

Research Article

Comparison of equipment prescriptions in the toilet/bathroom by occupational therapists using home visits and digital photos, for patients in rehabilitation

Sharon Sim,¹ Christopher J. Barr² and Stacey George²

¹Occupational Therapy, Society for the Physically Disabled, SPD Ability Centre, Singapore and ²Rehabilitation Aged and Extended Care, Flinders University, Adelaide, South Australia, Australia

Background/aim: Home visits, used by occupational therapists to facilitate independence and enhance safety, are effective but costly and time consuming. This research aims to establish the level of agreement in equipment prescribed by occupational therapists using: digital photographs only, and using home visits and digital photographs, respectively.

Method: Quasi-experimental methodological design conducted in private dwellings in the community in Adelaide with rehabilitation patients and their family members. The equipment recommended by occupational therapists for the toilet and bathroom using similar methods (both digital photographs from previous data; $n = 5$) was compared with equipment recommended using different methods (conventional home visits vs. digital photographs; $n = 14$).

Results: Percent agreement for equipment prescribed between groups, that is digital only and home visit/photography, were: 72.5/83.9% for toilet; 87.4/88.3% for bathroom and 83/87% for toilet and bathroom. Variability of agreement in the equipment prescribed showed that some items of equipment were incongruently prescribed, by both methods for toilet and bathroom areas.

Conclusion: Using digital photographs taken by family members, patient information, and an equipment list is a reliable method of making accurate equipment prescriptions in the toilet and bathroom areas. To enhance accuracy, in-depth patient information via face-to-face interview and measurements of physical environment should be included.

KEY WORDS ageing, domains of function, focus for assessment, home assessment, rehabilitation services.

Introduction

After an acute medical illness, the ability of patients to manage at home may be made difficult due to increased disability (Gill, Allore, Holford & Guo, 2004), with negative consequences including a risk of developing dependency, unplanned hospital readmissions and premature admission into residential care (Gill & Kurland, 2003; Naik, Concato & Gill, 2004). The incidence of falls in the home can increase due to a mismatch between the functional capability of the patient and the demands of the physical environment. Furthermore, fall-induced injuries can lead to hospital admission, admission into residential care (Rubenstein, 2006) or death, all contributing to increased health-care costs (Moller, 2003). These fall-induced injuries may be preventable with the implementation of a home visit to maximise an individual's safety at home.

Home visits conducted by occupational therapists have the aim of: identifying/modifying hazards; prescribing equipment; facilitating functional independence; enhancing safety; and minimising the need for care services, thereby reducing health-care costs (Connell & Sanford, 2001; Gitlin, 1998; Mann, Ottenbacher, Fraas, Tomita & Granger, 1999; Pynoos, 1993). The implementation of home visits is, however, time-consuming and costly. The time taken for home visits, including travelling time, ranges from an average of 68 (Lannin *et al.*, 2007) to 108.4 minutes (Renforth, Yapa & Forster, 2004) in metropolitan areas. Therapists spent an average of 49 minutes in the homes (Renforth *et al.*), with the remainder of time spent travelling, which reduce the number of patients serviced (Sanford & Butterfield, 2005).

Advancements in technology have enabled new research to be conducted in remote service delivery in the areas of telemedicine/telerehabilitation. Feasibility

Sharon Sim MCR, BOT (Hons), DipOT; Occupational Therapist. Christopher J. Barr PhD, MRes, BSc (Hons); Research Lecturer. Stacey George PhD, MHSc (OT), BAppSc (OT); Occupational Therapist.

Correspondence: Stacey George, Rehabilitation Aged and Extended Care, Flinders University, Daws Road, Daw Park, Adelaide, SA 5041, Australia. Email: stacey.george@health.sa.gov.au

Accepted for publication 3 February 2014.

© 2014 Occupational Therapy Australia

of using remote means in making a medical diagnosis (Bowman, Kennedy, Kirwan, Sze & Murdoch, 2003; Oz-tas *et al.*, 2004), implementing nursing (Mathewson, Adkins & Jones, 2000) or rehabilitation interventions (Lai, Woo, Hui & Chan, 2004; Russell, Buttrum, Wootton & Jull, 2004) have been widely studied.

