Carr & Shepherd, 2010, p. 40). It is expected that the person being trained replicates all steps and movements without the steps being verbalised (van Tilborg et al., 2011). The use of this method (also known as implicit modelling) was reported recently as beneficial in people with Alzheimer's disease who were learning how to use a coffee machine and a microwave (van Tilborg et al., 2011) and to perform selected ADL tasks (Dechamps et al., 2011).

2.3.4.4. Subject-performed tasks

Subject-performed task approach to learning in dementia involves practice and repetition of the skill being learnt and often includes enactment of action phrases (Charlesworth, Allen, Morson, Burn, & Souchay, 2014). This approach is thought to enable a person to better remember (motor encode) the action phrase that relates to a task when they actually perform the task, rather than hear the phrase spoken to them or observe someone else's performance (Masumoto, Takai, Tsuneto, & Kashiwagi, 2004). For example, instead of simply demonstrating STS or explaining verbally how it should be performed, a person may be provided with an action phrase, such as "lean forward" and be asked to repeat the phrase when performing the movement at the same time. The subject-performed approach to training has been also found to be more beneficial when used in combination with spaced retrieval, than just performance or repetition of a task alone (Bird, 1996).

In summary, learning of new information and skills in people living with dementia may be supported by specific training methods also known as cognitive rehabilitation. These methods can be used in various combinations and involve practicing according to special schedules (spaced retrieval), errorless learning (preventing errors) and instructions and cues delivered in a structured manner (accumulating or fading). When tasks are complex, external memory aids (signs or written instruction can be also used) to decrease cognitive load during practice. The positive role of modelling has been also demonstrated. In general, people living with dementia benefit from performing the task being trained rather than observing.

2.4. Retraining functional tasks in people living with dementia: scoping review

2.4.1. Introduction

People living with dementia often experience decline in mobility and other functional tasks following hospitalisation due to an acute illness (Covinsky et al., 2003; Pedone et al., 2005; Sands et al., 2002) or due to disease progression (Atkinson et al., 2007; Auyeung et al., 2008) Therefore, retraining mobility and improving independence in functional tasks can be seen as one of the main goals of physical rehabilitation. However, due to memory problems that are inherent to dementia, retraining functional tasks appears to be challenging, particularly if a specific sequence or procedure to complete the task has to be remembered.

People living with dementia have inherent declarative memory problems that worsen as dementia progresses (Clare, 2012; De Vreese et al., 2001). This is likely to decrease their ability to learn new information that is required during the first cognitive stage of learning new motor skills (Fitts & Posner, 1967). It has been demonstrated that people living with dementia can learn basic motor skills similarly to people without cognitive decline by repetition of the trained skill. Successful learning of skills such as tracing a path in a maze (Kuzis et al., 1999; Taylor, 1998), a rotor pursuit task (Dick et al., 2001; Dick et al., 2003; Dick et al., 1995), serial reaction time task and pattern learning task (van Tilborg & Hulstijn, 2010), or tossing a bean bag (Dick, Andel, et al., 2000; Dick, Hsieh, et al., 2000) have been reported. However, it appears that to learn more complex, functional tasks, additional training methods may need to be employed to support learning.

Various training approaches and methods are reported to be beneficial in supporting learning in dementia. Spaced retrieval (Camp et al., 1996; Creighton et al., 2013), errorless learning (Clare & Jones, 2008; de Werd et al., 2013) and vanishing cues (Haslam et al., 2010; Kessels & de Haan, 2003) are cognitive methods beneficial in memory rehabilitation. Instruction methods are also important during retraining functional tasks in people living with dementia. Observation and modelling (van Tilborg et al., 2011) where a person is required to observe and follow an instructor, use of external memory aids such as written signs and cues (Josephsson et al., 1993) or written step by step instructions (Lekeu et al., 2002) can assist with improving learning in people with dementia. It has been also reported that people with dementia learn better when they perform the task or enact an action phrase (subject performed task approach) rather than observe or hear the instructions (Charlesworth et al., 2014).

Functional task retraining in dementia, including STS and transfers between surfaces, are of particular interest for physiotherapists. In addition to improving general physical abilities, STS retraining often involves repeated practice of the task and teaching the sequence of STS strategies. The sequence of STS strategies such as sliding forward, feet backwards, leaning forward, and pushing up through the armrests, can make the STS task easier to perform but may be difficult for a person living with dementia to remember. It is possible that during STS retraining people living with dementia would benefit from specific training approaches and methods believed to support learning in this population. Therefore, a scoping review was conducted to inform the approach to STS retraining to be used in people living with dementia in Study 2. The specific aims of this review were to explore the studies involving functional task retraining in people living with dementia, particularly what functional tasks were trained, training methods used, amount of training provided, and learning outcomes.

2.4.2. Methods

A scoping review was undertaken to enable inclusion of studies with diverse designs, from single case to randomized controlled trials (Levac, Colquhoun, & O'Brien, 2010). The review was based on the framework developed by Arksey and O'Malley (2005). This framework comprises five stages; identifying the research question and relevant studies, selecting studies meeting the inclusion criteria, retrieving and charting study data, collating and summarizing study data, and finally reporting the results. The methodology section of this review will be presented according to the scoping review framework.

2.4.2.1. Identifying the research question

The research questions to be explored in this scoping review were developed with the aim to inform development of STS training protocol to be used in Study 2. The specific questions to be investigated by this scoping review were:

- In people living with dementia what types of functional tasks have been retrained, what training methods have been used, and how much training has been provided?
- What were the learning outcomes?

2.4.2.2. Identifying relevant studies

To answer the research questions, selection criteria for study inclusion in this scoping review were determined prior to searches and included:

- people living with dementia (Alzheimer’s disease or mix dementia)

- retraining of functional tasks involving a sequence of movements/actions
- experimental studies published in English

Studies were excluded that used assistive technologies to support training or when intervention was non-task specific.

The following databases were searched: PubMed Central, CINAHL via EBSCO, PsycINFO via Ovid, and Google Scholar. Initial searches were conducted in 2012 and repeated in June 2015. The following searching terms and key words were used: dementia or Alzheimer's, activities of daily living (tasks, skills, motor skills, functional skills) and cognitive rehabilitation (spaced retrieval, errorless learning, vanishing cues, therapy, learning, training, retraining, and rehabilitation). Reference lists of key publications were also searched. Searches were conducted by the candidate and a second member of the research team.

2.4.2.3. Selecting studies

The results of searches were downloaded to EndNote and duplicates were removed. The screening of studies against selection criteria was conducted by the candidate and another member of the team. Consensus was used to finalise study selection for inclusion.

2.4.2.4. Retrieving and charting data

Retrieved studies were charted in alphabetical order of the primary authors. The following data were extracted from the retrieved studies: study design, participant characteristics, study settings, tasks trained, training methods used, amount of practice, and learning outcomes including retention, transfer (generalisation) of learnt tasks.

2.4.2.5. Reporting results

Extracted data were summarised in a table and reported in a narrative format corresponding to the type of the data extracted.

2.4.3. Results

2.4.3.1. Identification and study selection

The process of identifying relevant studies is presented in the flow chart (Figure 5) and was based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher, Liberati, Tetzlaff, Altman, & Group, 2009). Database and additional searches identified 1056 studies. Following removal of duplicates and after initial screening of titles and abstracts, 971 studies were excluded as not relevant to the subject of the study. Following review of the full text of retrieved studies, a further nine studies were excluded as they involved non-functional laboratory based tasks (n=2), cognitive tasks (n =1) or interventions that were non-task specific (n = 6).

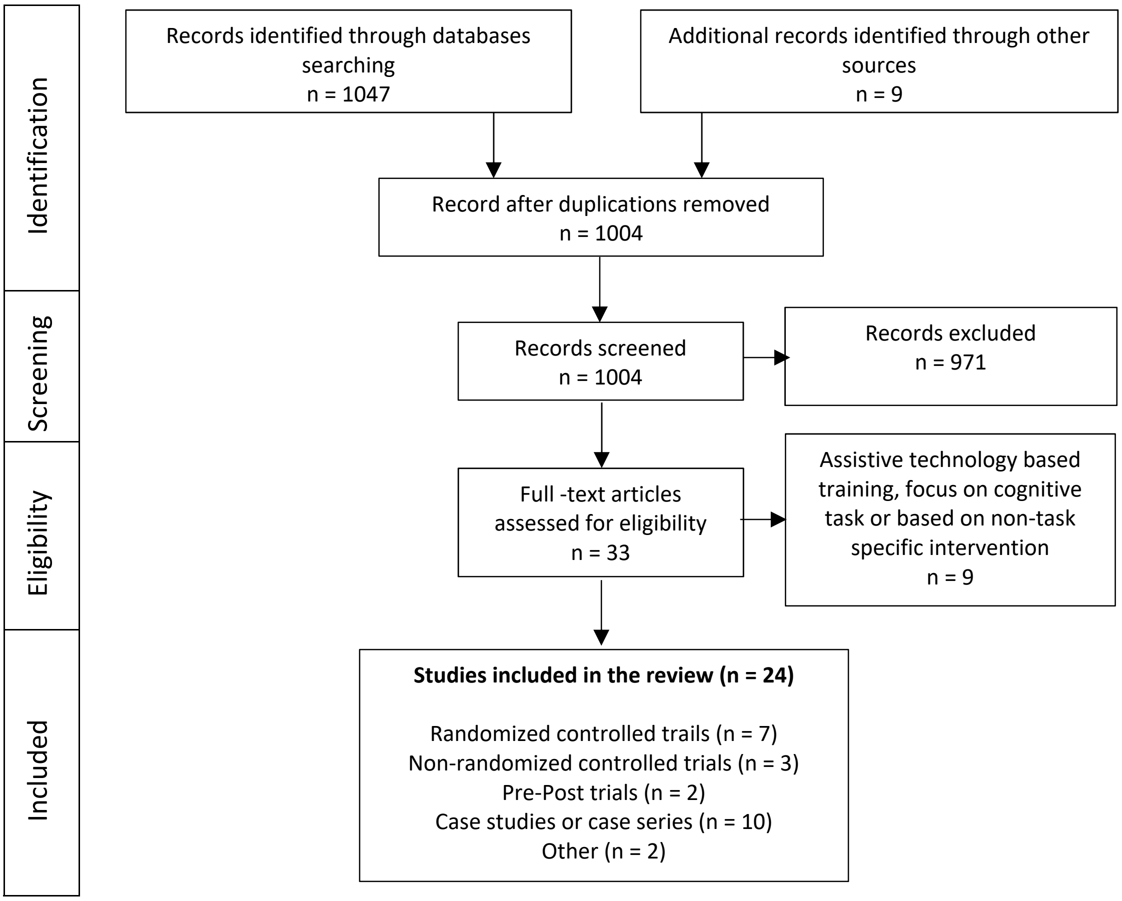


Figure 5 Flow chart of literature search and selection process

Table 2.1 summarises the included studies in terms of study design, participants' characteristics and settings, type of tasks being trained, training methods used, amount of practice undertaken, and reported outcomes. Twenty-four studies were retrieved meeting the inclusion criteria of the scoping review with a total of 731 participants involved in the studies. Nine studies (Farina et al., 2002; Hunter et al., 2011; Lam et al., 2010; Lin et al., 2010; Tappen, 1994; Thivierge et al., 2014; van Tilborg et al., 2011; Wu, Lin, Su, et al., 2014; Wu, Lin, Wu, et al., 2014) reported numbers of participants who dropped out. The overall completion rate in the included studies was 93.4%.

Table 2.1 Summary of included studies investigating retraining of functional tasks in people living with dementia

Author	Study design	Participants and settings	Task(s) trained	Training methods	Amount of practice	Learning effects
Avila et al., 2004	Pre-test and post-test trial	5 participants (4 F), mean MMSE 22.2.30 (SD=2.17), mean age 77.4 years (SD=2.88) Setting – not specified	ADL tasks: telephone use, giving and receiving messages, using diary and steps to prepare sandwich Memory task: remembering someone's name	Neurorehabilitation program: individual and group sessions based on EL, involving task practice and simulation; memory tasks: motor movements, associations and categorisation	60 min group sessions and 30 min individual session a week over 14 weeks	Improvement in ADL tasks: telephone use, giving and receiving messages; smaller effect in memory task
Bier et al., 2008	Single case experimental design (ABAB) with multiple baselines	2 participants: P1 (M) with probable AD, MMSE 26/30; P2 (F) with mixed AD and VD, MMSE 26/30, both participants aged 76 years Setting – home in the community	P1: use of calendar P2: three tasks (use of a familiar cassette radio; new video cassette recorder (multiple steps) and attending prayer group to a cue	P1: SR training during main intervention and progressive cueing provided by carer between sessions P2: EL and VC for use of cassette radio and video cassette recorder, SR for cue to attend rosary group:	P1: exact amount of training not specified; carer provided support for 3 weeks P2: 8 sessions for cassette radio, 10 sessions for video-cassette recorder, 27 sessions for attending rosary	P1: able to associate verbal response to cue, less successful performing task, difficulty incorporating into usual routines, low spontaneous use P2: relearnt to use familiar cassette radio and retained 9 weeks, learnt to use video recorder and retained 6 weeks, transfer and spontaneous use limited to similar situations, low spontaneous use; able to learn association with alarm clock and attending a rosary
Creighton et al., 2014	Case studies; pre-test and post-test	2 female participants: P1 with AD, MMSE 17/30, aged 91 years; P2 with probable AD, MMSE 8/30, aged 85 years Setting - care facility	Using wheeled walker	SR, EL	5 x 60 min sessions, 1 session a day over 5 consecutive days	Both participants improved in using walker. P1 (mild dementia) had better retention one week after training
Curtin, 2011	Case studies; pre-test and post-test	5 female participants with mild AD, MMSE ranged from 14 to 23/30, age ranged from 71 to 85 years Setting - home in the community	Breakfast meal preparation, 15 to 42 sub-tasks each individual activity	Individualised skills training with verbal, visual, physical prompts gradually decreased; precise sequence of sub-tasks practiced	5 x 45 min sessions, 1 session a day over 5 consecutive days provided by a nurse and followed by 5 similar sessions provided by caregivers	Improved meal preparation with modifications observed after nurse led training (decreased type and number of prompts); after caregiver training 2 participants maintained and 3 further improved their performance;

Author	Study design	Participants and settings	Task(s) trained	Training methods	Amount of practice	Learning effects
						none reached independence
Dechamps et al., 2011	Case studies; counterbalanced within-subject design with randomly allocated crossover sequence of intervention	14 participants (12 F) with dementia: 1 participant with mild dementia, 5 with moderate dementia and 8 with moderately severe dementia; mean MMSE 15.2/30; mean age 86.0 years (SD=5.7) Setting - care facility	Each participant practiced under 3 different training conditions; 3 individually selected tasks; tasks selected included making tea, using CD player, using coffee machine, using TV remote control, changing batteries of a remote control, mailing a letter, setting a table, lacing up a shoe, and folding a shirt)	Condition 1: EL (verbal instructions) Condition 2: participant modelled steps demonstrated and verbalised by therapists Condition 3: trial and error with guessing Tasks divided into small action sentences displayed on cue cards (one written, one picture)	Each task practiced during 6 x 30 min sessions in 1 week, (180 min training per task in total); cards used to test explicit knowledge (putting cards in order)	Improved performance demonstrated with EL and modelling. Modelling resulted in better performance during follow up assessments 1 and 3 weeks later; small improvement noted after trial and error training but was not maintained. No training conditions resulted in explicit learning as tested using the cue cards
Donaghey and O'Neill, 2010	Randomised controlled trial	30 participants (21 M) with trans-tibial amputation, 2 mixed groups EL group (n=15, 6 with dementia) ACE-R 82.4/100 (SD=3.5), mean age 62 (SD = 14.6) years Usual treatment group (n=15, 5 with dementia), ACE-R 83.7/100 (SD=8.6), mean age 66 (SD=6.80) years; Setting - limb fitting clinic	Putting on leg prosthesis (task with up to 13 steps)	Donning prosthesis was demonstrated; EL group guided through steps by a therapist to prevent errors. Usual treatment group allowed errors that were corrected afterwards	1 session lasting from 15 to 30 min – putting on prosthesis, task repeated 5 times during the session	EL group recalled more steps and made fewer mistakes, those who improved included participants with cognitive impairments
Farina et al., 2002	Non-randomised two-group clinical trial with 3 month follow up	22 participants with AD, (20 completed the study); Group 1 (n=11, 8 F): mean age 73.2 years (SD=6.8), mean MMSE 19.3/30 (SD=3.3), Group 2 (n=11, 7 M): mean age 74.5 years (SD=8.4), mean MMSE 20.1/30 (SD=3.1) Setting - day hospital	Group 1: 24 ADL tasks (12 in kitchen: e.g. washing hands, setting unsettling the table, preparing tea or coffee; 12 in room, e.g. writing/sending a letter, opening/closing a lock, identifying currency, making a phone call Group 2: short term memory, language,	Practice/task repetition	2 sessions a day, 45 min each, 3 times per week for 5 weeks	Both groups improved post training using Functional Living Skills Assessment, both groups returned to baseline 3 months later

Author	Study design	Participants and settings	Task(s) trained	Training methods	Amount of practice	Learning effects
			visuospatial tasks			
Fenney and Lee, 2010	Case studies with measures of performance at baseline, during all training sessions and follow up	3 male participants with dementia: P1 with mixed AD and Lewy body dementia, DRS 126/144, aged 68 years; P2 with AD, DRS 68/144, aged 79; P3 with AD, DRS 105/144, aged 90 years Setting – day program	Bowling using Nintendo Wii^{TM}	Usual practice – task repetition	5 to 8 group sessions lasting 60 min; each participant had 10 turns to play/session; follow up completed at 5-months (2 participants); 1 participant informally followed up at 6 months	Retention of ability to play and similar scores up to 6 months
Hunter et al., 2011	Case studies; pre-test and post-test with follow up	6 participants: 5 (4 F) with AD, 1 (F) with vascular dementia; 5 participants with AD completed the study, age median=89.5 years (range 79 to 95), MMSE median=17/30 (range 9 to 22) Setting - care facility		SR training delivered first by researcher then transitioned to nursing staff	20-30 min sessions, 2 to 9 training sessions over 3 weeks provided by a researcher and maintenance transferred to nursing staff; performance was assessed after training and retention 3 weeks later	All 5 participants were able to learn the response to the prompt question, 4 made progress towards achieving goals
Josephsson et al., 1993	Single case design; multiple pre-tests and post-tests	4 participants: P1 (F) with AD, aged 65 years, MMSE 4/30; P2 (F) with AD, aged 72 years, MMSE 10/30; P3 (M) with AD, aged 65 years, MMSE 18/30; P4 (F) with multi-infarct dementia, aged 74 years, MMSE 14/30 Setting - day care unit	Preparing and eating breakfast; setting table for lunch; preparing soft drink; setting table for coffee (one task per participant)	External guidance (signs on equipment and its organisation); verbal support (prompts, cues, answers to questions); physical support (demonstration of sub-activities)	9 sessions, 10 to 30 min, 3 to 5 sessions/week	One participant had no improvement; two demonstrated learning when environmental cues were maintained but not when removed; one participant improved and maintained improvement two months later
Kessels and Henseken, 2009	Randomised controlled group design	60 participants, grouped by cognition, randomly assigned to two training conditions (EL or trial and error) Group 1: severe dementia, mean MMSE 10.3/30 (SD=2.3) for both subgroups: EL (n=10, 6 F), mean age 83.6 years (SD=8.1); trial and error (n=10,9 F) mean age 83.2 years (SD=7.1), Group 2 - mild to moderate	Implicit and explicit task involving problem solving; specific sequence of 6 steps to remove a cork from a tube, (test from the Behavioural Assessment of Dysexecutive Syndrome Battery)	EL and trial and error training conditions	Learning during one session followed by immediate testing and delayed testing from 1 to 3 days later	Participants with dementia performed better after immediate testing compared with delayed testing; participants with dementia who practiced using EL performed better compared with trial and error practice; mild to moderate dementia participants performed better after delayed testing compared

Author	Study design	Participants and settings	Task(s) trained	Training methods	Amount of practice	Learning effects
		dementia, mean MMSE 22.0 (SD=2.6) and 21.0 (SD=3.9): EL (n=10, 7 F), mean age 76.5 years (SD=7.9); trial and error (n=10, 6 F), mean age 77.1 years (SD=9.4), Group 3: controls without dementia, mean MMSE 27.7/30 (SD=1.0) and 27.5/30 (SD=0.7): EL (n=10, 7 M) mean age 72.7 years (SD=11.0); trial and error (n=10, 5 F), mean age 71.9 years (SD=8.9) Setting - day clinic and ward of a care facility				to participants with severe dementia but worse that the control group
Lam et al., 2010	Randomised controlled trial	74 participants with dementia completed training, 1 month follow (n=66), 4 month follow up (n=57) Intervention group (n=37, 25 F), mean age 83.1 years (SD=6.9), mean MMSE 13.4/30 (SD=4.0) Control group (n=37, 30 F), mean age 83.87 years (SD=7.0), mean MMSE 13.9 (SD=4.8) Setting - social centres and care facility	Selection of not specified daily activities based on individual needs; Control group: randomly allocated activities	Training delivered in mixed groups (intervention and control group participants), therapist decided about the complexity of training in relation to cognitive abilities	2 sessions a week over 8 weeks, duration of sessions not specified	1-month post intervention both groups improved in process skills but a trend of skills deterioration was observed after training was stopped
Lekeu et al., 2002	Case studies; pre-test, post-test	2 participants with AD; P1 (F), aged 58 years, MMSE 21/30; P2 (M), aged 82 years, MMSE 22/30 Setting - ambulatory cognitive rehabilitation centre	Use of mobile phone	Instruction sheet attached to phone SR - to turn phone over to use instruction sheet EL - to prevent errors when using phone, verbal and physical cues	45 min sessions, 1 to 2 sessions a week over 3 months	Both participants succeeded in using instruction sheet without additional cueing; after 3 months, participants were able to use mobile phone without instruction sheet
Lin et al., 2010	Single blinded randomised controlled trial	85 participants with dementia (82 completed the study) SR group (n=32, 18 F), mean age 79.69 years (SD=6.1), mean MMSE 13.56/30 (SD=5.05)	Eating	SR group: each session trained one eating motion, Montessori: singing used for training eating step by step, Control – no intervention	SR and Montessori groups: 35-40 min sessions, 3 times a week over 8 weeks	SR and Montessori group decreased eating difficulties; SR improved eating ability; Montessori group decreased need for assistance

Author	Study design	Participants and settings	Task(s) trained	Training methods	Amount of practice	Learning effects
		Montessori group (n=29, 12 F), mean age 82.9 years (SD=5.96) Control group (n=24, 15 F), mean age 81.1 years (SD=6.94), mean MMSE 10.5/30 (SD=8.02) Setting - care facility				
Rogers et al., 1999	3 x 3 design (condition x ADL category); participants and caregivers observed for 25 weekdays (5 days usual care, 5 days intervention, 15 days habit training)	84 participants (58 F) with probable AD (n=19) and possible AD (n=65); mean age 82 years (SD=6.3), mean MMSE 6.07/30 (SD=5.49) Setting – care facility	Everyday morning care, including 3 main categories: dressing performance, other ADL (bathing, toileting, oral hygiene, grooming) and no ADL (inactivity or mobility)	Usual care delivered by nursing assistants Intervention delivered by research therapist providing occupational therapy with graded assistance (5 levels from neutral prompt to physical assistance) Habit training delivered by research assistant providing reduced assistance as skills were learnt	Usual care: 1 x session a day for 5 weekdays Intervention: 1 session a day for 5 weekdays Habit training: 1 session a day for 15 weekdays	Participants improved independence in dressing, increased participation in assisted dressing, decreased incidence of disruptive behaviour, increased appropriate requests for assistance during the intervention phase; gains were maintained but not further improved during habit training
Rösler et al., 2002	Pre-test, post-test; blinded assessor	10 participants (gender not specified) divided into 2 groups AD group (n=5), mean age 77.2 years (SD=4.66), mean MMSE 14.8/30 (SD=2.46) Depression group (n=5), mean age 78.6 years (SD=2.93), mean MMSE 27.2/30 (SD=0.74) Setting - not specified	Dancing – waltz to be danced alone	Standardise dance lesson, slow dance danced alone	30 min sessions over 12 consecutive days	AD participants made substantial progress; participants with major depression did not improve
Tappen, 1994	Randomised controlled trail	72 participants (63 completed the study), 75% female, mean age 84 years (SD=8.50), mean MMSE 6.4 (SD=6.57) randomly allocated to 3 groups of 21 participants: repetitive functional skills training, general stimulation and control group	Toileting, eating, bathing, dressing, grooming, standing, walking	Group based interventions: functional skill training involved repetitive practice of skills with verbal prompting, physical demonstration and graded assistance; general	2,5 hour session per day, 5 sessions per week over20 weeks	Functional skills training group improved on Physical Self-Maintenance Scale in comparison to small gains in general stimulation group and decline in control group; functional stimulation group improved in goal attainment in comparison to control group

Author	Study design	Participants and settings	Task(s) trained	Training methods	Amount of practice	Learning effects
		Setting-care facility		stimulation involved playing games, discussions, listening to music, and relaxation Controls - usual care		but general stimulation group did not differ from other groups; no significant treatment effect was found on the Performance Test of Activities of Daily Living
Thivierge, et al., 2014	Block-randomized cross-over controlled study, single blinded with follow up	20 participants (17 completed the study) randomised into two groups with the first group practicing first Group 1 (n=9, 6 F), mean age 80.00 years (SD=6.14), mean MMSE 21.56/30 (SD=2.51) Group 2 (N=8, 6 F), mean age 80.00 (SD=4.90), mean MMSE 22.13/30 (SD=2.36) Setting – home in the community	Chosen tasks: use of TV remote control, DVD, video, radio or other music devices, computer, games (including Wii game), origami; number of steps from 7 to 20	EL and SR, 5 levels of cueing and assistance (accumulating or fading as required), additional practice with caregivers	8 sessions (2 sessions per week), 45-60 min sessions (including assessments); additional practice provided by caregivers	All participants improved in trained tasks and demonstrated some retention of skills 2 to 3 months later
Van Tilborg et al., 2011	Counterbalanced self-controlled cases series, measures pre-test, during each sessions and follow up	28 participants (26 completed the study); gender not specified; participants with AD (n=10), mean age 79.8 years (SD=4.4), mean MMSE 20.4/30 (SD=3.5); participants without dementia (controls), aged, gender and education matched (n=16), mean age 76.3 years (SD=7.1), mean MMSE 27.7/30 (SD=1.7) Setting – day care facility	Using microwave oven and coffee machine, each task divided into 10 steps, each group practiced all tasks using different methods	Individualised training, one task implicit modelling (participant modelled the trainer without errors); second task providing verbal cues (explicit training) – trainer naming steps for participant who performed the steps	5 x 15 min sessions, each task trained 5 times during each session, some sessions the same day but separated by minimum 3 hours	Both groups able to learn tasks regardless of training method used; control group performed better in all tasks. A small but significant decrease in performance noted on follow up assessment in tasks trained implicitly but not explicitly
White et al., 2014	Case series; pre-test, post-test	3 female participants with AD: P1 aged 90 years, MMSE 14/30; P2 aged 89 years, MMSE 12/30; P3 aged 95 years, MMSE 11/30 Setting - residential care facility	One to four tasks per participants out of following: dual-task walking and standing with narrow base of support, walking with narrow base of support, stepping onto bathroom scale, supine to sit; stand to sit, static standing and balance	SR, EL, high repetition practice, modelling, cueing, physical assistance	30 min sessions, 10 to 12 physiotherapy sessions over 4 weeks, 3-15 task repetitions per session	All participants improved on balance measures; P1 incorporated sitting for a few seconds before standing up when getting up from bed; P2 incorporated arms support when sitting down

Author	Study design	Participants and settings	Task(s) trained	Training methods	Amount of practice	Learning effects
Wu et al., 2014 (a)	Single-blinded quasi-experimental design, with follow up 1, 3 and 6 months	99 male participants with dementia (90 completed the study), assigned to three groups Standardised SR group (n=25), mean age 82.1 years (SD=6.8), MMSE 18-23/30 (24%), 12-17/30 (28%), 6-11/30 (48%) Individualised SR group (n=38), mean age 82.7 years (SD=6.8), MMSE 18-23/30 (3%), 12-17/30 (47%), 6-11/30 (45%) Control group (n=27), mean age 83.4 years (SD=4.0), MMSE 18-23/30 (22%), 12-17/30 (52%), 6-11/30 (26%) Setting – care facilities	Eating: 5 eating procedures (realising it is mealtime, picking up bowl and spoon, scooping food and bringing to the mouth, putting food into the mouth and chewing, eating meals continuously) Feeding: 3 behaviours (opening and closing mouth, chewing, and swallowing	Standardised SR group practiced with 1, 2, 4, 8, 16, 32-min recall time intervals with additional Montessori based activities (e.g. scooping balls using a spoon) SR individualised group practiced the same but progressed individually with limits of practice being set Control group – no training	Standardised SR group: 35-45 min sessions, 3 sessions a week over 8 weeks, 1 task per week (24 sessions in total) SR individualised group - number of sessions depended on SR progress.	Standardised and individualised training using combined SR and Montessori based activities decreased eating difficulties, increased amount of food consumed and body weight in comparison to the control group
Wu et al., 2014 (b)	Randomised double blinded controlled trial	63 participants with dementia (61 completed the study); gender not specified) SR only control group (n=29), mean age 79.7 years (SD=6.4), mean MMSE 12.7/30 (SD=4.4), 31% mild, 41% moderate, 28% severe dementia SR and EL group (n=32), mean age 80.2 years (SD=8.1), mean MMSE 13.9/30 (SD=5.7), 38% mild, 34% moderate, 28% severe dementia Setting: care facilities	Eating and feeding – eight learning items (as in Wu et al., 2014 (a))	SR only group practiced with 1, 2, 4, 8, 16, and 32 min time intervals, card placed face down and participant could flip the card to see the correct answer; SR and EL group practiced similarly with additional accumulating cues (1 to 3 levels)	Each group practiced three times a week, 35-40 minute sessions over 8 weeks, 1 learning item per week	SR and EL improved more than SR alone in eating ability and food intake; first learning item (realising it is mealtime to a cue being a piece of Mozart music) had worse recall than remaining 7 eating learning items
Zanetti et al., 1997	Clinical controlled study	20 participants, 2 groups based on cognition Intervention group (n=10, 9 F) with dementia (AD), mean age 77.2 years (SD=5.3), mean MMSE 19.8/30 (SD=3.5) Control group (n=10) older adults without dementia (gender	20 basic or instrumental ADL in two groups of 10: (a) wash face, brush teeth, make coffee, setting table, opening/ closing door, sending postcard, read a sentence, pay a cheque,	Verbal support such as prompts, cues, answers to questions but maximum 3 per task Control group – no training	60 min training session, five sessions per week over 3 weeks Control group no training	AD participants improved on trained as well untrained tasks

Author	Study design	Participants and settings	Task(s) trained	Training methods	Amount of practice	Learning effects
		not specified), mean aged 68.0 years (SD=4.8), mean MMSE 28.7/30 (SD=0.9) Setting - day hospital dementia research unit	shop with a written list, identifying currency. (b) wash hands, dressing, opening/ closing door-lock, spread jam on bread, setting table, sending a letter, copying a sentence, reading a post-card, counting currency, using the telephone.			
Zanetti, et al., 2001	Non randomised controlled study	18 participants with AD, 2 groups Intervention group (n=11, 10 F), mean age 78.0 years (SD=8.4) years, mean MMSE 20/30 (SD=3.4) Control group (n=7, 6F), mean age 74.0 years (SD=12.0), mean MMSE 19/30 (SD=4.2) Setting – day hospital dementia research unit	13 basic and instrumental ADL tasks: washing face, washing hands, brushing teeth, opening/closing door, locking door, putting objects in correct place, spreading jam on bread, using the telephone, using a calendar, setting the table, reading brief sentences, using money, dressing	Intervention group: Prompts, cues, leading patient in the task, number of cues varied depending on individual participant needs; no more than two cues during baseline and follow up assessments Control group – no training	60 min individual sessions, 1 session a day, 5 days a week over 3 consecutive weeks; sessions provided by occupational therapist	Intervention group improved performance time and control group had non-significant increase in time required to complete tasks

Abbreviations: AD: Alzheimer's disease; ACE-R: Addenbrooke's Cognitive Examination – Revised; ADL: Activities of Daily Living; CDR: Clinical Dementia Rating Scale; DRS: Dementia Rating Scale II; EL: Errorless learning; F: Female; MMSE: Mini Mental State Examination; M: Male; P: Participant; SR: Spaced Retrieval; VC: Vanishing Cues

2.4.3.2. Study designs, participants' characteristics and study settings

Twenty-four studies were included in the review. Four of the studies were published before 2000, eleven were published between 2000 to 2010 and nine studies since 2010. The most common study design was single case study or cases series (n =10). This was then followed by randomised controlled trials (n = 7), non-randomised controlled trials (n = 3), pre and post trials (n =2), and two other designs (Rogers et al., 1999; Wu, Lin, Wu, et al., 2014). The overall number of participants across all included studies was 731. Learning outcomes were reported for 700 participants, including 17 participants (Lam et al., 2010) who did not complete follow up reviews. Out of 700 participants, 335 (47.8%) were females. Gender was not specified for 107 participants (Rosler et al., 2002; van Tilborg et al., 2011; Wu, Lin, Su, et al., 2014; Zanetti et al., 1997). The number of participants in the included studies ranged from two (Bier, Provencher, et al., 2008) to 90 (Wu, Lin, Wu, et al., 2014). Seventy (10%) participants were older adults without a diagnosis of dementia. These participants were involved in four studies as control or comparison groups (Kessels & Hensken, 2009; Rosler et al., 2002; van Tilborg et al., 2011; Zanetti et al., 1997) or were included in a mixed group design study (Donaghey et al., 2010). Participants living with dementia (n = 630) primarily had a diagnosis of Alzheimer's' disease ranging from mild to severe dementia, with MMSE between 26/30 (Bier, Provencher, et al., 2008) and 4/30 (Josephsson et al., 1993).

Of the 24 studies included in the review, 11 were conducted in residential care facilities. Two of these studies were also conducted in a second setting: day care (Kessels & Hensken, 2009) and social care centre (Lam et al., 2010). Remaining studies were conducted in other single settings such as day care or day hospitals (n=6), a cognitive rehabilitation centre (Lekeu et al., 2002), and a limb clinic (Donaghey et al., 2010). Three studies (Bier, Provencher, et al., 2008; Curtin, 2011; Thivierge et al., 2014) were conducted primarily in participants' homes. Two studies did not specify the setting (Avila et al., 2004; Rosler et al., 2002).

2.4.3.3. Tasks trained

The included studies reported a variety of functional tasks being trained. Seven studies focused on single or multiple basic activities of daily living including eating, bathing, dressing, grooming, toileting, and mobility tasks such walking with and without a walker, stepping up, standing, sitting down, and moving on bed (Creighton et al., 2014; Lin et al., 2010; Rogers et al., 1999; Tappen, 1994; White et al., 2014; Wu, Lin, Su, et al., 2014; Wu, Lin, Wu, et al., 2014). Instrumental activities such as using a phone or other electronic devices, preparing meals or setting a table, were trained in nine studies (Avila et al., 2004; Bier, Provencher, et al., 2008;

Curtin, 2011; Dechamps et al., 2011; Josephsson et al., 1993; Lam et al., 2010; Lekeu et al., 2002; Thivierge et al., 2014; van Tilborg et al., 2011). In three studies participants practiced a range of basic as well as instrumental activities of daily living tasks (Tappen, 1994; Zanetti et al., 1997; Zanetti et al., 2001). Other functional tasks trained included putting on an amputee lower limb prosthesis (Donaghey et al., 2010), learning a problem solving task that required a sequence of steps to be completed (Kessels & Hensken, 2009), bowling using Nintendo Wii™ (Fenney & Lee, 2010), and waltzing (Rosler et al., 2002). One study (Lam et al., 2010) did not specify exact activities of daily living being trained. Four studies out of the included 24 (17%) related to physiotherapy and involved mobility tasks (Creighton et al., 2014; Hunter et al., 2011; Tappen, 1994; White et al., 2014).

2.4.3.4. Training methods

Several training methods were consistently used across all included studies. All participants learnt the task being trained by performing the task. All studies employed some form of prompting and cueing to decrease errors during practice. However, several specific methods such as spaced retrieval, errorless learning, graded cues (vanishing cues) or modelling were also employed either in isolation or in combination to support the learning. The schedule of practice was structured according to spaced retrieval time intervals in nine studies. In six of these studies spaced retrieval was purposefully combined with preventing errors (errorless learning) (Bier, Provencher, et al., 2008; Creighton et al., 2014; Lekeu et al., 2002; Thivierge et al., 2014; White et al., 2014; Wu, Lin, Su, et al., 2014) and in two studies spaced retrieval was combined with the Montessori method that required participants to perform additional tasks, mimicking elements of the main tasks being learnt (Lin et al., 2010; Wu, Lin, Wu, et al., 2014). Providing errorless learning as a primary training method was the main foci of intervention in four studies (Avila et al., 2004; Dechamps et al., 2011; Donaghey et al., 2010; Kessels & Hensken, 2009). In three studies, spaced retrieval was combined with errorless learning and with cues being decreased in a structured manner (graded or vanishing cues) as participants improved their performance (Thivierge et al., 2014; White et al., 2014; Wu, Lin, Su, et al., 2014).

Seven studies employed task repetition with prompting and cueing as the main approach to training (Curtin, 2011; Josephsson et al., 1993; Lam et al., 2010; Rogers et al., 1999; Tappen, 1994; Zanetti et al., 1997; Zanetti et al., 2001). One study compared the effects of explicit verbal cues (steps of the tasks named by a trainer and followed by participants) to implicit modeling (steps of the task demonstrated by the trainer and modeled by participants) (van Tilborg et al., 2011). Modeling was also employed as one of the instruction methods in two other studies involving balance and mobility tasks retraining (White et al., 2014) and instrumental activities of daily living (Dechamps et al., 2011). In three studies external support such as written signs and cues (Josephsson et al., 1993), pictures (Dechamps et al., 2011) and a written list of steps or instructions on how to complete the task (Lekeu et al., 2002) were also used.

In the included studies, errorless learning was reported as more beneficial in people living with dementia in comparison to trial and error practice (Dechamps et al., 2011; Donaghey et al., 2010; Kessels & Hensken, 2009) and in one study spaced retrieval combined with errorless learning and graded cues (vanishing cues) were more beneficial than spaced retrieval alone (Wu, Lin, Su, et al., 2014). Spaced retrieval combined with errorless learning and graded cues (vanishing cues) was also reported as beneficial but no comparison was made to other training methods (Thivierge et al., 2014; White et al., 2014; Wu, Lin, Su, et al., 2014).

2.4.3.5. Amount of practice

The amount of practice (duration, frequency and total number of sessions) varied across the studies. Duration of practice sessions ranged from 15 minutes (van Tilborg et al., 2011) to 150 min (Tappen, 1994). The frequency of sessions also varied: from one a day (Curtin, 2011; Josephsson et al., 1993; Rosler et al., 2002; Zanetti et al., 1997; Zanetti et al., 2001) to two sessions a day (van Tilborg et al., 2011), or only one session a week with up to 24 weeks in between the sessions (Fenney & Lee, 2010). The total number of training sessions also was wide-ranging. Two studies provided only one training session that involved putting on a leg prosthesis (Donaghey et al., 2010) and a problem solving task (Kessels & Hensken, 2009). The largest number of training sessions (100 over 20 weeks) was delivered in the study involving basic and instrumental activities of daily living. In this study, the intervention was delivered in groups of participants and was based on task repetition and graded cueing and prompting (Tappen, 1994). The remaining studies provided between five to 30 training sessions. In studies based on spaced retrieval, the number of reported sessions ranged from five sessions (Creighton et al., 2014; Wu, Lin, Su, et al., 2014; Wu, Lin, Wu, et al., 2014), followed by eight (Thivierge et al., 2014) and 12 sessions (Hunter et al., 2011; White et al., 2014). The largest number of sessions in studies based on spaced retrieval was 24 (Lekeu et al., 2002; Lin et al., 2010).

2.4.3.6. Learning outcomes

All 24 studies reported that people living with dementia were able to improve their performance in the various basic and instrumental activities of daily living regardless of the training methods used. When compared to learning outcomes of participants without diagnosis of dementia, people living with dementia tended to have inferior learning outcomes (Kessels & Hensken, 2009) or did not reach a similar level of performance (Zanetti, 1997). Learning was also more impaired in participants with more severe dementia when compared to those with less advanced disease (Kessels & Hensken, 2009). However, in one study involving waltzing lessons, people living with dementia improved more in comparison to older adults diagnosed with depression (Rosler et al., 2002).

People living with dementia were able to learn functional tasks but demonstrated variable ability to retain the skills after the training. Retention up to six months was demonstrated when learning to bowl using Nintendo Wii™ (Fenney & Lee, 2010). However, in other studies, participants returned to baseline functioning when tested three months after the intervention was completed (Farina et al., 2002). In the majority (83.3%) of the included studies no specific skill support program was provided after the intervention period, other than participants performing tasks as required for usual functioning. Four studies included a maintenance or skill support program following the study intervention. These studies involved meal preparation tasks (Curtin, 2011), morning routines such as dressing and personal hygiene (Rogers et al., 1999), activities of daily living (Josephsson et al., 1993), and use of a walker when mobilising or armrest when standing up and sitting down (Hunter et al., 2011). In these studies, maintenance programs included five additional sessions, one session a day, over five days (Curtin, 2011), nine additional practice sessions of activities of daily living over five days (Josephsson et al., 1993), and 15 days of habituation program provided to participants practicing morning routines (Rogers et al., 1999). In one study (Hunter et al., 2011) nursing staff continued to use a similar approach to the intervention after the initial training was completed by the researcher. Retention was positive when tested immediately after the completion of the maintenance program (Rogers et al., 1999), after a two month period (Josephsson et al., 1993) and after three months of ongoing support (Hunter et al., 2011), suggesting that people living with dementia have some capacity to retain learnt functional tasks when support program is provided.

In comparison to retention, skills transfer in functional tasks in people living with dementia has not been extensively studied in the included studies. Zanetti et al. (2001) reported that people living with dementia who practiced some activities of daily living tasks improved in other activities not being trained. The authors (Zanetti et al., 2001) concluded that functional improvements may be independent of learning context. One other study (Bier, Provencher, et al., 2008) reported that transfer of the learnt tasks is possible to similar situations but generally may be difficult for people living with dementia.

2.4.4. Discussion

This scoping review aimed to identify studies involving functional tasks retraining in people living with dementia. Specifically, the aim of the review was to identify what types of functional tasks have been retrained, what training methods have been used, how much training has been provided and what were the learning outcomes. Data were extracted from the reviewed studies to inform Study 2 and particularly to assist with the development of a training protocol to be used to teach a sequence of STS strategies make the STS task easier to perform in people living with dementia.

Study designs included in this scoping review varied; from single case or case series studies to randomised controlled trials. Variability was also found in the participants of the included studies, with numbers ranging from two to 90 and disease severity ranging from mild to severe dementia. Nearly half the studies (45.8%) were conducted in residential care facilities and only three studies were conducted in participants' homes in the community. Functional tasks trained involved various single or multiple instrumental as well as basic activities of daily living. Four studies involved tasks relevant to physiotherapy such as standing, walking, sitting down using armrests or remembering to use a wheeled walker. Interventions in all studies were based on task repetition and used different types of cueing and prompting to decrease errors during the practice. Additional methods such as spaced retrieval, errorless learning, graded cues (vanishing cues), external memory aids (signs and lists of steps) as well as modelling were also used and reported as beneficial. Errorless learning was reported to be more beneficial for learning in dementia than trial and error approach. Spaced retrieval with errorless learning was reported as more advantageous than using spaced retrieval alone. Combining spaced retrieval, errorless learning and graded cues (vanishing cues) also delivered positive learning outcomes. The amount of practice varied across the studies; from 15 to 90 minutes, from one to two sessions a day, from one session a week to 24 weeks between sessions, and from 1 session only to 100 training sessions in the program over 20 weeks. People living with dementia were able to learn but retention varied, particularly when no maintenance (support) program was provided after the intervention. Only one study compared the learning outcomes of people living with dementia to older adults without dementia who were trained in the same task. The learning outcomes for people living with dementia were inferior, and worse for those with more advanced disease. This was in contrast to the studies involving waltzing when people living with dementia performed better than older adults diagnosed with depression. Transfer or generalisation was reported in two studies with implication that transfer of skills is possible in people living with dementia but limited to tasks with close similarity.

2.4.4.1. Design, participants, settings

The scoping review identified that functional tasks training was investigated using various study designs. Following the methodology of scoping reviews (Arksey & O'Malley, 2005; Levac et al., 2010; Pham et al., 2014), the quality of the studies was not formally assessed. However, it was noted that of the 11 case studies or case series, only three studies (Bier, Provencher, et al., 2008; Dechamps et al., 2011; van Tilborg et al., 2011) used single case methodology that could meet at least some of the quality criteria of single case studies (Tate et al., 2008; Tate, Perdices, et al., 2013). Other single case design studies involved mainly pre and post-test assessments. A benefit of using single case methodology in this area of research is that it allows inclusion of participants presenting with diverse physical and cognitive symptoms and at different stages of the disease progression (Komarova & Thalhauser, 2011).

Participants living with dementia were included across the spectrum of severity of the disease. However, only one study (Kessels & Hensken, 2009) investigated the training response on the severity of the disease, with more learning outcomes evident in those with less severe cognitive decline. In 22 out of 24 studies included in this review, MMSE was used (alone or in combination with other measures) to describe severity of dementia. Although use and reporting of MMSE in geriatric research has been criticized, this measure of global cognition remains one of the commonly used (Monroe & Carter, 2012).

Eleven out of 24 included studies were conducted in residential care facilities, followed by studies in day care centres or day hospitals, homes in the community and specific outpatient clinics. This perhaps highlights that people living with dementia in residential care facilities or living in a community are more likely to be medically stable. This assumption is supported by research indicating the people living with dementia hospitalised for an acute illness are at risk of developing delirium (Ryan et al., 2013), and therefore, may be less medically stable and less suitable to participate in research. The risk of delirium as well as early discharge before a project is finished, may pose challenges that limit the conduct of research in people living with dementia in acute care settings. However, despite these potential challenges, acute hospital settings cannot be omitted in future research. People living with dementia often experience functional decline related to hospital admissions due to acute illness (Pedone et al., 2005; Sands et al., 2002) which then requires functional task retraining. The outcomes of functional tasks retraining in this population could potentially be improved with evidence specific to this setting.

Only three studies involved participants living in their homes in the community (Bier, Provencher, et al., 2008; Curtin, 2011; Thivierge et al., 2014). This setting too may pose challenges to researchers. Challenges such as decreased control over the consistency of interventions and availability of caregivers to assist with the studies were reported (Bier, Provencher, et al., 2008; Curtin, 2011). On the other hand, caregivers who are too helpful may also be a challenge when the intervention needs to be controlled and specific (Curtin, 2011).

Conducting research with people living with dementia in residential care facilities also poses challenges. Staff of residential care facilities may find participation or supporting the research difficult due to time pressures during delivery of daily cares or potential disruption of usual routines (Hunter et al., 2011). Furthermore, it may be also difficult to gain informed consent, from residents diagnosed with dementia (Hall, Longhurst, & Higginson, 2009).

2.4.4.2. Tasks trained

A range of basic and instrumental activities of daily living tasks (from single to multiple tasks) were trained in people living with dementia. Only a small number of these tasks involved mobility (moving on bed, standing, walking, stepping up, sitting down, using a wheeled walker) and therefore were directly related to physiotherapy. Only two of 24 studies included in the review reported involvement of physiotherapists. One study was conducted by physiotherapists with a focus on specific mobility tasks that are frequently retrained during physiotherapy (White et al., 2014) and in the second, a physiotherapist with experience in cognitive rehabilitation delivered training sessions involving instrumental activities of daily living (Farina et al., 2002). No studies were found that involved retraining of STS strategies in people living with dementia. Although, the insight into learning from studies involving other functional tasks may be applied in tasks retrained by physiotherapists, there is a need for studies that would focus on retraining specific tasks, including STS, during physiotherapy in people living with dementia.

2.4.4.3. Training methods

Training methods to support learning functional tasks varied across the studies. Although some studies compared the effects of specific training methods, the majority of studies explored the effects of a single training method or a combination of a few methods. It is possible that at this stage of research into functional tasks retraining, the body of research comparing effects of different training methods is still developing. Furthermore, it is possible that different tasks require different training approaches and more research is needed to identify the best approach to retraining specific tasks. Based on the reviewed studies, it may be implied that people living with dementia learn by practicing the task with cueing and prompts, verbal instructions as well as modelling to minimise errors. The practice may be also supported by training based on spaced retrieval and combined with errorless learning and graded cues (vanishing cues) (Thivierge et al., 2014; White et al., 2014; Wu, Lin, Su, et al., 2014). The use of signs and written steps to follow to complete the task may also be beneficial (Lekeu et al., 2002). The training methods employed in the studies promoted consistency of practice; an approach reported as beneficial in previous studies involving learning basic motor skills in dementia (Dick, Hsieh, et al., 2000). Studies reporting retraining mobility tasks relevant to physiotherapy (Creighton et al., 2014; Hunter et al., 2011; Tappen, 1994; White et al., 2014) as well as studies involving tasks with a sequence of steps (Donaghey et al., 2010; Lekeu et al., 2002; Thivierge et al., 2014; Wu, Lin, Su, et al., 2014), provide some insight as to optimise STS strategies retraining.

2.4.4.4. Amount of practice

The variability of the amount of practice combined with the variability of tasks being trained and training methods employed, makes it difficult to recommend the amount of practice required to teach a person living with dementia specific tasks. Furthermore, none of the included studies compared different amounts or intensity of practice using the same task and the same training approaches. In one study involving basic instrumental activities of daily living and based on task practice and graded cues, 100 sessions were provided over 20 weeks (Tappen, 1994). To learn how to use a mobile phone with 100% correct responses and without referring to an instruction sheet, two participants received up to 24 sessions based on spaced retrieval and errorless learning (Lekeu et al., 2002). A large number of training sessions may not be feasible when delivering training across different settings (acute hospitals, private homes or residential care facilities) due to time constraints, hospital and care facility routines, or medical stability over the prolonged study periods. One option available to address these challenges may be to have the training supplemented or continued by family and carers outside of the therapy sessions (Bier, Provencher, et al., 2008; Curtin, 2011; Hunter et al., 2011).

Of eight studies included in the review and involving specific practice schedule (spaced retrieval), six studies (Creighton et al., 2014; Hunter et al., 2011; Thivierge et al., 2014; White et al., 2014; Wu, Lin, Su, et al., 2014; Wu, Lin, Wu, et al., 2014) reported the number of sessions ranging from five to 12 and only two studies reported up to 24 training sessions (Lekeu et al., 2002; Lin et al., 2010). Considering that single case methodology appears to be the most appropriate to be used in Study 2, the minimum number of training sessions appears to be at least five, to meet the required sampling criteria (Tate et al., 2008; Tate, Perdices, McDonald, Togher, & Rosenkoetter, 2014; Tate, Perdices, et al., 2013).

2.4.4.5. Learning outcomes

Generally, all studies included in the review reported positive learning outcomes regardless of the tasks being practiced, training methods employed or the amount of practice provided. Although the specific learning outcomes and retention varied, the reviewed studies provide evidence that people living with dementia can learn functional tasks. Generalisation or transfer appears to be impaired and limited to only similar tasks (Bier, Provencher, et al., 2008; Zanetti et al., 1997). Participants improved in trained as well as untrained tasks when tasks were matched such as washing face and washing hands, opening and closing door and opening and closing a door-lock, or identifying currency and counting currency (Zanetti et al., 1997). It would be clinically important for physiotherapists to investigate if people living with dementia could transfer STS strategies practiced during training sessions to standing up from different surfaces or in a room that was different from where training sessions were conducted. Furthermore, the response of people living with dementia to commands given by a person other than the person who provided the training, warrants investigation as this could have implication for transfer of skills outside of therapy sessions.