Evidence about the use of remote means in implementing home visits is limited. Two studies have examined the usage of remote means to assess for home modifications and equipment prescription (Sanford & Butterfield, 2005; Sim, 2006). Both of these studies utilised remote methods of making recommendations in the homes compared to the recommendations made during conventional home visits. Firstly, Sanford and Butterfield explored a paper-and-pencil and televideo protocol. Secondly, Sim explored the use of digital photographs taken by occupational therapists. Findings from both studies concur that using these novel methods for making recommendations in the home were as reliable as conventional home visits, indicating the use of digital technology to make recommendations in the home, without an actual home visit, is highly feasible. However, both studies resulted in a minimal reduction in resources as technician or an occupational therapist travelled to the patients' homes for the set up of equipment or the collection of data or for digital photography.

Methods for home assessment that further reduce time and costs need to be developed, whilst still enabling accurate equipment recommendations in the homes to be made. One potential strategy is to utilise digital photographs taken by the patients' family, enabling occupational therapists to make recommendations regarding the patients' homes without an actual home visit.

This study sought to establish the reliability of making equipment prescriptions in the toilet and bathroom areas of private dwellings using digital photographs taken by patients' family members, patient information and an equipment list, in comparison to equipment prescriptions made during a conventional home visit. Objectives of this study were: (i) to establish the level of agreement in the equipment prescribed in the toilet/bathroom areas by two occupational therapists using digital photographs only; (ii) to establish the level of agreement in the equipment prescribed in the toilet/bathroom areas by occupational therapists using different methods, namely home visits and digital photographs, respectively; and (iii) to analyse the difference in the variability of agreement in the equipment prescribed between both methods of equipment prescription.

Methods

A quasi-experimental methodological design was utilised for this study. This study was approved by the

Southern Adelaide Clinical Human Research Ethics Committee.

Personnel

Four occupational therapists were recruited to participate in this study, with three occupational therapists, from the Rehabilitation in the Home Program (RITHOM) of the Repatriation General Hospital (RGH), South Australia, these make up all occupational therapists performing home visits in this service. RITHOM provides multi-disciplinary active rehabilitation in patients' homes in lieu of in-patient rehabilitation. The fourth occupational therapist was independent of RGH. All participating occupational therapists were required to have at least 5 years of working experience and in a senior position.

Participants

Patients admitted into RITHOM from April to May 2012, were screened for inclusion into the study. Patients were invited to participate if they met the following criteria: (i) above the age of 18 and (ii) had a family member who was present and agreeable to take digital photographs during the home visit.

Instrument

A home visit form (see Appendix S1) and a photography guideline were developed and utilised in consultation with the occupational therapists. The home visit form captured information including: (i) patient's demographics, diagnosis, fall history and functional status (transfers, balance, physical endurance, assistance required); (ii) equipment prescribed in the toilet/bathroom areas; and (iii) family member's demographics, knowledge in operating a digital camera, ownership of an existing digital camera, confidence in up-loading and emailing digital photographs. A total of 27 pieces of equipment from the RGH equipment stock were listed in a check box format. Blank pages were provided for the inclusion of digital photographs taken of the toilet/bathroom areas.

A photography guideline was developed which included information and graphic examples of: how digital photographs should be taken, highlighting specific fixtures to be included: steps, kerbs or thresholds to shower area; rim of bath; position of toilet bowl in relation to wall; positions of toilet roll holder, taps, shower rose and shower hose; and any obvious hazards. Two 12.1 megapixel digital cameras (Canon Ixus 115HS, 800X600 pixels, with JPEG compression, North Ryde, NSW, Australia) were utilised for this study.

Procedures

Comparison using digital photographs: This examined the feasibility of the method of prescribing equipment from photographs, the usability of the forms developed and the general level of agreement. The four occupational

therapists made equipment prescriptions for five toilet/bathroom areas using the 27-item equipment list, information on patient's demographics, diagnosis and functional status, from gray-scaled digital photographs obtained from a previous study (Sim, 2006). Comparison using different methods, namely home visits and digital photographs, respectively. For those patients who met the inclusion criteria, information about the study as well as the photography guideline were provided to the patient and family member by the occupational therapist performing the conventional home visit. Written consent was obtained. The family member then proceeded to take digital photographs of the home toilet/bathroom areas without any physical or verbal assistance from the occupational therapist. The conventional home visit, inclusive of home modification and equipment prescription and measurements, was subsequently conducted by the occupational therapist. The participants received the equipment prescribed from the conventional home visit.

The home visit form was completed by the visiting occupational therapist, with digital colour photographs taken by the family member included. A de-identified duplicate of the original home visit form, excluding the equipment prescribed, was then sent to another occupational therapist, blinded to the equipment prescription from the conventional home visit. Completed forms with details of equipment prescription, by both occupational therapists using the different methods of prescription, i.e. conventional home visit and digital photo, were then sent to the researcher for data analysis.

Statistical analysis

Sample size was based on a similar study conducted by Sim (2006) who demonstrated moderate strength of agreement in the equipment prescribed between the occupational therapists performing home visits and occupational therapists taking a digital photo in the toilet/bathroom areas from 30 home visits. It was determined that a sample size of 40 patients should be recruited for this study so that a greater strength of agreement be established.

Descriptive statistics were used to: report patients' demographic and clinical characteristics; family members' demographic information; and responses to questions regarding knowledge, ownership and confidence on usage of digital technology.

Equipment prescribed by the occupational therapist in the toilet/bathroom areas were determined using a 'yes-no' response. A total of four possible combinations were derived (e.g. yes-yes, no-no, yes-no and no-yes). Percent agreement was used to determine the level of agreement in the equipment prescribed between the occupational therapists in the toilet/bathroom areas by both methods. Percent agreement describes the total proportion of equipment prescribed by occupational therapists on which there is an agreement. The positive and negative percent agreement, which describe the

total proportion of equipment prescribed (yes-yes) or not prescribed (no-no) by both occupational therapists, was also determined.

Descriptive statistics were used to determine the variability of agreement in the toilet/bathroom equipment prescribed between the occupational therapists using the two methods. Differences in variability of agreement in the equipment prescribed by occupational therapists using digital photographs only, and between occupational therapists using different methods, namely home visits and digital photographs, respectively, were qualitatively analysed. Statistical analyses were performed using Statistical Package for Social Sciences version 19 (IBM Corp., Armonk, NY, USA).

Results

Participants

Twenty-nine patients had family members present during the home visit, however, only 16 were recruited into the study. Reasons for non-recruitment include: patient/family member was in distress and unable to provide consent ($n = 3$); family member unable to participate due to medical condition ($n = 2$); declined participation ($n = 3$); hospital occupational therapist forgot to bring camera or recruit patient/family member ($n = 4$); and unidentified reason ($n = 1$). Digital photographs from two of 16 patients were incomplete and hence were excluded from the study, leaving a total of 14 patients. Table 1 shows the demographic and clinical characteristics of these 14 patients.

TABLE 1: Demographic and clinical characteristics of patients

Demographic features	Frequency ($n = 14$)	%
Age (mean \pm SD)	72.9 \pm 15.4	
<40 years	1	7.1
40–64 years	2	14.3
65–84 years	7	50
≥ 85 years	4	28.6
Gender		
Male	7	50
Female	7	50
Previous history of falls		
Yes	7	50
No	7	50
Diagnostic category		
Neurology	4	28.6
Orthopaedic	3	21.4
Cardiac	1	7.1
Cancer	2	14.3
Functional decline	4	28.6

The mean age of patients was 72.9 years (SD = 15.4), ranging from 31 to 96 years, with an equal proportion of male and female patients. Of the 14 patients, half of them had a history of falls. Patients presented with a variety of medical conditions, classified into the following categories: neurology, orthopaedic, cardiac, cancer and functional decline.

Family members

Fourteen family members took digital photographs of the patients' home toilet/bathroom areas. Table 2 shows their demographic information and responses regarding knowledge, ownership and confidence on usage of digital technology. The majority (42.9%) of family members were children of the patients, and all were below the age of 85. Nine (64.3%) had previous knowledge in using a digital camera, with the same number possessing a digital camera. Less than half (42.9%) were confident in up-loading and emailing the digital photographs to the occupational therapist. For those that were not confident emailing, the camera was brought back by the visiting occupational therapist and staff printed photographs.

Level of agreement

The occupational therapists made equipment prescriptions for five, by photograph only, and 14 for home visit/digital photograph in toilet and bathroom areas.