2.4.4.6. Implications for sit-to-stand retraining

No studies were found involving STS retraining that applied training methods known to support learning in people living with dementia. Therefore, a specific STS training protocol will be developed for Study 2. The training will involve teaching people living with dementia a sequence of four STS strategies to make the STS task easier to complete. To ensure consistency of practice and support errorless learning during the training, an instruction sheet with written STS strategies will be used (Dechamps et al., 2011; Lekeu et al., 2002). The training will be based on spaced retrieval training schedule with a consistent training command similarly to other studies (Bier, Provencher, et al., 2008; Creighton et al., 2014; Hunter et al., 2011; Lin et al., 2010; Thivierge et al., 2014; White et al., 2014; Wu, Lin, Su, et al., 2014; Wu, Lin, Wu, et al., 2014). To further support errorless learning, graded (vanishing) cues will be also provided (Thivierge et al., 2014; White et al., 2014; Wu, Lin, Su, et al., 2014). The research program will be conducted in a residential facility using single case methodology cognisant of the recommended criteria (Tate et al., 2008). Eight training sessions will be delivered and proceeded with a baseline period when no training will be provided (Bier, Provencher, et al., 2008). Following the intervention, a short maintenance program will be provided to promote retention of learnt skills (Curtin, 2011; Josephsson et al., 1993; Rogers et al., 1999). An attempt will be made to assess transfer (generalisation) of the STS strategies, as these have been explored in only two out of 24 studies (Bier, Provencher, et al., 2008; Zanetti et al., 1997).

2.4.4.7. Limitations of the review

The aim of this scoping review was to identify studies that involved functional tasks retraining and to extract data that could inform the STS retraining in people living with dementia to be used in Study 2. Although multiple terms and key words were searched, other terms may also exist and could potentially return additional studies. Considering the variability of study designs, a scoping approach seems to be the appropriate methodology for this review. However, this methodology has inherent limitations as it provides narrative synthesis without assessing the study quality and bias, unlike systematic reviews (Pham et al., 2014). Another limitation that cannot be overlooked is reviewers' bias. The reviewers focused on identifying studies and extracting data to inform specific studies. Therefore, it is possible that other reviewers would interpret inclusion criteria differently.

2.4.5. Conclusions

The scoping review provided evidence that people living with dementia can learn functional task. However, the reviewed studies varied in design, number of participants, settings, tasks trained and learning outcomes, particularly the retention. This review indicates that in addition to practicing tasks with cues and prompts additional methods can be employed. These methods may involve spaced retrieval, errorless learning, graded cues and prompts (vanishing cues), external memory aids such as instruction sheets with steps of a task, or modelling. The finding of the review also identified a need for more research involving functional tasks retraining at different stages of dementia as well as into training methods and amount of training needed for specific tasks. Considering the small number of studies involving mobility tasks, more research is required into specific tasks and methods that can be used to support learning in people living with dementia during physiotherapy.

2.5. Summary

This chapter comprised a background and scoping review. The background component of this chapter provided valuable insights into STS in older adults and people living with dementia, the learning abilities in this population as well as conditions required to learn basic motor tasks. The background on methods that support learning in dementia and the scoping review of studies involving retraining functional task provided information for the STS training protocol to be developed for Study 2.

Difficulties with STS are common in older adults and particularly in people living with dementia (Tappen et al., 1997; Wangblad et al., 2009). An inability to stand up independently, in the presence of cognitive decline has far reaching consequences that include dependency on physical assistance (Perry et al., 2006) and potential risk of institutionalisation. The ageing process, comorbidities as well cognitive decline, have been shown to have a detrimental effect on STS in older adults.

Older adults perform STS task slower (Fujimoto & Chou, 2012; Hughes & Schenkman, 1996; Papa & Cappozzo, 2000) and use a number of strategies to preserve stability during the task (Hughes & Schenkman, 1996; Hughes et al., 1994). These strategies may involve pushing through the arms, placing feet backwards, leaning forward and sliding forward (Barreca et al., 2004; Hughes et al., 1994; Janssen et al., 2002; Nuzik et al., 1986). Although the benefits of these strategies for older adults are well documented, there is no evidence how commonly they are used and whether they are used in any specific sequence when the task is unconstrained and performed from a standard chair.

There is limited evidence on specific STS problems experienced by people living with dementia and if this population completes the task differently to the healthy elderly. It appears that people living with dementia lean forward less than healthy elderly people (Manckoundia et al., 2006). However, there is no evidence what other STS strategies are used and in what sequence.

STS is frequently retrained by physiotherapists during physical rehabilitation. STS strategies are commonly evaluated by physiotherapists but there is no evidence regarding the consistency between physiotherapists when observing the same task. In STS retraining physiotherapists address performance limitations and often teach STS strategies using demonstration, movement facilitation and verbal instructions and provide ongoing feedback (Carr & Shepherd, 2010, pp. 37-42). During rehabilitation, in addition to guiding and facilitating movement, most communication initiated by physiotherapists is verbal and involves describing, explaining, and correcting the task (May, 2003; Parry, 2004; Parry, 2005a, 2005b; Talvitie, 2000; Talvitie & Reunanen, 2002). This approach may have a detrimental effect on communication and rehabilitation process of people with dementia, particularly those with Alzheimer’s disease or mixed dementia, who have decreased comprehension and need instructions in the form of short and clear action phrases, rather than lengthy explanations (Christenson et al., 2011).

Dementia is an umbrella term that covers a large number of disorders. The most commonly known type of dementia is Alzheimer’s disease but it frequently coexists with vascular pathology leading often to a diagnosis of mixed dementia. Dementia pathology affects a number of cognitive functions, including memory. The memory problems underlie a misconception that people living with dementia cannot learn new tasks (Thomas, 2005).

However, the two major memory systems, declarative memory and non-declarative memory, are not equally affected in dementia (Gold & Budson, 2008; Hopper et al., 2013). Declarative memory refers to memory of episodes and events, and non-declarative memory involves skills and habits, priming, emotional learning, simple conditioning, habituation and sensitisation, and perceptual leaning (Squire, 2009; Squire & Zola-Morgan, 1991). Non-declarative memory is preserved much longer into the disease (Camp et al., 1996; Clare, 2012; Harrison et al., 2007; Kuzis et al., 1999).

Different types of learning are involved in declarative and non-declarative memory systems; explicit and implicit respectively. During explicit leaning a person usually has an intention to learn and is aware of learning taking pace (Vidoni & Boyd, 2007). During implicit learning a person may be aware that some learning is taking place but the process is less conscious than during explicit learning (Vidoni & Boyd, 2007). For example, when learning motor skills, the only way to demonstrate that the skill was learnt is to perform the task. Implicit learning of skills is based on repeated practice. During skills learning both systems are usually involved (Ghilardi et al., 2009), although in people living with dementia, the declarative system is likely to contribute in a decreasing capacity as dementia progresses.

Preservation of the non-declarative memory system and implicit learning allows for the acquisition of basic motor skills as well as functional tasks in people living with dementia (Harrison et al., 2007; van Halteren-van Tilborg et al., 2007). Learning basic motor skills in people living with dementia appears to require specific conditions such consistent practice and visual feedback. Retention of basic motor skills is possible but transfer (generalisation) is likely to occur only to similar tasks. People living with dementia have been reported to have a similar rate of improvement when learning basic motor skills but the speed and coordination of movement as usually inferior to older adults without cognitive decline.

People living with dementia can also learn various functional tasks as demonstrated in the scoping review, although the learning outcomes may depend on severity of dementia (Kessels & Hensken, 2009). In addition to practicing tasks with cues and prompts to minimise errors during the training (Farina et al., 2002; Josephsson et al., 1993; Rogers et al., 1999) other methods supporting learning functional tasks were also reported as beneficial. These methods may involve spaced retrieval (Creighton et al., 2014; Hunter et al., 2011; Lin et al., 2010; White et al., 2014), errorless learning (Avila et al., 2004; Dechamps et al., 2011; Donaghey et al., 2010; Kessels & Hensken, 2009), graded cues and prompts (vanishing cues) (Thivierge et al., 2014; White et al., 2014; Wu, Lin, Su, et al., 2014) as well modelling (van Tilborg et al., 2011). External memory aids in a form of written instructions (Lekeu et al., 2002) and signs

(Josephsson et al., 1993) may also be used to support learning of functional tasks in dementia. The scoping review indicated that research into functional tasks retraining in people living with dementia is growing but study designs, training methods, setting and learning outcomes vary. More research is needed, particularly involving retraining mobility tasks, including STS, in people living with dementia during physiotherapy.

2.6. Research aims

The overarching aim of this program of research is to investigate use of spaced retrieval, errorless learning and vanishing cues principles in retraining the functional task of STS in people living with dementia. STS training will involve use of a command repeated verbatim and an instruction sheet that will be placed on a table in front. The instruction sheet will contain STS strategies presented in a specified sequence. The focus of the study is on investigating the effect of the training protocol on learning to incorporate these strategies into the STS task; therefore, only participants who can stand up independently will be included. Since there is very little empirical knowledge about the STS strategies used by older adults and people living with dementia when standing up with or without the table, this needs to be investigated first. Therefore, two studies were conducted as part of this research program.

Study 1 was an observational study with the primary aim to compare STS strategies used by older adults without suspected cognitive decline and people living with dementia. The specific objectives of the Study 1 were to:

1. Identify STS strategies (type, number and sequence) used by older adults and people living with dementia when standing up from a standard chair
2. Investigate whether a small table in front of the chair alters the type, number and sequence of strategies used by older adults and people living with dementia
3. Develop a structured and observation based STS assessment tool

It was hypothesised that there would be differences in the type, number and sequence of STS strategies used by older adults and people living with dementia. It was also hypothesised that the addition of table in front would alter the type, number and sequence of strategies used by older adults and people living with dementia.

Study 2 used a single case experimental design with multiple baselines lengths randomly allocated across four concurrent participants. The primary aim of Study 2 was to investigate the feasibility and utility of a STS training protocol based on spaced retrieval, errorless learning and vanishing cues principles, with a command repeated verbatim and an instruction sheet in people living with dementia. The specific objectives of Study 2 were to:

1. Develop a protocol of STS training based on principles of spaced retrieval, errorless learning and vanishing cues with an instruction sheet containing STS strategies expressed as short action phrases and a command repeated verbatim
2. Investigate if STS training can increase the number, change the type and the sequence of the STS strategies used
3. Investigate the feasibility and utility of implementing the STS training protocol for people living with dementia

It was hypothesised that STS training based on principles of spaced retrieval, errorless learning and vanishing cues with a command repeated verbatim and an instruction sheet would be feasible to implement in people living with dementia. Additionally, people living with dementia would be able to learn and retain the STS task.

Chapter 3 Comparison of sit-to-stand strategies used by older adults and people living with dementia

Acknowledgment of contributions

Parts of this chapter have been published as a co-authored publication[1]. Urszula Dolecka was the primary investigator and was responsible for the literature review, study design, recruitment of participants, data collection and analysis, and writing of the manuscript. Associate Professor Tamara Ownsworth provided initial inspiration for this study and assisted with data analysis and reviewing of the manuscript. Professor Suzanne Kuys provided input into the study design, assisted with data collection and analysis, and had substantial input into reviewing of the manuscript.

[1] Dolecka, U. E., Ownsworth, T., Kuys, S. S., et al. (2015). Comparison of sit-to-stand strategies used by older adults and people living with dementia. *Archives of Gerontology and Geriatrics, 60*(3): 528-534. (Appendix 1)

Abstract

Physiotherapists routinely retrain sit-to-stand (STS) during rehabilitation using strategies such as sliding forward, moving the feet backwards, leaning forward, and pushing through the armrests. It is unknown if people living with dementia use the same strategies as other older adults and if a table positioned in front alters their performance.

Twenty participants 65 years or older (10 with Alzheimer's disease or mixed dementia; 10 without dementia) performed six STS trials from a standard chair with armrests, including three trials without and three with a table in front. Trials were digitally recorded and the starting position and type and order of strategies used were rated by a blinded assessor.

Starting position was similar between the groups. The most common strategy was leaning forward (119 out of 120 trials) while the least used was sliding forward (four out of 120 trials). People living with dementia used significantly more strategies ($p = 0.037$), pushed through the armrests more than older adults ($p = 0.038$) and moved feet backwards more frequently in trials without the table in front ($p = 0.010$). Presence of the table had no significant effect on STS performance of older adults ($p > 0.317$).

Our results demonstrated that people living with dementia had a similar starting position but used more strategies to stand up, pushing through their arms more than older adults without dementia and moved their feet backwards more often when no table was in front. People living with dementia should be provided with chairs with armrests and space to move feet backwards.

3.1. Introduction

Sit-to-stand (STS) is a routine task required for mobility. An inability to complete the task independently has a detrimental effect on autonomy of older adults. STS difficulties in older adults correlate with risk of falling (Yamada & Demura, 2009), can cause serious injuries (Ellis & Trent, 2001), increase need for caregiver assistance (Perry et al., 2006), prolong hospital stay (Fisher et al., 2009), and lead to earlier institutionalisation (Fisher et al., 2009; Rothera, Jones, Harwood, Avery, & Waite, 2003; Sabol et al., 2011). Consequently, the STS task is frequently retrained by physiotherapists with the aim to improve safety with transfers and maximize independence in older adults.

During STS retraining physiotherapists address underlying impairments as well as teach specific strategies that can make the STS task easier. These strategies include using a chair with a seat height that enables the hips and knees to be positioned at least 90 degrees (Alexander et al., 2001; Alexander et al., 1996; Demura & Yamada, 2007; Hughes et al., 1996; Mazza et al., 2004; Schenkman et al., 1996), sliding or scooting forward to sit on the edge of the chair (Barreca et al., 2004; Bohannon & Corrigan, 2003; Hughes et al., 1994; Nuzik et al., 1986), moving the feet backwards behind the knee line (Akram & McIlroy, 2011; Khemlani et al., 1999; Schenkman et al., 1990; Schultz et al., 1992; Shepherd & Koh, 1996), leaning forward (Alexander et al., 1996; Hughes et al., 1994; Nuzik et al., 1986; Shepherd & Gentile, 1994), and pushing through the armrests (Etnyre & Thomas, 2007; Schultz et al., 1992) up into standing position.

Depending on peoples' individual functional abilities or the type of sitting surface, physiotherapists may need to teach all or only some of these strategies (Carr & Shepherd, 2010, pp. 77-92; Schenkman et al., 1990). Although clinical observation suggests that sliding forward and moving the feet backwards behind the knee line may be performed interchangeably as the first or second strategy followed by leaning forward and pushing up through the arms as the final strategies to complete the task, the specific arrangement or sequences of strategies involved in STS has received little empirical attention.

The STS task has been studied from a biomechanical (Janssen et al., 2002), and clinical measurement point of view (Bohannon, 2012). However, very little is known about which STS strategies are actually used by older adults and in what sequence, when the STS task is independently performed from a standard chair. The STS task can be performed in a variety of environments such as standing up from a lounge chair or standing up at a dining table. No existing research was found that investigated whether having a table in the front e.g. when having a meal alters the preferred STS strategies. Older community dwelling adults have reported avoiding seating surfaces that make STS difficult as their preferred strategy and identified pushing through the arms, sliding forward (scooting), and leaning forward as additional strategies that help to overcome STS difficulties (Bohannon & Corrigan, 2003).

STS difficulties in older adults are often the result of physical limitations related to acute illness (Britton, Harris, & Turton, 2008; Fisher et al., 2009), hospitalisation (Graf, 2006), and comorbid illnesses or injuries (Brodin, Ljungman, & Sunnerhagen, 2008; Turcot, Armand, Fritschy, Hoffmeyer, & Suva, 2012; Vincent, Vincent, & Lamb, 2010). Cognitive decline, as seen in an increasing number of older adults living with dementia, has potentially an additional detrimental effect on STS task performance due to disturbances in motor planning and programming, problem solving, and decreased ability to follow instructions (Finlay et al., 1983; Tappen et al., 1997; Wangblad et al., 2009). It is possible that cognitive decline as seen in dementia leads to differences in preferred STS strategies and their sequence as compared to older adults.

Therefore, this study aimed to compare STS strategies used by older adults without suspected cognitive decline and people living with dementia. The specific objectives of Study 1 were to:

1. Identify STS strategies (type, number and sequence) used by older adults and people living with dementia when standing up from a standard chair
2. Investigate whether a small table in front of the chair alters the type, number and sequence of strategies used by older adults and people living with dementia
3. Develop a structured and observation based STS assessment tool

It was hypothesised that there would be differences in the type, number and sequence of STS strategies used by older adults and people living with dementia. It was also hypothesised that the addition of table in front would alter the type, number and sequence of strategies used by older adults and people living with dementia.

3.2. Methods

3.2.1. Study Design

An observational study involving two groups of participants, community-dwelling older adults without suspected cognitive decline, and people living with dementia was conducted. Digital audio-visual recordings were made of participants standing up from a standard chair, with and without a table in front. Digital files were de-identified, randomized, and assessed by two independent assessors blinded to the cognitive status of the participants.

3.2.2. Participants

Men and women aged 65 years or older were eligible for recruitment to the study, if they met criteria for one of two groups; Dementia Group (DG) and Non-Dementia Group (N-DG). DG participants consisted of older adults living with dementia admitted to the Internal Medicine Unit of a tertiary hospital in Brisbane, Australia. Patients who had an established diagnosis of either Alzheimer’s disease or mixed dementia, were medically and cognitively stable (i.e. deemed not to be experiencing delirium or reversible causes of cognitive impairment) and had a documented Standardized Mini Mental State Examination (Folstein, Folstein, & McHugh, 1975; Molloy, Alemayehu, & Roberts, 1991) score of 25 or less (Perneczky et al., 2006), were identified by treating physiotherapists. The N-DG consisted of a convenience sample of older adults living in the community who did not report cognitive problems and scored a minimum of 28 on the Standardized Mini Mental State Examination (O'Bryant et al., 2008). Participants in this group were recruited from hospital visitors or were older adults living independently in a retirement village.

All participants were required to meet additional inclusion criteria of being able to stand up six times independently from a standard chair, speak English as their primary language, and have adequate receptive communication skills to follow instructions. Participants with any comorbidity that would limit their ability to stand up from a standard chair such as lower or upper limb pain, history of lower limb surgeries, or severe osteoarthritis or rheumatoid arthritis leading to decreased joint range of motion such as limited ankle dorsiflexion, less than 100 degrees of hip and knee flexion, were not eligible for the study.

Institutional ethics committees approved this study (Appendix 2). Participation in the study was voluntary. N-DG participants provided written consent and substitute decision makers’ consent was sought for DG participants (Appendix 3).

3.2.3. Procedures

All STS trials were conducted in a similar environmental setting for all participants using a standard chair that had a seat height of 46 cm from the floor, full length armrests, and an upright back rest. White stripes (for contrast on the blue upholstery) approximately 10 cm apart were placed on the side of the standard chair seat to assist with visual perception of movement during analysis of video recordings. White tape markings were also placed on the floor to allow the same positioning of the equipment between STS trails. For trials involving a table, the table had height of 76 cm and it was positioned 30 cm in front of the chair (Figure 6).

Figure 6 Standard chair and table

A digital video-camera (Canon, Legria FS 22, with the lens 2.6-96.2 mm) was positioned on a tripod (333 cm from the chair and 126 cm above the floor) to allow capture of the full left lateral view of participants during STS trials (Figure 7).

All participants were video recorded performing six STS trials from a standard chair with armrests in the following order; three trials without and three trials with a table. For all trials, participants started in a position that comprised sitting with hips and knees flexed approximately 90 degrees. However, trunk, hips, hands, and feet positions were not specified allowing participants to adopt their preferred starting position. All participants were given the same command ‘‘Please stand up’’ followed by a command ‘‘Please sit down’’.

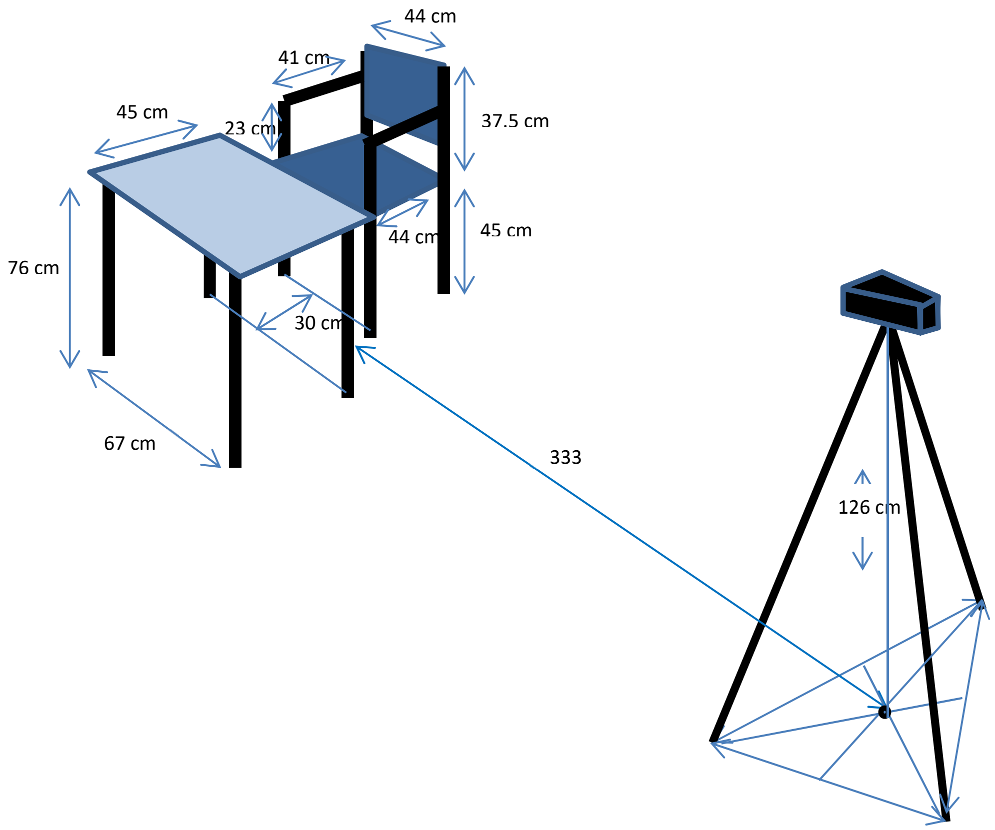


Figure 7 Equipment setting

Demographic data, clinical information, and measures were recorded for all participants and included age, gender, current accommodation, medical and falls history, and current Standardized Mini Mental Examination (SMMSE) scores. Additional information recorded for DG participants from their medical chart included type of dementia, reason for hospital admission and discharge destination. Clinical mobility measures were recorded for all participants using de Morton Mobility Index (DEMMI) and timed 10 m walk test (10 MWT).

3.2.3.1. Measures of cognition and functional status

Standardised Mini-Mental State Examination

SMMSE (Appendix 4) is a common screening measure of basic cognition used in clinical practice and research (van Steenoven et al., 2014; Vertesi et al., 2001). SMMSE consists of 30 questions that assess orientation to time and place; concentration; immediate and delayed recall; naming known items; repeating common words; reading, writing and constructional abilities; and following three stage commands (Folstein et al., 1975; Molloy et al., 1991; Perneczky et al., 2006). The maximum SMMSE score is 30 and the scores below 24/30 have been recognised as suggestive of cognitive impairment in older adults (Vertesi et al., 2001). However, the cut point for older adults with very high education level who complain about cognitive problems has been suggested as 27/30 (O'Bryant et al., 2008). Therefore, to minimise the risk of undiagnosed cognitive decline in older adults recruited for the study, only adults who did not complain of cognitive problems and had a minimum SMMSE score of 28/30 were included.

SMMSE scores have been found to discriminate between dementia stages (Perneczky et al., 2006). Stages of dementia severity are: no dementia (0), questionable (0.5), mild (1), moderate (2) and severe (3) measured using the Clinical Dementia Rating (CDR) (Morris, 1997), 1997). Substantial agreement between SMMSE and CDR has been reported for mild (SMMSE 21-25/30), moderate (SMMSE 11-20/30) and severe (SMMSE 0-10/30) stages of dementia of Alzheimer's type ($k > 0.62$, $p < 0.001$) (Perneczky et al., 2006). However, only moderate agreement was found for no dementia and fair agreement for questionable dementia (Perneczky et al., 2006). Therefore, to ensure that participants living with dementia recruited for the study had at least mild stage of dementia, the maximum SMMSE inclusion score was set as 22/30. This additional screening took place after potential participants were identified by treating physiotherapists.

de Morton Mobility Index

The de Morton Mobility Index (DEMMI) (Appendix 5) is a mobility index validated for older patients in acute medical wards (de Morton, Davidson, & Keating, 2008, 2011) and those in the community (Davenport & de Morton, 2011). The index consists of 15 tasks of increasing difficulty, ranging from the easiest of bridging in bed to the most difficult task where a person is asked to stand with eyes closed and arms crossed on the chest, with feet placed heel to toe (tandem standing).

Ten metre walk test

Timed ten metre walk test (10 MWT) is commonly used as a measure of walking speed (Tilson et al., 2010). Participants walked 14 meters at a comfortable walking pace wearing usual footwear and using usual walking aids. The middle 10 metres of the distance were timed with the first and last two metres allowing for acceleration and deceleration, respectively. Older adults who participated in the study were aware of being timed but the exact distance that was timed was not disclosed. To ensure cooperation and to minimise distractions, people living with dementia were encouraged to walk the distance but the time taken was measured covertly.

3.2.4. Measures of sit-to-stand

Starting position of the trunk, hips, feet, and hands, presence or absence of the STS strategies (sliding forward, moving feet backwards, leaning forward, and pushing through the arms), and the sequence of the strategies were assessed from digital audio-visual recordings. Two digital files, each containing three STS trials, with or without the table, were created for each participant. Digital audio-visual files, de-identified and randomised by an offsite investigator, were reviewed by an independent assessor blinded to group allocation, who was a physiotherapist with more than seven years of clinical experience.

3.2.4.1. STS observation based assessment tool

An observation based assessment tool was developed for the study to record starting position of hips, trunk, hands, and feet, STS strategies used and sequence (Table 3.1). The independent assessor was required to indicate the starting position observed, including position of the left and right ankles and hands. Starting positions were recorded to assess differences between participants and conditions as well as potential effect on STS strategies used.

Table 3.1 Assessment tool: starting position of trunk, hips, ankles and hands

Body part	Possible position	Symmetry
Trunk	☐ Back against the backrest ☐ Back away from the backrest	N/A
Hips	☐ Hips against the backrest ☐ Hips already forward	N/A
Ankles (In relation to an imaginary plumbline going through the knees)	☐ Anterior ☐ On line ☐ Posterior	☐ L ☐ R ☐ L ☐ R ☐ L ☐ R
Hands	☐ On armrests ☐ On knees	☐ L ☐ R ☐ L ☐ R

Abbreviations: L, Left; R, Right

Table 3.2 illustrates the recording of the type and sequence of the strategies. The assessor indicated the presence (1) or absence (0) of each strategy used. The assessor viewed each video clip as many times as required to score with confidence the sequence the strategies were used by allocating numbers from one to four. Four STS strategies were included in the tool: sliding forward, feet backwards, leaning forward, and pushing through the armrests.

Table 3.2 Assessment tool: sit-to-stand strategies

Strategy	(1) Present (0) Absent	Sequence From 1 to 4
Slides forward		
Moves feet backwards (at least one)		
Leaning forward		
Pushed through the arms using armrests		
Pushed through the arms using knees		
Pushed using armrest and a knee		

The assessor was provided with training on the use of the assessment tool and recognition of strategies according to the descriptors presented in Table 3.3.

Table 3.3 Sit-to-stand strategy descriptors

Strategy	**Descriptors**
Slide forward	Slides buttocks forward from the starting position as observed against marked distance lines on the side of the chair
Moves feet backwards	Actively positions (moves) at least one foot in backwards direction when at least one ankle is under or backwards from the imaginary plumbline going through the knee. This can be at the early or later phase of standing up.
Leaning forward	Leaning forward is directed forward rather than up and shoulders pass the mid thighs
Pushing up using armrests	Uses both arms to push up from the armrests and elbows move towards extension during buttocks off.
Pushing up using knees	Places both hands on the knees and pushes up. May also use one hand on the knee (the other hand does not push up at all)
Pushing up using armrest and knees	Places one hand on an armrest and other on the knee and pushes to stand

3.2.4.2. Reliability of sit-to-stand assessment

Inter-tester and intra-tester reliability of the tool were established using recorded video clips. Two physiotherapists, with more than seven years' experience, assessed all video clips; one physiotherapist viewed all clips twice (intra-tester reliability) and the second physiotherapist viewed once (inter-tester reliability). Reliability was determined using Cohen's kappa statistic (Kottner et al., 2011; Landis & Koch, 1977) for components of starting position, STS strategies observed and sequence of STS strategies. Analyses were undertaken using SPSS v. 22. Kappa strengths were categorised: no agreement < 0; slight = 0 – 0.20; fair = 0.21 - 0.40; moderate = 0.41 – 0.6; substantial = 0.61 – 0.8; and near perfect = 0.81 – 1.0 (Landis & Koch, 1977). The values for kappa and standard error are presented in Table 3.4.

Table 3.4 Cohen's Kappa and standard error values for inter- tester and intra- tester agreement

Variables	Inter-tester reliability	Intra- tester reliability
Starting position		
Trunk, kappa ($SE_{(k)}$)	0.702 (0.088)	1.000 (0.000)
Hips, kappa ($SE_{(k)}$)	0.387 (0.194)	0.797 (0.198)
Ankles, kappa ($SE_{(k)}$)	0.603 (0.092)	0.791 (0.069)
Hands, kappa ($SE_{(k)}$)	0.628 (0.058)	0.987 (0.013)
Sit-to-stand strategies		
Sliding forward, kappa ($SE_{(k)}$)	0.744 (0.174)	1.000 (0.000)
Feet backwards, kappa ($SE_{(k)}$)	0.754 (0.052)	0.949 (0.025)
Leaning forward, kappa ($SE_{(k)}$)	1.000 (0.000)	1.000 (0.000)
Pushing up (armrests, knees), kappa ($SE_{(k)}$)	0.974 (0.019)	1.000 (0.000)
Sequence of strategies, kappa ($SE_{(k)}$)	0.758 (0.020)	0.950 (0.010)

Overall good inter-tester and intra-tester reliability was found for the majority of variables. Substantial agreement was noted between testers for the starting position of trunk, ankles and hands. There was fair agreement (kappa = 0.387) between testers for starting position of the hips. Further data inspection identified that the percentage of agreement between assessors was 96% for the hips being positioned against the backrest (the position adopted by participants in 107 out of 120 trials). Intra-tester reliability was substantial or near perfect for starting position. Substantial or near perfect inter-tester reliability was found for identification of STS strategies and the sequence of STS strategies used. Near perfect intra-tester reliability was found for identification of STS strategies and the sequence of STS strategies used.

3.2.5. Data analysis

Demographic data were analysed using descriptive statistics. Frequencies of hip, trunk, hand, and feet position used at the start of the STS task were recorded for trials without and with the table in front. The type, number, and sequence of strategies used during the STS task were recorded for trials without and with the table in front. Differences in starting position, type, and number of strategies used within the groups (N-DG, DG) and consistency for trials without and with the table in front were examined using descriptive statistics and the Wilcoxon signed-rank test. Differences between groups (N-DG, DG) in starting position and type of strategies used to stand up without and with the table in front were examined using descriptive statistics, Chi-square and Fisher Exact test. The Mann–Whitney U test was used to analyse differences in age, mobility, speed of walking, and number of strategies between the groups (N-DG, DG). Analyses were undertaken using SPSS v.22 and significance was set at $p < 0.05$.

3.2.6. Ethical considerations

Ethical clearance for this study was obtained from the Griffith University and Metro South Human Research Ethics Committees. Written informed consent was obtained from all participants without dementia prior to data collection. For participants with dementia written informed consent to participate was obtained from substitute decision makers (enduring attorneys). Participants were also included in the decision making process (Beattie 2009). Participants who were reluctant to participate were excluded from the study. Copies of consent forms were filed in the participant's medical chart and originals with de-identified data, including video recordings, were securely stored.

3.3. Results

3.3.1. Flow of participants

Twenty-seven older adults were screened for inclusion in the study, with seven excluded. Six older adults were excluded from the N-DG; one because of inability to complete six STS trials independently and five, due to SMMSE scores below 28/30. In the DG, one participant was excluded during the screening process because the substitute decision maker could not be contacted to provide written consent. No participants withdrew or were withdrawn from the study and no adverse events occurred during the study. Twenty participants, 10 in each group (50% female; average age 81.5, SD = 7 years), completed six STS trials that involved three trials without a table and three with a table in front.

3.3.2. Participant characteristics

Participant characteristics are presented in Table 3.5. There were no statistical differences between N-DG and DG participants for age (U = 40.5, p = 0.47) or mobility level as measured by the DEMMI (U = 31.5, p = 0.14). However, DG participants walked significantly slower than N-DG participants (U = 20.5, p = 0.026). DG participants had a history of 2 to 3 falls on average within the last six months documented in their medical charts and only one participant from the N-DG self- reported one fall. Both groups had a range of comorbidities that included ischemic heart disease, heart failure, hyperlipidemia, and type two diabetes mellitus. All DG participants were community dwelling on hospital admission, although following hospitalisation seven were discharged to residential care facilities due to increased demand for dementia related care.

Table 3.5 Demographic and physical status characteristics of participants

Characteristic	Non-Dementia Group (*n*=10)	Dementia Group (*n*=10)
Gender, *n* female/male	5/5	5/5
Age (years), median (min-max)	79.5 (69-90)	83 (71-94)
SMMSE, median (min-max)	29 (28-30)	19.5 (15-21)
Alzheimer's Disease, *n*	N/A	8
Mixed Dementia, *n*	N/A	2
Mobility		
DEMMI (raw scores), median (min-max)	18 (16-18)	16.5 (9-18)
DEMMI (converted), median (min-max)	79.5 (67-85)	70.5 (39-85)
10 MWT (m/sec), median (min-max)[1]	0.87 (0.55-1.16)	0.70 (0.38-0.89)
ambulation with nil aids, *n*	8	9
ambulation with 4 wheeled walker, *n*	2	1

[1] Statistically significant difference between dementia and non-dementia participants, p = 0.026
Abbreviations: SMMSE, Standardised Mini Mental State Examination; DEMMI, de Morton Mobility Index; 10 MWT, 10 metre walk test

3.3.3. Starting position

Table 3.6 outlines the starting position used by N-DG and DG participants for STS trials without and with the table in front. For both N-DG and DG participants, the presence or absence of the table in front did not have any significant effect on the starting position of the trunk, hips, hands, and feet (N-DG p > 0.317, DG p > 0.414). There were no statistical differences in starting position of the hips, hands, and ankles between the groups (p > 0.254) and all participants were able to place their feet on the floor. However, DG participants started with the trunk against the backrest less frequently, particularly in trials without the table but this difference did not reach statistical significance (Fisher Exact Test, two-sided, p = 0.052).

Table 3.6 Starting position and sit-to-stand strategies for trials without and with the table

Variables	Non-Dementia Group (*n*=30 trials)		Dementia Group (*n*=30 trials)	
	No table	Table	No table	Table
Starting position				
Trunk against the backrest, *n* trials (%)	30 (100)	28 (93.3)	25 (83.3)	24(80)
Hips against the backrest, *n* trials (%)	30 (100)	29 (96.6)	30 (100)	30 (100)
At least one ankle behind knee, *n* trials (%)	28 (93.3)	29 (96.6)	26 (86.6)	27 (90)
At least one hand on armrests, *n* trials (%)	11 (36.6)	11 (36.6)	13 (43.3)	14 (46.6)
Type of strategies				
Sliding forward, *n* trials (%)	0 (0)	0 (0)	1 (3.3)	3 (10)
Feet backwards, *n* trials (%)[1]	10 (33.3)	11 (36.6)	20 (66.6)	11 (36.6)
Leaning forward, *n* trials (%)	30 (100)	30 (100)	30 (100)	29 (96.6)
Pushing through armrests, *n* trials (%)[2]	13 (43.3)	11 (36.6)	21 (70)	21 (70)
Pushing through knees, *n* trials (%)	11 (36.6)	12 (40)	6 (20)	9 (30)
Arms not used to push up, *n* trials (%)	6 (20)	7 (23.3)	3 (10)	0 (0)
Number and sequence of strategies				
One strategy, *n* trials (%)	4 (13.3)	3 (10)	1 (3.3)	1 (3.3)
LF, *n* trials	4	3	1	0
PA, *n* trials	0	0	0	1
Two strategies, n trials (%)	18 (60)	20 (66.6)	11(36.3)	18 (60)
FB+LF, *n* trial	2	4	2	0
LF+PA, or PK, *n* trials	16	16	9	18
Three strategies, *n* trials (%)	8 (26.6)	7 (23.3)	17 (56.6)	8 (26.6)
FB+LF+PA or PK, *n* trials	8	7	17	8
Four strategies, *n* trials (%)	-	-	1 (3.3)	3 (10)
FB+SF+LF+PA, *n* trials	0	0	1	3

[1] Statistically significant difference between groups in trials without table
[2] Statistically significant difference between groups in trials without and with table
Abbreviations: LF, Leaning forward; PA, Pushing through armrests; FB, Feet backwards; PK, pushing through the knees; SF, Sliding forward

3.3.4. Type of strategies

The type of strategies used by N-DG and DG participants during STS trials are outlined in Table 3.6. There was no significant difference for N-DG participants in frequency of use of STS strategies without or with the table in front ($p > 0.317$). Within the DG there were no differences in use of sliding forward, leaning forward, and pushing through the armrests ($p > 0.317$); however, DG participants used the feet backwards strategy significantly more in trials without the table than in trials with the table in front ($p = 0.041$).

Significant between group differences were found for use of the feet backwards strategy in trials without the table in front and for the method of pushing up into standing. DG participants moved their feet backwards more frequently than N-DG participants in trials without the table in front ($p = 0.010$). DG participants also pushed through the chair armrests more frequently than N-DG participants in trials without the table ($p = 0.037$) and with the table in front ($p = 0.010$). N-DG participants did not use their arms to push up in six of the 30 trials without the table and in seven trials with the table in the front. Among DG participants, pushing up was not used in three trials without the table in front and this method of standing was used by the same participant.

3.3.5. Number of STS strategies

The number of STS strategies used by N-DG and DG participants in trials without and with the table in the front is presented in the Table 3.6. N-DG participants used a maximum of three strategies to stand up while DG participants used a maximum of four strategies. There were no significant differences in the total number of strategies (sum of strategies in three trials) used by all participants when trials without and with the table in front were compared (N-DG $Z = 0.087$, $p = 0.931$; DG $Z = 0.779$, $p = 0.436$). However, there was a significant difference in the number of strategies used between the groups for trials without the table in front, with DG participants using more strategies than N-DG participants ($U = 23$, $p = 0.038$). The between group difference for trials with the table in front was not statistically significant ($U = 35$, $p = 0.241$).

3.3.6. Sequence of STS strategies

A maximum of four different strategies were used to stand up across all trials (Table 3.6). When using one strategy, N-DG and DG participants used either leaning forward or pushing up through the arms when standing up with or without table. When two strategies were used, two sequences were observed; either moving the feet backwards followed by leaning forward or leaning forward followed by pushing through the arms. The second sequence was used more frequently by both groups (Table 3.6). Three strategies were more frequently used by DG participants but both groups used the same sequence; feet backwards, leaning forward, and pushing up. Four strategies were only used by one DG participant in the same sequence: feet backwards, slide forward, leaning forward, and pushing up to stand.

3.3.7. Consistency of performance across trials

Table 3.7 reports data on consistency levels for starting position of the trunk, hips, ankles, and hands and strategies used in STS trials without and with the table in front. Participants in both groups performed STS trials without and with the table in front with similar levels of consistency (consistent either in three, two, or none of the trials) in the starting position of their trunk, hips, hands, and feet (N-DG $p > 0.317$, DG $p > 0.285$) and in the number, type, and sequence of STS strategies used (N-DG $p > 0.157$, DG $p > 0.180$). There was no statistical difference in consistency levels when all STS trials (without and with the table in front) were compared between the groups ($p > 0.116$). Only one N-DG participant and two DG participants used the same number, type, and sequence of strategies in trials without the table and with the table in front.

Table 3.7 Consistency of starting position and strategies across trials without and with the table

Variables	Non-Dementia Group (*n*= 10)		Dementia Group (*n*=10 trials)	
	No table	Table	No table	Table
Consistent starting position				
Trunk in three trials, *n* participants	10	9	8	8
Trunk in two trials, *n* participants	0	1	2	2
Hips in three trials, *n* participants	10	10	10	10
Hands in three trials, *n* participants	9	8	6	6
Hands in two trials, *n* participants	1	2	4	2
Hands in none of trials, *n* participants	0	0	0	2
Feet in three trials, *n* participants	8	6	7	7
Feet in two trials, *n* participants	2	4	3	3
Consistent strategies [1]				
In three trials, *n* participants	4	2	3	5
In two trials, *n* participants	6	5	7	5
In none of trials, *n* participants	0	3	0	0

[1] The same type, number and sequence of strategies

3.4. Discussion

Overall, findings from this study indicated that community dwelling older adults without suspected cognitive decline and people living with dementia employ similar STS strategies. Specifically, they adopt a similar starting position before standing up from a standard chair comprising the trunk and hips positioned against the backrest, hands mostly resting on knees, and at least one ankle behind the knee line. Regardless of group, the most commonly used strategy was leaning forward, followed by pushing through the armrests or the knees, and moving the feet backwards. The least frequently used strategy was sliding forward.

However, some significant differences were found between participant groups; people living with dementia employed more strategies to stand up when no table was in front and generally pushed through the armrests more frequently. The presence or absence of the table did not influence the type or number of strategies used to stand up by people without suspected cognitive decline. N-DG and DG participants adopted consistent starting positions and the majority of participants were consistent in the number, type, and sequence of strategies in at least in two out of three trials without and with the table in front.

The starting position used to stand up was similar between the groups. N-DG and DG participants most frequently started with trunk and hips positioned against the backrest, hands on armrests, and feet with ankles on or behind the knee line for all trials. This perhaps was not unexpected due to the influence of the testing environment which facilitated participants to sit with their feet, knees, and hips positioned at 90 degrees. However, it was noted that DG participants positioned the trunk forward rather than against the backrest in some trials. The difference in trunk position in comparison to ND-G participants was not statistically significant, but similar behaviour was observed less frequently in N-DG participants. It is possible that this variability in trunk position observed for the DG participants was the result of many factors, including general motor restlessness (Zuidema, Derksen, Verhey, & Koopmans, 2007), difficulty staying orientated to the purpose of the activity (Joray, Herrmann, Mulligan, & Schnider, 2004), or decreased ability to cope with the testing situation due to cognitive problems associated with dementia. The testing environment was new for participants and it has been found that people living with dementia can feel anxious when faced with a novel situation (Digby, Moss, & Bloomer, 2012). However, these proposed explanations are only speculative, as levels of motor restlessness, orientation, and anxiety during the task were not specifically assessed.

Leaning forward was the most commonly used strategy across all STS trials by both groups of participants (119 out of 120 trials). When standing up with arms crossed, people living with dementia have been shown to have less forward movement of the shoulders, therefore rising more vertically compared to people without suspected cognitive decline (Manckoundia et al., 2006). Although the degree of leaning forward was not quantified in our study, it is possible that DG participants used the leaning forward strategy less effectively compared with N-DG participants when standing up, particularly for trials without the table in front. This therefore, resulted in the DG participants using the feet backwards strategy to bring the centre of gravity over the base of support to ensure stability (Alexander et al., 1996; Kawagoe et al., 2000; Schultz et al., 1992). All DG participants had a history of falls and fear of falling forward has been suggested as one of the reasons why older adults lean forward less and rise more vertically maintaining the centre of gravity backwards in relation to the base of support (Mourey et al., 2000; Scarborough et al., 2007).

The increased use of the feet backwards strategy by DG participants in trials without the table but not with the table in front is a novel finding of this study. This difference cannot be adequately explained by a practice effect leading to less use of the feet backwards strategy in subsequent trials with the table in front, since a similar practice effect was not observed in N-DG participants. A possible explanation might be that people living with dementia were more confident and less afraid of falling with the table in front; therefore, they leaned forward more and used the feet backwards strategy less frequently. It has been shown that young adults when provided with a bar in front when standing up, generated much higher horizontal momentum than when standing up with an empty space in front (Pai & Lee, 1994). It is also possible that presence of the table provided a visual reference and compensated for spatial orientation and motion processing problems (Kavcic, Vaughn, & Duffy, 2011), decreased depth and contrast perception (Valenti, 2010), and balance problems, common in people living with dementia (Suttanon et al., 2012; Taylor, Delbaere, Lord, Mikolaizak, & Close, 2013).

DG participants pushed through the armrests significantly more often than N-DG participants in all trials despite being able to stand up without using the arms. Pushing through the armrests makes standing up easier by decreasing demands on lower limb extensors when rising more vertically (less leaning forward) but it helps to achieve better stability when rising more horizontally (Schultz et al., 1992). STS performance has been shown to depend on balance, in addition to speed, psychological status, strength (Lord et al., 2002), and visual feedback (Mourey et al., 2000). Although strength, balance, sensory, and psychological issues were not specifically tested in this study, DG participants walked slower and had lower scores on balance items of DEMMI than N-DG participants. Therefore, it is possible that DG participants experienced less stability during standing up.

Sliding forward or scooting has been self-reported as commonly used by older women living in the community (Bohannon & Corrigan, 2003). However, this was the least used strategy (four out of 120 trials) in the current study and was only used by one DG participant. In clinical practice, the sliding forward strategy is often used when retraining STS from a chair that is too low or too high, or when there is no space to move feet backwards and/or when a person has performance difficulties and needs to use this strategy to complete the STS task. Inspection of individual physical status on the DEMMI suggested that the DG participant who used the sliding forward strategy had the lowest functional level. It is possible that this strategy was used to overcome this performance limitation, particularly as repetition fatigue may have occurred. Additionally, it is also possible that the use of a standard chair in the current study did not provide sufficient STS challenge for the functional level of this group of participants to necessitate more frequent use of the sliding forward strategy (Mazza et al., 2004).

The STS task is frequently performed from a standard chair. Therefore, it is reasonable to expect that the task should be automatic, and be performed consistently across all trials, if the same chair was used. However, it was expected that some level of variability in task performance might occur so three trials were conducted for both conditions (STS without and with the table in front). The starting position of the trunk, hips, hands, and feet was quite consistent across both groups for all trials. However, participants were less consistent in the type, number, and sequence of the strategies, although there were no significant differences within or between the groups when the consistency levels were compared.

There are a number of limitations in the current study. The small convenience sample limits the generalizability of the findings. DG participants were recruited from hospital inpatients and therefore were likely to have experienced recent functional decline (Pedone et al., 2005) which may have influenced their STS performance. N-DG participants were more explicitly aware of being tested, and therefore potentially over performed and pushed through the armrests less. The same chair was used for all participants; regardless of their height and weight and this could have had an effect on performance. The order of testing was not randomized and STS trials without the table in front were performed first. This could have resulted in fatigue or practice effects on performance for trials with the table in front. We were also unable to rule out past exposure to STS retraining. Finally, STS performances were assessed visually from digital recordings and although using visual analysis of movement is a reliable assessment method in physiotherapy practice (Kuys, Brauer, Ada, & Russell, 2008; Pomeroy, Pramanik, Sykes, Richards, & Hill, 2003), it does not allow for more precise spatial and temporal data to be extracted.

3.5. Conclusions

People living with dementia were found to use more strategies to stand up, particularly pushing through the armrests and were more likely to move their feet backwards when there was no table in front of them. Such findings highlight the need for chairs provided for this population to have armrests and an open space to allow movement of the feet backwards. It also appears that there are benefits to providing a table or other reference point to improve confidence and independence with STS for people living with dementia. However, further investigation is required to confirm this.

Chapter 4 Sit-to-stand retraining in people living with dementia using spaced retrieval, errorless learning and vanishing cues

Acknowledgment of contributions

Urszula Dolecka was the primary investigator and was responsible for the literature review, study design, recruitment of participants, data collection and analysis, and writing of the manuscript. Associate Professor Tamara Ownsworth provided significant input into the study design and assisted with data analysis and reviewing of the manuscript. Professor Suzanne Kuys provided input into the study design, assisted with data collection and analysis, and had a substantial input into reviewing of the manuscript.

Abstract

People living with dementia frequently present with sit-to-stand (STS) difficulties. In STS retraining physiotherapists address physical impairments as well as teach strategies (sliding forward, feet backwards, leaning forward and pushing through the armrests) to make standing up easier. In people living with dementia STS retraining is challenging due to declarative memory problems and difficulties following instructions. This study aimed to investigate the feasibility and utility of spaced retrieval, errorless learning and vanishing cues in retraining STS for people living with dementia.

A single case experimental design with multiple baselines across concurrent subjects was employed involving four participants who were randomly allocated to baseline length. Two male and two female participants with Alzheimer's disease or mixed dementia (aged from 75 to 94 years) underwent baseline assessments (four to seven days), followed by eight STS training sessions (one per day for 8 days), four maintenance sessions (over two days) and a final assessment of generalisation. All assessments and training sessions were video recorded and randomised video clips were evaluated by a blinded assessor using an observation based assessment tool (type, number, sequence of STS strategies). Data were presented in graph format and analysed visually.

All participants demonstrated an ability to use all four STS strategies in the correct sequence during training sessions. Two participants with more severe cognitive decline progressed through the training sessions slower, yet demonstrated stronger learning outcomes than other participants when tested without the instruction sheet. Participants responded to commands provided by a person not involved in the study and more frequently used all four strategies when the instruction sheet were provided. Overall, these results support the feasibility and utility of using spaced retrieval, errorless learning and vanishing cues when supported by an instruction sheet and the command repeated verbatim for assisting with STS retraining in people living with dementia.

4.1. Introduction

People living with dementia who reside in aged care facilities often present with difficulties standing up, frequently requiring considerable amount of physical assistance (Thunborg et al., 2012; Varnam, 2011; Wangblad et al., 2009). Residential aged care staff report that people living with dementia often push back into the chair and/or grab or hold onto the chair during the task (Varnam, 2011). Transfers are often perceived as a reciprocal struggle from a physical and communication point of view between a resident and care staff (Thunborg et al., 2012). STS and transfer of people living with dementia are perceived by care staff as physically demanding because of misunderstandings between a resident and care worker during the task (Wangblad et al., 2009). Additionally, people living with dementia may present with motor restlessness (Zuidema et al., 2007) or reduced initiation of activities (Cook, Fay, & Rockwood, 2008), making delivery of everyday care and rehabilitation in this population challenging. Therefore, training people living with dementia to stand up efficiently in response to a command may decrease misunderstandings as well as decrease the amount of physical assistance that needs to be provided during the task.

Physiotherapists frequently retrain sit-to-stand (STS) in older adults and people living with dementia during rehabilitation. In addition to addressing performance limitations such as decreased muscle strength, physiotherapists may teach specific STS strategies (Carr & Shepherd, 2010, pp. 77-92) . These strategies including sliding or scooting forward (Barreca et al., 2004; Bohannon & Corrigan, 2003; Hughes et al., 1994; Nuzik et al., 1986), moving the feet backwards behind the knee line (Akram & McIlroy, 2011; Khemlani et al., 1999; Schenkman et al., 1990; Schultz et al., 1992; Shepherd & Koh, 1996), leaning forward (Alexander et al., 1996; Hughes et al., 1994; Nuzik et al., 1986; Shepherd & Gentile, 1994), and pushing through the armrests (Etnyre & Thomas, 2007; Schultz et al., 1992), are believed to make the standing up task easier, particularly when standing up from low, deep or tilted sitting surfaces.

The usual physiotherapy approach to functional task retraining may involve demonstration, verbal instructions, movement facilitation, correction and often, analysis of errors (Carr & Shepherd, 2010, pp. 37-42). People living with dementia have memory problems, predominantly with declarative memory and explicit learning (Gold & Budson, 2008; Hopper, 2003; Nestor et al., 2006). These problems have detrimental effects on the ability to learn new information (Squire & Wixted, 2011). Memory problems and decreased speech comprehension impair the ability of people living with dementia to follow commands and instructions; particularly when these are long or ambiguous (Christenson et al., 2011; Hart & Wells, 1997; Wangblad et al., 2009; Weirather, 2010). People living with dementia respond better to short, clear and action based commands (Christenson et al., 2011) that are repeated verbatim, provided the commands are understood (Small & Gutman, 2002).