TABLE 2: Demographic information of family members and their responses to questions on digital technology

Demographic features and responses to questions	Frequency (<i>n</i> = 14)	%
Relationship to patient		
Partner	5	35.7
Child	6	42.9
Grandchild	0	0
Others	3	21.4
Age range		
<40 years	2	14.3
40–64 years	6	42.9
65–84 years	6	42.9
≥85 years	0	0
Possess prior knowledge in using a digital camera		
Yes	9	64.3
No	5	35.7
Ownership of a digital camera		
Yes	9	64.3
No	5	35.7
Confidence in loading and emailing photos to hospital		
Yes	6	42.9
No	8	57.1

The level of agreement in the equipment prescribed between the occupational therapists by photograph only and for home visit/digital photograph in both the toilet and bathroom areas, and toilet and bathroom areas separately are shown in Table 3.

Toilet and bathroom

A total of 135 items of equipment were compared for level of agreement in the digital photograph only group, with percent agreement being 83%. A total of 78 items of equipment were compared for level of agreement in the home visit vs. digital photograph group, with the overall percent agreement in equipment prescriptions was 87% (Table 3).

Toilet

A total of 40 items of equipment were compared for level of agreement in digital photograph only group, with the percent agreement in equipment prescription in the toilet was 72.5%. In home visit/digital photographs group 112 items of equipment were compared, with percent agreement being 83.9% (Table 3).

Bathroom

A total of 95 items of equipment were compared for level of agreement in digital photograph only group and the percent agreement in equipment prescription was 87.4%. In home visit/digital photos group 266 items of equipment were compared, with percent agreement being 88.3%.

Variability of agreement

An overview of the variability of agreement in the equipment prescribed by the occupational therapists for the toilet/bathroom areas showed that some items of equipment were not consistently prescribed by occupational therapists using both methods of prescription, i.e. conventional home visits and digital photographs. Table 4 shows the variability of agreement in the equipment prescribed between the occupational therapists using digital photos only, and both methods of conventional homes visits and photographs in the toilet/bathroom areas.

Toilet

Equipment such as over toilet frame, raised toilet seat and others (e.g. mat removal and door rehinged to swing outwards) were prescribed by the conventional home visit and not by the digital photographs. Conversely, equipment such as raised toilet seat with arms was prescribed by the digital photographs and not by conventional home visit. There were some items of equipment, namely the raised toilet seat with lid and mobile commode, which were not prescribed by either method (Table 4).

Disagreements in the equipment prescribed between the occupational therapists in the toilet area were: a

TABLE 3: Level of agreement in the equipment prescribed occupational therapists by different methods of prescription. Group 1 – Digital photos only group, Group 2 – Home visit vs. digital photos group

	Toilet and bathroom		Toilet		Bathroom	
	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
Equipment prescriptions (n)	135	378	40	112	95	266
Agreement	112/135	329/378	29/40	94/112	83/95	235/266
Percent agreement	83	87	72.5	83.9	87.4	88.3
Positive percent agreement	7.4	2.9	2.5	0.9	9.5	3.8
Negative percent agreement	75.6	84.1	70	83	77.9	84.6

total of 11 of 40 in the digital photograph only group and 18 of 112 in the home visit vs. digital photograph group. Items of equipment with the most disagreement between the two groups of occupational therapists were the over toilet frame and raised toilet seat with arms (Table 4).

Bathroom

Transfer bench was prescribed by one occupational therapist and not by another occupational therapist using photographs only. Correspondingly, equipment such as the bathboard-plastic was prescribed by one occupational therapist, and not another. There were six items of equipment which were not prescribed by any occupational therapists using either method of home visit or digital photograph group (Table 4).

There were a total of 12 of 95 and 31 of 266 disagreements in the equipment prescribed between the occupational therapists in the bathroom area in digital only, and home visit/digital photograph groups, respectively. No distinct trends in disagreements in equipment prescriptions were found. Items of equipment with the most disagreement between the two groups of occupational therapists in home visit/digital photograph were the handheld hose and grab-rail (Table 4).

Discussion

This is the first study conducted to establish the reliability of using digital photographs taken by family members, patient information and an equipment list to make equipment prescriptions without the need for an actual home visit. The study findings suggest that the variability of prescription using digital photos only, by different occupational therapists has a high level of agreement.

The level of agreement between occupational therapists using different methods, i.e. home visit vs. digital photographs is slightly higher. This novel method of using digital photographs taken by family members is comparable to conventional home visits in making equipment prescriptions for the toilet and bathroom areas. The variability was within the range of variability,

due to individual occupational therapist preference rather than the method of prescription.

Patients

Evidence for home modification and equipment prescription interventions by occupational therapists mostly involve populations of older people (Cumming *et al.*, 1999; Day *et al.*, 2002; Gitlin, Corcoran, Winter, Boyce & Hauck, 2001; Gitlin *et al.*, 2006) from a variety of diagnostic groups, such as neurological and orthopaedic conditions, general medical and general surgical conditions (Gosman-Hedstrom, Claesson & Blomstrand, 2002; Harris, James & Snow, 2008; Hoffmann & McKenna, 2004; Neville-Smith, Trujillo & Ammundson, 2000). The majority of the patients in this study were above the age of 65 years, presenting with a variety of medical conditions, thus being representative of those who usually receive occupational therapist home modification and equipment prescription interventions.

Level of agreement

Level of agreements in equipment prescriptions made in both the toilet/bathroom areas for digital photos only, and home visit/digital photos groups were, 83% and 87%, respectively, higher than that found in the study by Sanford and Butterfield (2005) (78.8% using paper-and-pencil protocol, and 77.4% using televideo protocol). The broader scope in area for equipment prescription, in the study by Sanford and Butterfield, may have accounted for the difference in level of agreement in equipment prescription.

The level of agreement for the equipment prescribed in the toilet/bathroom areas separately for both groups was lower than the results of Sim (2006) study, which reported level of agreement of 86% (toilet) and 93% (bathroom). The equipment list in the study by Sim had one less item of equipment in the toilet area and two less in the bathroom area compared to this current study. Thus, the difference in the number of items of equipment included for data analysis, in the study by Sim, could have contributed to the variance in level of agreement. In addition, other literature quotes that an

TABLE 4: *Variability in the equipment prescribed between occupational therapists using different methods, that is digital photographs only and home visit vs. digital photographs*

Equipment	Prescription made by occupational therapists							
	Digital photos only				Home visit vs. digital photos			
	Yes/Yes	No/No	Yes/No	No/Yes	Yes/Yes	No/No	Yes/No	No/Yes
Toilet								
Over toilet frame (height adjustable)	0	2	3	0	0	9	5	0
Toilet surround (height adjustable)	0	4	1	0	0	14	0	0
Raised toilet seat	0	4	1	0	0	13	1	0
Raised toilet seat with arms	0	1	0	4	1	7	0	6
Raised toilet seat with lid	0	5	0	0	0	14	0	0
Mobile commode	0	5	0	0	0	14	0	0
Grabrail	1	3	0	1	0	10	1	3
Others	0	4	1	0	0	12	2	0
Total	1	28	6	5	1	93	9	9
Bathroom								
Bathboard – wooden	0	5	0	0	0	14	0	0
Bathboard – plastic	0	4	0	1	0	13	0	1
Bathboard – plastic with rails	1	3	0	1	0	14	0	0
Swivel bathchair	0	5	0	0	0	14	0	0
Handheld hose	1	2	1	1	1	6	2	5
Shower chair (height adjustable without arm rest)	0	5	0	0	0	14	0	0
Shower chair (height adjustable with arm rest)	1	4	0	0	4	7	0	3
Shower stool (height adjustable without arm rest)	0	5	0	0	0	14	0	0
Shower stool (height adjustable with arm rest)	1	4	0	0	0	10	4	0
Shower base insert	0	5	0	0	0	14	0	0
Shower hose bracket	0	3	2	0	0	14	0	0
Non-slip mat	0	3	1	1	0	12	2	0
Grabrail	3	1	0	1	4	3	3	4
Bariatric equipment	0	5	0	0	0	14	0	0
Handheld shower house (dual)	0	5	0	0	0	13	1	0
Handheld shower hose and Switchcock	0	5	0	0	0	13	0	1
Curtain rod and curtain	1	4	0	0	1	13	0	0
Transfer bench	0	3	2	0	0	13	1	0
Others	1	3	1	0	1	10	3	0
Total	9	74	7	5	10	225	17	14

agreement of 70% (Sanford & Butterfield, 2005) is considered acceptable when remote means are utilised for equipment prescription. Therefore, the results of the study reported in this paper indicated agreement levels at an acceptable level in comparison.