Due to declarative memory problems people living with dementia may be perceived as unable to participate in, or unlikely to benefit from therapy programs designed to support skills maintenance and new learning (Thomas, 2005). However, non-declarative memory and implicit learning are usually preserved in dementia and can be used in motor skills (van Halteren-van Tilborg et al., 2007) and more complex functional tasks retraining (van Tilborg et al., 2011; Zanetti et al., 1997; Zanetti et al., 2001) .

There is a body of research that supports the utility of cognitive rehabilitation techniques such as spaced retrieval (recalling information over extended time intervals) (Camp et al., 1996; Creighton et al., 2013; Hochhalter et al., 2005; Hopper et al., 2005; Oren et al., 2014), errorless learning (minimising or preventing errors) (Clare & Jones, 2008; de Werd et al., 2013; Kessels & Hensken, 2009) and vanishing cues (prompting and cueing) (Haslam et al., 2010) for supporting learning new information and skills in people living with dementia. These methods (usually in various combination) have been used in the retraining of functional tasks in people living with dementia (Creighton et al., 2014; Dechamps et al., 2011; Hunter et al., 2011; Lekeu et al., 2002; White et al., 2014). Application of these methods in the retraining of functional tasks has received little previous investigation (Creighton et al., 2014; White et al., 2014). Furthermore, no studies were found (Section 2.4, scoping review) that involved retraining STS strategies and use of methods supporting learning in people living with dementia.

The first study in this program of research highlighted that people living with dementia adopted a similar starting position to older adults without cognitive decline but required more strategies to stand up, specifically pushing through the armrests and moving their feet backwards. The most commonly used strategy in people living with dementia was leaning forward, followed by pushing through the armrests and moving feet backwards. Sliding forward was used least. However, with increasing functional decline inherent to dementia (Auyeung et al., 2008; Sauvaget et al., 2002) all four STS strategies may need to be performed in a specific sequence to make standing up easier and more efficient.

People living with dementia present with diverse physical and cognitive symptoms and heterogeneity of disease progression (Komarova & Thalhauser, 2011). Therefore, a single case experimental design was chosen as the most appropriate research methodology to enable analysis of the target behaviour (number, type and sequence of strategies used when standing up) at the individual level. In line with guidelines for reducing risk of bias in n-of-1 studies (Tate et al., 2008; Tate et al., 2014; Tate, Perdices, et al., 2013), a single case experimental design with multiple baselines across concurrent subjects was employed with baseline lengths randomly assigned to four participants.

Research aims

This study aimed to investigate the use of spaced retrieval, errorless learning and vanishing cues supported by an instruction sheet and a command repeated verbatim in retraining STS in people living with dementia. The specific objectives of Study 2 were to:

1. Develop a protocol of STS training based on principles of spaced retrieval, errorless learning and vanishing cues with an instruction sheet containing STS strategies expressed as short action phrases and a command repeated verbatim
2. Investigate if STS training can increase the number and/or change the type and sequence of STS strategies used
3. Investigate the feasibility and utility of implementing the STS training protocol for people living with dementia

4.2. Methods

4.2.1. Study design

A single case experimental design with multiple baselines across concurrent subjects was employed involving four participants who were randomly allocated to baseline length (Tate et al., 2008; Tate, Perdices, et al., 2013) (Table 4.1) comprising: pre-intervention period (A: four to seven days) when baseline measures were collected; intervention period (B: eight days) when STS training sessions were delivered and selected measures were collected; and post-intervention periods: (C) maintenance period (two days when assessment continued but training was withdrawn) and (D) assessment of generalisation (one day), when STS performance was tested in a different environment with commands provided by an independent person.

Table 4.1 Study periods

Pre- intervention	Intervention	Post-intervention	
A Baselines	B STS Training	C Maintenance	D Generalisation
4-7 days	8 days	2 days	1 day

Abbreviations: STS, Sit-to-stand

Baseline periods (ranging from four to seven days) were randomly allocated to participants by an offsite researcher. Participant codes (P1, P2, P3, and P4) were then allocated to reflect the increasing length of baselines. The duration of the intervention and post-intervention periods were the same for all participants. Baseline periods commenced on the same day for all participants, but the overall duration of the study differed ranging from 15 consecutive days for Participant 1 (P1) to 18 days for Participant 4 (P4).

Following the consent process participants were informed about partaking in the research project during the recruitment process. Assessments and training sessions were referred to as "activities" for the remainder of the project. Staff members of the residential care facility were aware of residents' involvement in the research project but no information was provided regarding the type of intervention being delivered.

4.2.2. Participants

Older adults living in a residential care facility were eligible for inclusion in the study if the following inclusion criteria were met:

- Aged over 65 years,
- Confirmed diagnosis of Alzheimer's type or mixed dementia (Alzheimer's and vascular dementia) with the severity of dementia rated according to clinical dementia rating by the facility's visiting geriatrician,
- Standardised Mini-Mental State Examination (SMMSE) score less than 22/30,
- Able to stand up from a chair independently,
- Able to communicate in English and follow basic instructions,
- Had hip and knee flexion of minimum 100 degrees, and
- At least plantar grade of ankle flexion.

Eligible participants had to perform adequately on screening tests of reading ability and spaced retrieval. Reading ability was determined by the participant reading a few short sentences printed in black ink on a white background in a gradually decreasing font size. This assessment determined the minimum font size and participants' ability to use written instructions during STS training (Brush & Camp, 1998). The test for spaced retrieval (Brush &Camp, 1998) (Appendix 6) involved presentation of a photograph with the full name of a person, followed by requests to recall the name when the photograph was presented again after 15 seconds, 30 seconds and 1 minute time intervals. Only participants who could read and were able to correctly recall the full name during each interval of the spaced retrieval test were recruited.

Participants who had a recent change in their health status or had comorbidities that would limit their ability to stand up from a standard chair were not eligible for the study. Potential participants were also excluded if known to have severe behavioural and psychological symptoms of dementia.

4.2.3. Recruitment

Participants were recruited from older adults living with dementia in a single residential care facility in Brisbane, Australia. The Nursing Unit Manager and a Registered Nurse identified potential participants. The researcher screened all potential participants against inclusion and exclusion criteria by reviewing medical charts and completing relevant tests (SMMSE, reading and spaced retrieval). Substitute decision makers were contacted to obtain written consent of identified eligible residents to participate in the study. Residents were also asked for their verbal consent (Beattie, 2009). Only residents, who met inclusion criteria, were willing to participate in the study, and for whom written consent was obtained from substitute decision makers, were recruited. Institutional ethics committees approved this study (Appendix 2).

Demographic and clinical information for all participants was obtained from medical charts. This included date of birth, marital status, gender, type of dementia, years since diagnosis, and comorbidities. Background information on social history such as occupation, past and current interests and preferred activities, type and management of behavioural and psychological symptoms of dementia, were obtained from the Nursing Unit Manager, carers, family and substitute decision makers.

4.2.4. Measures

Measures of STS, generalisation, cognition, and functional status were collected during all periods of the study. STS measures involved assessment of the target behaviour (number, type and sequence of STS strategies) from a standard chair without an instruction sheet using two commands; “Please stand up” and “What do you have to do to stand up, tell me and show me?”. A generalisation probe was used during all periods of the study with participants standing up from a wheelchair to the command “Please stand up”. An additional final assessment of generalisation was conducted on the last day of the study.

Participants were digitally video recorded when performing STS. The de-identified, randomised video clips were assessed by an independent assessor using a structured, observation based STS assessment tool (described in detail in Study 1, p. 64). The type, number and sequence of strategies used in the STS task were recorded. Verbal responses of participants to the command "What do you have to do to stand up, tell me and show me?" were also recorded.

To measure and monitor stability of cognition two measures were used; SMMSE (Appendix 4) and Mental Status Questionnaire (MSQ) (Appendix 7). Functional status was monitored using de Morton Mobility Index (DEMMI), ten metre walk test (10 MWT) and the level of independence with bed mobility. All measures used in the study will be discussed in more detail in subsequent sections. The frequency of measures and order of administration across the study periods are presented in Table 4.2 and Table 4.3, respectively.

Table 4.2 Frequency of measures across the study periods

Measures	Pre- intervention Baselines (4-7 days) Number of data points	Intervention STS training (8 days) Number of data points	Post-intervention[1] Maintenance (2 days) Number of data points
SMMSE	1	-	1
MSQ	4-7	8	4
DEMMI	1	-	1
Bed mobility	4-7	8	4
10 MWT	4-7	8	4
STS measures	4-7	8	4

[1] Final assessment of generalisation conducted on the last day of the study will be described separately
Abbreviations: SMMSE, Standardised Mini-Mental State Questionnaire; MSQ, Mental State Questionnaire; DEMMI, de Morton Mobility Index; 10 MWT, Ten metre walk test; STS, Sit-to stand

Table 4.3 Order of administration of measures across the study periods

Pre- intervention Baselines (4-7 days) Order of measures	Intervention Baselines (4-7 days) Order of measures	Post-intervention Maintenance (2 days) Order of measures
1. 10 MWT 2. Bed mobility 3. SCh-PSU 4. SMMSE/MSQ 5. WCh-PSU	1. 10 MWT 2. Bed mobility 3. SCh-WDY 4. MSQ 5. WCh-PSU *(STS training session)* 6. SCh-PSU	1. 10 MWT 2. Bed mobility 3. SCh-WDY 4. SMMSE/MSQ 5. WCh-PSU 6. SCh-PSU

Abbreviations: 10 MWT, Ten metre walk test; SCh-PSU, Sit-to-stand from the standard chair to the command "Please stand up"; SMMSE, Standardised Mini-Mental State Questionnaire; MSQ, Mental State Questionnaire; WCh-PSU, Sit-to-stand from the wheelchair to the command "Please stand up"; STS, Sit-to-stand; SCh-WDY, Sit-to-stand from the standard chair to the command "What do you have to do to stand up, tell me and show me?"

4.2.4.1. Target behaviour

The goal of the STS training with an instruction sheet was to increase the use of the trained STS strategies (type and number) in the preferred sequence in people living with dementia. Two measures of target behaviour were used. The primary measure was the type, number and sequence of STS strategies used when standing up without the instruction sheet from the standard chair to the command “Please stand up”.

The secondary measure involved assessment of STS (type, number and sequence of STS strategies) from the standard chair to the training command “What do you have to do to stand up, tell me and show me?”. People living with dementia are able to form an association between a cue that may be provided as a command and the expected response (task being trained) (Bier, Provencher, et al., 2008; Bird & Kinsella, 1996; Camp et al., 1996).

Sit-to-stand from a standard chair to the command “Please, stand-up”

This measure was used during all study periods. During the pre-intervention period (baselines) the measure was used to establish baseline STS performance from a standard chair (the same as used in the training sessions) to the command “Please stand up”. During the intervention period the measure was used at the end of the training session to assess whether STS training had an immediate effect on STS performance when a different command was used. During the post-intervention period (maintenance) the measure continued to be used after all other tests were conducted with the aim of assessing retention of any training effects.

Sit-to-stand from a standard chair to the training command “What do you…?”

This STS measure was collected during the intervention and post-intervention periods. The measure was not collected during the pre-intervention period to prevent participants from developing an association between the training command and the STS performance before the training was implemented. This measure was used with the aim to investigate the effect of the training command on STS performance when no instruction sheet was provided. During the intervention period this measure was used to assess the retention of training effects between the sessions (24 h). During the post-intervention period (maintenance) the measure was used to monitor retention of STS training effects after the training was withdrawn.

4.2.4.2. Generalisation

Generalisation was assessed with the aim to examine participants’ ability to use STS strategies in different functional situations. People living with dementia are reported to have decreased ability to transfer (generalise) learnt skills to novel situations (Bier, Provencher, et al., 2008; Dick et al., 2003; Dick, Hsieh, et al., 2000). Therefore, generalisation was assessed using a generalisation probe throughout study periods (STS task performed from a wheelchair) and a final assessment of generalisation. Both are described in more detail below.

Sit-to-stand from the wheelchair to the command "Please, stand-up"

This measure was used during all periods of the study as a generalisation probe. During the pre-intervention period it was used to establish participants' baseline STS performance when standing up from the wheelchair. During the intervention period the measure was used with the aim of assessing whether STS training had any spontaneous effect on use of the STS strategies when standing up from the wheelchair. The measure was also used during the post-intervention period (maintenance) to assess retention of training effects.

Final assessment of generalisation

The final assessment of generalisation was conducted by an independent person in a single session on the last day of the study for each participant and involved the following modifications to STS measures:

- Introduction of an independent person who gave the commands and provided the STS instruction sheet;
- Use of the training command "What do you…?" when participants were standing up from the wheelchair and lounge chair; and
- Introduction of a new chair in a different environment (lounge chair in the lounge room).

STS measures and the order and aims of measures during the assessment of generalisation are summarised in Table 4.4. Participants were asked to stand up eight times: four times from the wheelchair and four times from the lounge chair to two different commands used with or without the instruction sheet.

Table 4.4 Sit-to-stand measures and order of testing during assessment of generalisation

Chair type	Command	Instruction sheet	Aims
Wheelchair	1. “Please stand up” 2. “What do you…?” 3. “Please stand up” 4. “What do you…?”	No No Yes Yes	Assess the effect of the person giving the command, command itself and the instruction sheet on STS performance
	Recess (15-20 minutes) to minimise carryover		
Lounge chair	1.“Please stand up” 2. “What do you…?” 3. “Please stand up” 4. “What do you…?”	No No Yes Yes	Assess effect of a chair not used previously and a new environment on the STS performance

4.2.4.3. Cognition

Cognition was assessed using the SMMSE (Appendix 4) and monitored daily using the MSQ (Appendix 7). SMMSE was described in detail in Study 1. Baseline cognition was assessed before study commencement and again after completion of the intervention period (during maintenance period).

MSQ (MacKenzie, Copp, Shaw, & Goodwin, 1996) was administered daily during all periods of the study (pre-intervention, intervention, and post-intervention) to monitor stability of basic cognition. This measure is a short test consisting of 10 questions related to orientation in time, place, remote memory and general knowledge.

4.2.4.4. Functional status

Stability of functional status was monitored using assessments of basic mobility, speed of walking and bed mobility. Basic mobility was assessed using the DEMMI (Appendix 5). DEMMI was administered on the first day of baseline measures and on day one of the post-intervention period to asses for any changes in mobility. Daily functional status was monitored using speed of walking (10 MWT) and level of independence with bed mobility. DEMMI and 10 MWT were described in Study 1.

Bed mobility was assessed by determining the level of assistance required to complete the task of moving from supine to sitting over the edge of the bed. Level of assistance was rated using the seven-point ordinal scale of the Functional Independence Measure (FIM), (Kidd et al., 1995). A score of one corresponds to total dependency and seven to complete independence (Table 4.5). Bed mobility was assessed daily to monitor for changes in functional status.

Table 4.5 Functional Independence Measure - Level of assistance

Level of assistance		Description
7	Complete independence	Fully independent
6	Modified independence	Requiring the use of a device but no physical help
5	Supervision	Requiring only standby assistance or verbal prompting or help with set-up
4	Minimal assistance	Requiring incidental hands-on help only (subject performs > 75% of the task)
3	Moderate assistance	Subject still performs 50–75% of the task
2	Maximal assistance	Subject provides less than half of the effort (25–49%)
1	Total assistance	Subject contributes < 25% of the effort or is unable to do the task

Adapted from Functional Independence Measure (Kidd, Stewart et al. 1995)

4.2.5. Equipment and settings

All participants underwent assessment and training in the same environment using the same equipment. Assessment and training were conducted in a research room provided by the residential care facility and equipped with a single bed for monitoring bed mobility, a table, a standard chair and a wheelchair for STS assessments and training. The corridor outside the research room was used for monitoring speed of walking. The final part of the study (assessment of generalisation) was conducted in the research room and in a common lounge area (

Figure 8).

The standard chair and table described previously (Study 1) were used in Study 2. The setup of the chair with the table 30 cm in front was also maintained. The specifications for all research equipment used in Study 2 are summarised in Table 4.6. All STS assessments and training sessions were digitally video recorded by a camera positioned on a tripod approximately 333 cm from a chair and 126 cm above the floor during all periods of the study to allow capture of the full left lateral view of participants during STS trials (Figure 7).

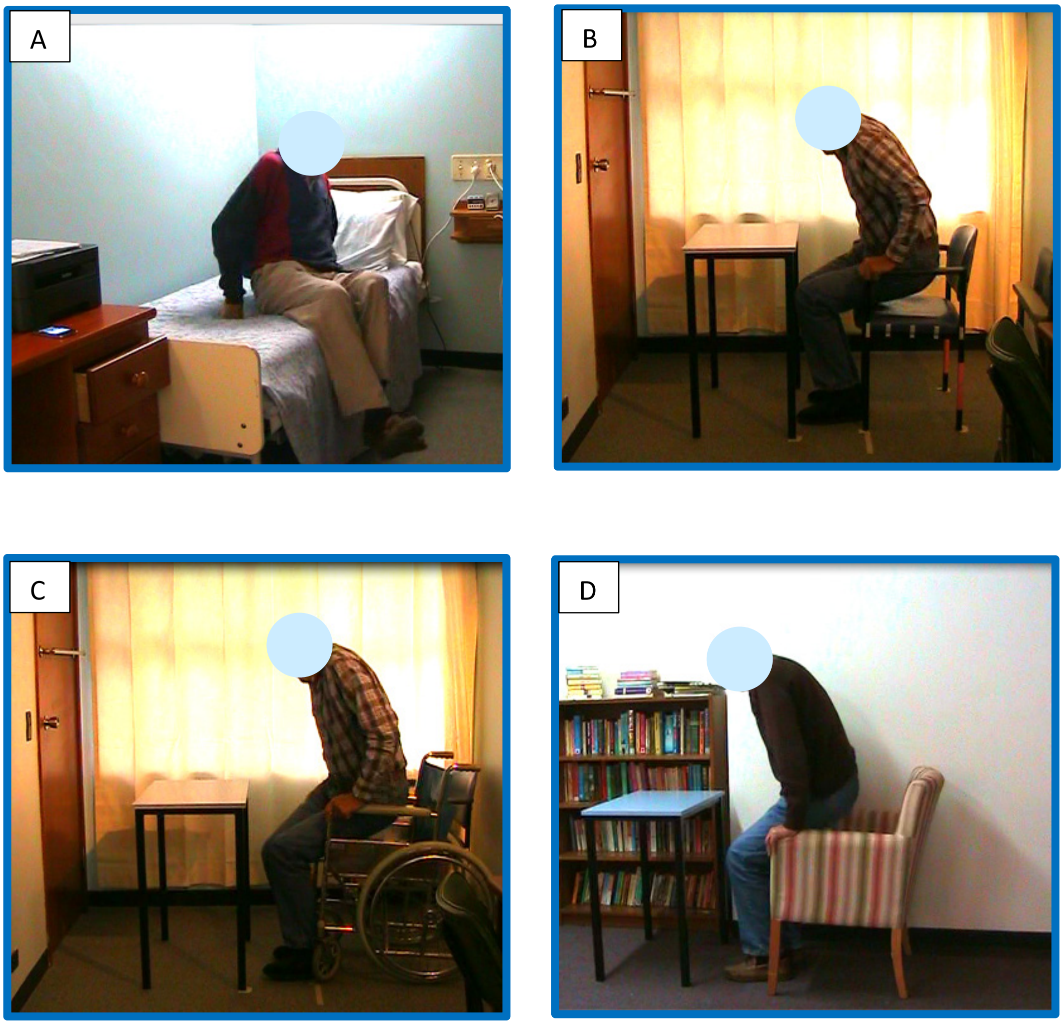


Figure 8 Setting of the testing and training environments
(A) Research room with single bed; (B) Research room with table and standard chair; (C) Research room with table and wheelchair; (D) Lounge room with table and lounge chair.

Table 4.6 Equipment specifications

Specifications	Standard chair	Wheelchair	Lounge chair	Bed	Table
Height, cm	45	43	43	50	76
Width, cm	44	45	50	90	45
Depth, cm	44	40	50	NA	NA
Length, cm	NA	NA	NA	200	67
Backrest angle, degrees	90	100	100	NA	NA
Armrests: Length	Full	Full	Full	NA	NA
Armrests: Height, cm	23	25	25	NA	NA

Abbreviations: NA, Not applicable

4.2.6. Training protocol

The intervention comprised eight STS training sessions (one session a day) delivered individually and based on principles of spaced retrieval (Brush & Camp, 1998; Camp et al., 1996; Creighton et al., 2013), errorless learning (Clare & Jones, 2008; Clare et al., 2000; de Werd et al., 2013) and vanishing cues(Bier, Van Der Linden, et al., 2008; Hunkin & Parkin, 1995; Kessels & de Haan, 2003). All training sessions were recorded using a digital camera and delivered in the research room that was free from external distractions. A study journal was kept and following each contact field notes were made regarding any factors that potentially could have an effect on participants' progress and participation in the training sessions.

All STS training was delivered by one physiotherapist. The physiotherapist (candidate) who delivered the intervention had more than 20 years' experience, including six years' working predominately with people living with dementia. The candidate attended two workshops (two days each) on the application of spaced retrieval, errorless learning and different methods of cueing in rehabilitation of people living with dementia. One of the workshops was conducted by Dr Cameron Camp, a neuropsychologist, who pioneered the use of spaced retrieval in people living with dementia (Camp et al., 1996; Creighton et al., 2013; Oren et al., 2014).

A member of the research team was present as an observer during all periods of the study, including 30% of training sessions. A random selection (20%) (Tate et al., 2014) of the recorded sessions were reviewed to assess fidelity of the STS training (Ledford & Gast, 2014). This confirmed that the research plan was implemented as intended: STS training was delivered only during the intervention period, STS practice was distributed according to spaced retrieval principles (time interval doubled after correct response and decreased after incorrect response), errors were prevented by provision of cues necessary to complete the STS task correctly, cues were delivered in a structured manner, and STS assessments were conducted consistently in the planned order.

4.2.6.1. Development and pilot testing of training protocol

Prior to study commencement, the STS training protocol was piloted with two people living with dementia. Practice sessions were digitally recorded and examined regarding application of spaced retrieval, errorless learning and vanishing cues. Refinements and modifications were made including application of spaced retrieval time intervals, method of recording incorrect and correct responses, and standardisation of the cues. Additionally, the final training command, "What do you have to do to stand up, tell me and show me?" was developed in response to difficulties of people living with dementia understanding the command.

4.2.6.2. Implementation of training protocol

The detailed STS training protocol, including step by step instructions, is presented in Appendix 8. STS training was conducted using the standard chair with the table positioned 30 cm in front. An instruction sheet with the four STS strategies (slide forward, feet backwards, lean forward, and push up to stand) printed in black ink on a white paper sheet (A4) in large font (Calibri 48) was placed on the table at the same time when the command to stand up was given.

Participants were trained in STS using errorless learning and over increasing time intervals (spaced retrieval) with the same instruction sheet and the same command given by the candidate; "What do you have to do to stand up, tell me and show me?". The purpose of the command provided with the instruction sheet was for the participant to make an association between the command and reading the instruction sheet and, at the same time, executing the STS strategies. During STS practice errors were avoided (errorless learning) and correct performance was reinforced by using the instruction sheet and increasing or decreasing (as necessary) the level of cueing in a systematic manner. The five levels of cueing used, from the highest to the lowest, are outlined in Table 4.7.

Table 4.7 Cueing levels

Cueing level	Type of the cue
Level 5	Instruction sheet with pointing to or tapping and with verbal cues such as "first, second", and reading (naming) two or more commands
Level 4	Instruction sheet with pointing to or tapping with verbal cues such as "first, second", and reading the first command
Level 3[1]	Instruction sheet with pointing to or tapping with verbal cues such as "first, second"
Level 2	Instruction sheet with pointing to the sheet or tapping
Level 1	Instruction sheet only

[1] Participants were able to progress to the next time interval when able to perform STS correctly with no more than level 3 cueing

At the beginning of the first training session the instruction sheet was introduced with the maximum level of cueing required until participants learnt to read and perform STS strategies according to the written commands. During the initial practice, attempts were made to decrease the level of cueing (vanishing cues) as participants improved their ability to perform STS with the instruction sheet. When hesitation or signs of potential errors were noted cueing was increased to ensure correct performance.

The first attempt to introduce spaced retrieval (15 seconds interval) for STS practice was made after participants achieved the first “correct” performance; that is, all strategies were verbalised out loud and STS performed without the strategies being named by the candidate (Level 3 cueing). Time intervals following a “correct” performance were doubled to a maximum of 32-minutes (15 seconds, 30 seconds, 1, 2, 4, 6, 8, 16, and 32-minutes), or decreased to the previous time interval when the performance was “incorrect”. If a participant failed three attempts to progress to the next time interval, STS practice (two to five times, as tolerated) with as many cues as required was provided before another recall attempt was made.

STS performance was deemed “incorrect” when participants hesitated, initiated the task in a manner indicating potential errors or when one or more strategies had to be named (Level 4 or 5 cueing). Each “incorrect” performance was followed by an immediate practice with as much cueing as required to successfully complete the task. This was instantly followed by an immediate recall.

Participants completed eight training sessions over eight consecutive days. If the maximum 32-minute interval was reached and maintained before the completion of the eight training sessions, participants continued to practice at a 32-minute interval. If participants performed and verbalised all four STS strategies in the correct sequence without the instruction sheet (STS measure conducted before each training session), no STS training was provided. Training sessions were terminated if participants showed signs of behavioural and psychological distress such as restlessness or decreased attention. Each training session commenced using the last time interval with “correct” practice from the previous session. Spaced retrieval time intervals and responses to training were monitored and recorded using an iPAD and spaced retrieval application “Spaced Retrieval TherAppy” (www.tactustherapy.com). A sample of the “Spaced Retrieval Therapy” record is presented in Figure 9.

Client answered the question "What do you have to do to stand up?" using the Spaced Retrieval TherAppy app at 09:07 on 26 Jun 2013. Starting with an interval of 15 seconds, client gave the correct response on 5/7 (71%) attempts. The longest interval in which a correct response was given was 2 minutes.

Total = 5/7 (71%)

15s	30s	1m	2m	4m	8m	16m	32m
+	-						
+	+	+	+	-			

Results provided by Spaced Retrieval TherAppy by Tactus Therapy Solutions ©2012 www.tactustherapy.com

Figure 9 Sample of spaced retrieval therapy record

Activities not related to STS practice were provided by the candidate between STS practices (Brush & Camp, 1998; Camp et al., 1996; Hopper et al., 2010). During shorter time intervals (below 2 minutes) participants were engaged in light conversation. During longer time intervals, participants undertook a variety of easy and engaging activities. These activities were based on each participant's experience and interests documented in the chart as well as reported by carers and substitute decision makers. Activities were individualised and involved perusing books and discussing photographs representing animals, natural wonders, ships, golf, and flowers. Participants were also involved in establishing a small fish tank and participated in regular feeding of the fish. Other activities involved knitting and using iPAD to watch and manipulate pictures.

The main aim of the intervention was to facilitate learning of STS strategies without errors and this was supported by:

- Use of the instruction sheet with STS strategies expressed as action phrases;
- Training command repeated verbatim;
- Preventing incorrect performance by immediately providing necessary cues;
- Vanishing cues gradually;
- Increasing or decreasing time intervals after "correct" or "incorrect" performances, respectively;
- Provision of immediate practice (immediate recall) after "incorrect performance" with as much cueing as required to ensure use of all STS strategies

4.2.7. Data collection and management

Data collection sheets were developed for the project and used to record demographic data including age, type of dementia, years since diagnosis, years since onset of symptoms, years in a residential facility, comorbidities, previous occupation, and background social information. Results for MMSE, MSQ, DEMMI and speed of walking were recorded for each participant. All bed mobility and STS assessments as well as intervention sessions were digitally recorded and saved as single clips for evaluation.

Demographic data were used to describe participant characteristics. Speed of walking (m/sec) was calculated from 10MWT and entered into a spread sheet. Digitally recorded video clips were de-identified and randomised across the sessions. Each video clip comprised a single STS assessment, regardless of chair (standard, wheelchair, and lounge) and command ("Please stand up", "What do you …?"). Randomised video clips were assessed by an independent assessor who was blinded to the period (pre-intervention, intervention and post intervention) of the study. The independent assessor used the observation based assessment tool (developed for Study 1) to record type, number and sequence of the STS strategies, type of chair and the command used. Participants' verbal responses to the training question "What do you have to do to stand up, tell me and show me?" were also recorded.

STS strategies identified by the independent assessor for each performance were coded using the first four letters of the alphabet (ABCD) in order of the STS training sequence (A - sliding forward, B - feet backwards, C - leaning forward, and D - pushing up to stand). Therefore, when STS performance reflected the STS training sequence, it was recorded as "ABCD". When there was a variation in the performance, e.g., leaning forward, followed by sliding forward and pushing through the armrest, the sequence was recorded "CAD". The aim of coding the strategies was to enable a quick visual inspection of the data to identify the type, number and sequence of strategies in each STS performance. A scoring system of the STS strategies used was developed. Creating a total score for the STS performance enabled graphic representation across the periods of the study.

All STS performances during pre- intervention, intervention and post-intervention periods were scored. The maximum score for each STS performance was 10, when all STS strategies were used. The sequence of the strategies was not taken into consideration in the scoring system. The scoring system was based on the frequency of STS strategies observed in older adults and people living with dementia identified in Study 1. Leaning forward was allocated one point, as this was the most commonly observed strategy. Pushing through the armrests scored two points, feet backwards strategy three points and the sliding forward strategy (the least used), four points. By allocating different scores to each strategy, each STS performance was able to be represented as a cumulative score that reflected the potential effect of the STS training, i.e. if the sliding forward strategy was used after the training commenced, a higher score would allow easier visual identification of the change.

4.2.8. Data analysis

Descriptive analyses (mean and standard deviation for continuous measures, median and range for ordinal measures) were calculated for all measures. Raw speed of walking data were plotted as a time series to visually identify trends of individual participants. Clinical and demographic data were presented as raw values.

Cumulative scores were plotted for each STS performance and presented as a time series with study periods identified. The time series were supplemented by stacked columns graph representing the contribution of each strategy to the cumulative STS score allowing for visual evaluation of the frequency each strategy. The sequence of the strategies used is presented as raw data.

In single case experimental design (SCED) methodology, there are several approaches to data analyses that can be used such as structured visual analysis (Lane & Gast, 2014) with or without specific statistical methods (Kratochwill et al., 2010). The choice of analytical approach depends on "specifics of the independent variables, participant characteristics, the desired and hypothesized outcomes, and the research question(s)" (Smith, 2012, p. 514), as well as the aim of the analysis (Manolov, Solanas, Sierra, & Evans, 2011). Data characteristics such as inconsistent baseline variability and restricted range of STS strategies, indicated that basic visual inspection was the most appropriate approach to data analysis relevant to the study aims. Graphical representation of data allowed for visual inspection of trends, changes in levels and contribution of strategies to the cumulative score for each STS performance.

4.2.9. Ethical considerations

Ethical clearance for this study was obtained from the Griffith University and Masonic Care Queensland Human Research Ethics Committees (Appendix 2). For participants who met the inclusion criteria, written informed consent to participate was obtained from substitute decision makers (enduring attorneys). Participants were also included in the decision making process (Beattie, 2009). Participants who were reluctant to participate (despite substitute decision makers' consent) were excluded from the study. Copies of consent forms were filed in the participant's medical chart and originals with de-identified data, including video recordings, were securely stored.

4.3. Results

4.3.1. Flow of participants through the study

The flow of participants in the study is represented in Figure 10. The Nursing Unit Manager with a Registered Nurse identified sixteen residents who met the inclusion criteria for the study. Twelve residents were excluded; family members declined consent for seven residents, Adult Guardian Office declined consent for one resident, three residents declined participation despite substitute decision makers' consent, and one resident was unable to participate due to acute health deterioration. Four residents (participants), two males, completed the study.

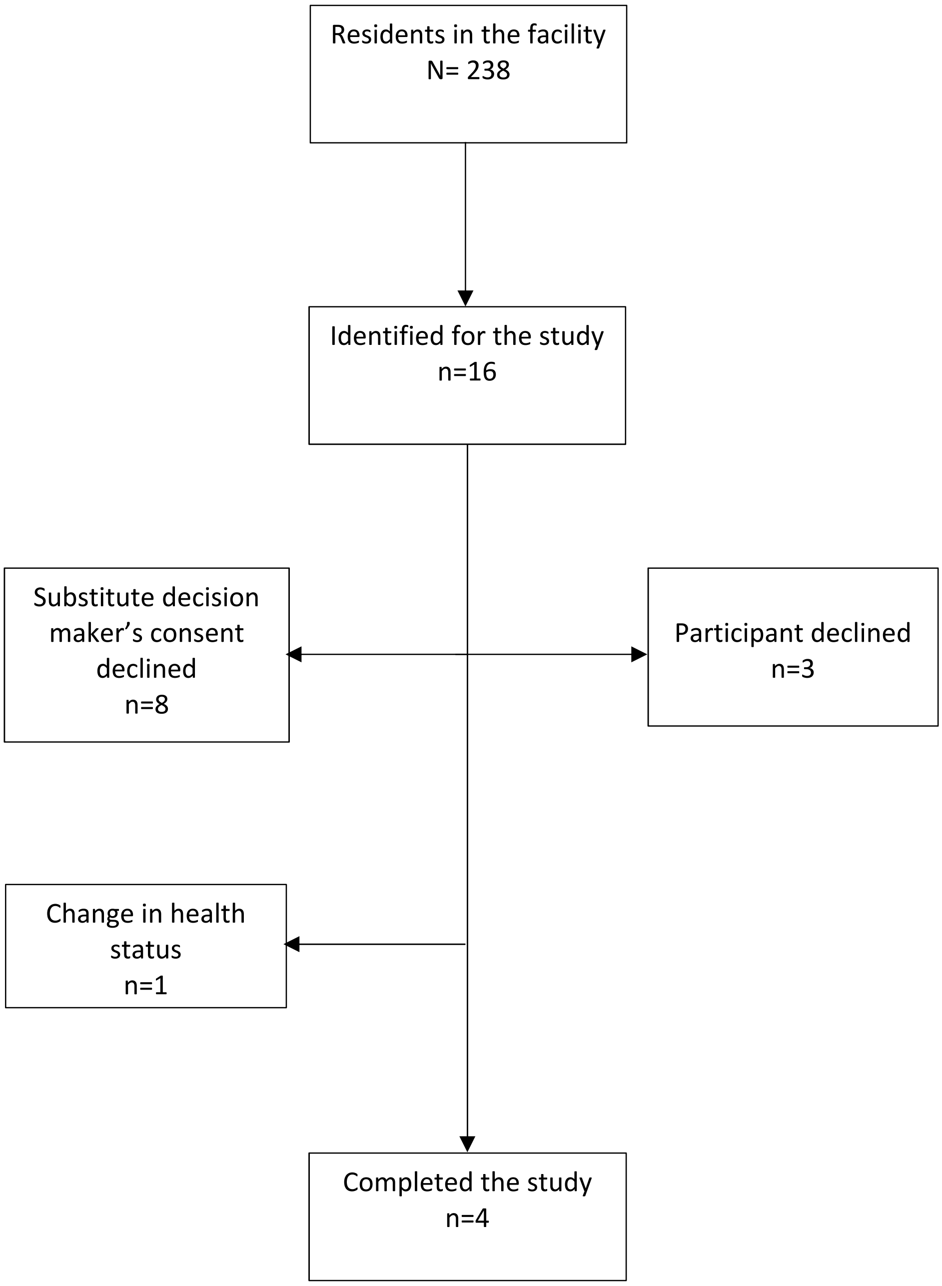


Figure 10 Flow of participants through the study

4.3.2. Participant characteristics

General participant characteristics will be presented in the following sections. Detailed information such as history of diagnosis, comorbidities, general functioning and social situation will be described for each participant in the individual result sections.

4.3.2.1. General characteristics

Participants' demographic and health characteristics are presented in Table 4.8. Of the four participants (P1, P2, P3, and P4) who completed the study, three participants (P1, P3 and P4) were living in a dementia specific secured area of the facility and one participant (P2) lived in the general residential area. All participants were able to stand up independently from a chair without using arms to push up. P1 mobilised without walking aids, P2 and P3 used four wheeled walkers whereas P4 used a single stick. Although none of the participants required physical assistance, all required supervision when walking around the facility. Similarly, all needed assistance with some aspects of personal care, with P4 being most dependent.

Table 4.8 Characteristics of participants

Characteristic	Participant 1	Participant 2	Participant 3	Participant 4
Age (years)	81	93	94	75
Gender	Male	Female	Female	Male
Height, cm	175	157	146	183
Weight, kg	79	66	48	91
Type of dementia[1]	Mixed (VaD/ADT)	Alzheimer's Disease	Mixed (ADT/VD)	Mixed (VD/ADT)
Clinical Dementia Rating[1]	2 (mild)	2 (mild)	2 (mild)	3 (severe)
Years since symptoms[2]	>3	>10	>15	>5
BPSD	Wandering	Nil reported	Wandering	Aggression Wandering
Years in the facility (years)	1.5	2	18	1.5
SMMSE (30/30)	15/30	20/30	11/30	10/30
SMMSE immediate recall	Able	Able	Able	Able
SMMSE delayed recall	Unable	Unable	Unable	Unable

[1] Rated by a Geriatrician
[2] Based on reports of substitute decision makers
Abbreviations: BPSD, Behavioural and Psychological Symptoms of Dementia; SMMSE, Standardised Mini Mental State Examination; DEMMI, de Morton Mobility Index; VaD, Vascular dementia; AD, Alzheimer's disease

4.3.2.2. Cognition and functional status during the study

Participants' cognitive and functional status are presented in Table 4.9. Comparison of SMMSE results from before and after the study revealed a one-point decrease for P1 and P3, and no change for P4. However, a three point decrease in SMMSE (from 20/30 to 17/30) was observed for P2 who was no longer able to repeat phrases (item 8), copy the design (item 11), and follow the three-stage command (item 12). MSQ scores were generally stable over the duration of the study for P1, P3 and P 4 but scores were more variable for P2. There were no changes in DEMMI scores or level of independence with bed mobility throughout the duration of the study.

Table 4.9 Cognition and functional status for all participants

Measures	P 1	P 2	P 3	P 4
SMMSE, (before/after)[1]	15/14	20/17	11/10	10/10
MSQ, median (min/max)[2]	3 (2/3)	3 (2/4)	2 (2/2)	1 (0/1)
DEMMI raw scores (before/after)[3]	17/17	16/16	16/16	15/15
DEMMI converted scores (before /after)[3]	74/74	67/67	67/67	62/62
Walking speed m/sec, (mean/SD)[4]	0.86/0.08	1.00/0.08	0.88/0.07	0.86/0.05
Bed mobility, FIM score[4] (before/after)	7/7	7/7	7/7	7/7

[1] Measured before the study and following intervention period
[2] Measured once a day during all study periods
[3] Measured twice: once during pre-intervention and once during post- intervention period
[4] Measured daily during pre-intervention and intervention periods and twice a day during post –intervention (maintenance) period
Abbreviations: SMMSE, Standardised Mini Mental State Examination; MSQ, Mental Status Questionnaire; DEMMI, de Morton Mobility Index; FIM, Functional Independence Measure

Speed of walking fluctuated with overall trends suggesting slowing of the walking speed as the study progressed for P1, P3, and P4. A similar trend was not observed for P2. Daily speed of walking for all participants is presented Figure 4.4.

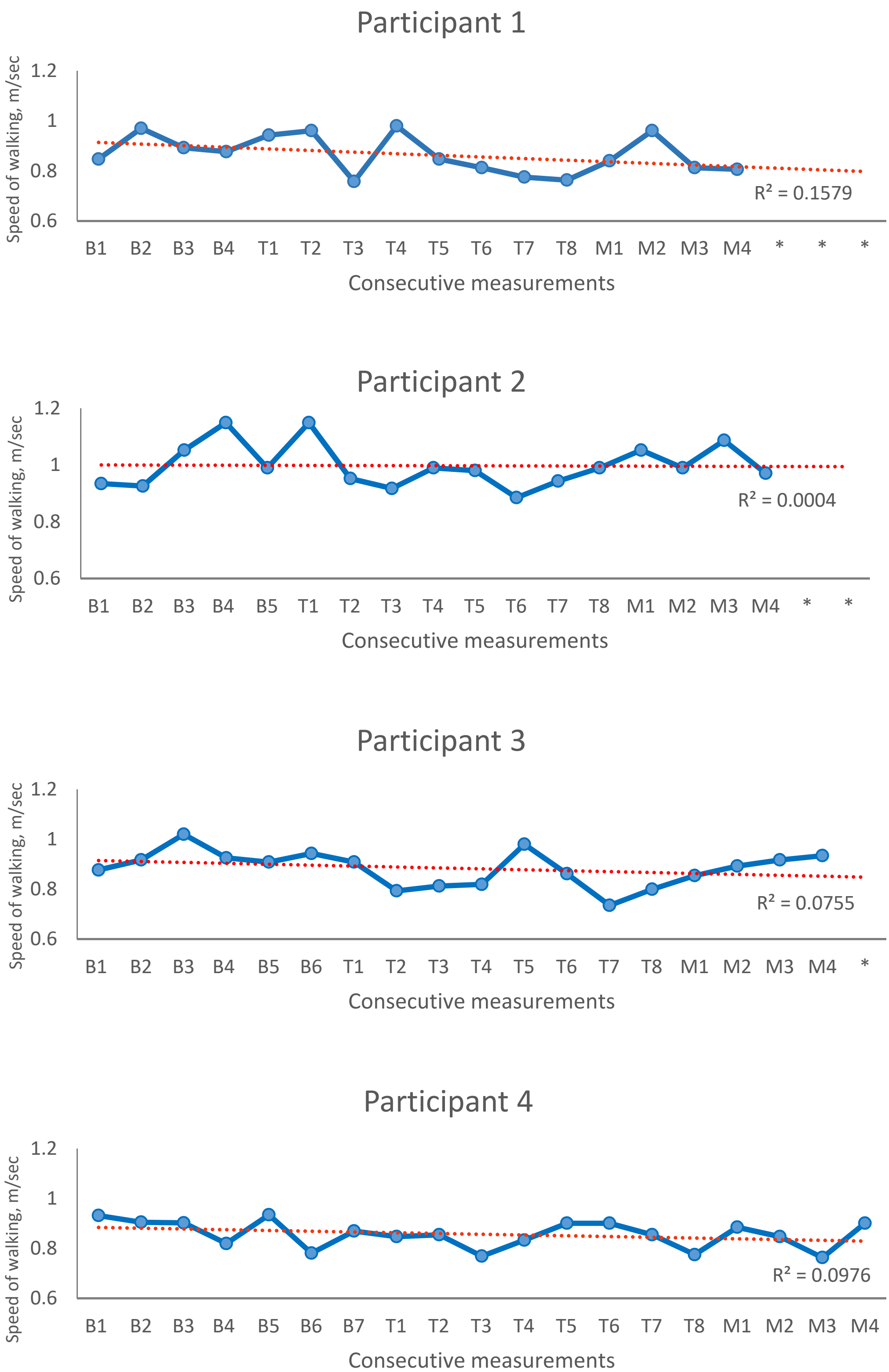


Figure 11 Walking speed for all participants during the study periods

Walking speed was measured at the beginning of baselines, training and maintenance sessions.
Abbreviations: B, Baselines; T, Training sessions during intervention period; M, Maintenance

4.3.3. Baselines for sit-to-stand from a standard chair and wheelchair

Participants completed four to seven baseline STS assessments, with P1 completing four and P4 seven assessments. During the baseline period, STS performance was measured using both the standard chair and wheelchair to the command "Please stand up" according to the order of testing presented in Table 4.3. Exact strategies and their sequence used by each participant are presented in Table 4.10.

Table 4.10 Baseline sit-to-stand strategies from the standard chair and wheelchair to the command "Please stand up"

Baselines	Participant 1		Participant 2		Participant 3		Participant 4	
	SCh	WCh	SCh	WCh	SCh	WCh	SCh	WCh
1	BCD	BCD	BCD	C	BC	CBD	CD	CD
2	BC	BCD	BCD	CBD	BCD	CBD	CD	CD
3	CD	BCD	BCD	BCD	C	CD	CD	BCD
4	BCD	CBD	BC	BC	BC	CBD	CD	CD
5	-	-	BC	BC	CB	CD	CD	CD
6	-	-	-	-	CB	C	CD	AD
7	-	-	-	-	-	-	CD	CD

Abbreviations: SCh, Standard chair; WCh, Wheelchair; A, Sliding forward; B, Feet backwards; C, Leaning forward; D, Pushing through the armrests

Overall, participants demonstrated different level of variability in the number and type of STS strategies used during the baseline period. When standing up from a standard chair P4 used the same two strategies whereas the remaining participants were less consistent in both the number and type of strategies used. When standing up from the wheelchair, P1 used the same three strategies during the four baseline assessments, P2 used the same strategies four times out of five, and P4 used the same strategies five times out of seven baseline assessments and once used sliding forward strategy. All participants demonstrated some variability in the sequence of the strategies.

The number and frequency of STS strategies used during baseline assessments is presented in Table 4.11. The most common strategies were leaning forward, followed by pushing through the armrests and feet backwards strategy. The least frequently used strategy was sliding forward which was used only once by P4 when standing up from the wheelchair. None of the participants used all four strategies either when standing up from a standard chair or wheelchair. Participants 3 and 4 demonstrated limited use of pushing through the armrests and feet backwards strategies, respectively.

Table 4.11 Frequency of strategies used during baseline sit-to-stand assessments

Participant (Number of baselines)	Chair type	Sliding forward	Feet backwards	Leaning forward	Pushing through the armrests
Participant 1, (4 Baselines)	SCh WCh	0 0	3 4	4 4	3 4
Participant 2 (5 Baselines)	SCh WCh	0 0	5 4	5 5	3 4
Participant 3 (6 Baselines)	SCh WCh	0 0	5 3	6 6	1 5
Participant 4 (7 Baselines)	SCh WCh	0 1	0 1	7 6	7 7

Abbreviations: SCh, Standard chair; WCh, Wheelchair

4.3.4. Effects of training on sit-to-stand for individual participants

Results for each participant will be presented individually and will be preceded by brief background information. The effects of STS training will be presented for each participant (P1, P2, P3, and P4) in the following order:

- Learning during STS training sessions using the instruction sheet;
- Effects of training sessions on target behaviour (type, number and sequence of STS strategies) measured without the instruction sheet and comprising STS from the standard chair to the commands:
    - "Please stand up", and
    - "What do you have to do to stand up, tell and show me?"
- Generalisation probe, comprising STS from the wheelchair to the command "Please stand up".

The final assessment of generalisation will be presented for all participants in a separate section following the individual results of all participants.

4.3.4.1. Participant 1 (P1)

Background (P1)

Participant 1 (P1) was an 81 year old widowed man with mixed dementia (Alzheimer's type and vascular) who at the time of the study had been in the facility for more than one year. He was formally diagnosed with dementia two years prior but according to a family member his memory problems became very obvious about three years before diagnosis. P1 had no history of cerebro-vascular events or any other neurological or psychiatric disorders recorded in his chart. At the time of the study, P1 was independently mobile without aids and was able to perform all basic activities of daily living. He resided in a secured area due to a history of wandering and risk of leaving the facility. He required supervision to mobilise around the facility due to orientation problems but had no difficulty in finding his room in a smaller secured area. During his working life he performed mainly physical work and had limited formal education. At the time of the study he could hold a basic conversation on topics related to cars, natural environment and horses. He was very cooperative and always willing to attend the training sessions.

Learning during training sessions with the instruction sheet (P1)

The number of STS practices per each intervention session, the lowest level of cueing achieved and highest cueing level required to ensure P1 performed all four STS strategies correctly are presented in Figure 12.

During the first session, P1 required four attempts of STS practice with full instructions and physical facilitation before he was able to use the instruction sheet and perform all strategies in the correct order to the training command "What do you have to do to stand up, tell me and show me?". He completed an additional 13 STS practices during the first session with varying levels of cueing and was able to achieve a spaced retrieval interval of four minutes with the lowest cueing during the first training session being Level 2 (i.e. pointing to the instruction sheet).

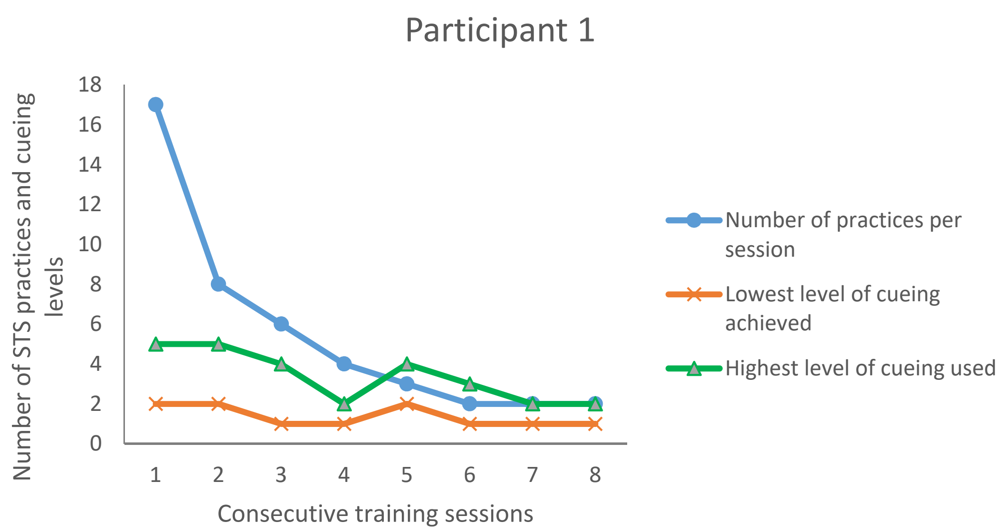


Figure 12 Number of sit-to-stand practices and levels of cueing for Participant 1
Abbreviations: STS, Sit-to-stand

As P1 progressed throughout the training sessions he was able to increase time intervals between correct practices achieving a 32-minute interval by the end of session three with Level 1 cueing (instruction sheet only). A slight increase in cueing as well as in the number of practices was recorded during session five. The level of cueing and number of practices decreased again in subsequent sessions.

Effects of training on sit-to-stand without the instruction sheet (P1)

The STS strategies used by P1 when standing up without the instruction sheet for each type of chair and each command during the study periods are presented in Table 4.12. The strategies (sliding forward, feet backwards, leaning forward and pushing through the armrests) are coded A, B, C, and D respectively and are aligned according to the final strategy used. Each STS performance is also represented as a cumulative score (maximum 10) based on the frequency of strategies used in Study 1. The cumulative STS scores for all STS assessments (STS from the standard chair and wheelchair to the command "Please stand up" and from the standard chair to the command "What do you…?" are graphically presented in Figure 13.

Table 4.12 Sit-to-stand strategies used by Participant 1 without the instruction sheet

Study period		Standard chair "Please stand up" [1]	Standard chair "What do you…?" [2]	Wheelchair "Please stand up" [3]
Pre-intervention	B 1	BCD	-	BCD
	B 2	BC	-	BCD
	B 3	CD	-	BCD
	B 4	BCD	-	CBD
Intervention	T 1	BACD	BC	BCD
	T 2	CD	CBD	BC
	T 3	BCD	BCD	BCD
	T 4	ACD	BCD	BC
	T 5	CD	BCD	BCD
	T 6	CD	BCD	BCD
	T 7	BCD	BCD	BCD
	T 8	CBD	BCD	CD
Maintenance	M 1	CD	BCD	BCD
	M 2	CD	BCD	BC
	M 3	Missing data	BCD	BCD
	M 4	Missing data	BCD	BCD

[1] Assessed during baselines (beginning of sessions), intervention and maintenance periods (end of sessions)
[2] Assessed only during intervention and maintenance periods (beginning of sessions)
[3] Assessed during baselines (end of sessions), intervention period (before the STS training) and during maintenance period before the STS from the standard chair to the command "Please stand up" was assessed
Abbreviations (strategies): A, Sliding forward; B, Feet backwards; C, Leaning forward; D, Pushing through the arms
Abbreviations (study periods): B (1-4), Baselines (1-4); T (1-8), Training sessions (1-8); M (1-4), Maintenance sessions (1-4)

Target behaviour: sit-to-stand from the standard chair to the command "Please stand up" (P1)

STS performance (number, type and sequence of strategies) demonstrated by P1 was comparable during the intervention and baseline periods. P1 used two or three strategies when standing up from the standard chair to the command "Please stand up". As an exception, P1 used four strategies on one occasion at the end of first training session. Specifically, he started with feet backwards instead of sliding forward. Sliding forward was used only once more at the end of the fourth session as one of three strategies. During the maintenance period, P1 reduced the number of strategies to two (leaning forward and pushing through the armrests) in two out of four planned assessments (data for the two last assessments are missing due to an error in data transfer from the camera).

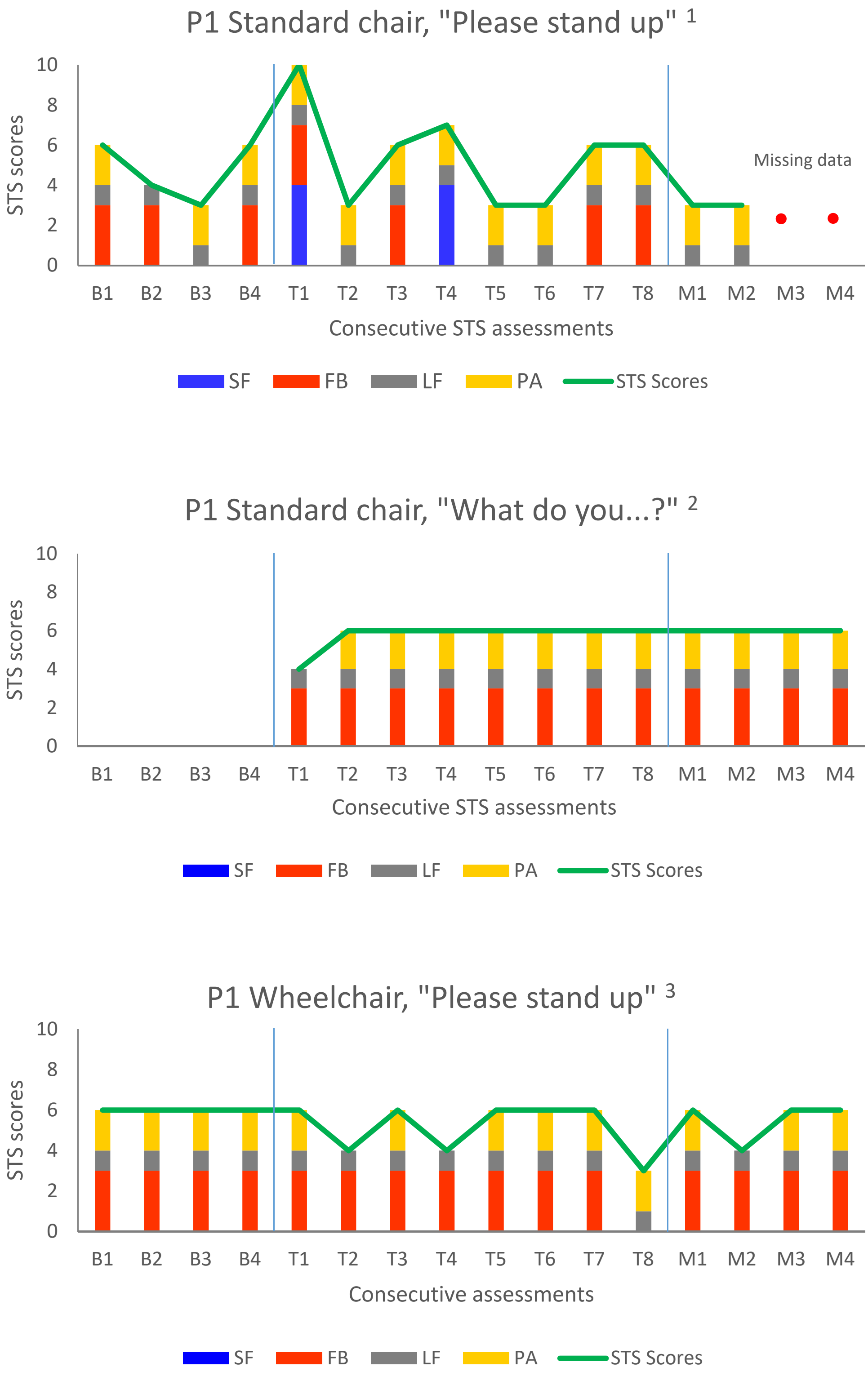


Figure 13 Cumulative scores for sit-to-stand assessments for Participant 1

[1] Assessed during baselines (beginning of sessions), intervention and maintenance periods (end of sessions)

[2] Assessed only during intervention and maintenance periods (beginning of sessions)

[3] Assessed during baselines (end of sessions), intervention period (before the STS training) and during maintenance period before the STS from the standard chair to the command “Please stand up” was assessed

Abbreviations: P1, Participant 1; B, Baselines during pre-intervention period; T, Training sessions during intervention period; M, Maintenance sessions, STS, Sit-to-stand; SF, Sliding forward; FB, Feet backwards, LF, Leaning forward, PA, Pushing through the arms

Target behaviour: sit-to-stand from the standard chair to the command “What do you…?” (P1)

The assessment of STS from the standard chair to the command “What do you…?” was conducted for the first time at the beginning of the first training session, that is before the STS training started. The same assessment was repeated at the beginning of the remaining training sessions and as a first assessment during maintenance period. P1 used two strategies (feet backwards and leaning forward) during the first assessment, but afterwards, P1 continued to use three strategies consistently throughout the intervention and maintenance periods. The sliding forward strategy was not used by P1. In response to the training command (without the instruction sheet) P1 named or described two to three strategies but the response did not always correspond to the number or the type of strategies being used.

Generalisation probe: sit-to-stand from the wheelchair to the command “Please stand up” (P1)

In the baseline period P1 used three strategies consistently when standing up from the wheelchair. His performance was less consistent during the intervention and maintenance periods, during which P1 used two or three strategies. The sliding forward strategy was not used by P1 when standing up from the wheelchair.

Summary of results for Participant 1

P1 was generally stable in terms of his cognitive and physical status over the duration of the study. He completed all eight STS training sessions. During the training sessions P1 was able to use all four STS strategies, performing them in the correct sequence using the instruction sheet without additional cueing being provided. He maintained the ability to use STS strategies towards the end of the training sessions with the instruction sheet despite a decrease in number of STS practices and the level of cueing (Figure 12). The effect of training sessions on STS performance without the instruction sheet varied (Figure 4.6). During the intervention period P1 demonstrated increased variability in the number and type of strategies used in comparison to baselines when standing up from the standard chair to the command “Please stand up”. Sliding forward was used only twice by P1 and only when standing up from the standard chair to the command “Please stand up”. However, P1 used only two strategies when standing up from the standard chair to the command “What do you…?” before commencing the first training session, and used three strategies consistently when assessed before all subsequent training sessions. The consistency of P1’s performance in response to the command “What do you…?” was also maintained during the maintenance period. STS performance from the wheelchair (generalisation probe) was stable during baselines (three strategies) but became more variable during intervention and maintenance periods.

4.3.4.2. Participant 2

Background (P2)

P2 was a 93 year old widowed lady with mixed dementia (Alzheimer's disease and vascular dementia) who at the time of the study had been in the facility for more than two years, having lived previously with her family. She was diagnosed with dementia two years prior but displayed memory problems for "many years", according to a family member. She had a history of type two diabetes, hypertension, depression, transient ischemic attacks, diverticular disease and hyperlipidaemia. At the time of the study, P2 lived in a main residential area and required supervision and assistance with direction to get to regular group activities. P2 was not able to find her way back to her room but she was able to recognise the part of the corridor by a specific wall feature. She required a four wheeled walker when walking long distances but walked without the walker around her room. P2 tried to perform basic domestic activities such as making own bed but needed assistance to complete the task correctly. According to a family member, P2 had a limited formal education and her previous occupation was looking after her house and family. She was an accomplished knitter and was still able to knit basic stitches very fast but she was not able to correct or accept stitching mistakes when she made them. She was constantly chatting and tried to talk to residents or staff when passing them in corridors, often telling the same stories using consistently the same phrases. P2 was always very keen to attend sessions and tolerated them well, except on one day (session five) when the participant attended a bus trip prior to the session.

Learning during training sessions with the instruction sheet (P2)

The number of STS practices per each intervention session, the lowest level of cueing achieved and highest cueing level required to ensure P2 performed all four STS strategies correctly are presented in Figure 14.

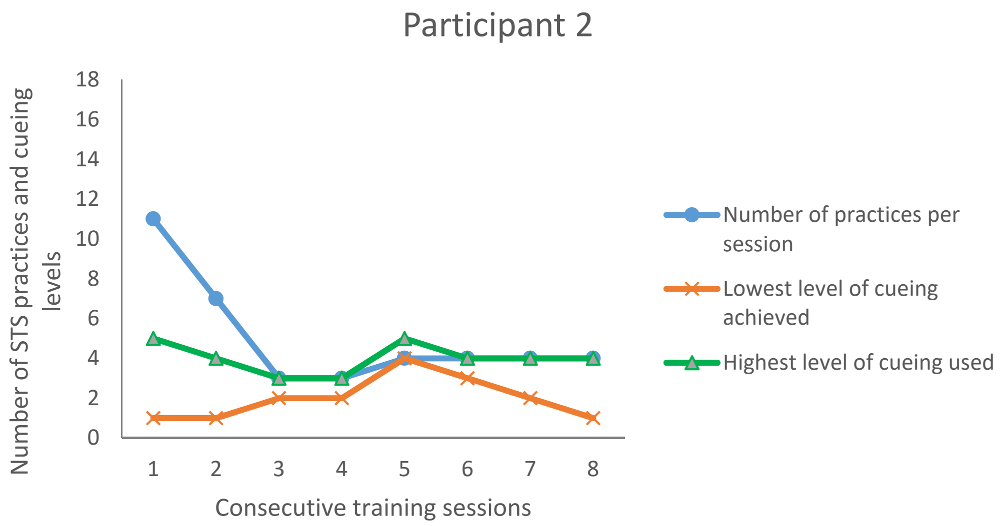


Figure 14 Number of sit-to-stand practices and levels of cueing for Participant 2
Abbreviations: STS, Sit-to-stand

During the first session, P2 required two fully cued and facilitated practices before being able to successfully read strategies from the instruction sheet in response to the training command ("What do you…?") and perform the STS strategies in the correct order with Level 3 cueing (tapping the instruction sheet and the candidate saying "first"). An additional nine STS practices were completed; seven according to the spaced retrieval protocol and two initiated by the participant without the command being given (before the instruction sheet was removed). These self-initiated practices occurred immediately after the participant successfully completed STS practices at 15 seconds and eight minute intervals. During the first session P2 was able to progress to 8-minute interval and achieved the lowest level of cueing (Level 1).

P2 was able to achieve the first 32-minute spaced interval during the third training session. This was maintained until the fifth session which occurred after P2 attended a bus trip. In this session, the participant required an increased level of cueing and had to return to the 16-minute spaced retrieval interval. P2 was able to achieve the 32-minute spaced retrieval interval again during the seventh training session but required increased number of practices.

Effects of training on sit-to-stand without the instruction sheet (P2)

STS strategies used by P2 when standing up without the instruction sheet for each type of chair and command during the study periods are presented in Table 4.13. Each STS performance is also represented as a cumulative score based on the frequency of strategies used in Study 1. The cumulative STS scores for all STS assessments are graphically presented in Figure 15.

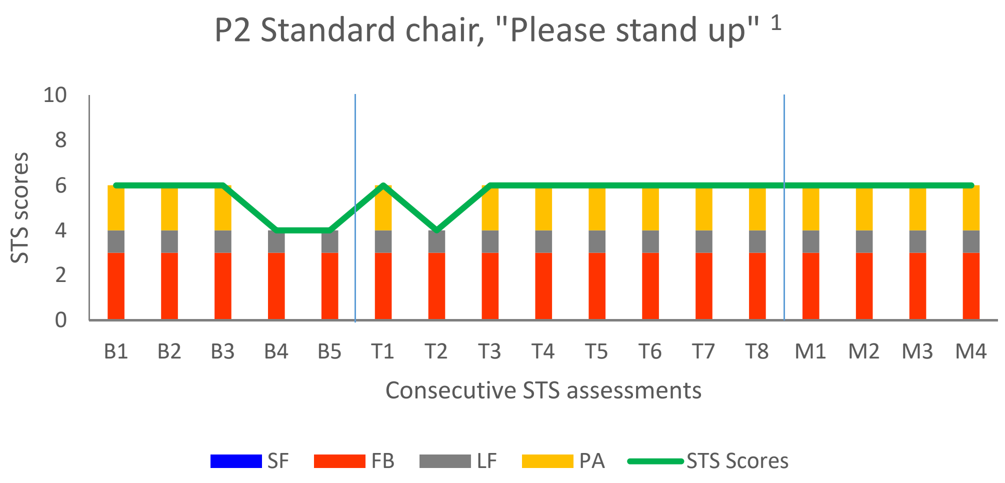
Table 4.13 Sit-to-stand strategies used by Participant 2 without the instruction sheet

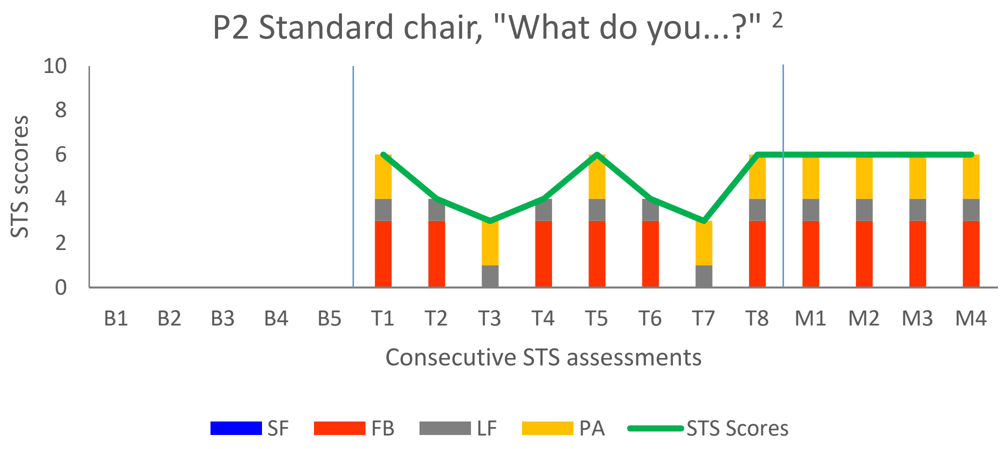
Study period		Standard chair "Please stand up" [1]	Standard chair "What do you…?" [2]	Wheelchair "Please stand up" [3]
Pre-intervention	B 1	BCD	-	C
	B 2	BCD	-	CBD
	B 3	BCD	-	BCD
	B 4	BC	-	BCD
	B 5	BC	-	CBD
Intervention	T 1	BCD	BCD	BCD
	T 2	BC	BC	CB
	T 3	BCD	CD	BCD
	T 4	BCD	BC	BCD
	T 5	BCD	BCD	CB
	T 6	BCD	BC	CBD
	T 7	BCD	CD	BCD
	T 8	CBD	BCD	BCD
Maintenance	M 1	BCD	BCD	CBD
	M 2	BCD	BCD	CD
	M 3	BCD	BCD	CD
	M 4	BCD	BCD	BCD

[1] Assessed during baselines (beginning of sessions), intervention and maintenance periods (end of sessions)
[2] Assessed only during intervention and maintenance periods (beginning of sessions)
[3] Assessed during baselines (end of sessions), intervention period (before the STS training) and during maintenance period before the STS from the standard chair to the command "Please stand up" was assessed
Abbreviations (strategies): A, Sliding forward; B, Feet backwards; C, Leaning forward; D, Pushing through the arms
Abbreviations (study periods): B (1-5), Baselines (1-5); T (1-8), Training sessions (1-8); M (1-4), Maintenance sessions (1-4)

Target behaviour: sit-to stand from the standard chair to the command "Please stand up" (P2)

P2 used two or three strategies (feet backwards, leaning forward and pushing through the arms) when standing up from the standard chair. There was some variability in the number of strategies used at the end of the baseline period and the beginning of the intervention period, but her performance stabilised and P2 started to use three strategies consistently following the third training session through to the completion of the maintenance period. Only once (after the last training session) P2 started with leaning forward instead of feet backwards. P2 did not use the sliding forward strategy when standing up from the standard chair.





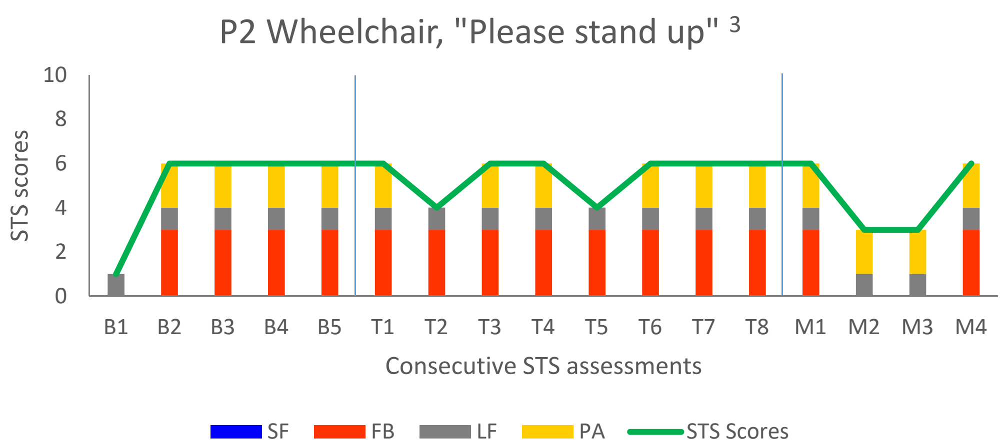


Figure 15 Cumulative scores for sit-to-stand assessments for Participant 2

[1] Assessed during baselines (beginning of sessions), intervention and maintenance periods (end of sessions)

[2] Assessed only during intervention and maintenance periods (beginning of sessions)

[3] Assessed during baselines (end of sessions), intervention period (before the STS training) and during maintenance period before the STS from the standard chair to the command “Please stand up” was assessed

Abbreviations: P2, Participant 2; B, Baselines during pre-intervention period; T, Training sessions during intervention period; M, Maintenance sessions, STS, Sit-to-stand; SF, Sliding forward; FB, Feet backwards, LF, Leaning forward, PA, Pushing through the arms

Target behaviour: sit-to-stand from the standard chair to the command "What do you…?" (P2)

P2 used two to three strategies when standing up from the standard chair to the command "What do you…?". P2 demonstrated minor variability in the number of strategies used (from two to three) during the intervention period but consistently used three strategies (feet backwards, leaning forward and pushing through the armrests) during the maintenance period.

Generalisation probe: sit-to-stand from the wheelchair to the command "Please stand up" (P2)

P2 demonstrated some variability in the sequence and number of strategies used when standing up from the wheelchair. During the baseline period P2 used one to three strategies and continued to demonstrate a tendency to use leaning forward instead of feet backwards strategy during the intervention period regardless of whether two or three strategies were used. This tendency was also noted during the maintenance period. Sliding forward strategy was not used by P2 when standing up from the wheelchair. In response to the command (without the instruction sheet), P2 named or described usually two or three strategies (feet backwards, leaning forward and pushing through the armrests) but none of the strategies were verbalised by P2 during the maintenance period. The verbalised strategies did not always correspond to the number and type of strategies used.

Summary of results for Participant 2

P2 was stable in terms of functional level but a change in SMMSE scores (from 20 to 17) was noted at the end of the study period. All eight STS training sessions were completed. P2 progressed very rapidly at the beginning of the training period to being able to use all four STS strategies in the correct sequence using only the instruction sheet without additional cueing being provided (Figure 14). However, P2 required increased cueing and a reduction of the spaced time interval during the fifth training session. This occurred following a long bus trip suggesting that fatigue may have been a factor. P2 was able to return to the 32-minute time interval in subsequent sessions, although more STS practices were required. The effect of training sessions on STS performance without the instruction sheet was limited (
Figure 15, Table 4.13). At the beginning of the intervention period P2 demonstrated similar variability in strategies observed at the end of the baseline when standing up from the standard chair to the command "Please stand up". Her performance stabilised throughout the remainder of training sessions and during the maintenance period. When standing up from the

standard chair to the command "What do you…?" P2 demonstrated greater variability during the intervention period and her performance stabilised during the maintenance period when three strategies (feet backwards, leaning forward and pushing through the armrests) were used consistently. STS performance from the wheelchair (generalisation probe) was slightly more variable during the intervention and maintenance periods in comparison to the baseline.

4.3.4.3. Participant 3

Background (P3)

P3 was a 94 year old lady diagnosed with Alzheimer's disease three years before the study commenced; however, she had resided in the facility for more than 18 years. She was admitted to the facility because of memory problems, wandering and an inability to live safely in the community. Initially she lived in a common residential area but at the time of the study she resided in a secure unit. She had no history of neurological or psychiatric disorders and her main medical issues involved hypertension, and diverticular disease. She had a mild hearing impairment but was still able to communicate. Ten years before she had a bowel surgery but no other major health problems since. P3 was able to initiate showering and toileting but required assistance to complete the tasks correctly. She mobilised with a four wheeled walker but occasionally walked unaided, particularly in her own room. When in the secure unit, she was able to find her room but required assistance with direction when attending group activities outside of the unit. P3's formal education was limited and her main occupation was looking after the house, family and garden. Her interests included gardening, particularly flowering plants and trees. P3 consistently used the same phrases when commenting about elements of the environment on the way to and from the training sessions. She was always happy to attend training sessions but had difficulty concentrating on activities between STS practices for long periods of time.

Learning during training sessions with the instruction sheet (P3)

The number of STS practices per each intervention session, the lowest level of cueing achieved and highest cueing level required to ensure P3 performed all four STS strategies correctly are presented in Figure 16.

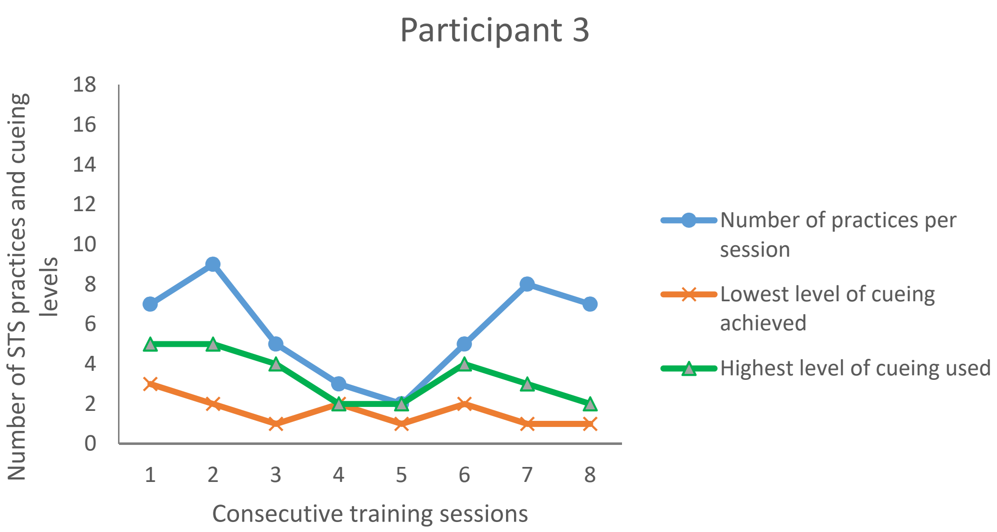


Figure 16 Number of sit-to-stand practices and levels of cueing for Participant 3
Abbreviations: STS, Sit-to-stand

During the first training session, P3 required four practices with varying levels of cueing before she was able to read the instruction sheet and perform the strategies with the candidate pointing to the sheet and saying "first" but not naming the strategy (cueing Level 3). Another three practices were required to be able to achieve the spaced retrieval interval of 1-minute; however, P3 was unable to have the cueing level reduced further during the session or progress the time interval. During the subsequent training sessions, P3 was able to achieve correct performance with just the instruction sheet (no additional cueing) during the third session and continued to reduce the highest number of cues required during subsequent sessions, achieving the best results during the fifth session. During the fifth session when P3 achieved the 16-minute spaced interval, she became anxious between practices and could not concentrate on activities. Therefore, in subsequent sessions the time interval between practices was maintained at a maximum of 16-minutes. During the sixth session an increased number of STS practices were initiated by the candidate with an aim of increasing the amount of sliding forward and this is represented by an increased level of cueing required during the session. The cueing level was able to be decreased in the subsequent sessions. P3 added one additional practice on three occasions (sessions three, six and eight) by self-initiating STS practice with the instruction sheet without being given the training command.

Effects of training on sit-to-stand without the instruction sheet (P3)

The STS strategies used by P3 when standing up without the instruction sheet from different chairs and to different commands during the study periods are presented in Table 4.14. Cumulative STS scores for all STS assessments are graphically presented in Figure 17.

Table 4.14 Sit-to-stand strategies used by Participant 3 without the instruction sheet

Study period		Standard chair "Please stand up" [1]	Standard chair "What do you…?" [2]	Wheelchair "Please stand up" [3]
Pre-intervention	B 1	BC	-	CBD
	B 2	BCD	-	CBD
	B 3	C	-	CD
	B 4	BC	-	CBD
	B 5	CB	-	CD
	B 6	CB	-	C
Intervention	T 1	CBD	BCD	CD
	T 2	CBD	BCD	C
	T 3	CBD	CBD	C
	T 4	CBD	BCD	CBD
	T 5	CBD	BCD	CBD
	T 6	CBD	BCD	CD
	T 7	CBD	CD	CBD
	T 8	CBD	CD	C
Maintenance	M 1	BCD	CD	CBD
	M 2	CBD	ABCD	CBD
	M 3	CD	CABD	CBD
	M 4	CB	CBD	CB

[1] Assessed during baselines (beginning of sessions), intervention and maintenance periods (end of sessions)
[2] Assessed only during intervention and maintenance periods (beginning of sessions)
[3] Assessed during baselines (end of sessions), intervention period (before the STS training) and during maintenance period before the STS from the standard chair to the command "Please stand up" was assessed
Abbreviations (strategies): A, Sliding forward; B, Feet backwards; C, Leaning forward; D, Pushing through the arms
Abbreviations (study periods): B (1-6), Baselines (1-6); T (1-8), Training sessions (1-8); M (1-4), Maintenance sessions (1-4)

Target behaviour: sit-to-stand from the standard chair to the command "Please stand up" (P3)

P3 mainly used two or three strategies on baseline STS assessments when standing up from the standard chair to the command "Please stand up". P3 pushed through the armrests only once, out of six baseline assessments. During the intervention period, P3 used three STS strategies consistently with leaning forward used first instead of feet backwards and she always pushed through the armrests. During the maintenance period P3's performance varied again and she used two or three strategies on two occasions but maintained pushing through the armrests in three out of the four assessments. The sliding forward strategy was not used by P3 when standing up from the standard chair to the command "Please stand up".

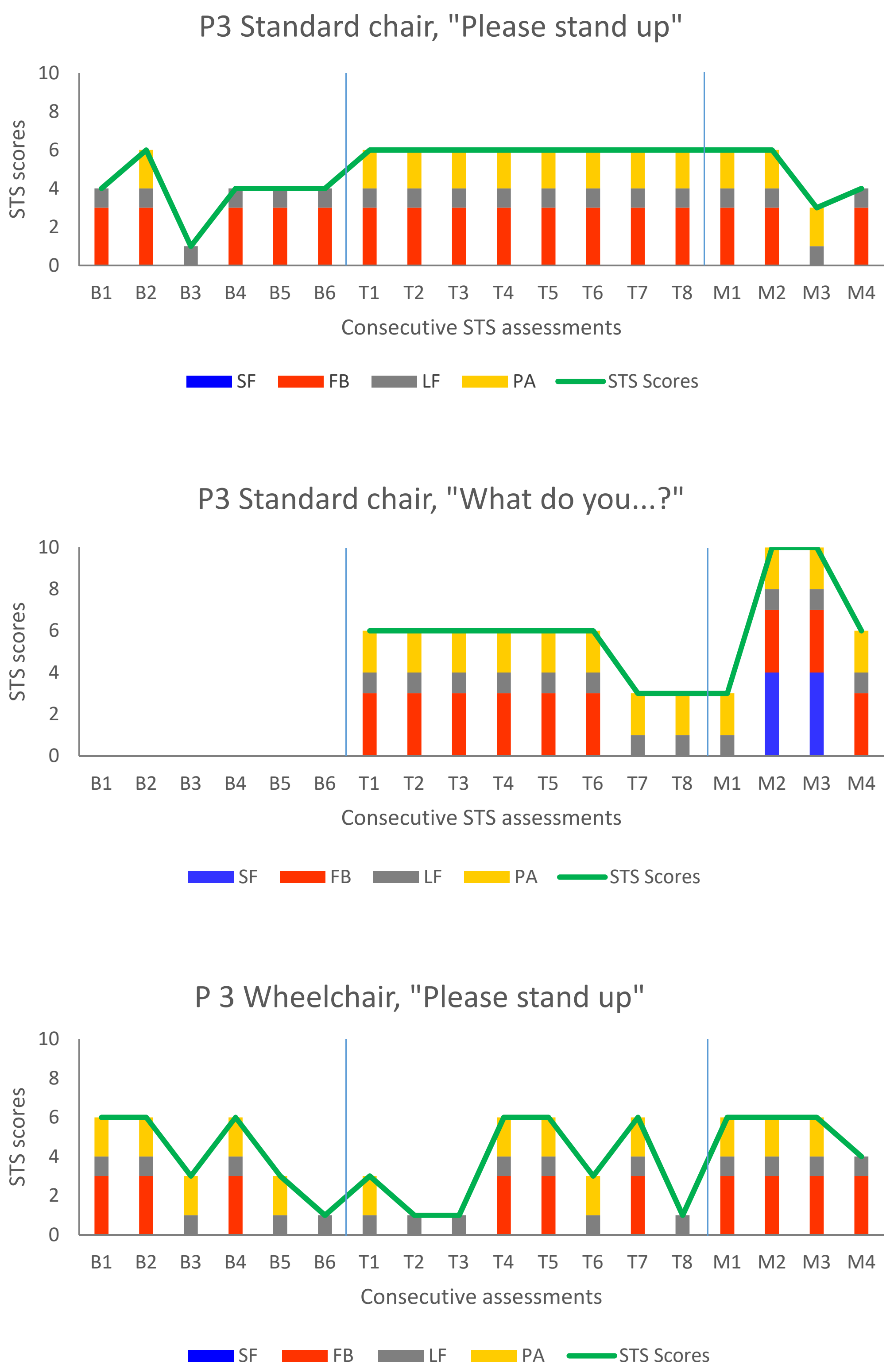


Figure 17 Cumulative scores for sit-to-stand assessments for Participant 3

[1] Assessed during baselines (beginning of sessions), intervention and maintenance periods (end of sessions)

[2] Assessed only during intervention and maintenance periods (beginning of sessions)

[3] Assessed during baselines (end of sessions), intervention period (before the STS training) and during maintenance period before the STS from the standard chair to the command “Please stand up” was assessed

Abbreviations: P3, Participant 3; B, Baselines during pre-intervention period; T, Training sessions during intervention period; M, Maintenance sessions, STS, Sit-to-stand; SF, Sliding forward; FB, Feet backwards, LF, Leaning forward, PA, Pushing through the arms

Target behaviour: sit-to-stand from the standard chair to the command "What do you…?" (P3)

P3 used three strategies during the first six of the eight STS assessments of the intervention period. During the last two assessments of the intervention period, P3 used two strategies: leaning forward and pushing through the armrests and the same two strategies were repeated during the first maintenance assessment. During the maintenance period, P3 performed all four strategies twice, although on one occasion these strategies were not performed in the correct order. P3 used pushing through the armrests consistently throughout all study periods in response to the command "What do you…?" and used the feet backwards before the leaning forward strategy more often when responding to the command "Please stand up" from the same chair.

Generalisation probe: sit-to-stand from the wheelchair to the command "Please stand up" (P3)

P3's STS performance varied and she used one to three strategies when standing up from the wheelchair during all periods of the study. During baselines, the number of strategies used decreased and this pattern continued into the beginning of the intervention period. Towards the end of the intervention period the number of strategies used increased but remained variable throughout the maintenance period. Regardless of the study period, P3 preferred to use leaning forward as the first strategy. P3 inconsistently used pushing through the armrests and did not use the sliding forward strategy when standing up from the wheelchair.

Summary of results for Participant 3

P3 was stable in terms of cognitive and functional status across during all study periods. She completed eight STS training sessions as planned. During the training sessions P3 was able to use all four STS strategies, performing them in the correct sequence using only the instruction sheet without additional cueing being provided (Figure 16). The effect of training sessions on STS performance without the instruction sheet (Table 4.14, Figure 17) was noted with more consistent use of three strategies observed when standing up from the standard chair to the command "Please stand up" during the intervention period in comparison to baselines. Additionally, P3 demonstrated more frequent use of pushing through the armrests, although leaning forward instead of feet backwards strategy was the preferred first strategy. However, when performing STS from the standard chair to the training command without the instruction sheet, P3 pushed through the armrests consistently, started to use feet backwards as the first strategy and on two occasions used all four strategies during the maintenance period. When standing up from the wheelchair (generalisation probe), P3 varied the number of strategies but consistently preferred leaning forward as the first strategy.

4.3.4.1. Participant 4

Background (P4)

P4 was a 75 year old single man with mixed dementia (Alzheimer's type and vascular) who had been in the facility (dementia secure section) for almost two years. He was formally diagnosed with dementia more than two years before the study but his memory problems had been reported more than three years before the diagnosis. He had a history of chronic obstructive pulmonary disease, coronary artery bypass (9 years prior), ischaemic heart disease, heart disease, obstructive sleep apnoea, osteoarthritis with bilateral total knee replacements, and cerebro-vascular accident before admission to the residential care facility. However, there were no unilateral neurological deficits noted in P4's physical presentation and his total knee replacements did not affect his STS ability. P4 required prompting and some assistance with personal care but was able to eat independently. He frequently wandered around the secured unit, pacing when agitated and according to nursing staff was prone to displaying aggressive behaviour toward staff and other residents. Participant 4 mobilised with a single stick and was able to walk a few kilometres when on outings with his friend. In the past he worked as a ship engineer and was a very keen golf player. He was able to talk about ships and golf when looking at pictures but often confabulated and had word finding difficulties. His cooperation during the sessions fluctuated but he was always keen to practice on days when his friend was able to attend sessions with him.

Learning during training sessions with the instruction sheet (P4)

The number of STS practices per each intervention session, the lowest level of cueing achieved and highest cueing level required to ensure P4 performed all four STS strategies correctly are presented in Figure 18.

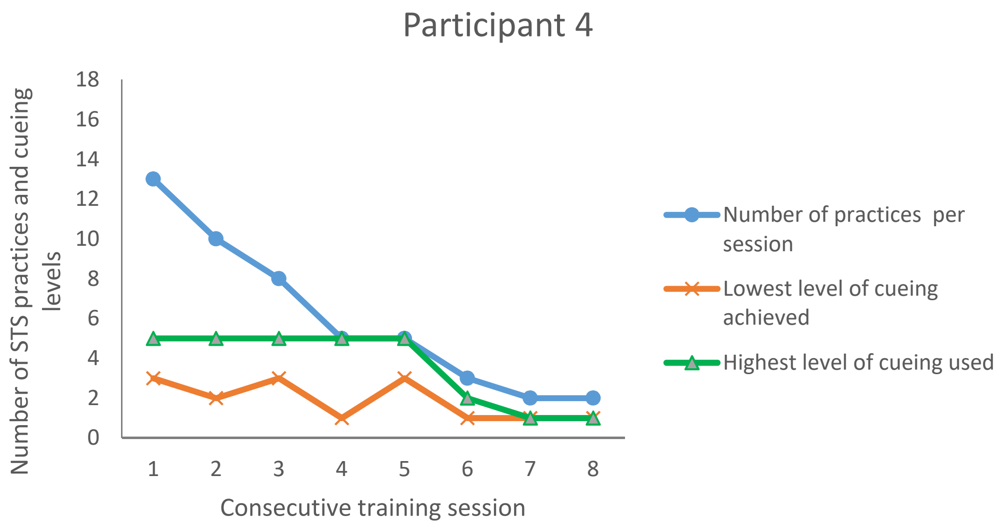


Figure 18 Number of sit-to-stand practices and levels of cueing for Participant 4
Abbreviations: STS, Sit-to-stand

During the first training session, P4 completed 13 STS practices, with eight practices required before he was able to achieve successful immediate recall; that is, read the instruction sheet correctly and complete the STS task with the instruction sheet and candidate tapping the sheet and saying "first" but without strategies being named (Level 3 cueing). P4 achieved only the first spaced retrieval interval (15 seconds) during the first session. P4 continued to attend daily training sessions; practicing the STS task with varying level of cueing. His longest interval of 16-minutes was achieved at the end of the sixth training session. It was noted that P4 was reluctant to stay in the research room between practices despite activities related to his hobbies being provided; therefore, sessions continued without increasing the spaced retrieval intervals beyond 16-minutes. P4 reached the lowest level of cueing (Level 1) involving only the instruction sheet without additional cues from the candidate for the first time during the fourth session. There was an increase in cueing required during session five but his performance stabilised during sessions seven and eight and improved to the lowest level of cueing. As P4 learnt and maintained the ability to stand up using all strategies with the instruction sheet in response to the training command "What do you…?", the number of practices decreased.

Effects of training on sit-to-stand without the instruction sheet (P4)

The STS strategies used by P4 when standing up without the instruction sheet from different chairs and to different commands during the study periods are presented in Table 4.15. Cumulative STS scores for all STS assessments are graphically presented in Figure 19.

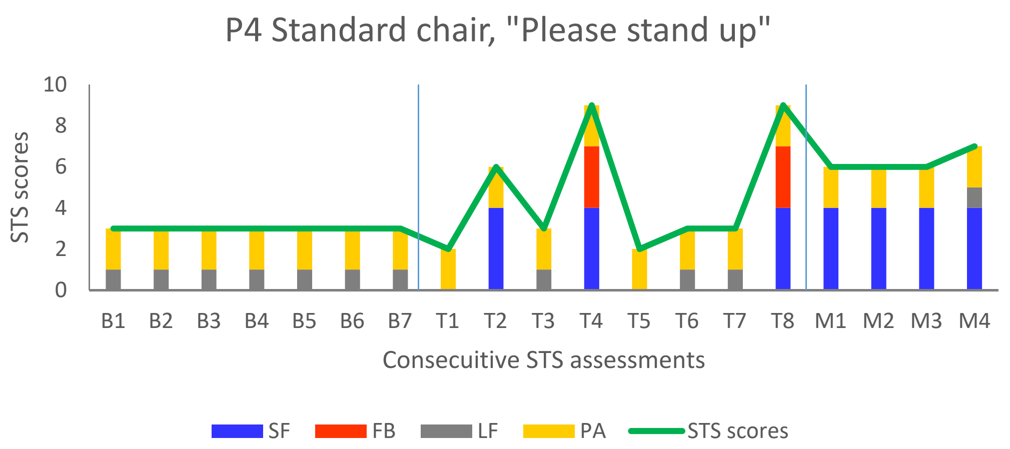
Table 4.15 Sit-to-stand strategies used by Participant 4 without the instruction sheet

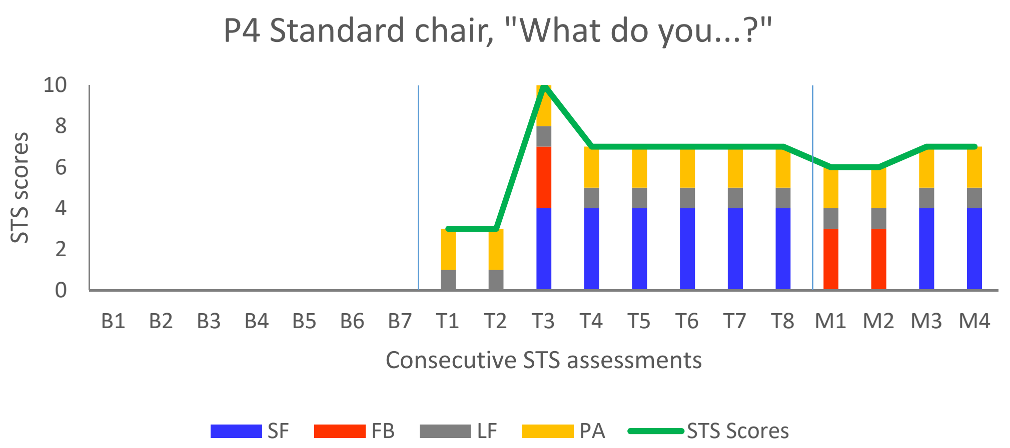
Study period		Standard chair "Please stand up" [1]	Standard chair "What do you…?" [2]	Wheelchair "Please stand up" [3]
Pre-intervention	B 1	CD	-	CD
	B 2	CD	-	CD
	B 3	CD	-	BCD
	B 4	CD	-	CD
	B 5	CD	-	CD
	B 6	CD	-	AD
	B 7	CD	-	CD
Intervention	T 1	D	CD	CD
	T 2	AD	CD	BCD
	T 3	CD	ABCD	CD
	T 4	BAD	ADC	CD
	T 5	D	BDC	CD
	T 6	CD	ADC	CD
	T 7	CD	ACD	ACD
	T 8	ABD	ACD	CAD
Maintenance	M 1	AD	ABDC	AD
	M 2	AD	BCD	ACD
	M 3	AD	ADC	AD
	M 4	ABD	ACD	BCD

[1] Assessed during baselines (beginning of sessions), intervention and maintenance periods (end of sessions)
[2] Assessed only during intervention and maintenance periods (beginning of sessions)
[3] Assessed during baselines (end of sessions), intervention period (before the STS training) and during maintenance period before the STS from the standard chair to the command "Please stand up" was assessed
Abbreviations (strategies): A, Sliding forward; B, Feet backwards; C, Leaning forward; D, Pushing through the arms
Abbreviations (study periods): B (1-7), Baselines (1-7); T (1-8), Training sessions (1-8); M (1-4), Maintenance sessions (1-4)

Target behaviour: sit-to-stand from the standard chair to the command "Please stand up" (P4)

P4's performance was consistent during the pre-intervention period (seven baseline measures) when standing up from the standard chair to the command "Please stand up". Two strategies (leaning forward and pushing up through the arm rests) were used during each baseline session and always in the same sequence. During the intervention period, as training sessions progressed, P4 started to use additional strategies such as sliding forward and feet backwards (three and two times out of eight measures respectively). As P4 introduced these additional strategies into his STS performance, decreased use of the leaning forward strategy was observed. During the maintenance period he retained the slide forward strategy when standing in three out of the four measures but did not use the feet backwards strategy.





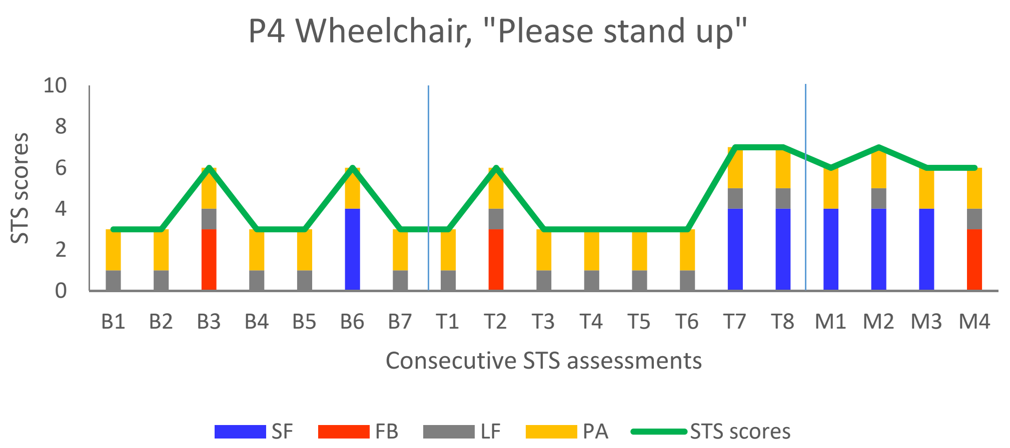


Figure 19 Cumulative scores for sit-to-stand assessments for Participant 4
[1] Assessed during baselines (beginning of sessions), intervention and maintenance periods (end of sessions)
[2] Assessed only during intervention and maintenance periods (beginning of sessions)
[3] Assessed during baselines (end of sessions), intervention period (before the STS training) and during maintenance period before the STS from the standard chair to the command “Please stand up” was assessed
Abbreviations: P4, Participant 4; B, Baselines during pre-intervention period; T, Training sessions during intervention period; M, Maintenance sessions, STS, Sit-to-stand; SF, Sliding forward; FB, Feet backwards, LF, Leaning forward, PA, Pushing through the arms

Target behaviour: sit-to-stand from the standard chair to the command "What do you…?" (P4)

P4 used leaning forward and pushing through the armrests strategies (the same strategies as when standing up from the standard chair to the command "What do you…?" during the first two assessments. Throughout the remaining six assessments during the intervention period, P4 used mainly three strategies; adding sliding forward five times and feet backwards twice to the leaning forward and pushing up strategies. On two occasions P4 performed all four strategies in the correct order: once during the intervention period and once during maintenance. P4 retained the slide forward strategy during the maintenance period in three out of four measures and feet backwards strategy in two.

Generalisation probe: sit-to-stand from the wheelchair to the command "Please stand up" (P4)

When standing up from the wheelchair during the pre-intervention period (baseline), P4 used the leaning forward and pushing through the armrests strategies five times out of seven baseline assessments. The feet backwards strategy was added once and leaning forward was replaced with the sliding forward strategy. Leaning forward and pushing through the armrests remained his preferred strategies during the intervention period and he twice used sliding forward and once used feet backwards. However, P4 retained the use of the sliding forward strategy during maintenance period in three out of four assessments but only once used the feet backwards strategy.

Summary of results for Participant 4

P4 was largely stable in terms of his cognitive and physical status over the duration of the study. He completed the eight training sessions as planned and was able to learn STS using all four strategies with the instruction sheet without additional cueing and maintained this performance across consecutive days toward the end of the intervention period (Figure 18). STS training with the instruction sheet had some effect on improved use of sliding forward and to a lesser degree, on feet backwards strategies, when tested without the instruction sheet (Table 4.15, Figure 18). The effects were more evident towards the end of intervention period and during the maintenance period. P4 managed to perform all STS strategies correctly twice when performing from the same chair and to the same command as during the training sessions. When standing up from the wheelchair P4 only once used the sliding forward strategy during baselines but increased use of this strategy towards the end of the intervention period and retained the strategy during the maintenance period.

4.3.5. Summary of training effects on sit-to-stand for all participants

A summary of the training effects for all participants are presented in Table 4.16. P1 and P2 demonstrated little or only a minor response to training when tested without the instruction sheet, though P2 showed increased variability of performance. P3 demonstrated increased use of pushing up through the armrests, improved the number and sequence of strategies but the effect of training varied across testing conditions. P4 was able to introduce previously not used strategies, particularly sliding forward and feet backwards as well as increased the number of strategies and used them in mainly correct sequence.

Table 4.16 Summary of training effects on sit-to-stand without the instruction sheet for all participants

Testing condition	Participant 1	Participant 2	Participant 3	Participant 4
Measure of target behaviour: STS from standard chair "Please stand up" SCh-PSU [1] Similarity to the trained task: the same chair, different command	In comparison to baseline, twice introduced SF strategy (not previously used) during intervention period, once used all four strategies, the number and sequence of strategies varied	In comparison to baseline, there was no effect on type or sequence of strategies used, however, the number of STS strategies was more consistent during the intervention and maintenance periods	In comparison to baseline, started to use PA strategy consistently during intervention period, increased number of strategies but the sequence was mainly incorrect	In comparison to baseline introduced SF strategy, particularly towards the end of the intervention period and during maintenance period, twice used FB (not previously used), the number of strategies varied
Measure of target behaviour: STS from standard chair "What do you…?"[1] **SCh-WDY** [2] Similarity to the trained task: the same chair and command	During intervention period used two strategies during the first assessment and then consistently used the same three strategies (FB, LF, PA), mainly in correct sequence	During the intervention period the variability in type and number of strategies increased but the performance stabilised during maintenance when training was withdrawn	During intervention and maintenance used PA strategy, sequence of strategies was mainly correct, during maintenance period used all four strategies twice, in varied sequence	During intervention period all four strategies used once and once during maintenance period, SF strategy used frequently during intervention and maintenance periods, sequence of strategies was mainly correct
Generalisation probe: STS from wheelchair "Please stand up" WCh-PSU [3] Similarity to the trained task: different chair and command	In comparison to baseline, during intervention and maintenance period the variability in the number of used strategies slightly increased, the sequence was mostly correct	In comparison to baseline, during intervention and maintenance periods the variability of strategies slightly increased	In comparison to baseline performance continued to be variable during intervention and maintenance period in terms of type and number of strategies used, the sequence of strategies was mainly incorrect	In comparison to baseline, during intervention and maintenance period increased use of SF strategy but the number of strategies varied, the sequence was mainly correct

[1] Assessed during baselines (beginning of sessions), intervention and maintenance periods (end of sessions)
[2] Assessed only during intervention and maintenance periods (beginning of sessions)
[3] Assessed during baselines (end of sessions), intervention period (before the STS training) and during maintenance period before the STS from the standard chair to the command "Please stand up" was assessed
Abbreviations: SF, Slide forward; FB, Feet backwards; LF, Leaning forward; PA, Pushing through the armrests

4.3.6. Final assessment of generalisation for all participants

Final assessment of generalisation was conducted on the last day of the study to determine participants' STS performance when the command was provided by an independent person not involved in the study, including using a different chair in a different room. The results in order of assessment are presented in Table 4.17.

Table 4.17 Assessment of generalisation based on an independent person providing the sit-to-stand commands

Chair type	Command	Instruction sheet	P1	P2	P3	P4
Wheelchair	"Please stand up"	No	BCD	BCD	CBD	BACD
Wheelchair	"What do you…?"	No	BCD	BCD	BCD	ACD
Wheelchair	"Please stand up"	Yes	BCD	BCD	ABCD	ACD
Wheelchair	"What do you…?"	Yes	ABCD	BCD	ABCD	ABCD
Recess (15-20 minutes)						
Lounge chair	"Please stand up"	No	BCD	BCD	BCD	ACD
Lounge chair	"What do you…?"	No	BCD	BCD	BCD	ACD
Lounge chair	"Please stand up"	Yes	BCD	CD	BCD	ACD
Lounge chair	"What do you…?"	Yes	ABCD	ABCD	ABCD	ACD

Abbreviations: A: Sliding forward; B: Feet backwards; C: Leaning forward; D: Pushing through the armrests; P, Participant

P1 and P2 used all four strategies in the correct sequence only when the instruction sheet was provided by an independent person together with the training command. P2 demonstrated this response from the lounge chair but not from the wheelchair. P3 used all STS strategies in the correct sequence when standing up from the wheelchair with the instruction sheet to both commands and when standing up from the lounge chair only after the training command was provided. P4 used all four strategies twice when standing up from the wheelchair, however, only once in the correct order (when instruction sheet was provided). P4 was the only participant who consistently used the sliding forward strategy, regardless of the type of command being provided.

4.3.7. Feasibility and utility of implementation of sit-to-stand training protocol

Feasibility and utility (Bowen et al., 2009; Smart, 2006) of the STS training protocol was determined by the acceptability of the protocol to participants (ability to complete and progress through the training sessions) and practicability of implementing the training protocol in a residential aged care setting to people living with dementia.

4.3.7.1. Acceptability of the training protocol to participants

All participants were able to complete the eight planned training sessions but their progress through the training differed and some modifications to the protocol were required. Participants' progress through the training sessions is summarised in Table 4.18.