In this study, the level of agreement in equipment prescription was higher in the conventional home visit vs. digital photograph group, than in only the digital photograph group. Thereby indicating a high level of

congruence in the equipment prescribed between two groups of occupational therapists regardless of the methods by which information was gathered. This, together with the higher than acceptable level of agreement, suggests that using digital photographs taken by family members, patient information and an equipment list to make equipment prescriptions in the toilet and bathroom are just as reliable as equipment prescriptions made during a conventional home visit.

Variability of agreement

Toilet

A similar trend in disagreements in equipment prescriptions was noted in both groups. The implication of disagreements may be minor because in the real-world situation, the range of solutions to resolve problems may vary widely (Sanford & Butterfield, 2005), depending on preferences of patients, their caregivers and/or occupational therapists. Given that the disagreements in the prescription of these two items, namely over toilet frame and raised toilet seat with arms, were similar in both groups it is highly likely that this occurred as a consequence of equipment preference by the different groups of occupational therapists. Furthermore, the two items of equipment serve the same purpose, which is to allow ease of getting off the toilet bowl by pushing through the armrests. Therefore, if equipment was categorised based on their functional usage, the level of agreement for equipment prescription would have increased significantly.

A similar occurrence in preferential prescription of equipment for the bathroom was noted in home visit/digital photos group. This preferential equipment prescription was not observed in digital photos only group, where occupational therapists made prescription for equipment from digital photographs. The difference in presentation of information to the occupational therapist prescribing from conventional home visits, and occupational therapist utilising digital photographs, may have contributed to this variance. During the home visit, the occupational therapists were able to see and/or measure the space required, to prescribe the most appropriate equipment to suit the needs of patients. Patients may have been asked to demonstrate certain tasks so that the occupational therapist may determine the suitability of the prescribed equipment. This information was not available to the occupational therapist prescribing from photographs.

Interestingly, the occupational therapist performing the home visits prescribed equipment which required precision in physical space and patient functional capabilities. Hence, it appeared that the home visits provided more information in order for more appropriate decisions in equipment prescriptions to be made.

The importance of in-depth information to allow more accurate equipment prescription was considered in the study by Sanford and Butterfield (2005), with the inclusion of patient's self-reported difficulty in task performance for the paper-and-pencil remote protocol and physical measurements in addition to photographs included for both remote protocols to facilitate the equipment prescription process. The digital photographs and patient information provided to the occupational therapist would facilitate enhanced accuracy of equipment prescription with information related to

measurement of the physical environment, patients' specific functional capabilities in using the equipment and preferences, are critical in making decisions in equipment prescription.

Disagreements in prescriptions, between the occupational therapists using both methods, for the same item of equipment in the toilet/bathroom areas are worth highlighting. Equipment prescribed by the occupational therapist performing the home visit and not prescribed by occupational therapist from photographs, representing an under-prescription of equipment, included over toilet frames on 8 occasions and shower hose bracket on 3 occasions. On the contrary, equipment prescribed by the occupational therapist from photographs, but not prescribed by the occupational therapist performing a home visit, representing an over-prescription, included raised toilet seat, with arms on 10 occasions. Furthermore, factors other than the occupational therapist themselves, such as patient characteristics may influence prescription. In the toilet/bathroom areas, there were 17% and 13% disagreements in the equipment prescribed between both groups of occupational therapists, respectively. Of the equipment in which there were disagreements in prescriptions, or under-prescriptions, 56.5% were in the digital photograph only group and 53% were in the home visit vs. digital photograph group. These values fall between those reported in the study by Sanford and Butterfield (2005), which were 42% and 66.7% of under-diagnosis of problems using the paper-and-pencil and televideo protocols, respectively.

Disagreements in equipment prescriptions can have significant clinical implications. An over-prescription of equipment not only incurs unnecessary cost, it may also jeopardise patients' safety, as a consequence of over-cluttering by redundant equipment. Secondly, the under-prescription of equipment represents a failure to identify equipment that is necessary for patients' task performance and/or safety. It is imperative to prevent both over and under-prescription of equipment when using a new method of equipment prescription. Ideally, the equipment prescribed using digital photographs taken by family members, patient information and an equipment list should be similar to that prescribed after a home visit. As abovementioned, the provision of measurements of the physical environment to digital photographs and more in-depth patient information is likely to facilitate this process.