Table 4.18 Number of sit-to-stand practices during training sessions and time interval achieved

Training session factors	P1	P2	P3	P4
Number of STS practices before able to use instruction sheet	4	2	4	8
Number of practices using SR, ER and VC per training session				
Training session 1, *(n)*	13	9[1]	3	5
Training session 2, *(n)*	8	7	9	10
Training session 3, *(n)*	6	3	5	8
Training session 4, *(n)*	4	3	3	5
Training session 5, *(n)*	3	4	2	5
Training session 6, *(n)*	2	4	5[1]	3
Training session 7, *(n)*	2	4[2]	8[2,3]	2
Training session 8, *(n)*	2	4	7[4,2]	2
Total number of STS practices in all training sessions	44	40	46	48
Time interval reached during the first training session	4 min	8 min	1 min	15 sec
Session when first 16-minutes time interval was achieved	3	3	5	6
Session when first 32-minutes time interval was achieved [5]	3	3	-	-

[1] Includes two self-initiated STS practices
[2] Includes one self-initiated STS practice
[3] Includes five STS practices initiated by the candidate to improve sliding forward
[4] Includes three STS practices initiated by the candidate to improve sliding forward
[5] The 32-minutes interval was attempted for P3 and P4 but due to decreased ability to tolerate activity time between practices, the maximal time interval was maintained at 16-minutes
Abbreviations: P, Participant, STS, Sit-to-stand; SR, Spaced retrieval; EL, Errorless learning; VC, Vanishing cues

The overall number of STS practices completed by participants during the eight training sessions ranged from 40 (P2) to 48 (P4). P4 required more STS practices than the other participants before being able to use the instruction sheet with no more than Level 3 cueing. P4 progressed the least during the first training session (15 sec time interval), whereas P2 was able to recall correct strategies using the instruction sheet after an eight minute time interval. P1 and P2 completed more STS practices and appeared more engaged during the first session compared to P3 and P4. P3 and P4 were able to increase the number of STS practices during the second training session. The maximum time interval of 32-minutes was achieved by P1 and P2 only. P3 and P4 demonstrated higher levels of psychomotor restlessness during periods of activities between STS practices and did not progress to 32-minutes spaced retrieval time interval.

Generally, STS practices per session decreased as training progressed and longer time intervals were achieved. However, a reduction in time interval and an increased number of STS practices was recorded for P2 during the fifth session which was conducted after the participant attended a bus trip. An increased number of STS practices was also recorded for P3 during the last three sessions. This reflects additional practices initiated by the candidate with the aim to improve the distance of sliding forward. Interestingly, P2 and P3 self-initiated STS practices (included in the overall number of STS practices per session). These practices were not planned or encouraged and were initiated by P2 and P3 without the training command being given.

Generally, the STS training protocol appeared to be acceptable for participants. This was indicated by:

- Participants were able to complete the physically demanding first training session that required multiple STS repetitions;
- It was possible to introduce a new instruction style (a command repeated verbatim with a written instruction sheet containing STS strategies expressed as short action phrases) during the first training session;
- All participants were able to use the written instruction sheet to perform STS strategies correctly with other cues gradually decreased;
- Participants with different levels of cognition, including three participants who resided in a secure dementia area, were able to complete the training;
- Participants completed eight training sessions as planned, with some sessions lasting up to 45 minutes;
- Participants were able to engage in activities between STS practices.

4.3.7.2. Practicality of the implementation of the protocol

The STS training protocol was delivered to residents of an aged care facility who were actively participating in multiple recreational activities every day. Regardless of the busy schedule of recreational activities provided by the facility, it was possible to conduct the training sessions (one session a day for individual participants) without disrupting their recreational programs. However, P2 was affected by one recreational activity (a long bus trip) prior to the training session and demonstrated decreased performance during that session.

The implementation of the training protocol required access to a quiet area (room) that could be protected from external noise and disruptions. The training area used in this study was familiar for the participants; being a standard bedroom equipped with similar pieces of the furniture that participants had in their bedrooms.

Participants had a relatively long distance to walk from their living areas to the training area. To maximise participation in training sessions a special guiding method of turning the participant’s attention from one landmark to another ahead was used (Staples, 2006). These landmarks were always within the visual field and were, for example flowers, a painting on a wall, a view through a window, or a novelty of using a lift.

4.4. Discussion

This study demonstrated that it was feasible to use spaced retrieval, errorless learning and vanishing cues principles, supported by an instruction sheet and a training command repeated verbatim when retraining STS strategies in people living with dementia. During the training sessions, all participants achieved correct use of STS strategies in response to the training command with the instruction sheet and no additional cueing. However, the speed of learning varied between participants, particularly during the initial training sessions. All participants completed the planned eight training sessions but they differed in their ability to sustain attention as the spaced retrieval time intervals progressed. The training sessions with the instruction sheet had a variable effect on the usual STS performance of individual participants when transfer of learnt skills was assessed without the instruction sheet. The ability to carry over the learnt STS strategies also varied when the training was withdrawn during the post-intervention period. Differences were also observed between participants’ ability to transfer the learnt STS strategies during final assessment of generalisation when the commands were provided by an independent person.

4.4.1. Progress through the training sessions

Participants differed in their speed of learning during the training sessions. P1 and P2 were able to learn to use the instruction sheet at the beginning of the first training session, practiced STS with decreasing levels of cueing and achieved longer spaced retrieval time intervals sooner than the other participants (P3, P4). It is plausible that P1 and P2 who had less advanced cognitive decline achieved faster progress during the initial sessions due to some residual declarative memory. A similar hypothesis was presented by Lekeu et al. (2002) when faster progress was demonstrated by a participant with less severe dementia. This may be plausible as it has been shown that some explicit learning may be still present in people living with mild dementia as decline in declarative memory occurs gradually (Klimkowicz-Mrowiec, Slowik, Krzywoszanski, Herzog-Krzywoszanska, & Szczudlik, 2008) and both memory systems can interact during motor skills acquisition (Vidoni & Boyd, 2007).

Regardless of differences in the speed of learning, all participants were able to achieve the correct STS performance with their lowest level of cueing around the fourth or fifth training session. However, the initial training sessions, particularly the first and second sessions, were challenging for participants. During the initial sessions, participants not only had to learn the STS strategies but also perform the strategies repeatedly (following short time intervals) in a novel sequence. Furthermore, participants had to become familiar with the novel instruction sheet and the command. Based on observations made during the study, it appears to be possible for four or five training sessions to be provided in a clinical setting by a therapist who has an understanding of the spaced retrieval, errorless learning and vanishing cues to achieve consistent performance in STS task. Additionally, carers or family may be trained in how to maintain appropriate levels of cueing during usual tasks that require standing up. A positive role of carers in providing support and maintenance to the training programs based on spaced retrieval errorless learning and structured cueing has been already demonstrated (Bier, Provencher, et al., 2008; Camp et al., 1996; Hunter et al., 2011).

4.4.2. Effects of training on sit-to-stand performance

Generally, P3 and P4 demonstrated better STS performance compared to P1 and P2 when tested without the instruction sheet during the intervention and post intervention periods. Unlike P1 and P2, P3 and P4 carried some training effects through the maintenance period during which participants were exposed to the training command twice a day. One reason for this may have been the number of STS practices undertaken during the training sessions. P3 and P4 (46 and 48 respectively) overall had a slightly higher number of STS practices compared to P1 and P2 (less than 44). Another plausible reason could be that the training protocol used in the study was more appropriate for people with more advanced cognitive decline. P3 and P4 were likely employing predominately implicit memory, therefore, hypothetically, were learning more procedurally, without contamination by explicit memory. This view can be supported by similar observations made by (Kessels, Remmerswaal, & Wilson, 2011; Klimkowicz-Mrowiec et al., 2008) who demonstrated that procedural learning outcomes are better when there is no competition with explicit memory (e.g. in more advanced dementia). Therefore, it is possible that the same residual explicit learning that benefited P1 and P2 during the initial training sessions, hindered procedural learning of STS strategies, resulting in lesser effect of training when STS was tested without the instruction sheet.

People living with dementia appear to have some difficulty in transferring (generalising) learnt skills to novel situations (Bier, Provencher, et al., 2008). For example, when learning a basic motor skill of tossing a bean bag, skill transfer was observed only to a similar task where one or two characteristics of the task were changed (Dick, Hsieh, et al., 2000). Therefore, in the current study, to measure the target behaviour (the type, number and sequence of the STS strategies used without the instructions sheet) two measures were used. The measures comprised STS from the standard chair to the command “Please stand up” and to the command “What do you…?” Participants with lower cognitive levels (P4, and P3) demonstrated better STS performance when the training command was used (in comparison to “Please stand up” command) by improving the use of the feet backwards strategy (P4) and the sequence of strategies (P3). The improved STS performance to the “What do you…?” could be attributed to the training command’s potential association with the expected response, or be the effect of a motor skill consolidation. Motor skills consolidation is an off-line improvement that is believed to occur after the training (Dayan & Cohen, 2011). The contribution of the off-line improvement cannot be excluded as the STS assessment to the training command “What do you…?” was conducted approximately 24 hours after the training session. In contrast, P1 and P2 did not demonstrate a similar response; P1 stabilised his performance whereas P2 increased the variability of STS performance, particularly during the intervention period. Interestingly, P2’s performance to the training command stabilised after the training was withdrawn (maintenance period).

Only P4 demonstrated improved STS performance (use of the sliding forward strategy) when standing up from the wheelchair (generalisation probe) as well as during the final assessment of generalisation. His better performance in comparison to other participants in skill transfer (although to a similar task) is surprising. P4 had most advanced dementia (SMMSE score 10) and potentially had to rely primarily on implicit memory (Klimkowicz-Mrowiec et al., 2008) more so than the other participants. All participants demonstrated improved ability to use all four strategies and in the correct sequence during the final assessment of generalisation (from the wheelchair and from the lounge chair) when the training command and the instruction sheet were provided by an independent person. This may suggest, that in a clinical situation, after the instruction sheet and the command is introduced and the association with the expected response is made, family and carers are likely to elicit a similar response of a person living with dementia in STS and transfers.

4.4.3. Training approach

This is the first known study that has investigated the combined use of spaced retrieval, errorless learning and vanishing cues principles in retraining the sequence of four STS strategies in people living with dementia. Only three studies were found that used a similar training approach and directly related to physiotherapy and STS task (Creighton et al., 2014; Hunter et al., 2011; White et al., 2014). People living with dementia were trained to use a wheeled walker and had to complete STS as a part of the expected response (Creighton et al., 2014; Hunter et al., 2011) or were practicing using armrests when standing up or sitting down (Hunter et al., 2011; White et al., 2014). Similarly, to the current study, participants were able to perform STS task independently and repeatedly when practicing over short time intervals during the initial sessions. However, the STS task is an everyday activity that is functionally demanding (Samuel, Rowe, & Nicol, 2013). Practicing such tasks over very short time intervals (that is, multiple task repetitions in a short period of time) may not always be possible in those patients who are frail.

In the current study, preventing errors (errorless learning) was another principle underpinning the training protocol. Errorless learning is commonly used in retraining functional tasks in people living with dementia as it is believed to support procedural learning and has been demonstrated as superior to trial and error practice (Clare & Jones, 2008; de Werd et al., 2013; Kessels & Hensken, 2009). In the current study, errors in the use of STS strategies were prevented through structured cues delivered in a flexible manner; that is, increased (accumulated) or vanished (faded) as participants improved in their performance on the trained task. However, the accumulation or fading of cues were controlled and staged (five levels) and based on the instruction sheet with STS strategies presented in a sequence.

The use of written cues or instructions comprising the steps required to complete a functional task has previously been reported. In studies involving meal preparation (Curtin, 2011), using a mobile phone (Lekeu et al., 2002) or putting on prosthesis (Donaghey et al., 2010), people living with dementia were able to learn to utilise this form of external memory aid. In the current study, the instruction sheet was provided together with the training command repeated verbatim. In response to the command, participants were expected to read the strategies from the instruction sheet and perform them at the same time. This approach was different to how instruction sheets have been used previously where a person living with dementia was expected to turn over a mobile phone to see the instruction sheet (Lekeu et al., 2002). The motor action involved in the process of turning the mobile phone was intended to tap into implicit learning, known to be enhanced by motor encoding (Bird & Kinsella, 1996; Camp et al., 1996). In the current study, the aim was to associate the training command and the instruction sheet together with reading and performing the STS strategies. This modification was developed to enable the future practical application for the STS task; that is, a therapist or carer could potentially provide a command with the instruction sheet when a person living with dementia needs to stand up from a bed, toilet or shower chair.

The STS task required four strategies to be performed in a specific sequence. Having the strategies written down ensured that the strategies and phrasing were consistent and commands were direct and action based; which has been shown to be beneficial for people living with dementia (Christenson et al., 2011; Smith et al., 2011). This approach to providing instructions may improve consistency of commands during STS and transfer tasks, potentially leading to elimination of errors and consequently, to improved performance and participation in the task through procedural (implicit learning). An additional benefit of teaching a person living with dementia to perform STS with an instruction sheet could be lessening of frustration related to misunderstandings and difficulties, commonly experienced by health care workers when assisting people living with dementia to stand up (Thunborg et al., 2012; Varnam, 2011; Wangblad et al., 2009).

The instruction sheet used in the study provided external support during the training, potentially reducing guessing, therefore helping prevent errors and minimising cognitive effort (Bourgeois et al., 2003). The relatively spared ability of people living with dementia to read (Benigas & Bourgeois, 2011; Vuorinen et al., 2000) and the beneficial use of written instructions and signs when performing functional tasks have been reported previously (Bourgeois et al., 2003; Lekeu et al., 2002). The current study provides further support that people living with dementia can learn to use written instruction sheets and that this approach can be applied to minimise errors during STS practice.

Participants in the current study differed in the expression of their behavioural and psychological symptoms of dementia; particularly, in the level of motor restlessness observed during and outside the training sessions. Increased motor restlessness was demonstrated by P3 and P4 which necessitated shorter maximal spaced retrieval time intervals during the training sessions (16 minutes, instead of 32). One of the methods to address behavioural issues and to facilitate implicit learning is to include activities that can be successfully completed between the practices which do not relate to the training (Brush & Camp, 1998; Camp et al., 1996; Hopper et al., 2010). In the current study, a variety of individualised activities were provided. It is possible, that if these activities were not provided, P3 and P4 may not have been able to complete the STS training program. Increased motor restlessness observed during the training sessions also corresponded to the participants' behaviour observed outside the training environment. For example, P3 was unable to sit for long periods of time and P4, was observed frequently walking laps of the dementia unit. P3 and P4 had more advanced cognitive decline, therefore were likely to have more severe behavioural and psychological symptoms of dementia (Thompson, Brodaty, Trollor, & Sachdev, 2010), including motor restlessness (Zuidema et al., 2007).

The necessity to shorten the maximum time interval for P3 and P4 suggests that the protocol for functional task retraining needs to be flexible (time intervals may need to modified) in response to participants' individual learning abilities and behavioural characteristics. However, the use of longer time intervals (32 minutes) should not be excluded for people who present with motor restlessness in clinical settings. In a clinical setting, patients and therapists are not constrained by specific research protocol requirements; therefore, patients with dementia would be able to move around as usual, particularly, during longer time intervals. This was not possible in the research situation where participants had to stay in the same room during the training session.

4.4.4. Methodological considerations and study limitations

A single case experimental design (SCED) with multiple baselines across concurrent subjects was employed involving four participants who were randomly allocated to baseline length. This methodology allows observation of individual responses to therapeutic intervention when there are variations in clinical presentation of participants (Tate et al., 2008). Participants had mostly mixed Alzheimer's disease and vascular dementia pathology but presented with different levels of physical and cognitive abilities as well as different comorbidities. Participants also responded differently to the STS training and required adaptations of the training protocol due to individual cognitive levels and different behavioural and psychological symptoms of dementia. The SCED methodology enabled modifications of the training protocol and allowed interpretation of outcomes in the context of individual differences.

The study was based on ABCD design; (A) baselines with no treatment, (B) intervention period when training was delivered, (C) post-intervention when training was withdrawn but the training question was still used during assessments, and (D) when generalisation was assessed. Multiple measures of the target behaviour, generalisation as well as cognitive and physical status were measured and recorded daily during all periods of the study. The study design was modelled predominantly on Single Case Experimental Design Scale (Tate et al., 2008) with the aim to meet the recommend criteria. The scale was recently revised and now consists of 15 items. The new Risk of Bias in *N*-of-1 trials (RoBiNT) Scale (Tate, Perdices, et al., 2013) places additional methodological demands on the quality of the study. Results of the self-assessment against the criteria of the RoBiNT Scale are presented in Table 4.19.

Table 4.19 Risk of Bias in N-of-1 Trials Scale (RoBiNT)

Item	Criteria	Criteria [1]
Internal validity		
1	Design	Partially met
2	Randomisation	Met
3	Sampling	Partially met
4	Blind participants/therapists	Not applicable
5	Blind assessors	Met
6	Inter-rater reliability	Met
7	Treatment adherence	Met
External validity		
8	Baseline characteristics	Met
9	Therapeutic settings	Met
10	Dependent variable (target behaviour)	Met
11	Independent variable (intervention)	Met
12	Raw data record	Met
13	Data analysis	Partially met
14	Replication	Not applicable
15	Generalisation	Met

[1] At the time of writing the RoBiNT Scale Manual was not available for detailed scoring against the criteria

Overall, 13 of the RoBiNT Scale (Tate, Perdices, et al., 2013) criteria were met or partially met. Two criteria were not applicable; the ABCD design did not provide inter-subject replication. It was also not feasible to blind the physiotherapist delivering the training sessions. Blinding of participants was also not feasible, considering the nature of the project. However, this was considered unlikely to pose a confounder given the nature of the training and outcome measures. The candidate delivered the training program and this may be considered a source of bias. In the current study, the lowest number of the recorded data points per study period was four, one less than recommended in the RoBiNT Scale. To minimise bias, all assessments and training sessions were digitally recorded. Additionally, another member of the research team observed 30% of all training sessions (including assessments) and reviewed a random selection (20%) of videorecorded sessions.

The data collected in the study did not allow statistical analysis due inconsistent baseline variability and restricted range of STS strategies (scores). Therefore, visual inspection of data was conducted. It was also not feasible to conduct rigorous and structured visual data analysis considering the type of data collected. Visual analysis of data is an acceptable method in single case methodology (Nourbakhsh & Ottenbacher, 1994) and a statistical approach is not always appropriate (Tate et al., 2008).

As with other research methods, SCED methodology has inherent limitations; one of them relating to generalisability of results (Kratochwill et al., 2013; Tate et al., 2008; Tate, Perdices, et al., 2013; Tate, Taylor, & Aird, 2013). The training was delivered to four concurrent participants whose responses varied. The variability of the training effects is one of the factors contributing to limited generalisability of the findings. To generalise the findings from a SCED study and to provide scientific evidence for the intervention, five studies involving at least twenty participants (in total) by three independent research teams are recommended (Kratochwill et al., 2013). In the context of these criteria, the results of the current study would need to be replicated to allow generalisation to a broader population of people living with dementia in a residential aged care facility.

The study involved only people with dementia who could stand up. Therefore, the training protocol that primarily aimed to teach STS strategies to make standing up easier may not be applicable to people with dementia who cannot stand up without further modifications. However, the findings of this study can be used as a guide for physiotherapists retraining STS or similar tasks in people living with dementia, or as an inspiration for future research.

4.5. Summary

Spaced retrieval, errorless learning and vanishing cues supported by an instruction sheet and command repeated verbatim can be used to retrain STS in people living with dementia. All participants were able to learn to use the instruction sheet and perform all STS strategies in a correct sequence. People with more severe cognitive decline learnt slower during the initial training sessions, but demonstrated a better response to training, that is, used STS strategies previously not used and/or improved the number and the sequence of the strategies when assessed without the instruction sheet. The STS training protocol may need to be flexible to allow for different learning abilities and behavioural characteristics. Although, there were only four participants in the current study and results cannot be generalised, this study provides some insight into STS retraining in people living with dementia.

Chapter 5 General discussion

People living with dementia can lose the ability to perform basic functional tasks due to the progressive nature of dementia (Delva et al., 2014), comorbidities (Poblador-Plou et al., 2014) and episodes of acute illness that are often accompanied by delirium (Zieschang et al., 2010). Due to the loss of function, a person with dementia is likely to become physically disabled (Sauvaget et al., 2002) and dependent on assistance with basic functional tasks, including STS and transfers. Providing assistance with STS and transfers between surfaces is perceived as physically demanding by health care workers (Thunborg et al., 2012; Wangblad et al., 2009) and likely by family carers who often are older adults (spouses) with their own health issues (Brodaty & Donkin, 2009). Therefore, maximising a person's participation in standing up by teaching STS strategies that can make the task easier, can be perceived as an important goal of rehabilitation.

The overarching aim of this thesis was to investigate the use of the STS training protocol based on spaced retrieval, errorless leaning and vanishing cues principles when retaining STS in people living with dementia. This thesis consists of two studies; namely an observational study (Study 1) and Study 2 which used single case experimental methodology. The main purpose of Study 1 was to investigate the STS strategies used by older people without cognitive decline and people living with dementia and if the presence of a table in front altered the performance of the strategies. Investigating the effect of adding a table in front on the use of the STS strategies was important to inform the implementation of the STS training protocol in Study 2 as the training protocol involved the use of an instruction sheet with STS strategies placed on a table in front. In Study 2 the instruction sheet was incorporated into the STS training protocol based on spaced retrieval, errorless learning and vanishing cues principles to teach four participants with dementia to use STS strategies when standing up from a standard chair.

In this chapter, the main findings of the studies will be summarised and discussed in the context of STS strategies used by participants with dementia, commands and instructions employed in STS retraining, frequency of STS practice and number of repetitions, as well as use of video recordings in assessment of STS strategies. This will be followed by discussion of potential clinical implications, study limitations, and future research directions. The chapter will end with general conclusions.

5.1. Summary of the main findings

The findings of the research program of this thesis indicate that people living with dementia use more strategies than older adults when standing up from a standard chair, particularly when standing up with no visual reference, such as a table in the front. The most common strategies used were leaning forward, followed by pushing through the armrests and moving feet backwards strategy. The feet backwards strategy was used more frequently by participants with dementia, particularly in trials without the table. The sliding forward strategy was used the least and only by one participant with dementia. The same pattern of frequency of strategies was observed in both studies.

Participants with dementia were able to learn STS strategies during training sessions based on spaced retrieval, errorless learning and vanishing cues, supported by a command repeated verbatim and an instruction sheet. The training protocol had to be modified to account for different levels of motor restlessness and participant's ability to cooperate during the training sessions. Regardless of the modifications, all participants completed the same number of training sessions (eight) but the overall number of STS practices ranged from 40 to 48 during the intervention period. The initial speed of learning during sessions varied, with two participants who had higher cognitive levels learning faster. However, the effect of training sessions on the usual STS performance, when tested without the instruction sheet, was more evident in the two participants, who had more advanced cognitive decline. During the final assessment of generalisation, all participants showed ability to perform STS correctly when the instruction sheet and command was provided by a person not involved in the study.

5.2. Discussion and clinical implications

5.2.1. Sit-to-stand strategies in people living with dementia

The effect of declining cognition on STS, as seen in dementia, has received limited investigation (Manckoundia et al., 2006) The available evidence suggests that people living with dementia, in addition to physical limitations (Tappen et al., 1997), may have difficulties with adapting STS strategies when faced with a new sitting surface (Finlay et al., 1983). It has been postulated that the decrease in problem solving abilities underlies these difficulties (Finlay et al., 1983). In the current studies, all participants were required to stand up independently from the standard chair, therefore, no STS difficulties were observed.

There is a common belief among clinicians that STS strategies (sliding forward, feet backwards, leaning forward, and pushing through the armrests) help make standing up easier by compensating for the discrepancy between physical abilities and the challenges posed by a sitting surface. In the current studies participants rarely used all four strategies. It is possible, that the standard chair used throughout this thesis did not provide a sufficient challenge to warrant the use of all four strategies (Mazza et al., 2004). The least used strategy was sliding forward and this was observed in Study 1 and during baseline assessments, in Study 2. Therefore, when participants started to incorporate this strategy into their usual STS after the training commenced (Study 2); the use of this strategy could indicate learning as direct result of training sessions.

In Study 2, the sliding forward strategy was not always used by participants in the sequence that was practiced. Instead on occasion, participants first moved their feet backwards. Similar variability in the sequence of the strategies was also demonstrated by one participant who used this strategy in Study 1. These observations parallel clinical opinion that sliding forward and feet backwards strategies may be used interchangeably when there is a sufficient space under the seat.

Participants with dementia used more strategies (particularly more frequently the feet backwards strategy) where there was an empty space in front (Study 1). In older adults without cognitive decline no difference was observed in the strategies used when standing up with and without the table in the front. The increased use of the strategies (in particular, feet backwards) when standing up with an empty space in front implies that participants with dementia somehow perceived the task as more difficult in comparison to standing up with the table in front. This may suggest that even when the same chair is used, people living with dementia may need to alter their STS strategies depending on the environment.

5.2.2. Commands and instructions

Clear, short and action based commands appear to be the most beneficial when working with people living with dementia (Christenson et al., 2011). In this program of research, the short action based command “Please, stand up” was used. No hesitation in initiation of the task performance or signs of misinterpretation of the command were observed throughout both studies. At times though, in clinical practice the use of short action commands may not be possible. This was the case in Study 2 where the command “What do you have to do to stand up, tell me and show me?” was longer. The command used in Study 2 was very similar to the commands used in other spaced retrieval studies involving comparable functional tasks (Creighton et al., 2014; Hunter et al., 2011; White et al., 2014). In these studies, as well as in the current study, participants were familiarised with the long command prior to commencing training using spaced retrieval principles. For this type of intervention to be successful, training cannot commence until participants are able to correctly respond to the long training command. In the current study, the number of practices that had to be provided before the participants were able to respond correctly by performing all STS strategies in the correct sequence with the instruction sheet, increased with the severity of dementia, with P2 requiring two and P4 eight practices.

5.2.3. Frequency of practice and number of repetitions

The STS training protocol based on spaced retrieval required the initial practices to be repeated at very short time intervals. Although, time intervals were increased as STS performance improved, initial training sessions were more intensive (requiring more STS repetitions) with less practice occurring in each session as training progressed (Table 4.18.

Table 4.18). However, the number of STS practices during the training sessions of Study 2 was relatively small in comparison to the number of times a day older people were reported to stand up. Healthy older adults living in the community were reported to stand up from 34 to 152 times a day, those who attended a day hospital therapy, from 12 to 117, and those who were undergoing inpatient rehabilitation from 5 to 107 times (Grant et al., 2011). Participants in the study were mobilising independently and were constantly moving around (except P1 who liked to spend time watching TV in his room); therefore, it is reasonable to expect that they were standing up very frequently as they moved outside the training sessions. This may explain why the effects of training when tested without the instruction sheet were not as evident.

Generally, when learning motor based tasks that are more complex, more practice is required. For example, playing a complex piano piece or reaching high level of skill when playing tennis or golf may require frequent practice over a number of years (Dayan & Cohen, 2011). In studies involving a basic motor task such as a rotor pursuit, people with and without dementia were not able to improve further after 40 repetitions (Dick et al., 1995). However, the amount of optimal practice cannot be yet established for functional tasks as the tasks, training methods as well as the amount of reported training differ between the studies (Table 2.1). Observations from Study 2 indicates that participants can reach correct STS performance with the command repeated verbatim and the instruction sheet with no additional cues by the fourth or fifth training session. This amount of practice provided by physiotherapist may be sufficient to reach a point when this method of instruction can be easily adopted and continued by family and carers during everyday activities involving STS.

If carers could adopt a similar approach to providing commands as during the training sessions the correct use of strategies would continue to be reinforced during everyday activities involving standing up. It is also possible that after a longer time of practice a person living with dementia could start to perform STS strategies to the verbal command only. It has been demonstrated that a person living with dementia can decrease reliance on an instruction sheet when learning a complex task of using a mobile phone (Lekeu et al., 2002). However, it was beyond the scope of the present study to provide long term training. This is one of the limitations of the study.

To enable people living with dementia to retain skills after training sessions are completed, a maintenance program of the skill may be required. The program may involve such interventions as booster sessions (Cherry et al., 2009) or be continued by carers (Hunter et al., 2011). In the current study, the maintenance program comprised standing up twice a day to the training command "What do you …?" but without the instruction sheet. This appeared to be adequate to continue to maintain some of the learnt strategies, particularly by P4 and to the lesser extent by P3 over three days post training. It is a limitation of the study that skill retention (with and without the instruction sheet) was not tested over a longer period of time.

5.2.4. Use of video recordings in assessment of sit-to-stand strategies

In this program of research STS assessments (Study 1 and 2) and training sessions (Study 2) were recorded. Physiotherapy clinicians and researchers are accustomed to the use of video recordings in movement analysis (Kuys et al., 2008; Pomeroy et al., 2003). The behaviour of participants with dementia suggested that they were not affected by the presence of the camera. This was in contrast to participants without suspected cognitive decline (Study 1) who showed signs of potential over performance during STS assessments. Use of video recorded clips for STS assessment allowed randomisation, blinding of assessors and identification of STS strategies with acceptable level of inter-and intra-tester reliability (Table 3.4).

5.2.5. Implications for clinical practice

This thesis presents findings that have clinical implications for physiotherapy management of people living with dementia. Physiotherapists need to be aware that people living with dementia may use different strategies to stand up compared with older adults without cognitive decline. As a result of these different strategies, in particular, moving the feet backwards and pushing up through the armrests, people with dementia appear to require specific seating. Clinical settings including hospitals and residential care facilities should provide suitable seating for people living with dementia. Chairs should have space to allow for feet to be able to be moved backwards and have long armrests to facilitate independent STS. It appears that provision of suitable seating in hospital environments requires attention. A recent study which investigated chairs across six general medical wards in a tertiary facility found that 85% of chairs did not meet minimum criteria for suitable seating (Kuys, Dolecka, & Morrison, 2011).

The finding that people living with dementia appear to have increased difficulty standing up when an empty space is in front was unexpected. This is difficult to explain but we have hypothesised that this may be due to people living with dementia perceiving this as a more difficult task, perhaps due to having no visual reference (feedback) (Scarborough et al., 2007) and being unable to compensate for spatial and movement perception problems (Kavcic et al., 2011). Although this requires further investigation, physiotherapists need to be aware that practicing STS with a table (or walker) as well as an empty space in front should be included during therapy. Practicing with an empty space in front is likely to be more demanding but it may be required in real life situations, for example, when standing up from a toilet during personal cares.

A training protocol based on spaced retrieval, errorless learning and vanishing cues appears to be suitable to use by physiotherapists for retraining other functional tasks. Using these training methods could assist therapists with adopting an instruction style and training approach that is believed to reflect the communication and learning needs of people living with dementia (Christenson et al., 2011; Hopper et al., 2013). By using these training methods, instead of providing extensive instructions (Roberts & Bucksey, 2007), physiotherapists might be able establish an association between the command and the expected response, as these support learning in dementia (Camp et al., 1996). Establishing the association between the command and the expected response should be as important as improving muscle strength or endurance during rehabilitation of people living with dementia. To achieve better outcomes, external memory aids (e.g. instruction sheet) (Bier, Provencher, et al., 2008) can also be considered as one of possible approaches for retraining STS or other functional tasks.

Therapists should also consider involving family and carers in the training program. The effects of therapy are likely to be improved by continuing the same approach (consistent commands and performance) outside the training sessions (Bier, Provencher, et al., 2008; Curtin, 2011). People living with dementia learn predominately procedurally (without detecting errors), therefore can learn mistakes, if these are allowed (Clare & Jones, 2008; Haslam et al., 2011). By providing ongoing consistent commands and practice (including outside of the training sessions), errors can be minimised and correct skills, rather than mistakes, are more likely to be reinforced (Bier, Provencher, et al., 2008; Clare & Jones, 2008; Haslam et al., 2011). The success of the training often depends on family and cares who can strengthen the correct performance achieved during the training session (Bier, Provencher, et al., 2008; Camp et al., 1996; Hunter et al., 2011). Being involved in retraining of meaningful functional tasks in people living with dementia and seeing positive outcomes, may also benefit carers and family; it can decrease their sense of helplessness and instead provide a purpose (Camp et al., 1996).

The candidate's journey for this research program began in acute hospital medical wards where increasing numbers of admissions of people living with dementia were observed and a desire to provide better rehabilitation. Pragmatics of conducting clinical based research resulted in the training protocol being implemented in a residential care facility, but it may also be applicable for people living with dementia during hospitalisation. Although the implementation of a similar training protocol in a hospital setting needs to be formally tested, this approach to retraining functional tasks in people living with dementia has the potential to improve efficiency of the retraining program, particularly important in the context of increasing demand for acute hospital beds (Chadaga et al., 2012).

5.3. Limitations

There are number of limitations to the studies that need to be acknowledged. The number of participants enrolled in Study 1 was small (n = 20) and participants were recruited as a sample of convenience. The small number of participants and the recruitment method pose risks of bias and do not allow generalisation of findings to the wider population of older adults or people living with dementia. In addition, participants with dementia in Study 1 were recruited from medical inpatients of an acute hospital. Although the participants were deemed as medically stable, a lower than usual level of function cannot be excluded as it is common for people living with dementia to experience functional decline during hospitalisation (Pedone et al., 2005). Decreased levels of cognition and awareness of self and environment in people living with dementia (Clare, Markova, Roth, & Morris, 2011) (particularly of being tested) could also have influenced the observed differences between the groups. A lack of randomisation of STS trials without and with the table in front is another limitation of the Study 1. Although only participants with dementia decreased use of strategies when standing up with the table in front (tested second after STS without the table), a practice effect cannot be excluded. It is also possible that some participants could have been exposed to STS retraining in the past.

The main limitations of Study 2 relate to methodology and STS training implementation. The short baseline periods did not allow sufficient time to discern if participants could stabilise their STS performance before training commenced. It is also possible that the number of training sessions was too small to have stronger impact on usual STS performance. Retention of learning was tested for a short period of time (three days) and this does not allow for conclusions to be made on participants' ability to retain the STS task beyond this period. As a result, the small number of data points across study periods combined with inconsistent baseline variability presented by some participants and restricted range of STS strategies, did not allow more rigorous data analysis.

The STS training protocol developed for Study 2 aimed to have people living with dementia learn to use or incorporate STS strategies known to make standing up easier or less physically demanding. This study provides some understanding into how people living with dementia learnt these strategies. However, it has to be also acknowledged that including only participants who could stand up independently, the observations cannot be generalised to people who cannot stand up. However, this study does provide insights for clinicians to use these principles for training STS in people living with dementia who cannot stand up.

Using visual analysis of the recorded video clips was another limitation of the studies comprising this program of research. Although, all STS assessments were reviewed by independent blinded assessors, the assessment still relied on assessor judgement of movement occurring. A video motion analysis system could have been considered to provide additional quantifiable spatial and temporary data.

All STS training was delivered by the candidate. This represents a primary source of bias in Study 2. The candidate designed and implemented the training protocol. As such, it is possible that the candidate was heavily invested in the outcome. This risk of bias was minimised by using an independent blinded assessor to review all STS video clips. Additionally, all training sessions were also video recorded and monitored by an independent person. Video recordings were reviewed to ensure adherence of protocol implementation.

5.4. Future research implications

This program of research has highlighted several areas for future investigations. The first study identified that people living with dementia used fewer strategies when standing up with the table in front compared to those without cognitive decline. This suggests that people living with dementia may perceive the STS task as easier to perform than when having an empty space in front. This observation requires further investigation, with larger numbers of participants and would also benefit from being verified in kinematic laboratory based studies. The role of environment and the impact of functional task performance also requires further exploration; for example, STS performance should be measured in a range of common environmental contexts such as standing up from a toilet, and with a walker in front.

The STS training protocol employed in Study 2 was based on the principles underlying cognitive training methods such as spaced retrieval, errorless learning and vanishing cues. The training was supplemented by consistent commands and an instruction sheet containing the sequence of STS strategies. The instruction sheet allowed controlled provision of cues and supported errorless learning approach. It is possible that the instruction sheet with written STS strategies assisted with reducing cognitive load during practice, seen as beneficial during rehabilitation in people living with dementia (Bayles & Kim, 2003). Therefore, the use of an instruction sheet and commands repeated verbatim (after these are introduced by a therapist) with an increased number of STS repetitions per session and without a specific training schedule may be also investigated in people living with dementia who retained reading abilities.

In clinical practice, it is likely that modifications would be required to the very specific training protocol used in Study 2 and these should be explored further. For example, participants practiced STS with the instruction sheet and the specific consistent command only during training sessions. It would be useful from a clinical point of view to investigate if STS training supplemented by additional practice during everyday activities would be more beneficial than training sessions alone. This would be clinically relevant where nursing staff and/or carers could be involved in provision of the additional STS practice. This approach to increasing the amount of practice appears reasonable as transition of a spaced retrieval based training to carers in a residential care facility has been reported as possible (Hunter et al., 2011).

Study 2 also provided some evidence that transitioning of the STS training program to carers research may be feasible in the future. Participants involved in Study 2 were able to execute the STS strategies to the command using only the instruction sheet by the fourth or the fifth training session. Furthermore, participants demonstrated similar STS performances with the instruction sheet when consistent commands were provided by other people than the researcher during the assessment of generalisation. These findings indicate that it might be possible to maintain consistency of practice during everyday activities with commands provided by carers.

A better response to the STS training protocol was observed in two participants with more severe dementia indicating another possible direction for future research. It is possible that the effects of STS training were reduced in less cognitively affected participants when tested without the instruction sheet because of potential interference of preserved explicit memory (expected in less severe dementia) during implicit learning (Kessels et al., 2011; Klimkowicz-Mrowiec et al., 2008). If the findings are replicated in another study, it would indicate that training approaches may need to be modified depending on severity of dementia. This could open a new research direction with focus on developing training approaches that reflect learning ability at different stages of dementia.

The effects of the training protocol on STS performance in people living with dementia who cannot stand up and need physical assistance should also be investigated. Inclusion of people living with dementia who could stand up independently in Study 2 enabled observation of the participants' usual methods of standing up, type of STS strategies used before the training commenced as well as provided an insight into the training sessions. To enable clinical application, the response to the STS training protocol needs to be tested in people living with dementia who cannot stand up. However, for this population, before the training protocol as described can be implemented, the physical abilities of the person living with dementia may need to be improved. Additionally, the protocol may need to be modified and STS practice supplemented with verbal rehearsal (encoding) (Bird & Kinsella, 1996). Verbal rehearsal could be based on the same STS training protocol but without the task being performed. Adding verbal rehearsal to the protocol may assist with management of potential fatigue, particularly during the early stages of the training when practice is based on short spaced retrieval time intervals.

Participants in Study 2 were residents of a residential care facility. However, investigating the effects and clinical utility of the STS training protocol in people living with dementia admitted to acute hospitals appears to be also clinically important. People living with dementia admitted to acute hospitals are at much higher risk of functional decline than older adults without cognitive decline (Pedone et al., 2005; Zisberg et al., 2011) and as a result may require physical assistance to perform basic functional tasks such as STS or transfers. Maximising independence by facilitation of participation in these tasks is an important goal of rehabilitation. As people living with dementia are more likely to experience delirium during hospitalisation (Ryan et al., 2013), the training protocol could be also extended to this group of patients. One of the foci of that study could be exploring the effect of consistent commands with or without an instruction sheet (depending on reading test) on ability to stand up.

Considering the small number of participants involved in Study 2, it seems logical to follow up with studies involving a larger number of participants. The aim of these studies would be to investigate if these observations from this program of research can be replicated. The value of these studies would increase if these were conducted by other research teams and involved independent therapists delivering the training program.

5.5. General conclusions

The overall aim of this research program was to investigate the use of spaced retrieval, errorless learning and vanishing cues to retrain STS strategies in people living with dementia. This research program investigated STS strategies used by older adults and people living with dementia, developed an objective reliable observational measurement tool of STS and developed and implemented a training protocol based on spaced retrieval, errorless learning and vanishing cues in STS retraining in people living with dementia.

The results indicate that people living with dementia use similar STS strategies as older adults without suspected cognitive decline when standing up from a standard chair. The sliding forward strategy appears to be the least used and it can be used interchangeably with the feet backwards strategy. People living with dementia used feet backwards strategy more frequently when standing up with empty space in front, suggesting that the task was potentially more demanding. These observations indicate that chairs with armrests and space for the feet should be provided to facilitate more independent STS in this population. Furthermore, practicing STS with an empty space as well as with a table or walker in front should be included as a part of usual therapy.

Retraining STS using a protocol based on spaced retrieval, errorless learning and vanishing cues, supported by an instruction sheet and command repeated verbatim can improve STS performance during the training sessions as well as have some effect on strategies when the instruction sheet is not used. It appears that another person (not involved in the training) may elicit similar STS performance in people living with dementia, particularly if consistent instruction methods are used. Therefore, if one of the goals of retraining functional tasks in people living with dementia was to develop the best instruction method and this method was handed over as a part of a care plan to family and carers, physical and psychological burden of assisting with everyday task could potentially be reduced.

Feasibility and utility of the STS training protocol as determined by participants' acceptability and the practicality of the implementation, suggest that a similar approach may have benefits for other tasks and clinical settings. However, the training protocol, particularly spaced retrieval time intervals, may need to be modified to address person's individual learning needs and behavioural characteristics.

It is important to tailor rehabilitation of functional tasks, such as STS retraining, to the learning abilities of people living with dementia. People living with dementia experience functional decline more commonly than older adults who do not have cognitive problems. As a result, they are more likely to require physical assistance to stand up and this increases care burden and risk of institutionalisation. This thesis provides some insight into STS strategies used by people living with dementia as well how these strategies may be retrained in this population to make the STS task easier to perform. Future investigations should confirm and progress these findings.

Appendices

Appendix 1 Published paper

Archives of Gerontology and Geriatrics 60 (2015) 528–534

Contents lists available at ScienceDirect

Archives of Gerontology and Geriatrics

journal homepage: www.elsevier.com/locate/archger

Comparison of sit-to-stand strategies used by older adults and people living with dementia

Urszula E. Dolecka [a,*], Tamara Ownsworth [b,1], Suzanne S. Kuys [c,2]

[a] Physiotherapy Clinical Team Leader Princess Alexandra Hospital, Woolloongabba, Qld, 4102, Australia
[b] School of Applied Psychology & Griffith Health Institute Griffith University, Mt Gravatt, Qld, 4211, Australia
[c] The Prince Charles Hospital, Chermside, Qld, 4032, Australia

ARTICLE INFO

Article history:
Received 21 August 2014
Received in revised form 15 December 2014
Accepted 18 December 2014
Available online 5 January 2015

Keywords:
Sit-to-stand
Dementia
Physiotherapy assessment

ABSTRACT

Physiotherapists routinely retrain sit-to-stand (STS) during rehabilitation using strategies such as sliding forward, moving the feet backwards, leaning forward, and pushing through the armrests. It is unknown if people living with dementia use the same strategies as other older adults and if a table positioned in front alters their performance. Twenty participants 65 years or older (10 with Alzheimer's disease or mixed dementia; 10 without dementia) performed six STS trials from a standard chair with armrests, including three trials without and three with a table in front. Trials were digitally recorded and the starting position and type and order of strategies used were rated by a blinded assessor. Starting position was similar between the groups. The most common strategy was leaning forward (119 out of 120 trials) while the least used was sliding forward (four out of 120 trials). People living with dementia used significantly more strategies (p = 0.037), pushed through the armrests more than older adults (p = 0.038) and moved feet backwards more frequently in trials without the table in front (p = 0.010). Presence of the table had no significant effect on STS performance of older adults (p > 0.317). Our results demonstrated that people living with dementia had a similar starting position but used more strategies to stand up, pushing through their arms more than older adults without dementia and moved their feet backwards more often when no table was in front. People living with dementia should be provided with chairs with armrests and space to move feet backwards.

1. Introduction

Sit-to-stand (STS) is a routine task required for mobility. An inability to complete the task independently has a detrimental effect on autonomy of older adults. STS difficulties in older adults correlate with risk of falling (Yamada & Demura, 2009), can cause serious injuries (Ellis & Trent, 2001), increase need for caregiver assistance (Perry, Marchetti, Wagner, & Wilton, 2006), prolong hospital stay (Fisher, Ottenbacher, Goodwin, & Ostir, 2009), and lead to earlier institutionalisation (Fisher et al., 2009; Rothera, Jones, Harwood, Avery, & Waite, 2003; Sabol et al., 2011). Consequently, the STS task is frequently retrained by physiotherapists with the aim to improve safety with transfers and maximize independence in older adults.

During STS retraining physiotherapists address underlying impairments as well as teach specific strategies that can make the STS task easier. These strategies include using a chair with a seat height that enables the hips and knees to be positioned at at least 90 degrees (Alexander, Gross, Medell, & Hofmeyer, 2001; Alexander, Koester, & Grunawalt, 1996; Demura & Yamada, 2007; Hughes, Myers, & Schenkman, 1996; Mazza, Benvenuti, Bimbi, & Stanhope, 2004; Schenkman, Riley, & Pieper, 1996), sliding or scooting forward to sit on the edge of the chair (Barreca, Sigouin, Lambert, & Ansley, 2004; Bohannon & Corrigan, 2003; Nuzik, Lamb, VanSant, & Hirt, 1986), moving the feet backwards behind the knee line (Akram & McIlroy, 2011; Khemlani, Carr, & Crosbie, 1999; Schenkman, Berger, Riley, Mann, & Hodge, 1990; Schultz, Alexander, & Ashton-Miller, 1992; Shepherd & Koh, 1996), leaning forward (Alexander et al., 1996; Hughes, Weiner, Schenkman, Long, & Studenski, 1994; Nuzik et al., 1986; Shepherd & Gentile, 1994), and pushing through the armrests (Etnyre & Thomas, 2007; Schultz et al., 1992) up into standing position.

* Corresponding author. Tel.: +61 731762401.
E-mail addresses: urszula.dolecka@health.qld.gov.au, gap63@bigpond.com (U.E. Dolecka).
[1] Tel.: +61 737353307, +61 450186377 (mobile).
[2] Griffith Health Institute, Griffith University, Gold Coast, Q 4215, Australia. Tel.: +61 7 31396319, +61 408198815 (mobile).

http://dx.doi.org/10.1016/j.archger.2014.12.007

Depending on peoples' individual functional abilities or the type of sitting surface, physiotherapists may need to teach all or only some of these strategies (Carr & Shepherd, 1998; Schenkman et al., 1990). Although clinical observation suggests that sliding forward and moving the feet backwards behind the knee line may be performed interchangeably as the first or second strategy followed by leaning forward and pushing up through the arms as the final strategies to complete the task, the specific arrangement or sequences of strategies involved in STS has received little empirical attention.

The STS task has been extensively studied from a biomechanical (Janssen, Bussmann, & Stam, 2002), and clinical measurement point of view (Bohannon, 2012). However, very little is known about which STS strategies are actually used by older adults and in what sequence, when the STS task is independently performed from a standard chair. The STS task can be performed in a variety of environments such as standing up from a lounge chair or standing up at a dining table. No existing research was found that investigated whether having a table in the front e.g. when having a meal alters the preferred STS strategies. Older community dwelling adults have reported avoiding seating surfaces that make STS difficult as their preferred strategy and identified pushing through the arms, sliding forward (scooting), and leaning forward as additional strategies that help to overcome STS difficulties (Bohannon & Corrigan, 2003).

STS difficulties in older adults are often the result of physical limitations related to acute illness (Britton, Harris, & Turton, 2008; Fisher et al., 2009), hospitalisation (Graf, 2006), and comorbid illnesses or injuries (Brodin, Ljungman, & Sunnerhagen, 2008; Turcot, Armand, Fritschy, Hoffmeyer, & Suva, 2012; Vincent, Vincent, & Lamb, 2010). Cognitive decline, as seen in an increasing number of older adults living with dementia, has potentially an additional detrimental effect on STS task performance due to disturbances in motor planning and programming, problem solving, and decreased ability to follow instructions (Finlay, Bayles, Rosen, & Milling, 1983; Tappen, Roach, Buchner, Barry, & Edelstein, 1997; Wangblad, Ekblad, Wijk, & Ivanoff, 2009). However, it is not known whether cognitive decline as seen in dementia leads to differences in preferred STS strategies and their sequence as compared to older adults.

Therefore, this study investigated the STS task performed from a standard chair with armrests in community dwelling older adults without suspected cognitive decline and people living with dementia. Specifically, this study aimed to determine the most common starting position, type, and number of STS strategies used and their sequence, and if the presence of a table in front changed the preferred starting position and the strategies. Additionally, consistency of the starting position and the type, number, and sequence of the strategies used in the STS task between the trials were investigated.

2. Methods

2.1. Study Design

An observational study involving two groups of participants, community-dwelling older adults without suspected cognitive decline, and people living with dementia was conducted. Digital audio-visual recordings were made of participants standing up from a standard chair, with and without a table in front. Digital files were de-identified, randomized, and assessed by an independent assessor blinded to the cognitive status of the participants.

2.2. Participants

Men and women aged 65 years or older were eligible for recruitment to the study, if they met criteria for one of two groups; Dementia Group (DG) and Non-Dementia Group (N-DG). DG participants consisted of older adults living with dementia admitted to the Internal Medicine Unit of a tertiary hospital in Brisbane, Australia. Patients who had an established diagnosis of either Alzheimer's disease or mixed dementia, were medically and cognitively stable (i.e. deemed not to be experiencing delirium or reversible causes of cognitive impairment) and had a documented Standardized Mini Mental State Examination (Folstein, Folstein, & McHugh, 1975; Molloy, Alemayehu, & Roberts, 1991) score of 25 or less (Perneczky et al., 2006), were identified by treating physiotherapists. The N-DG consisted of a convenience sample of older adults living in the community who did not report cognitive problems and scored a minimum of 28 on the Standardized Mini Mental State Examination (O'Bryant et al., 2008). Participants in this group were recruited from hospital visitors or were older adults living independently in a retirement village. All participants were required to meet additional inclusion criteria of being able to stand up six times independently from a standard chair, speak English as their primary language, and have adequate receptive communication skills to follow instructions. Participants with any comorbidity that would limit their ability to stand up from a standard chair such as lower or upper limb pain, history of lower limb surgeries, or severe osteoarthritis or rheumatoid arthritis leading to decreased joint range of motion such as limited ankle dorsiflexion, less than 100 degrees of hip and knee flexion, were not eligible for the study. Participation in the study was voluntary. N-DG participants provided written consent and substitute decision makers' consent was sought for DG participants. Institutional ethics committees approved this study.

2.3. Procedures

All STS trials were conducted in a similar environmental setting for all participants using a standard chair that had a seat height of 46 cm from the floor, full length armrests, and an upright back rest. For trials involving a table, the table had height of 76 cm and it was positioned 30 cm in front of the chair. A video-camera was positioned on a tripod (333 cm from the chair and 126 cm above the floor) to allow capture of the full left lateral view of participants during STS trials.

All participants were video recorded performing six STS trials from a standard chair with armrests in the following order; three trials without and three trials with a table. For all trials, participants started in a position that comprised sitting with hips and knees flexed approximately 90 degrees. However, trunk, hips, hands, and feet positions were not specified allowing participants to adopt their preferred starting position. All participants were given the same command "please stand up" followed by a command "please sit down".

Demographic data, clinical information, and measures were recorded for all participants and included age, gender, current accommodation, medical and falls history, and current Standardized Mini Mental Examination scores. Additional information recorded for DG participants from their medical chart included type of dementia, reason for hospital admission and discharge destination. Clinical mobility measures were recorded for all participants using de Morton Mobility Index (DEMMI) and timed 10 m walk test (10MWT). DEMMI has been validated for older patients in acute medical wards (de Morton, Davidson, & Keating, 2008, 2010) and older adults living in the community (Davenport & de Morton, 2011). The index consists of 15 tasks of increasing difficulty, ranging from the easiest of bridging in bed to the most difficult task where a person is asked to stand with eyes closed and arms crossed on the chest, with feet placed heel to toes (tandem standing). Timed 10 m walk test (10MWT) was used to measure walking speed (Tilson et al., 2010). All participants walked 14 m (with the middle 10 m timed using a hand held stop watch) wearing usual footwear and using usual walking aids. Participants were advised to walk at a comfortable pace and were not informed which part of the distance was timed.

2.4. Measures

Starting position of the trunk, hips, feet, and hands, presence or absence of the STS strategies (sliding forward, moving feet backwards, leaning forward, and pushing through the arms), and the sequence of the strategies were assessed from digital audio-visual recordings. Two digital files, each containing three STS trials, with or without the table, were created for each participant. Digital audio-visual files, de-identified and randomised by an offsite investigator, were reviewed by an independent assessor blinded to group allocation, who was a physiotherapist with more than seven years of clinical experience. An observation based assessment tool developed for the study was used to record starting position of hips, trunk, hands, and feet, STS strategies used and sequence.

2.5. Data analysis

Demographic data were analysed using descriptive statistics. Frequencies of hip, trunk, hand, and feet position used at the start of the STS task were recorded for trials without and with the table in front. The type, number, and sequence of strategies used during the STS task were recorded for trials without and with the table in front. Differences in starting position, type, and number of strategies used within the groups (N-DG, DG) and consistency for trials without and with the table in front were examined using descriptive statistics and the Wilcoxon signed-rank test. Differences between groups (N-DG, DG) in starting position and type of strategies used to stand up without and with the table in front were examined using descriptive statistics, Chi-square and Fisher Exact test. The Mann–Whitney U test was used to analyse differences in age, mobility, speed of walking, and number of strategies between the groups (N-DG, DG). Analyses were undertaken using SPSS 22 and significance was set at $p < 0.05$.

3. Results

3.1. Flow of participants

Twenty-seven older adults were screened for inclusion in the study, with seven excluded. Six older adults were excluded from the N-DG; one because of inability to complete six STS trials independently and five, due to Standardized Mini Mental State Examination scores below 28/30. In the DG, one participant was excluded during the screening process because the substitute decision maker could not be contacted to provide written consent. No participants withdrew or were withdrawn from the study and no adverse events occurred during the study. Twenty participants, 10 in each group (50% female; average age = 81.5 years, SD = 7 years), completed six STS trials that involved three trials without a table and three with a table in front.

3.2. Participant characteristics

Participant characteristics are presented in Table 1. There were no statistical differences between N-DG and DG participants for age (U = 40.5, p = 0.47) or mobility level as measured by the De Morton Mobility Index (U = 31.5, p = 0.14). However, DG participants walked significantly slower than N-DG participants (U = 20.5, p = 0.026). DG participants had a history of 2–3 falls on average within the last six months documented in their medical charts and only one participant from the N-DG self- reported one fall. Both groups had a range of comorbidities that included ischemic heart disease, heart failure, hyperlipidemia, and type two diabetes mellitus. All DG participants were community dwelling on hospital admission, although following hospitalisation seven were discharged to residential care facilities due to increased demand for dementia related care.

Table 1
Demographic and physical status characteristics of participants.

Characteristic	Non-dementia group (n = 10)	Dementia group (n = 10)
Gender, n female/male	5/5	5/5
Age (years), median (min–max)	79.5 (69–90)	83 (71–94)
sMMSE, median (min–max)	29 (28–30)	19.5 (15–21)
Alzheimer's disease, n	N/A	8
Mixed dementia, n	N/A	2
Mobility		
DEMMI (raw scores), median (min–max)	18 (16–18)	16.5 (9–18)
DEMMI (converted), mean (SD)	79.5 (67–85)	70.5 (39–85)
10 MWT (m/sec), median (min–max)[a]	0.87 (0.55–1.16)	0.70 (0.38–0.89)
Ambulation with nil aids, n	8	9
Ambulation with four-wheeled walker, n	2	1

[a] Statistically significant difference between dementia and non-dementia participants p = 0.026.
Abbreviations: sMMSE = standardized mini mental state examination; DEMMI = de Morton mobility index.

3.3. Starting position

Table 2 outlines the starting position used by N-DG and DG participants for STS trials without and with the table in front. For both N-DG and DG participants, the presence or absence of the table in front did not have any significant effect on the starting position of the trunk, hips, hands, and feet (N-DG $p > 0.317$, DG $p > 0.414$). There were no statistical differences in starting position of the hips, hands, and ankles between the groups ($p > 0.254$) and all participants were able to place their feet on the floor. However, DG participants started with the trunk against the backrest less frequently, particularly in trials without the table but this difference did not reach statistical significance (Fisher Exact Test, two-sided, p = 0.052).

3.4. Type of strategies

The types of strategies used by N-DG and DG participants during STS trials are outlined in Table 2. There was no significant difference for N-DG participants in frequency of use of STS strategies without or with the table in front ($p > 0.317$). Within the DG there were no differences in use of sliding forward, leaning forward, and pushing through the armrests ($p > 0.317$); however, DG participants used the feet backwards strategy significantly more in trials without the table than in trials with the table in front (p = 0.041).

Significant between group differences were found for use of the feet backwards strategy in trials without the table in front and for the method of pushing up into standing. DG participants moved their feet backwards more frequently than N-DG participants in trials without the table in front (p = 0.010). DG participants also pushed through the chair armrests more frequently than N-DG

Table 2
Starting position and sit-to-stand strategies for trials without and with the table.

Variables	Non-dementia group(n = 30 trials)		Dementia group(n = 30 trials)	
	No table	Table	No table	Table
Starting position				
Trunk against the backrest, *n* trials (%)	30(100)	28 (93.3)	25 (83.3)	24 (80)
Hips against the backrest, *n* trials (%)	30(100)	29 (96.6)	30 (100)	30 (100)
At least one ankle behind the knee, *n* trials (%)	28 (93.3)	29 (96.6)	26 (86.6)	27 (90)
At least one hand on armrests, *n* trials (%)	11 (36.6)	11 (36.6)	13 (43.3)	14 (46.6)
Type of strategies				
Sliding forward, *n* trials (%)	0(0)	0 (0)	1 (3.3)	3 (10)
Feet backwards, *n* trials (%) [a]	10(33.3)	11 (36.6)	20 (66.6)	11 (36.6)
leaning forward, *n* trials (%)	30(100)	30 (100)	30 (100)	29 (96.6)
Pushing through armrests, *n* trials (%) [b]	13 (43.3)	11 (36.6)	21 (70)	21 (70)
Pushing through knees, *n* trials (%)	11 (36.6)	12 (40)	6 (20)	9 (30)
Arms not used to push up, *n* trials (%)	6 (20)	7 (23.3)	3 (10)	0 (0)
Number and sequence of strategies				
One strategy, *n* trials (%)	4 (13.3)	3 (10)	1 (3.3)	1 (3.3)
LF, *n* trials	4	3	1	0
PA, *n* trials	0	0	0	1
Two strategies, *n* trials (%)	18 (60)	20 (66.6)	11(36.3)	18 (60)
FB+ LF, *n* trial	2	4	2	0
LF +PA, or PK, *n* trials	16	16	9	18
Three strategies, *n* trials (%)	8 (26.6)	7 (23.3)	17 (56.6)	8 (26.6)
FB+ LF +PA or PK, *n* trials	8	7	17	8
Four strategies, *n* trials (%)	–	–	1 (3.3)	3 (10)
FB+ SF+LF+PA, *n* trials	0	0	1	3

[a] Statistically significant difference between groups in trials without table.
[b] Statistically significant difference between groups in trials without and with table.
Abbreviations: LF = leaning forward; PA = pushing through armrests; FB = feet backwards; PK = pushing through the knees; SF = sliding forward.

participants in trials without the table ($p = 0.037$) and with the table in front ($p = 0.010$). N-DG participants did not use their arms to push up in six of the 30 trials without the table and in seven trials with the table in the front. Among DG participants, pushing up was not used in three trials without the table in front and this method of standing was used by the same participant.

3.5. Number of STS strategies

The number of STS strategies used by N-DG and DG participants in trials without and with the table in the front is presented in the Table 2. N-DG participants used a maximum of three strategies to stand up while DG participants used a maximum of four strategies. There were no significant differences in the total number of strategies (sum of strategies in three trials) used by all participants when trials without and with the table in front were compared (N-DG $Z = 0.087$, $p = 0.931$; DG $Z = 0.779$, $p = 0.436$). However, there was a significant difference in the number of strategies used between the groups for trials without the table in front, with DG participants using more strategies than N-DG participants ($U = 23$, $p = 0.038$). The between group difference for trials with the table in front was not statistically significant ($U = 35$, $p = 0.241$).

3.6. Sequence of STS strategies

A maximum of four different strategies were used to stand up across all trials (Table 2). When using one strategy, N-DG and DG participants used either leaning forward or pushing up through the arms when standing up with or without table. When two strategies were used, two sequences were observed; either moving the feet backwards followed by leaning forward or leaning forward followed by pushing through the arms. The second sequence was used more frequently by both groups (Table 2). Three strategies were more frequently used by DG participants but both groups used the same sequence; feet backwards, leaning forward, and pushing up. Four strategies were only used by one DG participant in the same sequence: feet backwards, slide forward, leaning forward, and pushing up to stand.

3.7. Consistency of performance across trials

Table 3 reports data on consistency levels for starting position of the trunk, hips, ankles, and hands and strategies used in STS trials without and with the table in front. Participants in both groups performed STS trials without and with the table in front with similar levels of consistency (consistent either in three, two, or none of the trials) in the starting position of their trunk, hips, hands, and feet (N-DG $p > 0.317$, DG $p > 0.285$) and in the number, type, and sequence of STS strategies used (N-DG $p > 0.157$, DG $p > 0.180$). There was no statistical difference in consistency levels when all STS trials (without and with the table in front) were compared between the groups ($p > 0.116$). Only one N-DG participant and two DG participants used the same number, type, and sequence of strategies in trials without the table and with the table in front.

4. Discussion

Overall, findings from this study indicated that community dwelling older adults without suspected cognitive decline and people living with dementia employ similar STS strategies. Specifically, they adopt a similar starting position before standing up from a standard chair comprising the trunk and hips positioned against the backrest, hands mostly resting on knees, and at least one ankle behind the knee line. Regardless of group, the most commonly used strategy was leaning forward, followed by pushing through the armrests or the knees, and moving the feet backwards. The least frequently used strategy was sliding forward.

However, some significant differences were found between participant groups; people with dementia employed more strategies to stand up when no table was in front and generally pushed through the armrests more frequently. The presence or absence of the table did not influence the type or number of strategies used to

Table 3
Consistency of starting position and strategies across three trials without and the table.

Variables	Non-dementia group (n = 10)		Dementia group (n = 10 trials)	
	No table	Table	No table	Table
Consistent starting position				
Trunk in three trials, n participants	10	9	8	8
Trunk in two trials, n participants	0	1	2	2
Hips in three trials, n participants	10	10	10	10
Hands in three trials, n participants	9	8	6	6
Hands in two trials, n participants	1	2	4	2
Hands in none of trials, n participants	0	0	0	2
Feet in three trials, n participants	8	6	7	7
Feet in two trials, n participants	2	4	3	3
Consistent strategies [a]				
In three trials, n participants	4	2	3	5
In two trials, n participants	6	5	7	5
In none of trials, n participants	0	3	0	0

[a] The same type, number, and sequence of strategies.

stand up by people without suspected cognitive decline. N-DG and DG participants adopted consistent starting positions and the majority of participants were consistent in the number, type, and sequence of strategies in at least in two out of three trials without and with the table in front.

The starting position used to stand up was similar between the groups. N-DG and DG participants most frequently started with trunk and hips positioned against the backrest, hands on armrests, and feet with ankles on or behind the knee line for all trials. This perhaps was not unexpected due to the influence of the testing environment which facilitated participants to sit with their feet, knees, and hips positioned at 90 degrees. However, it was noted that DG participants positioned the trunk forward rather than against the backrest in some trials. The difference in trunk position in comparison to ND-G participants was not statistically significant, but similar behavior was observed less frequently in N-DG participants. It is possible that this variability in trunk position observed for the DG participants was the result of many factors, including general motor restlessness (Zuidema, Derksen, Verhey, & Koopmans, 2007), difficulty staying orientated to the purpose of the activity (Joray, Herrmann, Mulligan, & Schnider, 2004), or decreased ability to cope with the testing situation due to cognitive problems associated with dementia. The testing environment was new for participants and it has been found that people living with dementia can feel anxious when faced with a novel situation (Digby, Moss, & Bloomer, 2012). However, these proposed explanations are only speculative, as levels of motor restlessness, orientation, and anxiety during the task were not specifically assessed.

Leaning forward was the most commonly used strategy across all STS trials by both groups of participants (119 out of 120 trials). When standing up with arms crossed, people living with dementia have been shown to have less forward movement of the shoulders, therefore rising more vertically compared to people without suspected cognitive decline (Manckoundia, Mourey, Pfitzenmeyer, & Papaxanthis, 2006). Although the degree of leaning forward was not quantified in our study, it is possible that DG participants used the leaning forward strategy less effectively compared with N-DG participants when standing up, particularly for trials without the table in front; therefore requiring the feet backwards strategy to bring the center of gravity over the base of support to ensure stability (Alexander et al., 1996; Kawagoe, Tajima, & Chosa, 2000; Schultz et al., 1992). All DG participants had a history of falls and fear of falling forward has been suggested as one of the reasons why older adults lean forward less and rise more vertically maintaining the center of gravity backwards in relation to the base of support (Mourey, Grishin, d'Athis, Pozzo, & Stapley, 2000; Scarborough, Mc Gibbon, & Krebs, 2007).

The increased use of the feet backwards strategy by DG participants in trials without the table but not with the table in front is a novel finding of this study. This difference cannot be adequately explained by a practice effect leading to less use of the feet backwards strategy in subsequent trials with the table in front, since a similar practice effect was not observed in N-DG participants. A possible explanation might be that people living with dementia were more confident and less afraid of falling with the table in front; therefore, they leaned forward more and used the feet backwards strategy less frequently. It has been shown that even young adults when provided with a bar in front when standing up, generated much higher horizontal momentum than when standing up with an empty space in front (Pai & Lee, 1994). It is also possible that presence of the table provided a visual reference point and compensated for spatial orientation and motion processing problems (Kavcic, Vaughn, & Duffy, 2011), decreased depth and contrast perception (Valenti, 2010), and balance problems, common in people living with dementia (Suttanon et al., 2012; Taylor, Delbaere, Lord, Mikolaizak, & Close, 2013).

DG participants pushed through the armrests significantly more often than N-DG participants in all trials despite being able to stand up without using the arms. Pushing through the armrests makes standing up easier by decreasing demands on lower limb extensors when rising more vertically (less leaning forward) but it helps to achieve better stability when rising more horizontally (Schultz et al., 1992). STS performance has been shown to depend on balance, in addition to speed, psychological status, strength (Lord, Murray, Chapman, Munro, & Tiedemann, 2002), and visual feedback (Mourey, Grishin, d'Athis, Pozzo, & Stapley, 2000). Although strength, balance, sensory, and psychological issues were not specifically tested in this study, DG participants walked slower and had lower scores on balance items of DEMMI than N-DG participants. Therefore, it is possible that DG participants experienced less stability during standing up.

Sliding forward or scooting has been self-reported as commonly used by older women living in the community (Bohannon & Corrigan, 2003). However, this was the least used strategy (four out of 120 trials) in the current study and was used only by one DG participant. In clinical practice, the sliding forward strategy is often used when retraining STS from a deep surface that is too low or too high for a person, from a bed or chair when there is no space to move feet backwards and/or when a person has performance difficulties and needs to use this strategy to complete the STS task.

Inspection of individual physical status on the DEMMI suggested that the DG participant who used the sliding forward strategy had the lowest functional level. It is possible that this strategy was used to overcome this performance limitation, particularly as repetition fatigue may have occurred. Additionally, it is also possible that the use of a standard chair in the current study did not provide sufficient STS challenge for the functional level of this group of participants to necessitate more frequent use of the sliding forward strategy (Mazza et al., 2004).

The STS task is frequently performed from a standard chair. Therefore, it is reasonable to expect that the task should be automatic, and be performed consistently across all trials, if the same chair was used. However, it was expected that some level of variability in task performance might occur so three trials were conducted for both conditions (STS without and with the table in front). The starting position of the trunk, hips, hands, and feet was quite consistent across both groups for all trials. However, participants were less consistent in the type, number, and sequence of the strategies, although there were no significant differences within or between the groups when the consistency levels were compared.

There are a number of limitations in the current study. The small convenience sample limits the generalizability of the findings. DG participants were recruited from hospital inpatients and therefore were likely to have experienced recent functional decline (Pedone et al., 2005) which may have influenced their STS performance. N-DG participants were more explicitly aware of being tested, and therefore potentially over performed and pushed through the armrests less. The same chair was used for all participants; regardless of their height and weight and this could have had an effect on performance. The order of testing was not randomized and STS trials without the table in front were performed first. This could have resulted in fatigue or practice effects on performance for trials with the table in front. We were also unable to rule out past exposure to STS retraining. Finally, STS performances were assessed visually from digital recordings and although using visual analysis of movement is a reliable assessment method in physiotherapy practice (Kuys, Brauer, Ada, & Russell, 2008; Pomeroy, Pramanik, Sykes, Richards, & Hill, 2003), it does not allow for more precise spatial and temporal data to be extracted.

5. Conclusions

People living with dementia were found to use more strategies to stand up, particularly pushing through the armrests and were more likely to move their feet backwards when there was no table in front of them. Such findings highlight the need for chairs provided for this population to have armrests and an open space to allow movement of the feet backwards. It also appears that there are benefits to providing a table or other reference point to improve confidence and independence with STS for people living with dementia. However, further investigation is required to confirm this.

Conflict of interest statement

None.

Acknowledgments

Ethical clearance was obtained for this study from the Metro South and Griffith University Human Research Ethics Committees. The study was supported by Queensland Health—Health Practitioner Research Scheme Grant (AH0071, HPRGS2010).

References

Akram, S. B., & McIlroy, W. E. (2011). Challenging horizontal movement of the body during sit-to-stand: Impact on stability in the young and elderly. *Journal of Motor Behavior, 43*(2), 147–153.

Alexander, N. B., Gross, M. M., Medell, J. L., & Hofmeyer, M. R. (2001). Effects of functional ability and training on chair-rise biomechanics in older adults. *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 56*(9), M538–M547.

Alexander, N. B., Koester, D. J., & Grunawalt, J. A. (1996). Chair design affects how older adults rise from a chair. *Journal of American Geriatric Society, 44*(4), 356–362.

Barreca, S., Sigouin, C. S., Lambert, C., & Ansley, B. (2004). Effects of extra training on the ability of stroke survivors to perform an independent sit-to-stand: a randomized controlled trial. *Journal of Geriatric Physical Therapy, 27*(2), 39–70.

Bohannon, R. W. (2012). Measurement of sit-to-stand among older adults. *Topics in Geriatric Rehabilitation, 28*(1), 11–16.

Bohannon, R. W., & Corrigan, D. L. (2003). Strategies community dwelling elderly women employ to ease the task of standing up from household surfaces. *Topics in Geriatric Rehabilitation, 19*(2), 137–144.

Britton, E., Harris, N., & Turton, A. (2008). An exploratory randomized controlled trial of assisted practice for improving sit-to-stand in stroke patients in the hospital setting. *Clinical Rehabilitation, 22*(5), 458–468.

Brodin, E., Ljungman, S., & Sunnerhagen, K. S. (2008). Rising from a chair: A simple screening test for physical function in predialysis patients. *Scandinavian Journal of Urology and Nephrology, 42*(3), 293–300.

Carr, J., & Shepherd, R. B. (1998). Neurological Rehabilitation. Optimizing Motor Performance. Oxford: Butterworth-Heinemann.

Davenport, S. J., & de Morton, N. A. (2011). Clinimetric properties of the de Morton Mobility Index in healthy, community-dwelling older adults. *Archives of Physical Medicine and Rehabilitation, 92*(1), 51–58.

de Morton, N. A., Davidson, M., & Keating, J. L. (2008). The de Morton Mobility Index (DEMMI): An essential health index for an ageing world. *Health and Quality of Life Outcomes, 6*, 63.

de Morton, N. A., Davidson, M., & Keating, J. L. (2010). Reliability of the de Morton mobility index (DEMMI) in an older acute medical population. *Physiotherapy Research International, 16*(3), 159–169.

Demura, S., & Yamada, T. (2007). Height of chair seat and movement characteristics in sit-to-stand by young and elderly adults. *Perceptual & Motor Skills, 104*(1), 21–31.

Digby, R., Moss, C., & Bloomer, M. (2012). Transferring from an acute hospital and settling into a subacute facility: The experience of patients with dementia. *International Journal of Older People Nursing, 7*(1), 57–64.

Ellis, A. A., & Trent, R. B. (2001). Do the risks and consequences of hospitalized fall injuries among older adults in California vary by type of fall? *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 56*(11), M686–M692.

Etnyre, B., & Thomas, D. Q. (2007). Event standardization of sit-to-stand movements. *Physical Therapy, 87*(12), 1651–1666.

Finlay, O. E., Bayles, T. B., Rosen, C., & Milling, J. (1983). Effects of chair design, age and cognitive status on mobility. *Age Ageing, 12*(4), 329–335.

Fisher, S. R., Ottenbacher, K. J., Goodwin, J. S., & Ostir, G. V. (2009). Chair rise ability and length of stay in hospitalized older adults. *Journal of American Geriatric Society, 57*(10), 1938–1940.

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). Mini-mental state. A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research, 12*(3), 189–198.

Graf, C. (2006). Functional decline in hospitalized older adults. *American Journal of Nursing, 106*(1), 58–67. (quiz 67–58).

Hughes, M. A., Myers, B. S., & Schenkman, M. L. (1996). The role of strength in rising from a chair in the functionally impaired elderly. *Journal of Biomechanics, 29*(12), 1509–1513.

Hughes, M.A., Weiner, D.K., Schenkman, M. L., Long, R. M., & Studenski, S. A. (1994). Chair rise strategies in the elderly. *Clinical Biomechanics (Bristol, Avon), 9*(3), 187–192.

Janssen, W., Bussmann, H., & Stam, H. (2002). Determinants of the sit-to-stand movement: A review. *Physical Therapy, 82*(9), 866–879.

Joray, S., Herrmann, F., Mulligan, R., & Schnider, A. (2004). Mechanism of disorientation in Alzheimer's disease. *European Neurolodgy, 52*(4), 193–197.

Kavcic, V., Vaughn, W., & Duffy, C. J. (2011). Distinct visual motion processing impairments in aging and Alzheimer's disease. *Vision Research, 51*(3), 386–395.

Kawagoe, S., Tajima, N., & Chosa, E. (2000). Biomechanical analysis of effects of foot placement with varying chair height on the motion of standing up. *Journal of Orthopaedic Science, 5*(2), 124–133.

Khemlani, M. M., Carr, J. H., & Crosbie, W. J. (1999). Muscle synergies and joint linkages in sit-to-stand under two initial foot positions. *Clinical Biomechanics (Bristol, Avon), 14*(4), 236–246.

Kuys, S. S., Brauer, S. G., Ada, L., & Russell, T. G. (2008). Immediate effect of treadmill walking practice versus overground walking practice on overground walking pattern in ambulatory stroke patients: An experimental study. *Clinical Rehabilitation, 22*(10-11), 931–939.

Lord, S. R., Murray, S. M., Chapman, K., Munro, B., & Tiedemann, A. (2002). Sit-to-stand performance depends on sensation, speed, balance, and psychological status in addition to strength in older people. *Journals of Gerontology. Series A, Biological Sciences & Medical Sciences, 57*(8), M539–M543.

Manckoundia, P., Mourey, F., Pfitzenmeyer, P., & Papaxanthis, C. (2006). Comparison of motor strategies in sit-to-stand and back-to-sit motions between healthy and Alzheimer's disease elderly subjects. *Neuroscience, 137*(2), 385–392.

Mazza, C., Benvenuti, F., Bimbi, C., & Stanhope, S. J. (2004). Association between subject functional status, seat height, and movement strategy in sit-to-stand performance. *Journal of American Geriatric Society, 52*(10), 1750–1754.

Molloy, D. W., Alemayehu, E., & Roberts, R. (1991). Reliability of a standardized mini-mental state examination compared with the traditional mini-mental state examination. *American Journal of Psychiatry, 148*(1), 102–105.

Mourey, F., Grishin, A., d'Athis, P., Pozzo, T., & Stapley, P. (2000). Standing up from a chair as a dynamic equilibrium task: A comparison between young and elderly subjects. *The Journals of Gerontology. Series A, Biological Sciences & Medical Sciences, 55*(9), B425–B431.

Nuzik, S., Lamb, R., VanSant, A., & Hirt, S. (1986). Sit-to-stand movement pattern. *Physical Therapy, 66*(11), 1708–1713.

O'Bryant, S. E., Humphreys, J. D., Smith, G. E., Ivnik, R. J., Graff-Radford, N. R., Petersen, R. C., et al. (2008). Detecting dementia with the mini-mental state examination in highly educated individuals. *Archives of Neurology, 65*(7), 963–967.

Pai, Y. C., & Lee, W. A. (1994). Effect of a terminal constraint on control of balance during sit-to-stand. *Journal of Motor Behaviour, 26*(3), 247–256.

Pedone, C., Ercolani, S., Catani, M., Maggio, D., Ruggiero, C., Quartesan, R., et al. (2005). Elderly patients with cognitive impairment have a high risk for functional decline during hospitalization: The GIFA study. *Journals of Gerontology. Series A, Biolological Sciences and Med Sciences, 60*(12), 1576–1580.

Perneczky, R., Wagenpfeil, S., Komossa, K., Grimmer, T., Diehl, J., & Kurz, A. (2006). Mapping scores onto stages: Mini-mental state examination and clinical dementia rating. *American Journal of Geriatric Psychiatry, 14*(2), 139–144.

Perry, S. B., Marchetti, G. F., Wagner, S., & Wilton, W. (2006). Predicting caregiver assistance required for sit-to-stand following rehabilitation for acute stroke. *Journal of Neurologic Physical Therapy, 30*(1), 2–11.

Pomeroy, V. M., Pramanik, A., Sykes, L., Richards, J., & Hill, E. (2003). Agreement between physiotherapists on quality of movement rated via videotape. *Clinical Rehabilitation, 17*(3), 264–272.

Rothera, I., Jones, R., Harwood, R., Avery, A., & Waite, J. (2003). Health status and assessed need for a cohort of older people admitted to nursing and residential homes. *Age and Ageing, 32*(3), 303–309.

Sabol, V. K., Resnick, B., Galik, E., Gruber-Baldini, A. L., Morton, P. G., & Hicks, G. E. (2011). Exploring the factors that influence functional performance among nursing home residents. *Journal of Aging and Health, 23*(1), 112–134.

Scarborough, D. M., McGibbon, C. A., & Krebs, D. E. (2007). Chair rise strategies in older adults with functional limitations. *Journal of Rehabilitation Research and Development, 44*(1), 33–42.

Schenkman, M., Berger, R. A., Riley, P. O., Mann, R. W., & Hodge, W. A. (1990). Whole-body movements during rising to standing from sitting. *Physical Therapy, 70*(10), 638–648. (discussion 648-651).

Schenkman, M., Riley, P. O., & Pieper, C. (1996). Sit to stand from progressively lower seat heights—alterations in angular velocity. *Clinical Biomechanics (Bristol, Avon), 11*(3), 153–158.

Schultz, A. B., Alexander, N. B., & Ashton-Miller, J. A. (1992). Biomechanical analyses of rising from a chair. *Journal of Biomechanics, 25*(12), 1383–1391.

Shepherd, R. B., & Gentile, A. M. (1994). Sit-to-stand: Functional relationship between upper body and lower limb segments. *Human Movement Science, 13*, 817–840.

Shepherd, R. B., & Koh, H. P. (1996). Some biomechanical consequences of varying foot placement in sit-to-stand in young women. *Scandinavian Journal of Rehabilitation Medicine, 28*(2), 79–88.

Suttanon, P., Hill, K. D., Said, C. M., Logiudice, D., Lautenschlager, N. T., & Dodd, K. J. (2012). Balance and mobility dysfunction and falls risk in older people with mild to moderate Alzheimer disease. *American Journal of Physical Medicine and Rehabilitation, 91*(1), 12–23.

Tappen, R. M., Roach, K. E., Buchner, D., Barry, C., & Edelstein, J. (1997). Reliability of physical performance measures in nursing home residents with Alzheimer's disease. *Journals of Gerontology. Series A, Biological Sciences & Medical Sciences, 52A*(1), M52–M55.

Taylor, M. E., Delbaere, K., Lord, S. R., Mikolaizak, A. S., & Close, J. C. (2013). Physical impairments in cognitively impaired older people: Implications for risk of falls. *International Psychogeriatrics, 25*(1), 148–156.

Tilson, J. K., Sullivan, K. J., Cen, S. Y., Rose, D. K., Koradia, C. H., Azen, S. P., et al. (2010). Meaningful gait speed improvement during the first 60 days poststroke: Minimal clinically important difference. *Physical Therapy, 90*(2), 196–208.

Turcot, K., Armand, S., Fritschy, D., Hoffmeyer, P., & Suva, D. (2012). Sit-to-stand alterations in advanced knee osteoarthritis. *Gait and Posture, 36*(1), 68–72.

Valenti, D. A. (2010). Alzheimer's disease: Visual system review. *Optometry, 81*(1), 12–21.

Vincent, H. K., Vincent, K. R., & Lamb, K. M. (2010). Obesity and mobility disability in the older adult. *Obesity Reviews, 11*(8), 568–579.

Wangblad, C., Ekblad, M., Wijk, H., & Ivanoff, S. D. (2009). Experiences of physical strain during person transfer situations in dementia care units. *Scandinavian Journal of Caring Sciences, 23*(4), 644–650.

Yamada, T., & Demura, S. (2009). Relationships between ground reaction force parameters during a sit-to-stand movement and physical activity and falling risk of the elderly and a comparison of the movement characteristics between the young and the elderly. *Archives of Gerontology & Geriatrics, 48*(1), 73–77.

Zuidema, S. U., Derksen, E., Verhey, F. R., & Koopmans, R. T. (2007). Prevalence of neuropsychiatric symptoms in a large sample of Dutch nursing home patients with dementia. *International Journal of Geriatriatric Psychiatry, 22*(7), 632–638.

Appendix 2 Ethical clearance

Metro South
Human Research Ethics Committee

Enquiries to:	Ethics Secretariat
Phone:	(07) 3176 7672
Fax:	(07) 3176 7667
E-mail	PAH_Ethics_Research@health.qld.gov.au
Date	17th April 2010

Mrs Urszula Dolecka
Physiotherapy Department
Ipswich Road
Woolloongabba
4102

APPROVAL LETTER – PRINCESS ALEXANDRA HOSPTIAL

Dear Mrs Dolecka

HREC Reference number: HREC/10/QPAH/48

Project title: The use of spaced retrieval, errorless learning and vanishing cues in retraining sit to stand in patients with dementia during hospitalisation

This study has been executively approved by a sub-committee of the Metro South Health Service District Human Research Ethics Committee on 24th March 2010 The Committee is duly constituted, operates in accordance and complies with the current National Health and Medical Research Council's *National Statement on Ethical Conduct in Human Research 2007.*

On the recommendation of the Human Research Ethics Committee approval is granted for your project to proceed. This approval is subject to researcher(s) compliance throughout the duration of the research with certain requirements as outlined in the *National Statement on Ethical Conduct in Human Research 2007* and *Australian Code for the Responsible Conduct of Research.*

The following links have been provided for your convenience:
http://www.nhmrc.gov.au/publications/synopses/e72syn.htm
http://www.nhmrc.gov.au/publications/synopses/r39syn.htm

Some requirements are briefly outlined below. Please ensure that you communicate with the HREC on the following:

- ***Protocol Changes:*** Substantial changes made to the protocol require HREC approval.
- ***Lapsed Approval***: If the study has not commenced within twelve months approval will lapse requiring resubmission of the study to the HREC.
- ***Annual Reviews:*** All studies are required by the NHMRC to be reviewed annually. To assist with reporting obligations an Annual Report template is available on the MSHSD HREC website. This form is required to be completed and returned to the HREC within the 12 month reviewing period.

As this research involves the recruitment of patients from the Metro South Health Service District (MSHSD), it is my responsibility to remind you of your ongoing duty of care for all people recruited into projects or clinical trials whilst public patients. All conditions and requirements regarding confidentiality of public information and patient privacy apply. You are required to comply at all times with any application requirements of Australian and Queensland Laws including the Health Services Act, the Privacy Act,

alth • care • people

Queensland Government

Public Health Act (2005) and other relevant legislation, ethics obligations and guidelines which may be applicable to the MSHSD from time to time including, without limitation, any requirement in respect of the maintenance, preservation or destruction of patient records.

When the study involves patient contact, it is your responsibility as the principal investigator to notify the relevant consultant and request their approval.

Should you have any problems, please liaise directly with the Chair of the HREC early in the program.

A copy of this letter should be presented when required as official confirmation of the approval of the Metro South Health Service District Human Research Ethics Committee.

We wish you every success in undertaking this research.

Yours sincerely,

David Theile

Dr David Theile Snr
DISTRICT CHIEF EXECUTIVE OFFICER
METRO SOUTH

6 / 5 / 10

Office
Centres for Health Research
Princess Alexandra Hospital
Metro South Health Service District

Postal
Ipswich Road
Woolloongabba Q 4102

Phone
61 7 3176 7672

Fax
61 7 3176 7667

>>> Ethics Research PAH 2/13/2012 12:06 pm >>>
Dear Mrs Dolecka,

RE: HREC/10/QPAH/048 - *The use of spaced retrieval, errorless learning and vanishing cues in retraining sit to stand in patients with dementia during hospitalisation*

On the 24 January 2012 the Chair of the Metro South Health Service District Human Research Ethics Committee reviewed and approved the following:-

* Protocol version 3, dated 12.12.2011
* Summary of Changes to protocol, dated 12.12.2011
* Rationale for the amendment, dated 12.12.2011
* PICF, version 2, dated 12.12.2011
* PICF (Substitute Decision Maker), version 3, dated 12.12.2011
* Monitoring Report, dated 02.11.2011
* Replacement of Associate Investigator (A/Prof Jenny Fleming) with - Dr Tamara Ownsworth

The signed Approval is in the mail

Kind regards
Vanessa

Metro South Health Service District
Human Research Ethics Committee (EC00167) - **NHMRC** Certified for Single Ethical Review
Centres for Health Research
Princess Alexandra Hospital

Ph: (07) 3176 7672 or 3176 5856
Fax: (07) 3176 7667

Email: PAH_Ethics_Research@health.qld.gov.au
Website: http://www.health.qld.gov.au/pahospital/research/default.asp

When completing your QLD NEAF online Form, please remember to upload all documents with the correct name, version and date for the document type. Ethics submissions without uploaded documents might be regarded as an invalid/incomplete application.

GRIFFITH UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE

05-Jul-2012

Dear Mrs Dolecka

I write further to the additional information provided in relation to the conditional approval granted to your application for ethical clearance for your project "PR: Spaced retrieval, errorless learning and vanishing cues in retraining sit to stand in patients with dementia during hospitalisation" (GU Ref No: PES/35/11/HREC).

This is to confirm receipt of the remaining required information, assurances or amendments to this protocol.

Consequently, I reconfirm my earlier advice that you are authorised to immediately commence this research on this basis.

The standard conditions of approval attached to our previous correspondence about this protocol continue to apply.

Regards

Dr Gary Allen
Manager, Research Ethics
Office for Research
N54 room 0.10 Nathan Campus
Griffith University
ph: 3735 5585
fax: 07 373 57994
email: g.allen@griffith.edu.au
web:

Cc:

At this time all researchers are reminded that the Griffith University Code for the Responsible Conduct of Research provides guidance to researchers in areas such as conflict of interest, authorship, storage of data, & the training of research students.
You can find further information, resources and a link to the University's Code by visiting
http://www62.gu.edu.au/policylibrary.nsf/xupdatemonth/e7852d226231d2b44a25750c0062f457?opendocument

GRIFFITH UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE

28-Jun-2012

Dear Mrs Dolecka

I write further to your application for ethical clearance for your project PR: Spaced retrieval, errorless learning and vanishing cues in retraining sit to stand in patients with dementia during hospitalisation" (GU Ref No: PES/35/11/HREC). This project has been considered by Human expedited review 1.

The Chair resolved to grant this project conditional ethical clearance, subject to you resolving the following matters:

As per the expectations articulated in the National Statement on Ethical Conduct in Human Research (2007) and Booklet 8 of the Griffith University Research Ethics Manual, because of the prior review by another HREC, this research has been subject to a special administrative review.

Please note that this research should have been submitted via the shorter prior review form.

The use of an alternative contact point for concerns or complaints about the ethical conduct of this research is accepted. Please provide an assurance that the Manager, Research Ethics will be promptly notified if any concerns or complaints are received about the ethical conduct of this research.

The contact person signing the s17 declaration (available from the forms page of the Griffith University Human Research Ethics web site or upon request from the Office for Research).

Please arrange for an appropriate authorising officer, who is not a member of the research team, to complete and sign the s18 declaration (available from the forms page of the Griffith University Human Research Ethics web site or upon request from the Office for Research).

This decision was made on 28-Jun-12. Your response to these matters will be considered by Office for Research.

The ethical clearance for this protocol runs from 28-Jun-12 to 15-Apr-15.

Please forward your response to Dr Gary Allen, Manager, Research Ethics, Office for Research, as per the details below.

Please refer to the attached sheet for the standard conditions of ethical clearance
at Griffith University, as well as responses to questions commonly posed by researchers.

It would be appreciated if you could give your urgent attention to the issues raised
by the Committee so that we can finalise the ethical clearance for your protocol promptly.

Regards

Dr Gary Allen
Manager, Research Ethics
Office for Research
N54 room 0.10 Nathan Campus
Griffith University
ph: 3735 5585
fax: 07 373 57994
email: g.allen@griffith.edu.au
web:

Cc:

At this time all researchers are reminded that the Griffith University Code for the Responsible Conduct of Research provides guidance to researchers in areas such as conflict of interest, authorship, storage of data, & the training of research students.
You can find further information, resources and a link to the University's Code by visiting
http://www62.gu.edu.au/policylibrary.nsf/xupdatemonth/e7852d226231d2b44a25750c0062f457?opendocument

Masonic Care Queensland

GRIFFITH UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE

16-Jul-2013

Dear Mrs Dolecka

I write further to the additional information provided in relation to the conditional approval granted to your application for ethical clearance for your project "PR: Spaced retrieval, errorless learning and vanishing cues in retraining of sit to stand in dementia" (GU Ref No: PES/30/13/HREC).

This is to confirm receipt of the remaining required information, assurances or amendments to this protocol.

Consequently, I reconfirm my earlier advice that you are authorised to immediately commence this research on this basis.

The standard conditions of approval attached to our previous correspondence about this protocol continue to apply.

Regards

Dr Kristie Westerlaken
Policy Officer
Office for Research
Bray Centre, Nathan Campus
Griffith University
ph: +61 (0)7 373 58043
fax: +61 (07) 373 57994
email: k.westerlaken@griffith.edu.au
web:

Cc:

Researchers are reminded that the Griffith University Code for the Responsible Conduct of Research provides guidance to researchers in areas such as conflict of interest, authorship, storage of data, & the training of research students.
You can find further information, resources and a link to the University's Code by visiting
http://policies.griffith.edu.au/pdf/Code%20for%20the%20Responsible%20Conduct%20of%20Research.pdf

Appendix 3 Participant information and consent forms

PARTICIPANT INFORMATION AND CONSENT FORM

Princess Alexandra Hospital

Information and Consent Form
Version 2 **Dated** 12.12.2011
Site Princess Alexandra Hospital

Full Project Title: The use of spaced retrieval, errorless learning and vanishing cues in retraining sit to stand in patients with dementia during hospitalisation.

Principal Researcher:
Mrs Urszula Dolecka – Senior Physiotherapist Acute Aged Care and Cancer Services, IMU, PAH

Associate Researcher(s):
Mrs Cecile Prescott – Senior Occupational Therapist, Acute Care, PAH; Dr Suzanne Kuys, Principal Research Fellow, The Prince Charles Hospital/ Griffith University; Dr Tamara Ownsworth, School of Applied Psychology, Griffith University, Mt Gravatt Campus

1. Introduction

You are eligible for this research project because you are living in the community, are at least 65 years old and do not have cognitive problems such as dementia. This is an initial part of a larger project that is aiming to find out whether a specific memory training method can help the people with dementia with learning how to stand up more efficiently.

The Consent Form explains the project and procedure involved. Researchers will explain the project to you but its up to you whether you participate or not. Knowing what is involved will help you to make a decision.

Please read this information carefully. Ask questions about anything that you don't understand or want to know more about. Before deciding whether or not to agree to participate, you might want to talk about it with other healthcare workers, colleagues, family or friends.

Participation in this research is based on your consent and it is voluntary. If you don't wish to agree for participation, you don't have to.

If you decide to agree for participation, you will be asked to sign the consent section. By signing it you are telling us that you:

- Understand what you have read;
- Consent to take part in the research project;
- Consent to take part in the research processes that are described;
- Consent to the use of your personal and health information as described.

You will be given a copy of this Consent Form to keep.

2. What is the purpose of this research project?

The research project is aiming to find out whether a specific memory training method can help people with dementia learn how to stand up more efficiently, intending to improve independence and decrease amount of physical assistance that has to be provided.

In older people, physical abilities decrease with age but they still try to stand up from the chair the way they used to. There is a more energy efficient method of standing up that requires a sequence of the movements to occur: sliding forward to the edge of the chair, placing feet backwards to the knee line, leaning forward and pushing up simultaneously from the armrests. This is the way therapists teach weak or elderly people to stand up. However, people with dementia are commonly believed to have no ability to learn new information or new skills therefore are at risk of not being given an opportunity to practice and improve.

The project consists of three parts. The part you are invited to participate in is the first and the aim of this part of the project is to determine if there is any difference in how people with dementia and those without dementia stand up. Approximately 20 people with dementia and 20 people from community will participate in the project. The second and third part will involve people with dementia (5 in each part). The aims of the second and third part are to develop training protocol and then to use that protocol to find out whether it helps people with dementia to learn how to stand up more efficiently.

This research has been initiated by Mrs Urszula Dolecka and being conducted in conjunction with Mrs Cecile Prescott, Dr Suzanne Kuys, Dr Tamara Ownsworth

3. What does participation in this research project involve?

Only people who meet the selection criteria and who have provided written consent will participate in the project. Basic information will be collected from you, such as your age, general health, and functional level. Also a short (10- 15 min) questionnaire, called Mini-Mental State Examination will be used to measure your cognitive abilities (like memory, ability to follow instructions, general orientation).

You will be asked to stand up six times from a standard chair (3 with and 3 without a table in the front) with armrests to the command "please stand up". You will be recorded digitally using a video camera. You will not be paid for participation in this research.

4. **What are the possible benefits?**

There are potential benefits from participating in this phase of the project.

Your performance of the sit to stand task will be assessed by a qualified Physiotherapist and if any difficulties are noted, a short re-training session in this fundamental task will be provided. You will also have the task explained and a written handout for sit to stand task retraining will be provided for future reference.

5. What are the possible risks?

We do not foresee any possible risks to you in this research project, above that of performing a usual fundamental task of daily living.

6. Can participant have other treatments during this research project?

Yes, you can have any or all other treatments as prescribed by your doctor.

7. Does the participant have to take part in this research project?

Participation in the study is on a purely voluntary basis. You may withdraw your consent for the study at any point without penalty. If you do wish to withdraw, this will not influence your current or future relationship with the Princess Alexandra Hospital.

We encourage you to ask questions at any time during the study. Please feel free to contact any of the investigators during the study if you have any questions.

8. What if I withdraw from this research project?

If you decide to withdraw, please notify a member of the research team before you withdraw. If you decide that you would like to leave the project, the researchers would like to keep any information that has been collected. This is to help them make sure that the results of the research can be measured properly. If you do not want them to do this, you must tell them.

9. How will I be informed of the results of this research project?

You will be able to access your information regarding to this study at any time.

10. What else do I need to know?

- **What will happen to information about participant?**

Involvement in the present study will be strictly confidential. Only you and the investigators will have access to the results. However, according to requirements related to human research, the records may be reviewed by regulatory bodies, Human Research Ethics Committee or their delegates. The videorecorded materials will be viewed by independent assessors who are Queensland Health employees and subject to the same confidentiality as researchers. Your identity will be "masked". Individual participant data will be kept in a locked filing cabinet in the office of the principal investigator–Urszula Dolecka. In addition, data will be coded on the computer, so that the identity of each subject remains confidential.

The records relating to participation will be kept for approximately 7 years. Participant's personal information will not be divulged to any third party.

In any publication and/or presentation, information will be provided in such a way that you cannot be identified, except with your permission. The videorecorded materials will not be used in conference presentations unless separate written consent is given.

- **How can I access information?**

In accordance with relevant Australian privacy laws, you have the right to access the information collected and stored by the researchers about participant. You also have the right to request that any information, with which you disagree, be corrected. Please contact one of the researchers named at the end of this document if you would like to access any information.

- **What happens if I am injured as a result of participating in this research project?**

If participant suffers an injury as a result of participating in this research project, care and treatment will be provided by the public health service at no extra cost to participant or you if you elect to be treated as a public patient

- **Is this research project approved?**

The ethical aspects of this research project have been approved by the Human Research Ethics Committee of Princess Alexandra Hospital.

This project will be carried out according to the *National Statement on Ethical Conduct in Human Research* (2007) produced by the National Health and Medical Research Council of Australia. This statement has been developed to protect the interests of people who agree to participate in human research studies.

11. Who can I contact?

Who you may need to contact will depend on the nature of your query, therefore, please note the following:

If you want any further information concerning this project or if participant has any medical problems which may be related to his/her involvement in the project (for example, any side effects), you can contact the principal researcher, Urszula Dolecka, on 3176 2111, pager 5040 (office hours) or 0402 062 142 (at all times).

For complaints:

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about being a research participant in general, then you may contact:

Ethics Manager, Princess Alexandra Hospital Human Research Ethics Committee

Telephone: (07) 3240 5856

You will need to tell the Ethics Manager the name of the principal researcher~~s~~ given in section 11 above.

CONSENT FORM

Consent Form
Version 2 **Dated** 12.12.2011
Site Princess Alexandra Hospital

Full Project Title: The use of spaced retrieval, errorless learning and vanishing cues in retraining sit to stand in patients with dementia during hospitalisation

Principal Researcher:
Mrs Urszula Dolecka – Senior Physiotherapist Acute Aged Care and Cancer Services, IMU, PAH
Associate Researcher(s):
Mrs Cecile Prescott – Senior Occupational Therapist, Acute Care, PAH; Dr Suzanne Kuys, Principal Research Fellow, The Prince Charles Hospital/ Griffith University; Dr Tamara Ownsworth, School of Applied Psychology, Griffith University, Mt Gravatt Campus

I have read, or have had read to me in a language that I understand, the Participant Information Version, dated 19 April 2011 and I understand the purposes, procedures and risks of this research project as described within it.

I acknowledge that the researchers would like to enrol me in the research project named above, according to the conditions in the Participant Information.

I will be given a copy of the Participant Information and Consent Form to keep. The researcher has agreed not to reveal my identity and personal details if information about this project is published or presented in any public form.

Participant's Name (printed): ____

Signature: ____Date: ___/___/___

Witness to Signature (printed): ____

Signature: _______________________________________ Date: ___/___/___

Declaration by researcher*: I have given a verbal explanation of the research project, its procedures and risks and I believe that the person named above as the Third Party has understood that explanation.

Researcher's Name (printed): ____

Signature: ______________________________________ Date: ___/___/___

* A senior member of the research team must provide the explanation and provision of information concerning the research project.

Note: All parties signing the Consent Form must date their own signature.

REVOCATION OF CONSENT FORM

(To be used to withdraw from the project.)

(Attach the Participant Information and Consent Form)

Revocation of Consent Form

Full Project Title:

The use of spaced retrieval, errorless learning and vanishing cues in retraining sit to stand in patients with dementia during hospitalisation

I hereby wish to WITHDRAW my consent for participation in the research proposal described above and understand that such withdrawal WILL NOT jeopardize any treatment or my relationship with Princess Alexandra Hospital.

Participant's Name (printed): ____

Signature: ________________________________ Date: _____ /______/______

SUBSTITUTE DECISION MAKER
INFORMATION AND CONSENT FORM

Princess Alexandra Hospital

Substitute Decision Maker Information and Consent Form
Version 3 Dated 15.12.2011
Site Princess Alexandra Hospital

Full Project Title: The use of spaced retrieval, errorless learning and vanishing cues in retraining sit to stand in patients with dementia during hospitalisation.

Principal Researcher:
Mrs Urszula Dolecka – Senior Physiotherapist Acute Aged Care and Cancer Services, IMU, PAH
Associate Researcher(s):
Mrs Cecile Prescott – Senior Occupational Therapist, Acute Care, PAH; Dr Suzanne Kuys, Principal Research Fellow, The Prince Charles Hospital/ Griffith University; Dr Tamara Ownsworth, School of Applied Psychology, Griffith University, Mt Gravatt Campus

1. Introduction

A patient becomes eligible for this research project because he/she has been admitted to the Internal Medicine Unit, is 65 years old or older, has a diagnosis of dementia and requires assistance with standing up from a chair. The research project is aiming to find out whether people with dementia stand up any differently from those without dementia, whether a specific memory training method can help the participant with learning how to stand up more efficiently, and how the task of standing up can be accurately measured in people with dementia. The use of the memory retraining method used in this study is intending to improve independence and decrease amount of physical assistance that has to be provided.

This Substitute Decision Maker Information and Consent Form explain the project and procedure involved. Researchers will try to explain the project and it’s every step to participants but you are asked for making this decision on behalf of the participant as there is a possibility that he/she may not be able to fully understand the project aims and procedures due to primary diagnosis of dementia that affects understanding and memory. Knowing what is involved will help you to make a decision.

Please read this information carefully. Ask questions about anything that you don’t understand or want to know more about. Before deciding whether or not to agree for participation, you might want to talk about it with other healthcare workers, colleagues, family or friends.

Participation in this research is based on your consent and it is voluntary. If you don’t wish to agree for participation, you don’t have to. The patient will receive the best possible care whether you agree or not.

If you decide to agree for participation, you will be asked to sign the consent section. By signing it you are telling us that you:

- o Understand what you have read;
- o Consent on behalf of the participant to take part in the research project;
- o Consent on behalf of the participant to take part in the research processes that are described;
- o Consent to the use of participant's personal and health information as described.

You will be given a copy of this Substitute Decision Maher Information and Consent Form to keep.

2. What is the purpose of this research project?

The research project is aiming to find out whether a specific memory training method can help the participant with learning how to stand up more efficiently, intending to improve independence and decrease amount of physical assistance that has to be provided.

In older people, physical abilities decrease with age but they still try to stand up from the chair the way they used to. There is a more energy efficient method of standing up that requires a sequence of the movements to occur: sliding forward to the edge of the chair, placing feet backwards to the knee line, leaning forward and pushing up simultaneously from the armrests. This is the way therapists teach sick or elderly people to stand up. However, people with dementia are commonly believed to have no ability to learn new information or new skills therefore are at risk of not being given an opportunity to practice and improve.

The aims of the project are:

- To determine if there is any difference in how elderly people with and without dementia stand up. Approximately 20 people with dementia and 20 people from community will participate in the project.
- To determine if it possible to apply a special method of teaching and learning, called "spaced retrieval" that allows using a type of memory that is still preserved in dementia. Approximately 5 people will participate in this phase of the project.

This research has been initiated by Mrs Urszula Dolecka and being conducted in conjunction with Mrs Cecile Prescott, Dr Suzanne Kuys, Dr Tamara Ownsworth

3. What does participation in this research project involve?

Only patients who meet selection criteria and who have consent from Substitute Decision Makers will participate in the project. Information will be collected from participant's medical chart such as age, general health, diagnosis, reason for admission and potential discharge destination.

There are three phases to this research project. The first phase aims to determine if there is any difference in how people with dementia and those without dementia stand up. Approximately 20 people with dementia and 20 people from community will participate in this phase of the project. The second and third part will involve people with dementia (5 in each part). The aims of the second phase is to develop training protocol and third phase to use that protocol to find out whether it helps people with dementia to learn how to stand up more effectively. In all phases of the project participants will be recorded on a digital video camera. What is required of participants depends on which phase of the project they are recruited to. Below are check boxes outlining what is required for this project. The boxes checked outline the requirements for the person you are consenting for. Those that the participant is not required to do will be crossed out.

- ☐ Phase 1: Participants will be asked to stand up six times (3 with and 3 without a table in the front) from a standard chair with armrests.

- ☐ Phase 2: Participants will be practicing sit to stand tasks following the command "please stand up" with instructions that aim to make standing up easier. Rest times will be provided between trials but they will vary depending on the progress and participant cooperation. Sessions will last from 1 to 2 per day and from 10 to 30 minutes. No more than 12 training sessions are planned.