Using digital photographs taken by family members, patient information and an equipment list to make equipment prescriptions, is dependent on family members' confidence in taking and emailing digital photographs of the patients' home areas to the hospital occupational therapist. More than half (57.1%) of the family members in this study did not have the confidence to do so, although the specific aspect of the task

in which they lacked confidence could not be determined. The lack of knowledge in using the digital camera did not deter family members (35.7%) from participating in this study. Hence, it could be postulated that emailing the digital photographs could be one barrier. If this aspect could be eliminated (e.g. by bringing the camera in to the hospital occupational therapist), the application of this new method in the clinical setting is feasible.

There were methodological limitations within this study which may have influenced the results. Firstly, recruitment was limited as a result of limited time for data collection. Hence, the sample size recruited was small and did not meet the target of 40 participants. The small sample size also prevented statistical tests of significance, such as chi-square test, to be conducted. Secondly, the results may have been influenced by the long equipment list, resulting in a corresponding increase in the number of negative agreements, affecting the total percent agreement. In addition, the list is of basic equipment and does not account for complex equipment that requires a trial period to determine suitability.

Thirdly, the study only focused on the toilet/bathroom areas. Home visits conducted by occupational therapists usually consist of reviewing the entire home for environmental barriers. Future studies should consider replicating this study to include other areas of the home. Methodological considerations should take into account using more in-depth patient information via face-to-face interview/observation and for the family members to supplement the digital photographs by taking measurements of the physical environment so that agreement in equipment prescriptions can be further enhanced. Additionally, there should be agreements in positioning of equipment (e.g. placement of shower chair, location and height of grabrail). A future study could investigate not only the agreement in the equipment prescribed, but also the positions in which the prescribed items are placed. Future research areas could include the compliance with equipment prescribed via photos and those by home assessments. The findings of this study provide feasibility of performing a randomised controlled trial, comparing prescription from digital photos and by home visits by occupational therapists, to more rigorously evaluate the effectiveness of this novel method.

Conclusion

This study provided evidence that using digital photographs taken by family members, patient information and an equipment list by occupational therapists, is comparable to equipment prescriptions performed by home visits. Accuracy in equipment prescriptions will be further enhanced with the provision of in-depth patient information and the inclusion of measurements

of the physical environment. The development of more time and cost effective methods for increasing safety for older people in their home environment is imperative for health systems to face the challenges of an increasing ageing population.

Acknowledgements

The authors acknowledge Claire Morris, Manager and Rehabilitation in the Home Team, Kate Hoskins and Kate Laver for assistance in data collection.

References

- Bowman, R. J. C., Kennedy, C., Kirwan, J. F., Sze, P. & Murdoch, I. E. (2003). Reliability of telemedicine for diagnosing and managing eye problems in accident and emergency departments. *Eye*, 17, 743–746.
- Connell, B. R. & Sanford, J. A. (2001). Difficulty, dependence, and housing accessibility for people aging with a disability. *Journal of Architecture and Planning Research*, 18, 235–242.
- Cumming, R. G., Thomas, M., Szonyi, G., Salkeld, G., O'Neill, E., Westbury, C. *et al.* (1999). Home visits by an occupational therapist for assessment and modification of environmental hazards: A randomized trial of falls prevention. *Journal of the American Geriatric Society*, 47, 1397–1402.
- Day, L., Fildes, C., Gordon, I., Fitzharris, M., Flamer, H. & Lord, S. (2002). Randomised factorial trial of falls prevention among older people living in their own homes. *British Medical Journal*, 325, 128–133.
- Gill, T. M. & Kurland, B. (2003). The burden and patterns of disability in activities of daily living among community-living older persons. *Journal of Gerontology, Series A: Biological Sciences and Medical Sciences*, 58A, M70–M75.
- Gill, T. M., Allore, H. G., Holford, T. R. & Guo, Z. (2004). Hospitalization, restricted activity, and the development of disability among older persons. *The Journal of American Medical Association*, 292, 2115–2124.
- Gitlin, L. N. (1998). From hospital to home: Individual variations inexperience with assistive devices among older adults. In: B. G. Gray, L. A. Quatrano & M. L. Lieberman (Eds.), *Designing and using assistive technology: The human perspective*. Baltimore, MD: Paul H. Brookes Publishing Co.
- Gitlin, L. N., Corcoran, M., Winter, L., Boyce, A. & Hauck, W. W. (2001). A randomized, controlled trial of a home environmental intervention: Effect on efficacy and upset in caregivers and on daily function of persons with dementia. *The Gerontologist*, 41, 4–14.
- Gitlin, L. N., Winter, L., Dennis, M. P., Corcoran, M., Schinfeld, S. & Hauck, W. W. (2006). A randomized trial of a multicomponent home intervention to reduce functional difficulties in older adults. *Journal of the American Geriatrics Society*, 54, 809–816.
- Gosman-Hedstrom, G., Claesson, L. & Blomstrand, C. (2002). Assistive devices in elderly people after stroke: A longitudinal, randomized study – The Goteborg 70 +

- stroke study. *Scandinavian Journal of Occupational Therapy*, 9, 109–118.
- Harris, S., James, E. & Snow, P. (2008). PredischARGE occupational therapy home assessment visits: Towards an evidence base. *Australian Occupational Therapy Journal*, 55, 85–95.
- Hoffmann, T. & McKenna, K. (2004). A survey of assistive equipment use by older people following hospital discharge. *British Journal of Occupational Therapy*, 67, 75–82.
- Lai, J. C. K., Woo, J., Hui, E. & Chan, W. M. (2004). Telerehabilitation: A new model for community-based stroke rehabilitation. *Journal of Telemedicine and Telecare*, 10, 199–205.
- Lannin, N. A., Clemson, L., McCluskey, A., Lin, C. W., Cameron, I. D. & Barras, S. (2007). Feasibility and results of a randomised pilot-study of pre-discharge occupational therapy home visits. *BioMed Central Health Services Research*, 7, 42.
- Mann, W. C., Ottenbacher, K. J., Fraas, L., Tomita, M. & Granger, C. V. (1999). Effectiveness of assistive technology and environmental interventions in maintaining independence and reducing home care costs for the frail elderly. *Archives of Family Medicine*, 8, 210–217.
- Mathewson, C., Adkins, V. K. & Jones, M. L. (2000). Initial experiences with telerehabilitation and contingency management programs for the prevention and management of pressure ulceration in patients with spinal cord injuries. *Journal of Wound Ostomy & Continence Nursing*, 27, 269.
- Moller, J. (2003). *Projected costs of fall related injury to older persons due to demographic change in Australia: Report to the Commonwealth Department of Health and Ageing*. Canberra: New Directions in Health and Safety.
- Naik, A. D., Concato, J. & Gill, T. M. (2004). Bathing disability in community-living older persons: Common, consequential and complex. *Journal of the American Geriatrics Society*, 52, 1805–1810.
- Neville-Smith, M., Trujillo, L. & Ammundson, R. (2000). Special feature: Consistency in postoperative education programs following total hip replacements. *Topics in Geriatric Rehabilitation*, 15, 68–76.
- Oztas, M. O., Calikoglu, E., Baz, K., Birol, A., Onder, M., Calikoglu, T. *et al.* (2004). Reliability of web-based tele-dermatology consultations. *Journal of Telemedicine and Telecare*, 10, 25–28.
- Pynoos, J. (1993). Toward a national policy on home modification. *Technology and Disability*, 2, 1–8.
- Renforth, P., Yapa, R. S. & Forster, D. P. (2004). Occupational therapy predischARGE home visits: A study from a community hospital. *British Journal of Occupational Therapy*, 67, 488–494.
- Rubenstein, L. Z. (2006). Falls in older people: Epidemiology, risk factors and strategies for prevention. *Age and Ageing*, 35(S2), ii37–ii41.
- Russell, T. G., Buttrum, P., Wootton, R. & Jull, G. A. (2004). Rehabilitation after total knee replacement via low-bandwidth telemedicine: The patient and therapist experience. *Journal of Telemedicine and Telecare*, 10 (Suppl 1), 85–87.
- Sanford, J. A. & Butterfield, T. (2005). Using remote assessment to provide home modification services to underserved elders. *The Gerontologist*, 45, 389–398.
- Sim, S. (2006). *Reliability of the use of digital photographs to prescribe equipment in the toilet and bathroom by occupational therapists*. Unpublished Honours thesis, La Trobe University, Victoria.

Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Equipment prescriptions in the bathroom and toilet for rehabilitation patients: Use of family members' photographs as an alternative to home visits.