- ☐ Phase 3: Participants will complete 12 practice sessions (1-2 a day, including over the weekends) involving repeating loudly the following commands: "slide forward", "feet backwards" and "lean forward and push up". At the same time, they will be practicing the task. Sessions are expected to last from 10 to 30 minutes, depending on progress. E.g. a participant who will be learning the task and remembering for longer periods of time will have longer sessions.

  "Sit to stand" task will be repeated after increasing "rest" periods, e.g. 1min, 2 min, 4, min, 8 min, 16 min, 32 min. If participant remembers the task, time will be increased before he/she is asked to repeat the task. On the other hand, if participant is unable to repeat the task independently, the time of rest period will decrease to previous period after which participant was successful.

  During the rest periods participant will be provided with activities or therapy that are different to practiced task. These activities may include a conversation when rest periods are very short and hand coordination exercises or balance practice, when the rest periods are much longer. Diverting attention from the practiced task during increasing rest periods are the main principles of this learning and teaching method called "spaced retrieval''. The learning in this method should be effortless; therefore, some participants who may be able to read, will be given a card with the sequence of standing up written on it, to eliminate effort and mistakes. Every time participant has problems with the task, they will be assisted by a therapist who will provide verbal and physical assistance to ensure that the task is performed without errors to follow principles of "errorless learning". As participant learns and performs task more independently number of prompts (card, verbal commands) will decrease and this is a principle of "vanishing cues".

- ☐ Phase 2 and Phase 3: Participants' functional and cognitive ability may be monitored over several days before, during and after the training sessions. In addition, functional ability will be monitored once a week until discharge. This will form part of the participants' usual physiotherapy. The functional tasks being monitored will include walking, getting in and out of bed and standing up.

All sessions will be conducted in the physiotherapy gym in the Internal Medicine Unit. Participants will not be paid for participation in this research.

4. What are the possible benefits?

There are direct and indirect benefits from the project.

Direct benefits for participant involve learning to perform such a fundamental daily task as standing up in a more efficient and safer way. The learnt ability will improve participant's independence and decrease his/her need for physical assistance. If participant shows positive learning in the project, the same principle can be used to teach participant any task or information in the future, e.g. remembering her/his room number, faces, names as well as how to correctly use a walker or stick, if required. In addition, participant will receive additional therapy during hospital stay and this will add to better physical outcomes on discharge.

Indirect benefits relate to the effects this project can have on increasing awareness that people with dementia can learn new things despite of memory problems, in contrary to common beliefs. This can help to advocate for better access to rehabilitation following acute hospital admissions for all people with dementia.

5. What are the possible risks?

We do not foresee any possible risks to participants in this research project.

6. Can participant have other treatments during this research project?

Yes, participant can have any or all other treatments as prescribed by their medical team.

7. Does the participant have to take part in this research project?

Participation in the study is on a purely voluntary basis. You may withdraw your consent for the study at any point without penalty. If you do wish to withdraw, this will not influence your or participant relationship with the hospital.

We encourage you to ask questions at any time during the study. Please feel free to contact any of the investigators during the study if you have any questions.

8. What if I withdraw participant from this research project?

If you decide to withdraw the participant, please notify a member of the research team before you withdraw. If you decide that participant should leave the project, the researchers would like to keep any information that has been collected. This is to help them make sure that the results of the research can be measured properly. If you do not want them to do this, you must tell them.

9. How will I be informed of the results of this research project?

You will be able to access information related to the participant you consented for and regarding to this study at any time.

10. What else do I need to know?

- **What will happen to information about participant?**

Involvement in the present study will be strictly confidential. Only yourself (on behalf of the participant) and the investigators will have access to the results. However, according to requirements related to human research, the records may be reviewed by regulatory bodies, Human Research Ethics Committee or their delegates. The videorecorded materials will be viewed by independent assessors who are Queensland Health employees and subject to the same confidentiality as researchers. The identity of the participant will be "masked". Individual subject data will be kept in a locked filing cabinet in the office of the principal investigator, Urszula Dolecka.

In addition, data will be coded on the computer, so that the identity of each subject remains confidential.

The records relating to participation will be kept for approximately 7 years. Participant's personal information will not be divulged to any third party.

In any publication and/or presentation, information will be provided in such a way that the participant cannot be identified, except with your permission. The videorecorded materials will not be used in conference presentations unless separate written consent is given.

- **How can I access information?**

In accordance with relevant Australian and/or Queensland privacy and other relevant laws, you have the right to access the information collected and stored by the researchers about participant. You also have the right to request that any information, with which you disagree, be corrected. Please contact one of the researchers named at the end of this document if you would like to access any information.

- **What happens if a participant is injured as a result of participating in this research project?**

If participant suffers an injury as a result of participating in this research project, hospital care and treatment will be provided by the public health service at no extra cost to participant or you if you elect the participant to be treated as a public patient

- **Is this research project approved?**

The ethical aspects of this research project have been approved by the Human Research Ethics Committee of Princess Alexandra Hospital.

This project will be carried out according to the *National Statement on Ethical Conduct in Human Research* (2007) produced by the National Health and Medical Research Council of Australia. This statement has been developed to protect the interests of people who agree to participate in human research studies.

11. Who can I contact?

Who you may need to contact will depend on the nature of your query, therefore, please note the following:

If you want any further information concerning this project or if participant has any medical problems which may be related to his/her involvement in the project (for example, any side effects), you can contact the principal researcher, Urszula Dolecka, on 3176 2111, pager 5040 (office hours) or 0402 062 142 (at all times).

For complaints:

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about being a research participant in general, then you may contact:

Ethics Manager, Princess Alexandra Hospital Human Research Ethics Committee

Telephone: (07) 3240 5856

You will need to tell the Ethics Manager the name of one of the principal researcher~~s~~ given in section 11 above.

SUBSTITUTE DECISION MAKER FORM

(To be used for participants who cannot consent for themselves, as a result of temporary incapacitation.)

(Attach to Substitute Decision Maker Information)

Consent Form
Version 3 **Dated** 12.12.2011
Site Princess Alexandra Hospital

Full Project Title: The use of spaced retrieval, errorless learning and vanishing cues in retraining sit to stand in patients with dementia during hospitalisation

Principal Researcher:
Mrs Urszula Dolecka – Senior Physiotherapist Acute Aged Care and Cancer Services, IMU, PAH
Associate Researcher(s):
Mrs Cecile Prescott – Senior Occupational Therapist, Acute Care, PAH; Dr Suzanne Kuys—Principal Research Fellow, The Prince Charles Hospital/ Griffith University; Dr Tamara Ownsworth, School of Applied Psychology, Griffith University, Mt Gravatt Campus

I have read, or have had read to me in a language that I understand, the Substitute Decision Maker Information version 2 dated 5 May 2011 and I understand the purposes, procedures and risks of this research project as described within it.

I acknowledge that the researchers would like to enrol ___________________________ in the research project named above, according to the conditions in the Participant Information.

I will be given a copy of Substitute Decision Maker Information and Substitute Decision Maker Form to keep.

The researcher has agreed not to reveal _____________________________________'s identity and personal details if information about this project is published or presented in any public form.

Participant's Name (printed): ____

Name of Person providing Substitute Decision (printed): __________________

Relationship to participant: _____________________________

Signature: _____________________________________Date: ___/___/___

Witness to Signature (printed): ______________________________________

Signature: _____________________________________Date: ___/___/___

Declaration by researcher*: I have given a verbal explanation of the research project, its procedures and risks and I believe that the person named above as the Third Party has understood that explanation.

Researcher’s Name (printed): ____

Signature: __________________________________Date: ___/___/___

* A senior member of the research team must provide the explanation and provision of information concerning the research project.

Note: All parties signing the Consent Form must date their own signature.

REVOCATION OF CONSENT FORM

(To be used for Substitute Decision Maker who wishes to withdraw a participant from the project.)

(Attach to Substitute Decision Maker Information and Consent Form)

Revocation of Consent Form

Full Project Title:

The use of spaced retrieval, errorless learning and vanishing cues in retraining sit to stand in patients with dementia during hospitalisation

I hereby wish to WITHDRAW my consent for participation in the research proposal described above and understand that such withdrawal WILL NOT jeopardize any treatment or my or participant relationship with Princess Alexandra Hospital.

Participant's Name (printed): ____

Substitute Decision Maker Name (printed) __________________________________

Signature: ________________________________Date: _____ /______/______

SUBSTITUTE DECISION MAKER
INFORMATION AND CONSENT FORM

Masonic Care Queensland, Central and Southern Region

Substitute Decision Maker Information and Consent Form
Version 4 Dated 30.04.2013
Site Masonic Care Queensland, Central and Southern Region

Full Project Title: The use of spaced retrieval, errorless learning and vanishing cues in retraining sit to stand in patients with dementia during hospitalisation.

Principal Researcher:
Mrs Urszula Dolecka – Senior Physiotherapist Acute Aged Care and Cancer Services, Internal Medicine Unit, Princess Alexandra Hospital
Associate Researcher(s):
Dr Suzanne Kuys, Principal Research Fellow, The Prince Charles Hospital/ Griffith University

A/Prof Tamara Ownsworth, School of Applied Psychology, Griffith University, Mt Gravatt Campus

1. Introduction

A person becomes eligible for this research project because he/she is a resident of a Masonic Care Queensland, Central and Southern Region facility, is 65 years old or older, has a diagnosis of dementia and can stand up from a chair. The research project is aiming to find out whether people with dementia stand up any differently from those without dementia, whether a specific memory training method can help the participant with learning how to stand up more efficiently, and how standing up can be accurately measured in people with dementia. The use of the memory retraining method used in this study is intending to improve independence and decrease amount of physical assistance that has to be provided.

This Substitute Decision Maker Information and Consent Form explain the project and procedure involved. Researchers will explain the project where possible to residents but you are asked to make the decision to participate on behalf of the resident as there is a possibility that he/she may not be able to fully understand the project. Knowing what is involved will help you to make a decision.

Please read this information carefully. Ask questions about anything that you don't understand or want to know more about. Before deciding whether or not to agree for the resident to participate, you might want to talk about it with other healthcare workers, colleagues, family or friends.

Participation in this research is based on your consent and it is voluntary. If you don't wish the resident to participate, you don't have to. The resident will receive the best possible care whether you agree or not.

If you agree for the resident to participate, you will be asked to sign the consent section. By signing it you are telling us that you:

- Understand what you have read;
- Consent on behalf of the resident to take part in the research project;
- Consent on behalf of the resident to take part in the research processes that are described;
- Consent to the use of resident's personal and health information as described.

You will be given a copy of this Substitute Decision Maker Information and Consent Form, including the Revocation of Consent Form, to keep.

2. What is the purpose of this research project?

The research project is aiming to find out whether a specific memory training method can help with learning how to stand up more efficiently, to improve independence and decrease amount of physical assistance that has to be provided.

In older people, physical abilities decrease with age but they still try to stand up from the chair the way they used to. There is a more energy efficient method of standing up that requires a sequence of the movements to occur: sliding forward to the edge of the chair, placing feet backwards to the knee line, leaning forward and pushing up simultaneously from the armrests. This is the way therapists teach frail or elderly people to stand up. However, people with dementia are commonly believed to have no ability to learn new information or new skills therefore are at risk of not being given an opportunity to practice and improve.

The aims of the project are:

- To determine if there is any difference in how elderly people with and without dementia stand up. Approximately 20 people with dementia and 20 people from community will participate in the project.
- To determine if it is possible to apply a specific method of teaching and learning, called "spaced retrieval" that allows using a type of memory that is still preserved in dementia. Up to 20 people will participate in this phase of the project.

This research has been initiated by Mrs Urszula Dolecka and being conducted in conjunction with Dr Suzanne Kuys, A/Prof Tamara Ownsworth

3. What does participation in this research project involve?

Only patients who meet selection criteria and who have consent from Substitute Decision Makers will participate in the project. Information will be collected from participant's medical chart such as age, general health, diagnosis, reason for admission and potential discharge destination.

There are two phases to this research project. The first phase aims to determine if there is any difference in how people with dementia and those without dementia stand up. Approximately 20 people with dementia and 20 people from community will participate in this phase of the project. The second and third part will involve people with dementia. The aims of the second phase is to develop a training protocol and use that protocol to find out whether it helps people with dementia to learn how to stand up more effectively. In all phases of the project participants will be recorded on a digital video camera. What is required of participants depends on which phase of the project they are recruited to. Below are check boxes outlining what is required for this project. The boxes checked outline the requirements for the person you are consenting for. Those that the participant is not required to do will be crossed out.

- ☐ Participants will be asked to stand up six times (3 with and 3 without a table in the front) from a standard chair with armrests.

- ☐ Participants will be practicing sit to stand tasks with instructions that aim to make standing up easier. Rest times will be provided between trials but they will vary depending on the progress and participant cooperation. Participants will complete up to 12 practice session over 6 days, with 1-2 practice sessions per day. Some sessions may occur on the weekend. Each session is expected to last from 10 to 30 minutes, depending on progress.

  During each session, residents will be asked to recall the instructions provided. Every time they remember correctly, a rest period is provided. Rest periods will be slowly increased over the training sessions as the resident's memory is trained. In addition, all the practice undertaken will be accompanied by written instructions and only correct practice will be encouraged. These strategies are all part of the memory training techniques being tested in this study.

- ☐ Participants' thinking and ability to move in bed, stand and walk may be monitored over several days before, during and after the training sessions.

All sessions will be conducted in the treatment area of Masonic Care Queensland facility. Participants will not be paid for participation in this research.

4. What are the possible benefits?

There are direct and indirect benefits from the project.

Direct benefits for the participant may involve learning to perform such a fundamental daily task as standing up in a more efficient and safer way. The learnt ability will improve participant's independence and decrease his/her need for physical assistance. If participant shows positive learning in the project, the same principle can be used to teach participant any task or information in the future, e.g. remembering her/his room number, faces, names as well as how to correctly use a walker or stick, if required. In addition, participant will receive additional therapy/activity and this should add to better physical outcomes. An opportunity will be given to carers to learn techniques used in the project.

Indirect benefits relate to the effects this project can have on increasing awareness that people with dementia can learn new things despite of memory problems, in contrary to common beliefs. This can help to advocate for better access to rehabilitation following acute hospital admissions for all people with dementia.

5. What are the possible risks?

We do not foresee any possible risks to participants in this research project.

6. Can participant have other treatments during this research project?

Yes, participant can have any or all other treatments as prescribed by their medical officer as well nursing care as usual.

7. Does the participant have to take part in this research project?

Participation in the study is on a purely voluntary basis. You may withdraw your consent for the study at any point without penalty. If you do wish to withdraw, this will not influence your or participant relationship with the Masonic Care Queensland.

We encourage you to ask questions at any time during the study. Please feel free to contact any of the investigators during the study.

8. What if I withdraw participant from this research project?

If you decide to withdraw the participant, please notify a member of the research team before you withdraw. If you decide that participant should leave the project, the researchers would like to keep any information that has been collected. This is to help them make sure that the results of the research can be measured properly. If you do not want them to do this, you must tell them. Please use the attached Revocation of Consent Form, if you decide to withdraw the participant from the study.

9. How will I be informed of the results of this research project?

You will be able to access information related to the participant you consented for and regarding to this study at any time.

10. What else do I need to know?

- **What will happen to information about participant?**

Involvement in the present study will be strictly confidential. Only you (on behalf of the participant) and the investigators will have access to the results. However, according to requirements related to human research, the records may be reviewed by regulatory bodies, Human Research Ethics Committee or their delegates. The videorecorded materials will be viewed by independent assessors who are Queensland Health employees and subject to the same confidentiality as researchers. The identity of the participant will be "masked". Individual participant data will be kept in a locked filing cabinet in a locked filing cabinet and in the office of the principal investigator, Urszula Dolecka. In addition, data will be coded on the computer, so that the identity of each subject remains confidential.

The records relating to participation will be kept for approximately 7 years. Participant's personal information will not be divulged to any third party.

In any publication and/or presentation, information will be provided in such a way that the participant cannot be identified, except with your permission. The videorecorded materials will not be used in conference presentations unless separate written consent is given.

- **How can I access information?**

In accordance with relevant Australian and/or Queensland privacy and other relevant laws, you have the right to access the information collected and stored by the researchers about participant. You also have the right to request that any information, with which you disagree, be corrected. Please contact one of the researchers named at the end of this document if you would like to access any information.

- **What happens if a participant is injured as a result of participating in this research project?**

If participant suffers an injury as a result of participating in this research project, hospital care and treatment will be provided by the public health service at no extra cost to participant or you if you elect the participant to be treated as a public patient

- **Is this research project approved?**

The ethical aspects of this research project have been approved by the Human Research Ethics Committee of Masonic Care Queensland. This project also has ethical clearance from Metro South Human Research Ethics Committee, Griffith University Human Research Ethics Committee and Masonic Care Queensland Human Research Ethics Committee

This project will be carried out according to the *National Statement on Ethical Conduct in Human Research* (2007) produced by the National Health and Medical Research Council of Australia. This statement has been developed to protect the interests of people who agree to participate in human research studies.

11. Who can I contact?

Who you may need to contact will depend on the nature of your query, therefore, please note the following:

If you want any further information concerning this project or if participant has any medical problems which may be related to his/her involvement in the project (for example, any side effects), you can contact the principal researcher, Urszula Dolecka, on 3176 2111, pager 5040 (office hours) or 0402 062 142 (at all times).

12. For complaints or for further information

Dear Resident/Substitute Decision Maker

This study has been received and approved by the Board of Benevolence and of Aged Masons Widows and Orphans.

Should you wish to discuss the study with someone not directly involved, in particular, in relation to matters concerning policies, information about the conduct of the study or your rights as a participant, or should you wish to make an independent complaint, you may contact the Secretary, Masonic Care Qld Human Research Ethics Committee, 60 Wakefield Street, SANDGATE QLD 4017 or telephone 07 3869 6000 or fax 07 3269 2470.

Signature:____ Date: ____________

SUBSTITUTE DECISION MAKER CONSENT FORM

(To be attached to Substitute Decision Maker Information)

Consent Form, Version 4 Dated 30.04.2013
Site Masonic Care Queensland, Central and Southern Region

Full Project Title: The use of spaced retrieval, errorless learning and vanishing cues in retraining sit to stand in patients with dementia during hospitalisation

Principal Researcher:
Mrs Urszula Dolecka – Senior Physiotherapist Acute Aged Care and Cancer Services, Internal Medicine Unit, Princess Alexandra Hospital
Associate Researcher(s):
Dr Suzanne Kuys——Principal Research Fellow, The Prince Charles Hospital/ Griffith University, Dr Tamara Ownsworth, School of Applied Psychology, Griffith University, Mt Gravatt Campus

I have read, or have had read to me in a language that I understand, the Substitute Decision Maker Information version 4 dated 30 April 20132 dated 5 May 2011 and I understand the purposes, procedures and risks of this research project as described within it.

I acknowledge that the researchers would like to enrol ____________________ in the research project named above, according to the conditions in the Participant Information.

I will be given a copy of Substitute Decision Maker Information and Substitute Decision Maker Form to keep.

The researcher has agreed not to reveal ________________________________'s identity and personal details if information about this project is published or presented in any public form.

Participant's Name (printed): ____

Name of Person providing Substitute Decision (printed): __________________

Relationship to participant: ______________________________

Signature: _____________________________________Date: ___/___/___

Witness to Signature (printed): ____

Signature: _______________________________________Date: ___/___/___

Declaration by researcher*: I have given a verbal explanation of the research project, its procedures and risks and I believe that the person named above as the Third Party has understood that explanation.

Researcher's Name (printed): ____

Signature: _______________________________________Date: ___/___/___

* A senior member of the research team must provide the explanation and provision of information concerning the research project. All substitute decision makers signing the Consent Form must date their own signature.

REVOCATION OF CONSENT FORM

(To be used by Substitute Decision Maker who wishes to withdraw a resident from *the project.)*

Revocation of Consent Form

Full Project Title:

The use of spaced retrieval, errorless learning and vanishing cues in retraining sit to stand in patients with dementia during hospitalisation

I hereby wish to WITHDRAW my consent for participation in the research proposal described above and understand that such withdrawal WILL NOT jeopardize any treatment, care or participant relationship with Masonic Care Queensland.

Participant's Name (printed): ____

Substitute Decision Maker Name (printed) ____________________________________

Signature: ________________________________Date: _____ /______/______

Appendix 4 Standardised Mini-Mental State Examination

PA793 1M 10139449

Queensland Government

PRINCESS ALEXANDRA HOSPITAL
METRO SOUTH HEALTH SERVICE DISTRICT

STANDARDISED MINI-MENTAL STATE EXAMINATION (SMMSE)

(Affix patient identification label here)

Family Name: URN:

Given Names:

Date of Birth: Sex: ☐ M ☐ F

Instructions: Refer to page 3

	Score
I am going to ask you some questions and give you some problems to solve. Please try to answer as best you can.	
1. (Allow 10 seconds for each reply)	
a) **What year is this?** (accept exact answer only)	____ / 1
b) **What season is this?** (during the last week of the old season or first week of a new season, accept either)	____ / 1
c) **What month is this?** (on the first day of a new month or the last day of the previous month, accept either)	____ / 1
d) **What is today's date?** (accept previous or next date)	____ / 1
e) **What day of the week is this?** (accept exact answer only)	____ / 1
2. (Allow 10 seconds for each reply)	
a) **What country are we in?** (accept exact answer only)	____ / 1
b) **What state are we in?** (accept exact answer only)	____ / 1
c) **What city / town are we in?** (accept exact answer only)	____ / 1
d) (In hospital) **What is the name of this hospital / building?** (accept exact name of hospital or institution only) (In home) **What is the street address of this house?** (accept street name and house number or equivalent in rural areas)	____ / 1
e) (In hospital) **What floor of the building are we on?** (accept exact answer only) (In home) **What room are we in?** (accept exact answer only)	____ / 1
3. Say: **I am going to name three objects. When I am finished, I want you to repeat them. Remember what they are because I am going to ask you to name them again in a few minutes.** (say slowly at approximately one second intervals) **Ball Car Man** (For repeated use: Bell, jar, fan; Bill, tar, can; Bull, bar, pan) **Please repeat the three items for me.** (score one point for each correct reply on the first attempt) Allow 20 seconds for reply; if the person did not repeat all three, repeat until they are learned or up to a maximum of five times. (but only score first attempt)	____ / 3
4. **Spell the word WORLD.** (you may help the person spell the word correctly) Say: **Now spell it backwards please.** (allow 30 seconds; if the person cannot spell world even with assistance, score 0) Refer to page 3 for scoring instructions.	____ / 5
5. Say: **Now what were the three objects I asked you to remember?** (score one point for each correct answer regardless of order; allow 10 seconds)	____ / 3
6. Show wristwatch. Ask: **What is this called?** (score one point for correct response; accept "wristwatch" or "watch"; do not accept "clock" or "time", etc.; allow 10 seconds)	____ / 1
7. Show pencil. Ask: **What is this called?** (score one point for correct response; accept "pencil" only; score 0 for pen; allow 10 seconds for reply)	____ / 1
8. Say: **I would like you to repeat a phrase after me: No ifs, ands, or buts.** (allow 10 seconds for response. Score one point for a correct repetition. Must be exact, e.g. no ifs or buts, score 0)	____ / 1

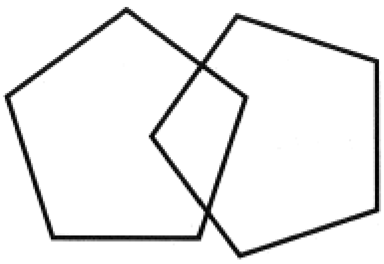
	Score
9. Say: **Read the words on this page and then do what it says.** Then, hand the person the sheet with CLOSE YOUR EYES on it (page 4). If the subject just reads and does not close eyes, you may repeat: Read the words on this page and then do what it says, (a maximum of three times. This is covered in #3 directions section on page 3). Allow 10 seconds, score one point only if the subject closes eyes. The subject does not have to read aloud.	_____ / 1
10. Hand the person a pencil and paper. Say: **Write any complete sentence on that piece of paper.** Allow 30 seconds. Score one point. The sentence must make sense. Ignore spelling errors.	_____ / 1
11. Place design, pencil, eraser and paper in front of the person. Say: **Copy this design please.** Allow multiple tries. Wait until the person is finished and hands it back. Score one point for a correctly copied diagram. The person must have drawn a four-sided figure between two five-sided figures. Maximum time: One minute.	_____ / 1
12. Ask the person if he / she is right or left handed. Take a piece of paper, hold it up in front of the person and say the following: **Take this paper in your right / left hand** (whichever is non-dominant), **fold the paper in half once with both hands and put the paper down on your lap.** Allow 30 seconds. Score one point for each instruction executed correctly.	
Takes paper in correct hand	_____ / 1
Folds it in half	_____ / 1
Puts it on lap	_____ / 1
TOTAL TEST SCORE:	____ **/ 30**
Adjusted Score: If task cannot be modified for people with physical disabilities the score is adjusted for a new total score (Actual Score x 30) / Possible Score	____ */ 30*

Assessor Name: ______________________________ Profession: ______________________________

Signature: ______________________________ Date: ______________ Time: ______________

Reference: Molloy, D.W., Alemayehu, E., & Roberts, R. (1991). Reliability of a standardised Mini-Mental State Examination compared with the traditional Mini-Mental State Examination. *The American Journal of Psychiatry*, 14 (1), 102-105.

FOLD HERE



Appendix 5 de Morton Mobility Index

de Morton Mobility Index (DEMMI)

	0	1	2
Bed			
1. Bridge	☐ unable	☐ able	
2. Roll onto side	☐ unable	☐ able	
3. Lying to sitting	☐ unable	☐ min assist ☐ supervision	☐ independent
Chair			
4. Sit unsupported in chair	☐ unable	☐ 10 sec	
5. Sit to stand from chair	☐ unable	☐ min assist ☐ supervision	☐ independent
6. Sit to stand without using arms	☐ unable	☐ able	
Static balance (no gait aid)			
7. Stand unsupported	☐ unable	☐ 10 sec	
8. Stand feet together	☐ unable	☐ 10 sec	
9. Stand on toes	☐ unable	☐ 10 sec	
10. Tandem stand with eyes closed	☐ unable	☐ 10 sec	
Walking			
11. Walking distance +/- gait aid *Gait aid (circle): nil/frame/stick/other*	☐ unable ☐ 5m	☐ 10m ☐ 20m	☐ 50m
12. Walking independence	☐ unable ☐ min assist ☐ supervision	☐ independent with gait aid	☐ independent without gait aid
Dynamic balance (no gait aid)			
13. Pick up pen from floor	☐ unable	☐ able	
14. Walks 4 steps backwards	☐ unable	☐ able	
15. Jump	☐ unable	☐ able	
COLUMN TOTAL SCORE:			

RAW SCORE TOTAL (sum of column total scores) /19

DEMMI SCORE (MDC_{90} = 9 points; MCID = 10 points) /100

easiest

sit unsupported

bridge

stand unsupported

sit to stand

roll

lie to sit

standing feet together

pick up pen from floor

walks backwards

walking distance

sit to stand no arms

walking independence

jump

stand on toes

tandem stand eyes closed

hardest

Raw-DEMMI Score Conversion Table

Raw Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
DEMMI score	0	8	15	20	24	27	30	33	36	39	41	44	48	53	57	62	67	74	85	100

Comments:

Signature:______________________________ Date:____________

Appendix 6 Spaced retrieval screening test

Spaced Retrieval Screening Test

(Adapted from workshop notes "Innovative Dementia Care", provided by Dr Cameron Camp, Brisbane, Aug, 2008)

Test 1 (no name printed)

Participant: ____________________ **Date**__________

Scoring: **Indicate by (+) correct and by (-) incorrect responses**

STEP 1 No delay	**STEP 2 Short delay 10-15 sec**	**Step 3 Long delay 15-20 sec**
Start: "Today we are going to practice remembering the name of this man." Say it when pointing to the Photograph:	Start: "Good. I will give you more chances to practice" Ask when pointing to the Photograph:	Start: "You are doing really well. I would like you to always remember his name. I will be asking you about his name often" Ask when pointing to the Photograph:
Step 1. "His name is Peter Smith" What's his name?"	Step 2. "What's his name?"	Step 3. "What's his name?"
Record answer by (+) or (-) Trial 1_____2_____3______	Record answer by (+) or (-) Trial 1_____2_____3______	Record answer by (+) or (-) Trial 1_____2_____3______
Note observations:	Note observations:	Note observations:
(-) incorrect answer – wait 1 min chatting with the participant and repeat Step 1. Participant has only three attempts at this level. **(+) correct answer** – say" That's right. I am glad you remembered" and go to Step 2	**(-) incorrect answer** – immediately repeat Step1 trial second or third (whichever was not used previously). Then return to the next trial in Step2. Participant has only three attempts at this level. **(+) correct answer** – say" That's right. I am glad you remembered" and go to Step 3	**(-) incorrect answer** – immediately provide correct answer "His name is Peter Smith" and repeat Step 2 trial second or third (whichever was not used previously). Then return to the next trial in Step3. Participant has only three attempts at this level. **(+) correct answer** – say" That's right. I am glad you remembered. We are going to practice this later." **If there was a correct answer at this step (long interval recall), participant is deemed suitable for spaced retrieval in training of sit to stand.**

Note: Participant has only three trials at any step. If the participant is incorrect on three trials at the same step (recall intervals), including "returns" from a step above, participant may not be suitable for spaced retrieval training. If the participant has not mastered successfully step 1, 2 or 3, try again another day using photograph with the name printed on the back of the photograph. Turn the photograph to demonstrate that the name is printed on the back. Participant is correct if he/she recalls the name without or with turning and reading the name from the back of the photograph. Do not enrol in the study if the participant failed the screening with the card.

Appendix 7 Mental Status Questionnaire

OCCUPATIONAL THERAPY DEPARTMENT
PRINCESS ALEXANDRA HOSPITAL

MENTAL STATUS QUESTIONNAIRE

DATE									
What town is this?									
What place is this?									
What is today's date?									
What moth is this?									
What year is this?									
How old are you?									
What year were you born?									
What month were you born?									
Who is the Prime Minister?									
Who was the Prime Minister before?									

Appendix 8 Sit-to-stand training protocol

The aim of the sit-to-stand (STS) training protocol is to teach a person with dementia to execute a sequence of STS strategies (slide forward, feet backwards, lean forward, and push up) in response to a training command when using a written instruction sheet.

Principles underlying the STS training protocol

The following principles underlie the training:

- Preventing errors by providing cues/assistance when hesitation or incorrect response is noted (errorless learning)
- Practicing over increasing time intervals as a person improves performance (spaced retrieval) and returning to the previous successful time interval after an incorrect response
- Providing only necessary cues to prevent errors, with the aim of systematically decreasing cues while still achieving a correct response (vanishing cues)
- Using a written instruction sheet to support the training

Screening tests

To benefit from this training protocol, a person needs to pass the following screening tests: test of suitability for spaced retrieval, reading test and test of physical abilities.

1. **Test for suitability for spaced retrieval** has been recommended before spaced retrieval training commences. During the test, a person may be provided with a photograph of a man and told: "I would like you to remember the name of this man. His name is Peter Smith."

- Step 1. Without delay (immediate recall), point to the photograph and ask the person "What's his name?"
    - If the response is <u>correct</u>, the question is repeated 10 to 15 seconds later (that is, after a short delay, Step 2).
    - If the response is <u>incorrect,</u> the correct answer is provided and the person is asked the question again without delay. If the person provides three incorrect responses in a row, testing should stop. This indicates that the person is not suitable for training involving spaced retrieval.
- Step 2. After a short delay (10 to 15 seconds time interval), point to the photograph and ask "What's his name?"
    - If the response is <u>correct</u>, the question may be repeated 20 to 30 seconds later (long delay, Step 3).
    - If the response was <u>incorrect</u>, the correct answer is provided and the person is asked the question again without delay. If this time the response was correct, short delay recall is attempted again (Step 2). If the person provides three incorrect responses in a row, testing should stop.
- Step 3. After a long delay (20 to 30 seconds time interval) point to the photograph and ask "What's his name?"

- If the response was correct, the question may be repeated 20 to 30 seconds later (long delay).
- If the response was incorrect, the correct answer is provided and the person is asked the question again without delay (immediate recall). If this time the response was correct, short delay (the previous successful time interval, Step 2) is attempted again, followed by Step 3, if successful. If the person provides three incorrect responses at this level, the testing should stop.

A person has no more than three attempts at each of the time intervals, although, the test may be repeated the next day if the test was unsuccessful.

2. Reading test

- A person is asked to read STS strategies (slide forward, feet backwards, lean forward and push up) printed in black on white paper (A4) in large simple font (Calibri 48).

3. Test of physical abilities

- A person must be able to physically execute each STS strategy before the training protocol is implemented. This may require practicing of each strategy before the STS task is executed as a sequence.

Equipment

The following equipment is required:

- An instruction sheet (A4) with sit to stand strategies printed in black ink in a simple large font (48) and simple font (e.g. Calibri, Arial)
- An iPAD based spaced retrieval application (stop watch and recording sheet can also be used)
- A chair and a table in front

Training command and response

A specific training command is used and the correct response needs to be identified prior to training commencement:

- The STS training command: "What do you have to do to stand up, tell me and show me?" is repeated verbatim by the therapist.
- The correct response: the person reads the STS strategies from the instruction sheet and executes them at the same time in the desired sequence. The response can be still recognized as correct when some cues but no more than Level 3 (see below for further explanation) are provided.

Levels of cueing

The lowest level of cueing required to produce the correct response by the person should be provided. The response is recognized as correct if the person performs STS strategies with no more than Level 3 cueing; that is, with the instruction sheet pointed to or tapped, in conjunction with verbal cues. When Level 4 and 5 cues are provided, performance is recognized as incorrect (Table 1). It is expected that as the person progresses in the training, less cues will be required to complete STS correctly.

Table 1. Levels of cueing

Level	Cueing	Responses
Level 5	Instruction sheet with pointing to or tapping and with verbal cues such as “first, second”, and reading (naming) two or more commands	Responses recognised as incorrect
Level 4	Instruction sheet with pointing to or tapping with verbal cues such as “first, second”, and reading the first command	
Level 3	Instruction sheet with pointing to or tapping with verbal cues such as “first, second”	Responses recognised as correct
Level 2	Instruction sheet with pointing to the sheet or tapping	
Level 1	Instruction sheet only	

Spaced retrieval time intervals used in STS training

Spaced retrieval is a cognitive training method to support learning with the aim of gradually increasing the time that the desired response is successfully recalled. Following each correct response, time intervals are usually doubled. An example of doubled time intervals is presented in Figure 1. Other, shorter time intervals can also be used depending on the person’s progress.

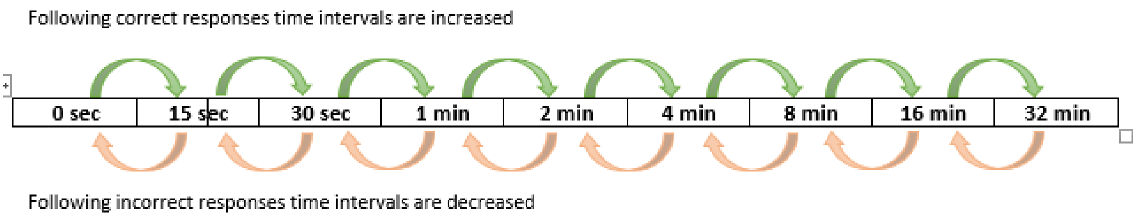


Figure 1. Spaced retrieval - expanding time intervals

When the person provides an incorrect response (or hesitation) cueing and/or physical assistance are provided to ensure correct performance. This is followed by immediate recall (0 sec) of the correct performance. The next practice is provided using the previous successful time interval (Figure 1). The process is demonstrated in Figure 2.

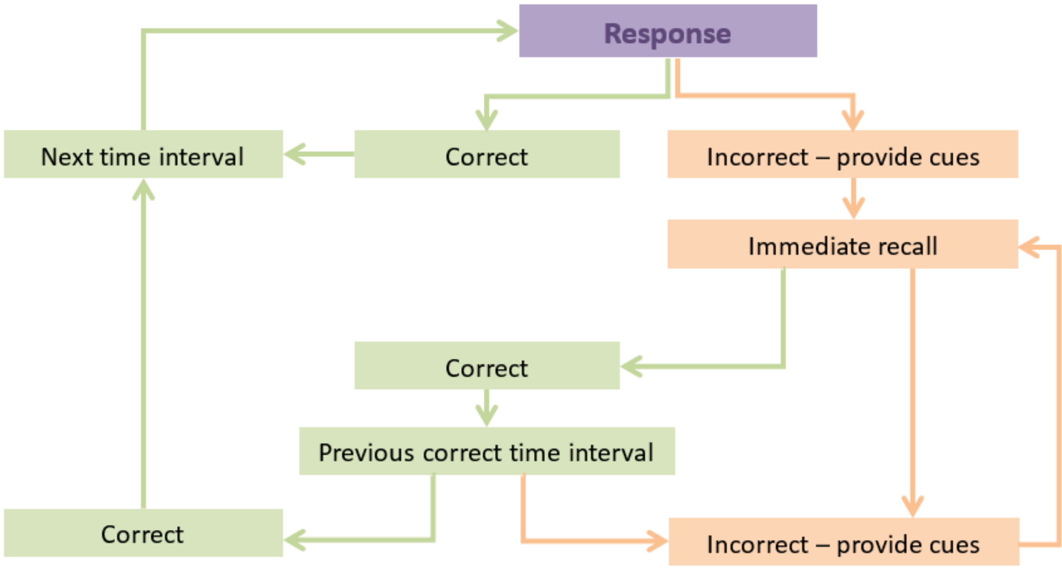


Figure 2. Spaced retrieval pathways for correct and incorrect responses

Other spaced retrieval principles used in the training:

- When practicing recall over longer time intervals (4 min +), other activities (not related to the practiced task) should be provided. Care must be taken to prevent mental or physical fatigue with the addition of other activities.
- When a session has to cease (such as due to fatigue and/or inability to progress), the next session is started with the training command. If the response is incorrect or the person hesitates, cues are provided and followed with immediate recall (see Figure 2).
- If progress to the next time interval cannot be achieved, a shorter than doubled time interval may be used.
- Training sessions cease when the 32 min time interval is reached during a session or when the correct response is provided at the commencement of the session.
- Training ceases when the person is able to provide the correct response daily for three consecutive days. It means that the person has learnt the task. If the response is incorrect at any stage, a short practice may be provided and recall tested the next day. Many people with dementia may never reach this stage of training.
- Family and carers may be taught to use the same approach to continue training and/or to help to maintain the learnt skill.

Implementing STS training protocol: step by step instructions

Preliminary steps:

Before training can begin the person must be introduced to the training command and desired response by providing all necessary cues and assistance.

Therapist: *I would like to teach you an easy way to stand up. When I ask you "What do you have to do to stand up, tell me and show me?", I want you to read from this sheet of paper and do what is written at the same time".* Therapist points to the instruction sheet on the table and reads the strategies and demonstrates them.

Therapist: *"What do you have to do to stand up, tell me and show me?".* Therapist helps to read or provide other cues and/or assistance but only those necessary to ensure correct performance. The practice should be as intensive (frequent) as individually tolerated without increasing anxiety. This practice should continue until the person is able to refer to the instruction sheet and perform the strategies with no more than Level 3 cueing (Table 1). After achieving this level of performance, the STS training based on spaced retrieval may start with immediate recall.

Step 1. Start of spaced retrieval - immediate recall) 0 secs

Therapist: *"What do you have to do to stand up, tell me and show me?".*

Person: Reads from the sheet *"slide forward, feet backwards, lean forward and push up"* and performs the strategies

- Correct response (no more than Level 3 cueing) – practice delayed recall using the next time interval (15 sec)
- Person attempted to provide incorrect response, signs of hesitation were noted and/or Level 4 or higher levels of cueing were required to complete the STS - repeat Step 1 (immediate recall) until correct performance (no more than Level 3 cueing) was demonstrated and then try to progress again to 15 sec time interval.

Step 2. Delayed recall, 15 secs later

Therapist: *"What do you have to do to stand up, tell me and show me?".*

Person: Reads from the sheet *"slide forward, feet backwards, lean forward and push up"* and performs the strategies

- Correct response (no more than Level 3 cueing) – practice delayed recall using the next time interval (30 sec)
- Person attempted to provide incorrect response, signs of hesitation were noted and/or Level 4 or higher levels of cueing were required to complete the STS - repeat Step 1 (immediate recall) and then tray to progress again to 15 sec time interval.

Step 3. Delayed recall, 30 secs later

Therapist: *"What do you have to do to stand up, tell me and show me?".*

Person: Reads from the sheet *"slide forward, feet backwards, lean forward and push up"* and performs the strategies

- Correct response (no more than Level 3 cueing) – practice delayed recall using the next time interval (1 min)
- Person attempted to provide incorrect response, signs of hesitation were noted and/or Level 4 or higher levels of cueing were required to complete the STS - repeat Step 1 (immediate recall) and then use the previous successful time interval (15 sec).

Between Step 3 and 4 turn the person's attention away from the STS practice – small talk

Step 4. Delayed recall, 1 minute later

Therapist: *"What do you have to do to stand up, tell me and show me?".*

Person: Reads from the sheet *"slide forward, feet backwards, lean forward and push up"* and performs the strategies.

- Correct response (no more than Level 3 cueing) – practice delayed recall using the next time interval (2 min)
- Person attempted to provide incorrect response, signs of hesitation were noted and/or Level 4 or higher levels of cueing were required to complete the STS - repeat Step 1 (immediate recall) and then use the previous successful time interval (30 sec).

Between Step 4 and 5 turn the person's attention away from the practiced task – engage in a small talk or encourage the person to make comments about something in the visual field.

Step 5. Delayed recall, 2 minutes later

Therapist: *"What do you have to do to stand up, tell me and show me?".*

Person: Reads from the sheet *"slide forward, feet backwards, lean forward and push up"* and performs the strategies.

- Correct response (no more than Level 3 cueing) – practice delayed recall using the next time interval (4 min)
- Person attempted to provide incorrect response, signs of hesitation were noted and/or Level 4 or higher levels of cueing were required to complete the STS - repeat Step 1 (immediate recall) and then use the previous successful time interval (1 min).

Between Step 5 and 6 turn the person's attention away from the practiced task – engage in talking or provide a short physically and cognitively non-demanding activity that can be completed in 4 minutes or can be interrupted without any distress.

Step 6. Delayed recall, 4 minutes later

Therapist: *"What do you have to do to stand up, tell me and show me?".*

Person: Reads from the sheet *"slide forward, feet backwards, lean forward and push up"* and performs the strategies.

- Correct response (no more than Level 3 cueing) – practice delayed recall using the next time interval (8 min)
- Person attempted to provide incorrect response, signs of hesitation were noted and/or Level 4 or higher levels of cueing were required to complete the STS - repeat Step 1 (immediate recall) and then use the previous successful time interval (2 min).

Between Step 6 and 7 turn the person's attention away from the practiced task – provide one longer or two short, physically and cognitively non-demanding activities that can be completed in 8 minutes or can be interrupted without any distress.

Step 7. Delayed recall, 8 minutes later

Therapist: *"What do you have to do to stand up, tell me and show me?".*
Person: Reads from the sheet *"slide forward, feet backwards, lean forward and push up"* and performs the strategies.

- Correct response (no more than Level 3 cueing) – practice delayed recall using the next time interval (16 min)
- Person attempted to provide incorrect response, signs of hesitation were noted and/or Level 4 or higher levels of cueing were required to complete the STS - repeat Step 1 (immediate recall) and then use the previous successful time interval (4 min).

Between Step 7 and 8 turn the person's attention away from the practiced task – provide a few short physically and cognitively non-demanding activities that can be completed in 16 minutes or can be interrupted without any distress. Activities need to be engaging but not fatiguing as during longer time intervals the risk of decreased cooperation increases. If the person presents with motor restlessness, a short walk can be also used to fill in the time between practices.

Step 8. Delayed recall, 16 minutes later

Therapist: *"What do you have to do to stand up, tell me and show me?".*
Person: Reads from the sheet *"slide forward, feet backwards, lean forward and push up"* and performs the strategies.

- Correct response (no more than Level 3 cueing) – practice delayed recall using the next time interval (32 min)
- Person attempted to provide incorrect response, signs of hesitation were noted and/or Level 4 or higher levels of cueing were required to complete the STS - repeat Step 1 (immediate recall) and then use the previous successful time interval (8 min).

Between Step 8 and 9 turn the person's attention away from the practiced task – provide various physically and cognitively non-demanding activities that can be completed in 32 minutes or can be interrupted without any distress. Activities need to be engaging, preferably related to persons' interests and not fatiguing. A couple of short walks can be used when the person presents with motor restlessness combined with less physically demanding activities such as listening to music, viewing or colouring a book, or playing cards. If the training was conducted in bedroom of the person, therapist may leave the room and return after some time.

Step 9. Delayed recall, 32 minutes later

Therapist: *"What do you have to do to stand up, tell me and show me?".*
Person: Reads from the sheet *"slide forward, feet backwards, lean forward and push up"* and performs the strategies.

- Correct response (no more than Level 3 cueing) – training completed for this day. Recall will be tested over the next three consecutive days.
- Person attempted to provide incorrect response, signs of hesitation were noted and/or Level 4 or higher levels of cueing were required to complete the STS - repeat Step 1 (immediate recall) and then use the previous successful time interval (16 min). Due to fatigue, the 16 min time interval practice may not be possible the same day. However, if the training was provided in the person's room, therapist may return 16 min later and assess if the level of fatigue and cooperation is sufficient to continue training.

Step 10. Delayed recalls, 1, 2, 3 days later

Therapist: *"What do you have to do to stand up, tell me and show me?".*
Person: Reads from the sheet *"slide forward, feet backwards, lean forward and push up"* and performs the strategies.

- Correct response (no more than Level 3 cueing) – training completed for this day. The recall will be tested next day.
- Person attempted to provide incorrect response, signs of hesitation were noted and/or Level 4 or higher levels of cueing were required to complete the STS - repeat Step 1 (immediate recall) and then use the previous successful time interval (32 min). Activities as in Step 7 may be provided or if training occurred in the person's room, therapist may return after 32 minutes.

Note:
After achieving correct and consistent performance, if time allows, this training protocol can be adapted to teach the sequence of the STS strategies without the use of the instruction sheet.

References

Access Economics. (2009). *Keeping dementia front of mind:incidence and prevalence 2009-2050*. Alheimer's Australia. Retrieved from https://fightdementia.org.au.

Akram, S. B., & McIlroy, W. E. (2011). Challenging horizontal movement of the body during sit-to-stand: impact on stability in the young and elderly. *Journal of Motor Behavior, 43*(2), 147-153.

Alexander, N. B., Gross, M. M., Medell, J. L., & Hofmeyer, M. R. (2001). Effects of functional ability and training on chair-rise biomechanics in older adults. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 56*(9), M538-547.

Alexander, N. B., Koester, D. J., & Grunawalt, J. A. (1996). Chair design affects how older adults rise from a chair. *Journal of the American Geriatrics Society, 44*(4), 356-362.

Andel, R. (2000). Application of variability of practice hypothesis in Alzheimer patients. *Journal of Clinical Geropsychology, 6*(2), 111-119.

Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a Methodological Framework. *International Journal of Social Research Methodology, 8*(1), 19-32.

Atabati, M., Jahangiri, N., & Mokhber, N. (2011). Inner speech, active part of working memory phonologicl loop, inactive in dementia. *Psychology, 2*(6), 624-630.

Atkinson, H. H., Rapp, S. R., Williamson, J. D., Lovato, J., Absher, J. R., Gass, M., . . . Espeland, M. A. (2010). The relationship between cognitive function and physical performance in older women: results from the women's health initiative memory study. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 65*(3), 300-306.

Atkinson, H. H., Rosano, C., Simonsick, E. M., Williamson, J. D., Davis, C., Ambrosius, W. T., . . . Kritchevsky, S. B. (2007). Cognitive function, gait speed decline, and comorbidities: the health, aging and body composition study. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 62*(8), 844-850.

Auyeung, T. W., Kwok, T., Lee, J., Leung, P. C., Leung, J., & Woo, J. (2008). Functional decline in cognitive Impairment - the relationship between physical and cognitive function. *Neuroepidemiology, 31*(3), 167-173.

Avila, R., Bottino, C. M., Carvalho, I. A., Santos, C. B., Seral, C., & Miotto, E. C. (2004). Neuropsychological rehabilitation of memory deficits and activities of daily living in patients with Alzheimer's disease: a pilot study. *Brazilian Journal of Medical and Biological Research, 37*(11), 1721-1729.

Baddeley, A. D., Bressi, S., Della Sala, S., Logie, R., & Spinnler, H. (1991). The decline of working memory in Alzheimer's disease. A longitudinal study. *Brain, 114 (Pt 6)*, 2521-2542.

Barreca, S., Sigouin.C.S., Lambert, C., & Ansley, B. (2004). Effects of extra training on the ability of stroke survivors to perform an independent sit-to-stand: a randomized controlled trial. *Journal of Geriatric Physical Therapy, 27*(2), 39-70.

Bayles, K. A. (2003). Effects of working memory deficits on the communicative functioning of Alzheimer's dementia patients. *Journal of Communication Disorders, 36*(3), 209-219.

Bayles, K. A., & Kim, E. S. (2003). Improving the functioning of individuals with Alzheimer's disease: emergence of behavioral interventions. *Journal of Communication Disorders, 36*(5), 327-343.

Bayley, P. J., & Squire, L. R. (2003). The medial temporal lobe and decalrative memory. *Interantional Congress Series 1250*, 245-259.

Beattie, E. (2009). Research participation of individuals with dementia. *Research in Gerontological Nursing, 2*(2), 94-102.

Belleville, S., Chertkow, H., & Gauthier, S. (2007). Working memory and control of attention in persons with Alzheimer's disease and mild cognitive impairment. *Neuropsychology, 21*(4), 458-469.

Benigas, J. E., & Bourgeois, M. S. (2011). Evaluating oral reading and reading comprehension in patients with dementia: a comparison of generic and personally relevant stimuli. *Non-Pharmacological Therapies in Dementia, 2*(1), 41-54.

Bennett, S. E., & Karnes, J. L. (1998). Neurological disabilities. Assessment and tratment. Philadelphia: Lippincott.
Bier, N., Provencher, V., Gagnon, L., Van der Linden, M., Adam, S., & Desrosiers, J. (2008). New learning in dementia: transfer and spontaneous use of learning in everyday life functioning. Two case studies. *Neuropsychological Rehabilitation, 18*(2), 204-235.
Bier, N., Van Der Linden, M., Gagnon, L., Desrosiers, J., Adam, S., Louveaux, S., & Saint-Mleux, J. (2008). Face-name association learning in early Alzheimer's disease: a comparison of learning methods and their underlying mechanisms. *Neuropsychological Rehabilitation, 18*(3), 343-371.
Bird, M., & Kinsella, G. (1996). Long-term cued recall of tasks in senile dementia. *Psychology and Aging, 11*(1), 45-56.
Black, S. A., & Rush, R. D. (2002). Cognitive and functional decline in adults aged 75 and older. *Journal of the American Geriatric Society, 50*(12), 1978-1986.
Blair, M., Marczinski, C. A., Davis-Faroque, N., & Kertesz, A. (2007). A longitudinal study of language decline in Alzheimer's disease and frontotemporal dementia. *Journal of the International Neuropsychological Society, 13*(2), 237-245.
Bohannon, R. W. (2012). Measurementof sit-to-stand among older adults. *Topics in Geriatric Rehabilitation, 28*(1), 11-16.
Bohannon, R. W., & Corrigan, D. L. (2003). Strategies community dwelling elderly women employ to ease the task of standing up from household surfaces. *Topics in Geriatric Rehabilitation, 19*(2), 137-144.
Bourgeois, M. S., Camp, C., Rose, M., White, B., Malone, M., Carr, J., & Rovine, M. (2003). A comparison of training strategies to enhance use of external aids by persons with dementia. *Journal of Communication Disorders, 36*(5), 361-378.
Bowen, D. J., Kreuter, M., Spring, B., Cofta-Woerpel, L., Linnan, L., Weiner, D., . . . Fernandez, M. (2009). How we design feasibility studies. *American Journal of Preventive Medicine, 36*(5), 452-457.
Britton, E., Harris, N., & Turton, A. (2008). An exploratory randomized controlled trial of assisted practice for improving sit-to-stand in stroke patients in the hospital setting. *Clinical Rehabilitation, 22*(5), 458-468.
Brodaty, H., & Donkin, M. (2009). Family caregivers of people with dementia. *Dialogues in Clinical Neuroscience, 11*(2), 217-228.
Brodin, E., Ljungman, S., & Sunnerhagen, K. S. (2008). Rising from a chair: a simple screening test for physical function in predialysis patients. *Scand J Urol Nephrol, 42*(3), 293-300.
Brush, J. A., & Camp, C. J. (1998). *A therapy technique for improving memory: spaced retrieval*. Beachwood, OH, USA: Menorah Park Center for Senior Living.
Burdett, R. G., Habasevich, R., Pisciotta, J., & Simon, S. R. (1985). Biomechanical comparison of rising from two types of chairs. *Physical Therapy, 65*(8), 1177-1183.
Camp, C. J., Foss, J. W., O'Hanlon, A. M., & Stevens, A. B. (1996). Memory interventions for persons with dementia. *Applied Cognitve Psychology, 10*, 193-210.
Carr, J., & Shepherd, R. B. (1998). *Neurological Rehabilitation. Optimizing Motor Performance.* Oxford: Butterworth-Heinemann.
Carr, J. H., & Shepherd, R. B. (2010). *Neurological rehabilitation. Optimizing motor performance.* (2nd ed.): Churchil Livingstone.
Chadaga, S. R., Maher, M. P., Maller, N., Mancini, D., Mascolo, M., Sharma, S., . . . Chu, E. S. (2012). Evolving practice of hospital medicine and its impact on hospital throughput and efficiencies. *Journal of Hospital Medicine, 7*(8), 649-654.
Charlesworth, L. A., Allen, R. J., Morson, S., Burn, W. K., & Souchay, C. (2014). Working memory and the enactment effect in early Alzheimer's disease. *ISRN Neurology, 2014*, 694761.
Cherry, K. E., Hawley, K. S., Jackson, E. M., & Boudreaux, E. O. (2009). Booster sessions enhance the long-term effectiveness of spaced retrieval in older adults with probable Alzheimer's disease. *Behavior Modification, 33*(3), 295-313.

Cherry, K. E., & Simmons-D'Gerolamo, S. S. (2005). Long-term effectiveness of spaced-retrieval memory training for older adults with probable Alzheimer's disease. *Experimental Aging Research, 31*(3), 261-289.

Cherry, K. E., Walvoord, A. A., & Hawley, K. S. (2010). Spaced retrieval enhances memory for a name-face-occupation association in older adults with probable Alzheimer's disease. *The Journal of Genetic Psychology, 171*(2), 168-181.

Christenson, A. M., Buchanan, J. A., Houlihan, D., & Wanzek, M. (2011). Command use and compliance in staff communication with elderly residents of long-term care facilities. *Behavior Therapy, 42*(1), 47-58.

Clare, L. (2012). *Cognitive rehabilittion and people with dementia*: Http://cirrie.buffalo.edu/encyclopedia/en/article/129/.

Clare, L., & Jones, R. S. (2008). Errorless learning in the rehabilitation of memory impairment: a critical review. *Neuropsychology Review, 18*(1), 1-23.

Clare, L., Markova, I. S., Roth, I., & Morris, R. G. (2011). Awareness in Alzheimer's disease and associated dementias: theoretical framework and clinical implications. *Aging Ment Health, 15*(8), 936-944.

Clare, L., Willson, B. A., Breen, K., & Hodges, J. R. (1999). Errorless learning of face-name association in early Alzheimer's disease. *Neurocase, 5*, 37-46.

Clare, L., Wilson, B. A., Carter, G., Breen, K., Gosses, A., & Hodges, J. R. (2000). Intervening with everyday memory problems in dementia of Alzheimer type: an errorless learning approach. *Journal of Clinical and Experimental Neuropsychology, 22*(1), 132-146.

Cook, C., Fay, S., & Rockwood, K. (2008). Decreased initiation of usual activities in people with mild-to-moderate Alzheimer's disease: a descriptive analysis from the VISTA clinical trial. *International Psychogeriatrics, 20*(05), 952-963.

Covinsky, K. E., Palmer, R. M., Fortinsky, R. H., Counsell, S. R., Stewart, A. L., Kresevic, D., . . . Landefeld, C. S. (2003). Loss of independence in activities of daily living in older adults hospitalized with medical illnesses: increased vulnerability with age. *Journal of the American Geriatric Society, 51*(4), 451-458.

Creighton, A. S., Davison, T. E., van der Ploeg, E. S., Camp, C. J., & O'Connor, D. W. (2014). Using spaced retrieval training to teach people with dementia to independently use their walking aids: two case studies. *Clinical Gerontologist, 38*(2), 170-178.

Creighton, A. S., van der Ploeg, E. S., & O'Connor, D. W. (2013). A literature review of spaced-retrieval interventions: a direct memory intervention for people with dementia. *International Psychogeriatrics, 25*(11), 1743-1763.

Curtin, A. J. (2011). Individualized skills training program for community-dwelling adults with mild Alzheimer's disease. *Journal of Gerontological Nursing, 37*(10), 20-29; quiz 30-21.

Davenport, S. J., & de Morton, N. A. (2011). Clinimetric properties of the de Morton Mobility Index in healthy, community-dwelling older adults. *Archives of Physical Medicine and Rehabilitation, 92*(1), 51-58.

Dayan, E., & Cohen, L. G. (2011). Neuroplasticity subserving motor skill learning. *Neuron, 72*(3), 443-454.

de Morton, N. A., Davidson, M., & Keating, J. L. (2008). The de Morton Mobility Index (DEMMI): an essential health index for an ageing world. *Health and Quality of Life Outcomes, 6*, 63.

de Morton, N. A., Davidson, M., & Keating, J. L. (2011). Reliability of the de Morton mobility index (DEMMI) in an older acute medical population. *Physiotherapy Research International 16*(3), 159-169.

De Vreese, L. P., Neri, M., Fioravanti, M., Belloi, L., & Zanetti, O. (2001). Memory rehabilitation in Alzheimer's disease: a review of progress. *International Journal of Geriatric Psychiatry, 16*(8), 794-809.

de Werd, M. M., Boelen, D., Rikkert, M. G., & Kessels, R. P. (2013). Errorless learning of everyday tasks in people with dementia. *Clinical Iinterventions in Aging, 8*, 1177-1190.

Dechamps, A., Fasotti, L., Jungheim, J., Leone, E., Dood, E., Allioux, A., . . . Kessels, R. P. (2011). Effects of different learning methods for instrumental activities of daily living in patients with Alzheimer's dementia: a pilot study. *American Journal of Alzheimer's Disease and Other Dementias, 26*(4), 273-281.

Dehail, P., Bestaven, E., Muller, F., Mallet, A., Robert, B., Bourdel-Marchasson, I., & Petit, J. (2007). Kinematic and electromyographic analysis of rising from a chair during a "Sit-to-Walk" task in elderly subjects: role of strength. *Clinical Biomechanics, 22*(10), 1096-1103.

Delva, F., Edjolo, A., Peres, K., Berr, C., Barberger-Gateau, P., & Dartigues, J. F. (2014). Hierarchical structure of the activities of daily living scale in dementia. *The Journal of Nutrition, Health & Aging, 18*(7), 698-704.

Demirbuken, I., Algun, C., Tekin, N., & Ilcin, N. (2011). Investigation of motor strategies of sit to stand activity in elderly population. *Fizyoterapi Rehabilitasyon, 22*(2), 86-92.

Demura, S., & Yamada, T. (2007). Height of chair seat and movement characteristics in sit-to-stand by young and elderly adults. *Perceptual & Motor Skills, 104*(1), 21-31.

Dick, B. M., Andel, R., Bricker, J., Gorospe, J. B., Hsieh, S., & Dick-Meuhlke, C. (2001). Dependence on visual feedback during motor skill learning in Alzheimer's disease. *Aging, Neuropsychology, and Cognition, 8*(2), 120-136.

Dick, B. M., Andel, R., Hsieh, S., Bricker, J., Davis, S. D., & Dick-Meuhlke, C. (2000). Contextual iterference and motor skill learning in Alzheimer's disease. *Aging, Neuropsychology, and Cognsition, 7*(4), 273-287.

Dick, M. B., Hsieh, S., Bricker, J., & Dick-Meuhlke, C. (2003). Facilitating acquisition and transfer of a continous motor task in healthy older adults and patients with Alzheimer's disease. *Neuropsychology, 17*(2), 202-212.

Dick, M. B., Hsieh, S., Dick-Meuhlke, C., Davis, D. S., & Cotman, C. W. (2000). The variability of practice hypothesis in motor learning: does it apply to Alzheimer's disease? *Brain and Cognition, 44*, 470-489.

Dick, M. B., Nielson, K. A., Beth, R. E., Shankle, W. R., & Cotman, C. W. (1995). Acquisition and long-term retention of fine motor skill in Alzheimer's disease. *Brain and Cognition, 29*, 294-306.

Dick, M. B., Shankle, R. W., Beth, R. E., Dick- Muehlke, C., Cotman, C. W., & Kean, M.-L. (1996). Acquisition and long term retention of gross motor skill in Alzheimer's disease patients under constant and varied practice conditions. *The Journal of Gerontology, 51B*(2), 103-111.

Digby, R., Moss, C., & Bloomer, M. (2012). Transferring from an acute hospital and settling into a subacute facility: the experience of patients with dementia. *International Journal of Older People Nursing, 7*(1), 57-64.

Donaghey, C. L., McMillan, T. M., & O'Neill, B. (2010). Errorless learning is superior to trial and error when learning a practical skill in rehabilitation: a randomized controlled trial. *Clinical Rehabilitation, 24*(3), 195-195-201.

Driskell, J. E., Willis, R., & Copper, C. (1992). Effect of overlearning on retention. *Journal of Applied Psychology, 77*(5), 615-622.

Eldridge, L. L., Masterman, D., & Knowlton, B. J. (2002). Intact implicit habit learning in Alzheimer's disease. *Behavioral Neuroscience, 116*(4), 722-726.

Ellis, A. A., & Trent, R. B. (2001). Do the risks and consequences of hospitalized fall injuries among older adults in California vary by type of fall? *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 56*(11), M686-692.

Engkvist, I.-L. (2004). The accident process preceding back injuries among Australian nurses. *Safety Science, 42*(3), 221-235.

Engkvist, I.-L. (2008). Back injuries among nurses – a comparison of the accident processes after a 10-year follow-up. *Safety Science, 46*(2), 291-301.

Etnyre, B., & Thomas, D. Q. (2007). Event standardization of sit-to-stand movements. *Physical Therapy, 87*(12), 1651-1666.

Farina, E., Fioravanti, R., Chiavari, L., Imbornone, E., Alberoni, M., Pomati, S., . . . Mariani, C. (2002). Comparing two programs of cognitive training in Alzheimer's disease: a pilot study. *Acta Neurologica Scandinavica* (105), 365-371.

Fenney, A., & Lee, T. D. (2010). Exploring spared capacity in persons with dementia: Wii™ Can Learn. *Activities, Adaptation & Ageing, 34*(4), 303-313.
Finlay, O. E., Bayles, T. B., Rosen, C., & Milling, J. (1983). Effects of chair design, age and cognitive status on mobility. *Age and Ageing, 12*(4), 329-335.
Fisher, B. E., Morton, S. M., & Lang, C. E. (2014). From motor learning to physical therapy and back again: the state of the art and science of motor learning rehabilitation research. *Journal of Neurologic Physical Ttherapy, 38*(3), 149-150.
Fisher, S. R., Ottenbacher, K. J., Goodwin, J. S., & Ostir, G. V. (2009). Chair rise ability and length of stay in hospitalized older adults. *Journal of the American Geriatrics Society, 57*(10), 1938-1940.
Fitts, P. M., & Posner, M. I. (1967). *Human Performance*. Belmont: Ca:Brooks Cole.
Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research, 12*(3), 189-198.
Fujimoto, M., & Chou, L. (2012). Dynamic balance control during sit-to-stand movement: An examination with the center of mass acceleration. *Journal of Biomechanics, 45*(3), 543-548.
Gaugler, J., Duval, S., Anderson, K., & Kane, R. (2007). Predicting nursing home admission in the U.S: a meta-analysis. *BMC Geriatrics, 7*(13), 1-14.
Ghilardi, M. F., Moisello, C., Silvestri, G., Ghez, C., & Krakauer, J. W. (2009). Learning of a sequential motor skill comprises explicit and implicit components that consolidate differently. *Journal of Neurophysiology, 101*(5), 2218-2229.
Gillette, J. C., Stevermer, C., Raina, S., & Derrick, T. R. (2005). *Support torques during simulated sit-to-stand movements*. Paper presented at the Rocky Mountain Bioengineering Symposium & International ISA Biomedical Sciences Instrumentation Symposium, Copper Mountain, Colorado.
Gillis, A., & MacDonald, B. (2005). Deconditioning in the hospitalized elderly. *The Canadian Nurse, 101*(6), 16-20.
Gold, C. A., & Budson, A. E. (2008). Memory loss in Alzheimer's disease: implications for development of therapeutics. *Expert Review of Neurotherapeutics, 8*(12), 1879-1891.
Graf, C. (2006). Functional decline in hospitalized older adults. *The American Journal of Nursing, 106*(1), 58-67, quiz 67-58.
Graham, N. L., Emery, T., & Hodges, J. R. (2004). Distinctive cognitive profiles in Alzheimer's disease and subcortical vascular dementia. *Journal of Neurology Neurosurgery and Psychiatry, 75*(1), 61-71.
Grandmaison, E., & Simard, M. (2003). A critical review of memory stimulation programs in Alzheimer's disease. *The Journal of Neuropsychiatry and Clinical Neurosciences, 15*(2), 130-144.
Grant, P. M., Dall, P. M., & Kerr, A. (2011). Daily and hourly frequency of the sit to stand movement in older adults: a comparison of day hospital, rehabilitation ward and community living groups. *Aging Clinical and Experimental Research, 23*(5-6), 437-444.
Gross, M. M., Stevenson, P. J., Charette, S. L., Pyka, G., & Marcus, R. (1998). Effect of muscle strength and movement speed on the biomechanics of rising from a chair in healthy elderly and young women. *Gait & Posture, 8*(3), 175-185.
Hall, S., Longhurst, S., & Higginson, I. J. (2009). Challenges to conducting research with older people living in nursing homes. *BMC Geriatrics, 9*(1), 1-8.
Harrison, B. E., Son, G. R., Kim, J., & Whall, A. L. (2007). Preserved implicit memory in dementia: a potential model for care. *American Journal of Alzheimer's Disease and Other Dementias, 22*(4), 286-293.
Hart, B. D., & Wells, D. L. (1997). The effects of language used by caregivers on agitation in residents with dementia. *Clinical nurse specialist CNS, 11*(1), 20-23.
Haslam, C., Hodder, K. I., & Yates, P. J. (2011). Errorless learning and spaced retrieval: how do these methods fare in healthy and clinical populations? *Journal of Clinical and Experimental Neuropsychology, 33*(4), 432-447.

Haslam, C., Moss, Z., & Hodder, K. (2010). Are two methods better than one? Evaluating the effectiveness of combining errorless learning with vanishing cues. *Journal of Clinical and Experimental Neuropsychology, 32*(9), 973-985.
Hawley, K. S., & Cherry, K. E. (2004). Spaced-retrieval effects on name-face recognition in older adults with probable Alzheimer's disease. *Behavior Modification, 28*(2), 276-296.
Henke, K. (2010). A model memory systems based on procesing modes rather than consciousness. *Nature Reviews Neuroscience, 11*, 523-532.
Heuninckx, S., Wenderoth, N., Debaere, F., Peeters, R., & Swinnen, S. P. (2005). Neural basis of aging: the penetration of cognition into action control. *The Journal of Neuroscience, 25*(29), 6787-6796.
Heuninckx, S., Wenderoth, N., & Swinnen, S. P. (2008). Systems neuroplasticity in the aging brain: recruiting additional neural resources for successful motor performance in elderly persons. *The Journal of Neuroscience, 28*(1), 91-99.
Hirono, N., Mori, E., Ikejiri, Y., Imamura, T., Shimomura, T., Ikeda, M., . . . Yamadori, A. (1997). Procedural memory in patients with mild Alzheimer's disease. *Dementia and Geriatric Cognitive Disorders, 8*(4), 210-216.
Hochhalter, A. K., Bakke, B. L., Holub, R. J., & Overmier, J. B. (2004). Adjusted spaced retrieval training. *Clinical Gerontologist, 27*(1-2), 159-168.
Hochhalter, A. K., Overmier, J. B., Gasper, S. M., Bakke, B. L., & Holub, R. J. (2005). A comparison of spaced retrieval to other schedules of practice for people with dementia. *Experimental Aging Research, 31*(2), 101-118.
Hopper, T., Bourgeois, M., Pimentel, J., Qualls, C. D., Hickey, E., Frymark, T., & Schooling, T. (2013). An evidence-based systematic review on cognitive interventions for individuals with dementia. *American Journal of Speech-Language Pathology, 22*(1), 126-145.
Hopper, T., Drefs, S. J., Bayles, K. A., Tomoeda, C. K., & Dinu, I. (2010). The effects of modified spaced-retrieval training on learning and retention of face-name associations by individuals with dementia. *Neuropsychological Rehabilitation, 20*(1), 81-102.
Hopper, T., Mahendra, N., Azuma, T., Bayles, K. A., Cleary, S. J., & Tomoeda, C. K. (2005). Evidence- based practice recommendations for working with individuals with dementia: spaced-retrieval training. *Journal of Medical Speech-Language Pathology, 13*(4), xxvii-xxxiv.
Hopper, T. L. (2003). "They're just going to get worse anyway": perspectives on rehabilitation for nursing home residents with dementia. *Journal of Communication Disorders, 36*(5), 345-359.
Hughes, M. A., Myers, B. S., & Schenkman, M. L. (1996). The role of strength in rising from a chair in the functionally impaired elderly. *Journal of Biomechanics, 29*(12), 1509-1513.
Hughes, M. A., & Schenkman, M. L. (1996). Chair rise strategy in the functionally impaired elderly. *Journal of Rehabilitation Research and Development, 33*(4), 409-412.
Hughes, M. A., Weiner, D. K., Schenkman, M. L., Long, R. M., & Studenski, S. A. (1994). Chair rise strategies in the elderly. *Clinical Biomechanics, 9*(3), 187-192.
Hunkin, N. M., & Parkin, A. J. (1995). The method of vanishing cues: an evaluation of its effectiveness in teaching memory-impaired individuals. *Neuropsychologia, 33*(10), 1255-1279.
Hunter, C. E. A., Ward, L., & Camp, C. J. (2011). Transitioning spaced retrieval training to care staff in an Australian residential aged care setting for older adults with dementia: a case study approach. *Clinical Gerontologist, 35*(1), 1-14.
Iadecola, C. (2010). The overlap between neurodegenerative and vascular factors in the pathogenesis of dementia. *Acta Neuropathologica, 120*(3), 287-296.
Ikeda, E., Schenkman, M. L., O' Riley, P., & Hodge, W. A. (1991). Influence of age on dynamics of rising from a chair. *Physical Therapy, 71*(6), 473 - 481.
Janssen, W. G. M., Bussmann, H., & Stam, H. (2002). Determinants of the sit-to-stand movement: a review. *Physical Therapy, 82*(9), 866-879.
Jellinger, K. A., & Attems, J. (2007). Neuropathological evaluation of mixed dementia. *Journal of the Neurological Sciences, 257*(1-2), 80-87.

Jeneson, A., & Squire, L. R. (2012). Working memory, long-term memory, and medial temporal lobe function. *Learning & Memory, 19*(1), 15-25.
Jeng, S. F., Schenkman, M., Riley, P. O., & Lin, S. J. (1990). Reliability of a clinical kinematic assessment of the sit-to-stand movement. *Physical Therapy, 70*(8), 511-520.
Joray, S., Herrmann, F., Mulligan, R., & Schnider, A. (2004). Mechanism of disorientation in Alzheimer's disease. *Eur Neurol, 52*(4), 193-197.
Josephsson, S., Backman, L., Borell, L., Bernspang, B., Nygard, L., & Ronnberg, L. (1993). Supporting everyday activities in dementia: an intervention study. *International Journal of Geriatric Psychaitry, 8*, 395-400.
Kalaria, R. (2002). Similarities between Alzheimer's disease and vascular dementia. *Journal of Neurological Sciences, 203-204*, 29-34.
Kavcic, V., Vaughn, W., & Duffy, C. J. (2011). Distinct visual motion processing impairments in aging and Alzheimer's disease. *Vision Research, 51*(3), 386-395.
Kawagoe, S., Tajima, N., & Chosa, E. (2000). Biomechanical analysis of effects of foot placement with varying chair height on the motion of standing up. *Journal of Orthopaedic Science, 5*(2), 124-133.
Kessels, R. P., & de Haan, E. H. (2003). Implicit learning in memory rehabilitation: a meta-analysis on errorless learning and vanishing cues methods. *Journal of Clinical and Experimental Neuropsychology, 25*(6), 805-814.
Kessels, R. P., & Hensken, L. M. (2009). Effects of errorless skill learning in people with mild-to-moderate or severe dementia: a randomized controlled pilot study. *NeuroRehabilitation, 25*(4), 307-312.
Kessels, R. P., Remmerswaal, M., & Wilson, B. A. (2011). Assessment of nondeclarative learning in severe Alzheimer dementia: the Implicit Memory Test (IMT). *Alzheimer Disease and Associated Disorders, 25*(2), 179-183.
Khemlani, M. M., Carr, J. H., & Crosbie, W. J. (1999). Muscle synergies and joint linkages in sit-to-stand under two initial foot positions. *Clinical Biomechanics, 14*(4), 236-246.
Kidd, D., Stewart, G., Baldry, J., Johnson, J., Rossiter, D., Petruckevitch, A., & Thompson, A. J. (1995). The Functional Independence Measure: a comparative validity and reliability study. *Disability and Rehabilitation, 17*(1), 10-14.
Kimberley, T. J., Samargia, S., Moore, L. G., Shakya, J. K., & Lang, C. E. (2010). Comparison of amounts and types of practice during rehabilitation for traumatic brain injury and stroke. *Journal of Rehabilitation Research and Development, 47*(9), 851-862.
Klimkowicz-Mrowiec, A., Slowik, A., Krzywoszanski, L., Herzog-Krzywoszanska, R., & Szczudlik, A. (2008). Severity of explicit memory impairment due to Alzheimer's disease improves effectiveness of implicit learning. *Journal of Neurology, 255*(4), 502-509.
Komarova, N. L., & Thalhauser, C. J. (2011). High degree of heterogeneity in Alzheimer's disease progression patterns. *PLoS Computational biology, 7*(11), e1002251.
Kottner, J., Audige, L., Brorson, S., Donner, A., Gajewski, B. J., Hrobjartsson, A., . . . Streiner, D. L. (2011). Guidelines for Reporting Reliability and Agreement Studies (GRRAS) were proposed. *Int J Nurs Stud, 48*(6), 661-671.
Kratochwill, T. R., Hitchcock, J. H., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M., & Shadish, W. R. (2010). Single-case design technical documentation. Retrieved 4 September, 2015, from http://ies.ed.gov/ncee/wwc/pdf/wwc_scd.pdf
Kratochwill, T. R., Hitchcock, J. H., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M., & Shadish, W. R. (2013). Single-case intervention research design standards. *Remedial and Special Education, 34*, 26-38.
Kuo, Y. L., Tully, E. A., & Galea, P. (2010). Kinematics of sagittal spine and lower limb movement in healthy older adults during sit-to-stand from two seat heights. *Spine, 35*(1), E1-7.
Kuys, S. S., Brauer, S. G., Ada, L., & Russell, T. G. (2008). Immediate effect of treadmill walking practice versus overground walking practice on overground walking pattern in ambulatory stroke patients: an experimental study. *Clinical Rehabilitation, 22*(10-11), 931-939.

Kuys, S. S., Dolecka, U. E., & Morrison, C. A. (2011). Appropriate seating for medical patients: an audit. *Australian Health Review, 35*(3), 316-319.

Kuzis, G., Sabe, L., Tiberti, C., Merello, M., Leiguarda, R., & Starkstein, S. E. (1999). Explicit and implicit learning in patients with Alzheimer disease and Parkinson disease with dementia. *Neuropsychiatry, Neuropsychology and Behavioral Neurology, 12*(4), 265-269.

Lam, L. C. W., Lui, V. W. C., Luk, D. N. Y., Chau, R., So, C., Poon, V., . . . Ko, F. S. L. (2010). Effectiveness of an individualized functional training program on affective disturbances and functional skills in mild and moderate dementia--a randomized control trial. *International Journal of Geriatric Psychiatry, 25*(2), 133-141.

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*, 159-174.

Lane, J. D., & Gast, D. L. (2014). Visual analysis in single case experimental design studies: brief review and guidelines. *Neuropsychological Rehabilitation, 24*(3-4), 445-463.

Ledford, J. R., & Gast, D. L. (2014). Measuring procedural fidelity in behavioural research. *Neuropsychological Rehabilitation, 24*(3-4), 332-348.

Lekeu, F., Wojtasik, V., Van der Linden, M., & Salmon, E. (2002). Training early Alzheimer patients to use a mobile phone. *Acta Neurologica Belgica, 102*(3), 114-121.

Leung, C. Y., & Chang, C. S. (2009). Strategies for posture transfer adopted by elders during sit-to-stand and stand-to-sit. *Perceptual and Motor Skills, 109*(3), 695-706.

Levac, D., Colquhoun, H., & O'Brien, K. K. (2010). Scoping studies: advancing the methodology. *Implementation Science, 5*(1), 1-9.

Lin, L. C., Huang, Y. J., Su, S. G., Tsai, B. W. J., & Wu, S. C. (2010). Using spaced retrieval and Montessori-based activities in improving eating ability for residents with dementia *International Journal of Geriatric Psychiatry, 25*, 953-959.

Livner, A., Laukka, E. J., Karlsson, S., & Backman, L. (2009). Prospective and retrospective memory in Alzheimer's disease and vascular dementia: similar patterns of impairment. *Journal of the Neurological Sciences, 283*(1-2), 235-239.

Lord, S. R., Murray, S. M., Chapman, K., Munro, B., & Tiedemann, A. (2002). Sit-to-stand performance depends on sensation, speed, balance, and psychological status in addition to strength in older people. *Journals of Gerontology Series A-Biological Sciences & Medical Sciences, 57*(8), M539-543.

Lucas, J. A. (2005). Disorders of memory. *The Psychiatric Clinics of North America, 28*(3), 581-597, 594.

Luft, A. R., & Buitrago, M. M. (2005). Stages of motor skill learning. *Molecular Neurobiology, 32*(3), 205-216.

MacKenzie, D. M., Copp, P., Shaw, R. J., & Goodwin, G. M. (1996). Brief cognitive screening of the elderly: a comparison of the Mini-Mental State Examination (MMSE), Abbreviated Mental Test (AMT) and Mental Status Questionnaire (MSQ). *Psychological Medicine, 26*(2), 427-430.

Manckoundia, P., Mourey, F., Pfitzenmeyer, P., & Papaxanthis, C. (2006). Comparison of motor strategies in sit-to-stand and back-to-sit motions between healthy and Alzheimer's disease elderly subjects. *Neuroscience, 137*(2), 385-392.

Manolov, R., Solanas, A., Sierra, V., & Evans, J. J. (2011). Choosing among techniques for quantifying single-case intervention effectiveness. *Behavior Therapy, 42*(3), 533-545.

Masumoto, K., Takai, T., Tsuneto, S., & Kashiwagi, T. (2004). Influence of motoric encoding on forgetting function of memory for action sentences in patients with Alzheimer's disease. *Perceptual and Motor Skills, 98*(1), 299-306.

Mathiyakom, W., McNitt-Gray, J. L., Requejo, P., & Costa, K. (2005). Modifying center of mass trajectory during sit-to-stand tasks redistributes the mechanical demand across the lower extremity joints. *Clinical Biomechanics, 20*(1), 105-111.

Mattay, V. S., Fera, F., Tessitore, A., Hariri, A. R., Das, S., Callicott, J. H., & Weinberger, D. R. (2002). Neurophysiological correlates of age-related changes in human motor function. *Neurology, 58*(4), 630-635.

May, B. J. (2003). Mobility training for the older adult. *Topics in Geriatric Rehabilitation, 19*(3), 191-198.

Mazza, C., Benvenuti, F., Bimbi, C., & Stanhope, S. J. (2004). Association between subject functional status, seat height, and movement strategy in sit-to-stand performance. *Journal of the American Geriatrics Society, 52*(10), 1750-1754.

Middleton, E. L., & Schwartz, M. F. (2012). Errorless learning in cognitive rehabilitation: a critical review. *Neuropsychological Rehabilitation, 22*(2), 138-168.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Group, P. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA Statement. *Open Medicine, 3*(3), e123-130.

Molloy, D. W., Alemayehu, E., & Roberts, R. (1991). Reliability of a Standardized Mini-Mental State Examination compared with the traditional Mini-Mental State Examination. *Am J Psychiatry, 148*(1), 102-105.

Monroe, T., & Carter, M. (2012). Using the Folstein Mini Mental State Exam (MMSE) to explore methodological issues in cognitive aging research. *European Journal of Ageing, 9*(3), 265-274.

Morris, J. C. (1997). Clinical Dementia Rating: a reliable and valid diagnostic and staging measure for dementia of the Alzheimer type. *International Psychogeriatrics, 9 Suppl 1*, 173-176; discussion 177-178.

Mourey, F., Grishin, A., d'Athis, P., Pozzo, T., & Stapley, P. (2000). Standing up from a chair as a dynamic equilibrium task: comparison between young and elderly subjects. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 55A*(9), B425-431.

Mourey, F., Pozzo, T., Rouhier-Marcer, I., & Didier, J. P. (1998). A kinematic comparison between elderly and young subjects standing up from and sitting down in a chair. *Age and Ageing, 27*(2), 137-146.

Neely, A. S., Vikstrom, S., & Josephsson, S. (2009). Collaborative memory intervention in dementia: caregiver participation matters. *Neuropsychological Rehabilitation, 19*(5), 696-715.

Nestor, P. J., Fryer, T. D., & Hodges, J. R. (2006). Declarative memory impairments in Alzheimer's disease and semantic dementia. *Neuroimage, 30*(3), 1010-1020.

Nourbakhsh, M. R., & Ottenbacher, K. J. (1994). The statistical analysis of single-subject data: a comparative examination. *Physical Therapy, 74*(8), 768-776.

Nuzik, S., Lamb, R., VanSant, A., & Hirt, S. (1986). Sit-to-stand movement pattern. A kinematic study. *Physical Therapy, 66*(11), 1708-1713.

O'Bryant, S. E., Humphreys, J. D., Smith, G. E., Ivnik, R. J., Graff-Radford, N. R., Petersen, R. C., & Lucas, J. A. (2008). Detecting dementia with the Mini-Mental State Eexamination in highly educated individuals. *Archives of Neurolology, 65*(7), 963-967.

Oren, S., Willerton, C., & Small, J. (2014). Effects of spaced retrieval training on semantic memory in Alzheimer's disease: a systematic review. *Journal of Speech, Language, and Hearing Research, 57*(1), 247-270.

Pai, Y.-C., Naughton, B. J., Chang, R. W., & Rogers, M. W. (1994). Control of body centre of mass momentum during sit-to-stand among young and elderly adults. *Gait & Posture, 2*(2), 109-116.

Pai, Y. C., & Lee, W. A. (1994). Effect of a terminal constraint on control of balance during sit-to-stand. *Journal of Motor Behavior, 26*(3), 247-256.

Papa, E., & Cappozzo, A. (2000). Sit-to-stand motor strategies investigated in able-bodied young and elderly subjects. *Journal of Biomechanics, 33*(9), 1113-1122.

Parry, R. H. (2004). Communication during goal-setting in physiotherapy treatment sessions. *Clinical Rehabilitation, 18*, 668-682.

Parry, R. H. (2005a). Official recommendations and actual practice in physiotherapy: managing troubles of physical performance. *Communication & Medicine, 2*(2), 151-161.

Parry, R. H. (2005b). A video analysis of how physiotherapists comunicate with patients about errors of performance: insight for practice and policy. *Physiotherapy, 91*, 204-214.

Pedone, C., Ercolani, S., Catani, M., Maggio, D., Ruggiero, C., Quartesan, R., . . . Group, G. S. (2005). Elderly patients with cognitive impairment have a high risk for functional decline during hospitalization: The GIFA Study. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 60*(12), 1576-1580.
Perneczky, R., Wagenpfeil, S., Komossa, K., Grimmer, T., Diehl, J., & Kurz, A. (2006). Mapping scores onto stages: Mini-Mental State Examination and Clinical Dementia Rating. *The American Journal of Geriatric Psychiatry, 14*(2), 139-144.
Perry, S. B., Marchetti, G. F., Wagner, S., & Wilton, W. (2006). Predicting caregiver assistance required for sit-to-stand following rehabilitation for acute stroke. *Journal of Neurologic Physical Therapy, 30*(1), 2-2-11.
Peters, F., Collette, F., Degueldre, C., Sterpenich, V., Majerus, S., & Salmon, E. (2009). The neural correlates of verbal short-term memory in Alzheimer's disease: an fMRI study. *Brain, 132*(Pt 7), 1833-1846.
Pham, M. T., Rajic, A., Greig, J. D., Sargeant, J. M., Papadopoulos, A., & McEwen, S. A. (2014). A scoping review of scoping reviews: advancing the approach and enhancing the consistency. *Research Synthesis Methods, 5*(4), 371-385.
Poblador-Plou, B., Calderon-Larranaga, A., Marta-Moreno, J., Hancco-Saavedra, J., Sicras-Mainar, A., Soljak, M., & Prados-Torres, A. (2014). Comorbidity of dementia: a cross-sectional study of primary care older patients. *BMC Psychiatry, 14*(84), 1-8.
Pomeroy, V. M., Pramanik, A., Sykes, L., Richards, J., & Hill, E. (2003). Agreement between physiotherapists on quality of movement rated via videotape. *Clinical Rehabilitation, 17*(3), 264-272.
Provencher, V., Bier, N., Audet, T., & Gagnon, L. (2008). Errorless-based techniques can improve route finding in early Alzheimer's disease: a case study. *American Journal of Alzheimer's Disease and Other Dementias, 23*(1), 47-56.
Rice, M. S., Fertig, P. A., Maitra, K. K., & Miller, B. K. (2008). Reduced Feedback: Motor Learning Strategy in Persons with Alzheimer's Disease. *Physical & Occupational Therapy in Geriatrics, 27*(2), 122-138.
Riley, P. O., Krebs, D. E., & Popat, R. A. (1997). Biomechanical analysis of failed sit-to-stand. *IEEE Transactions on Rehabilitation Engineering, 5*(4), 353-359.
Roberts, L., & Bucksey, S. J. (2007). Communicating with patients: what happens in practice? *Physical Therapy, 87*(5), 586-594.
Rogers, J. C., Holm, M. B., Burgio, L. D., Granieri, E., Hsu, C., Hardin, J. M., & McDowell, B. J. (1999). Improving morning care routines of nursing home residents with dementia. *Journal of the American Geriatric Society, 47*(9), 1049-1057.
Rönnberg, J. (1999). Cognitive and communicative perspectives on physiotherapy: a review. *Advances in Physiotherapy, 1*(1), 37-44.
Rosano, C., Simonsick, E. M., Harris, T. B., Kritchevsky, S. B., Brach, J., Visser, M., . . . For the Health, A. B. C. C. R. G. (2005). Association between physical and cognitive function in healthy elderly: The Health, Aging and Body Composition Study. *Neuroepidemiology, 24*(1-2), 8-14.
Rosler, A., Seifritz, E., Krauchi, K., Spoerl, D., Brokuslaus, I., Proserpi, S. M., . . . Hofmann, M. (2002). Skill learning in patients with moderate Alzheimer's disease: a prospective pilot-study of waltz-lessons. *International Journal of Geriatric Psychiatry, 17*(12), 1155-1156.
Rothera, I., Jones, R., Harwood, R., Avery, A., & Waite, J. (2003). Health status and assessed need for a cohort of older people admitted to nursing and residential homes. *Age and Ageing, 32*(3), 303-309.
Rouleau, I., Salmon, D. P., & Vrbancic, M. (2002). Learning, retention and generalization of a mirror tracing skill in Alzheimer's disease. *Journal of Clinical and Experimental Neuropsychology, 24*(2), 239-250.
Ryan, D. J., O'Regan, N. A., Caoimh, R. O., Clare, J., O'Connor, M., Leonard, M., . . . Timmons, S. (2013). Delirium in an adult acute hospital population: predictors, prevalence and detection. *BMJ Open, 3*(1).

Sabol, V. K., Resnick, B., Galik, E., Gruber-Baldini, A. L., Morton, P. G., & Hicks, G. E. (2011). Exploring the factors that influence functional performance among nursing home residents. *Journal of Aging and Health, 23*(1), 112-134.

Samuel, D., Rowe, P., & Nicol, A. (2013). The functional demand (FD) placed on the knee and hip of older adults during everyday activities. *Archives of Gerontology and Geriatrics, 57*(2), 192-197.

Sands, L. P., Yaffe, K., Lui, L. Y., Stewart, A., Eng, C., & Covinsky, K. (2002). The effects of acute illness on ADL decline over 1 year in frail older adults with and without cognitive impairment. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 57*(7), M449-454.

Sauvaget, C., Yamada, M., Fujiwara, S., Sasaki, H., & Mimori, Y. (2002). Dementia as a predictor of functional disability: a four-year follow-up study. *Gerontology, 48*(4), 226-233.

Scarborough, D. M., McGibbon, C. A., & Krebs, D. E. (2007). Chair rise strategies in older adults with functional limitations. *Journal of Rehabilitation Research and Development, 44*(1), 33-42.

Schenkman, M., Berger, R. A., Riley, P. O., Mann, R. W., & Hodge, W. A. (1990). Whole-body movements during rising to standing from sitting. *Physical Therapy, 70*(10), 638-648.

Schenkman, M., Riley, P. O., & Pieper, C. (1996). Sit to stand from progressively lower seat heights - alterations in angular velocity. *Clinical Biomechanics, 11*(3), 153-158.

Schultz, A. B., Alexander, N. B., & Ashton-Miller, J. A. (1992). Biomechanical analyses of rising from a chair. *Journal of Biomechanics, 25*(12), 1383-1391.

Seelye, A. M., Schmitter-Edgecombe, M., Das, B., & Cook, D. J. (2012). Application of cognitive rehabilitation theory to the development of smart prompting technologies. *IEEE Reviews in Biomedical Ingineering, 5*, 29-44.

Seidler, R. D. (2007). Aging affects motor learning but not savings at transfer of learning. *Learning & Memory, 14*(1-2), 17-21.

Shepherd, R. B., & Gentile, A. M. (1994). Sit-to-stand: Functional relationship between upper body and lower limb segments. *Human Movement Science, 13*(6), 817-840.

Shepherd, R. B., & Koh, H. P. (1996). Some biomechanical consequences of varying foot placement in sit-to-stand in young women. *Scandinavian Journal of Rehabilitation Medicine, 28*(2), 79-88.

Small, J. A., & Gutman, G. (2002). Recommended and reported use of communication strategies in Alzheimer caregiving. *Alzheimer Disease and Associated Disorders, 16*(4), 270-278.

Smart, A. (2006). A multi-dimensional model of clinical utility. *International Journal for Quality in Health Care, 18*(5), 377-382.

Smith, E. R., Broughton, M., Baker, R., Pachana, N. A., Angwin, A. J., Humphreys, M. S., . . . Chenery, H. J. (2011). Memory and communication support in dementia: research-based strategies for caregivers. *International Psychogeriatrics 23*(2), 256-263.

Smith, J. D. (2012). Single-case experimental designs: a systematic review of published research and current standards. *Psychol Methods, 17*(4), 510-550.

Squire, L. R. (2009). Memory and brain systems: 1969-2009. *The Journal of Neuroscience, 29*(41), 12711-12716.

Squire, L. R., & Wixted, J. T. (2011). The cognitive neuroscience of human memory since H.M. *Annual Review of Neuroscience, 34*, 259-288.

Squire, L. R., & Zola-Morgan, S. (1991). The medial temporal lobe memory system. *Science, 253*(5026), 1380-1386.

Staples, S. (2006). Comprehensive rehabilitation for older persons with dementia. *Topics in Geriatric Rehabilitation, 22*(3), 197-2012.

Suttanon, P., Hill, K. D., Said, C. M., Logiudice, D., Lautenschlager, N. T., & Dodd, K. J. (2012). Balance and mobility dysfunction and falls risk in older people with mild to moderate Alzheimer disease. *Am J Phys Med Rehabil, 91*(1), 12-23.

Takata, Y., Ansai, T., Soh, I., Awano, S., Nakamichi, I., Akifusa, S., . . . Sonoki, K. (2013). Activities of daily living dependency and disease-specific mortality during 12-year follow-up in an 80-year-old population. *Aging Clinical and Experimental Research, 25*(2), 193-201.

Talvitie, U. (2000). Socio-affective characteristics and properties of extrinsic feedback in physiotherapy. *Physiotherapy Research International, 5*(3), 173-189.

Talvitie, U., & Reunanen, M. (2002). Interaction between hysiotherapists and patients in stroke treatment *Physiotherapy, 88*(2), 77-88.

Tappen, R. M. (1994). The effect of skill training on functional abilities of nursing home residents with dementia. *Research in Nursing Health, 17*(3), 159-165.

Tappen, R. M., Roach, K. E., Buchner, D., Barry, C., & Edelstein, J. (1997). Reliability of physical performance measures in nursing home residents with Alzheimer's disease. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 52*(1), M52-55.

Tate, R. L., McDonald, S., Perdices, M., Togher, L., Schultz, R., & Savage, S. (2008). Rating the methodological quality of single-subject designs and n-of-1 trials: introducing the Single-Case Experimental Design (SCED) Scale. *Neuropsychological Rehabilitation, 18*(4), 385-401.

Tate, R. L., Perdices, M., McDonald, S., Togher, L., & Rosenkoetter, U. (2014). The design, conduct and report of single-case research: resources to improve the quality of the neurorehabilitation literature. *Neuropsychological Rehabilitation, 24*(3-4), 315-331.

Tate, R. L., Perdices, M., Rosenkoetter, U., Wakim, D., Godbee, K., Togher, L., & McDonald, S. (2013). Revision of a method quality rating scale for single-case experimental designs and n-of-1 trials: the 15-item Risk of Bias in N-of-1 Trials (RoBiNT) Scale. *Neuropsychological Rehabilitation, 23*(5), 619-638.

Tate, R. L., Taylor, C., & Aird, V. (2013). Applying empirical methods in clinical practice: introducing the model for assessing treatment effect. *The Journal of Head Trauma Rehabilitation, 28*(2), 77-88.

Taylor, M. E., Delbaere, K., Lord, S. R., Mikolaizak, A. S., & Close, J. C. (2013). Physical impairments in cognitively impaired older people: implications for risk of falls. *Int Psychogeriatr, 25*(1), 148-156.

Taylor, R. (1998). Spiral maze performance in dementia. *Perceptual and Motor Skills, 87*(1), 328-330.

Thivierge, S., Jean, L., & Simard, M. (2014). A randomized cross-over controlled study on cognitive rehabilitation of instrumental activities of daily living in Alzheimer disease. *The American Journal of Geriatric Psychiatry, 22*(11), 1188-1199.

Thivierge, S., Simard, M., Jean, L., & Grandmaison, E. (2008). Errorless learning and spaced retrieval techniques to relearn instrumental activities of daily living in mild Alzheimer's disease: a case report study. *Neuropsychiatric Disease and Treatment, 4*(5), 987-999.

Thomas, V. S. (2005). Restoring success where once was thought only failure lay: the viability of functional rehabilitation for people with cognitive impairment. *Journal of the American Geriatrics Society, 53*(9), 1624-1626.

Thompson, C., Brodaty, H., Trollor, J., & Sachdev, P. (2010). Behavioral and psychological symptoms associated with dementia subtype and severity. *Internationa Psychogeriatrics, 22*(2), 300-305.

Thunborg, C., Von Heideken Wagert, P., Soderlund, A., & Gotell, E. (2012). Reciprocal struggling in person transfer task - caregivers' expereince in dementia care. *Advances in Physiotherapy, 14*, 175-182.

Tilson, J. K., Sullivan, K. J., Cen, S. Y., Rose, D. K., Koradia, C. H., Azen, S. P., & Duncan, P. W. (2010). Meaningful gait speed improvement during the first 60 days poststroke: minimal clinically important difference. *Physical Therapy, 90*(2), 196-208.

Tully, E. A., Fotoohabadi, M. R., & Galea, M. P. (2005). Sagittal spine and lower limb movement during sit-to-stand in healthy young subjects. *Gait & Posture, 22*(4), 338-345.

Turcot, K., Armand, S., Fritschy, D., Hoffmeyer, P., & Suva, D. (2012). Sit-to-stand alterations in advanced knee osteoarthritis. *Gait & Posture, 36*(1), 68-72.

Valenti, D. A. (2010). Alzheimer's disease: visual system review. *Optometry, 81*(1), 12-21.
van Halteren-van Tilborg, I. A., Scherder, E. J., & Hulstijn, W. (2007). Motor-skill learning in Alzheimer's disease: a review with an eye to the clinical practice. *Neuropsychology Review, 17*(3), 203-212.
van Steenoven, I., Aarsland, D., Hurtig, H., Chen-Plotkin, A., Duda, J. E., Rick, J., . . . Weintraub, D. (2014). Conversion between Mini-Mental State Examination, Montreal Cognitive Assessment, and Dementia Rating Scale-2 scores in Parkinson's disease. *Movement Disorders, 29*(14), 1809-1815.
van Tilborg, I. A., & Hulstijn, W. (2010). Implicit motor learning in patients with Parkinson's and Alzheimer's disease: differences in learning abilities? *Motor Control, 14*(3), 344-361.
van Tilborg, I. A., Kessels, R. P., & Hulstijn, W. (2011). How should we teach everyday skills in dementia? A controlled study comparing implicit and explicit training methods. *Clinical Rehabilitation, 25*(7), 638-648.
Varnam, W. (2011). How to mobilise patients with dementia to a standing position. *Nursing Older People, 23*(8), 31-36.
Verfaellie, M., Keane, M. M., & Johnson, G. (2000). Preserved priming in auditory perceptual identification in Alzheimer's disease. *Neuropsychologia, 38*(12), 1581-1592.
Vertesi, A., Lever, J. A., Molloy, D. W., Sanderson, B., Tuttle, I., Pokoradi, L., & Principi, E. (2001). Standardized Mini-Mental State Examination. Use and interpretation. *Canadian Family Physician, 47*, 2018-2023.
Vidoni, E. D., & Boyd, L. A. (2007). Achieving enlightenment: what do we know about the implicit learning system and its interaction with explicit knowledge? *Journal of neurologic physical therapy : JNPT, 31*(3), 145-154.
Vieira, E. R., Kumar, S., Coury, H. J., & Narayan, Y. (2006). Low back problems and possible improvements in nursing jobs. *Journal of Advanced Nursing, 55*(1), 79-89.
Vincent, H. K., Vincent, K. R., & Lamb, K. M. (2010). Obesity and mobility disability in the older adult. *Obes Rev, 11*(8), 568-579.
Voss, J. L., & Paller, K. A. (2008). Brain substrates of implicit and explicit memory: the importance of concurrently acquired neural signals of both memory types. *Neuropsychologia, 46*(13), 3021-3029.
Vuorinen, E., Laine, M., & Rinne, J. (2000). Common pattern of language impairment in vascular dementia and in Alzheimer disease. *Alzheimer Disease and Associated Disorders, 14*(2), 81-86.
Wangblad, C., Ekblad, M., Wijk, H., & Ivanoff, S. D. (2009). Experiences of physical strain during person transfer situations in dementia care units. *Scandinavian Journal of Caring Sciences, 23*(4), 644-650.
Weirather, R. R. (2010). Communication strategies to assist comprehension in dementia. *Hawaii Medical Journal, 69*(3), 72-74.
Wheeler, J., Woodward, C., Ucovich, R. L., Perry, J., & Walker, J. M. (1985). Rising from a chair. *Physical Therapy, 65*(1), 22-26.
White, L., Ford, M. P., Brown, C. J., Peel, C., & Triebel, K. L. (2014). Facilitating the use of implicit memory and learning in the physical therapy management of individuals with Alzheimer disease: a case series. *J Geriatr Phys Ther, 37*(1), 35-44.
Wilson, R., Rochon, E., Mihailidis, A., & Leonard, C. (2012). Examining success of communication strategies used by formal caregivers assisting individuals with Alzheimer's disease during an activity of daily living. *Journal of Speech, Language, and Hearing Research, 55*(2), 328-341.
Wixted, J. T., & Squire, L. R. (2011). The medial temporal lobe and the attributes of memory. *Trends in Cognitive Sciences, 15*(5), 210-217.
Wolf, S. L., Blanton, S., Baer, H., Breshears, J., & Butler, A. J. (2002). Repetitive task practice: a critical review of constraint-induced movement therapy in stroke. *Neurologist, 8*(6), 325-338.
Wu, H. S., Lin, L. C., Su, S. C., & Wu, S. C. (2014). The effects of spaced retrieval combined with errorless learning in institutionalized elders with dementia: recall performance,

cognitive status, and food intake. *Alzheimer Disease and Associated Disorders, 28*(4), 333-339.
Wu, H. S., Lin, L. C., Wu, S. C., Lin, K. N., & Liu, H. C. (2014). The effectiveness of spaced retrieval combined with Montessori-based activities in improving the eating ability of residents with dementia. *Journal of Advanced Nursing, 70*(8), 1891-1901.
Yamada, T., & Demura, S. (2009). Relationships between ground reaction force parameters during a sit-to-stand movement and physical activity and falling risk of the elderly and a comparison of the movement characteristics between the young and the elderly. *Archives of Gerontology & Geriatrics, 48*(1), 73-77.
Yamada, T., Demura, S., & Takahashi, K. (2013). Center of gravity transfer velocity during sit-to-stand is closely related to physical functions regarding fall experience of the elderly living in community dwelling. *Health, 5*(12), 2097-2103.
Yan, J. H., & Dick, B. M. (2006). Practice effect on motor control in healthy seniors and patients with mild cognitive impairement and Alzheimer's disease. *Aging, Neuropsychology, and Cognition, 13*, 385-410.
Yu, F., Evans, L. K., & Sullivan-Marx, E. M. (2005). Functional outcomes for older adults with cognitive impairment in a comprehensive outpatient rehabilitation facility. *Journal of the American Geriatrics Society, 53*(9), 1599-1606.
Zanetti, O., Binetti, G., Magni, E., Rozzini, L., Bianchetti, A., & Trabucchi, M. (1997). Procedural memory stimulation in Alzheimer's disease: impact of a training programme. *Acta Neurologica Scandinavica, 95*(3), 152-157.
Zanetti, O., Zanieri, G., Giovanni, G. D., De Vreese, L., . P., Pezzini, A., Metitieri, T., & Trabucchi, M. (2001). Effectiveness of proceduaral memory stimulation in mild Alzheimer's disease patients: A controlled study. *Neuropsychological Rehabilitation. An International Journal, 11*(3/4), 263-272.
Zieschang, T., Dutzi, I., Müller, E., Hestermann, U., Grünendahl, K., Braun, A. K., . . . Oster, P. (2010). Improving care for patients with dementia hospitalized for acute somatic illness in a specialized care unit: a feasibility study. *International Psychogeriatrics, 22*(1), 139-146.
Zisberg, A., Shadmi, E., Sinoff, G., Gur-Yaish, N., Srulovici, E., & Admi, H. (2011). Low mobility during hospitalization and functional decline in older adults. *Journal of the American Geriatrics Society, 59*(2), 266-273.
Zuidema, S. U., Derksen, E., Verhey, F. R., & Koopmans, R. T. (2007). Prevalence of neuropsychiatric symptoms in a large sample of Dutch nursing home patients with dementia. *International Journal of Geriatric Psychiatry, 22*(7), 632-638.