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An exploration of the effects of introducing a telemonitoring system for continence assessment in a nursing home

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Abstract

Aims and objectives To explore the effects of introducing a telemonitoring and care planning system for urinary continence assessment in a nursing home and adherence by care staff to urinary continence care plans. Background Only a few studies have explored the effect of introducing telemonitoring system on urinary continence care, none for older people in nursing homes. Design Pre- and postintervention repeated measures design. Methods Data for the study were collected from August-October 2011. Care staff were trained in the use of a telemonitoring system for continence assessment. Voiding events for each older person were recorded using the system during a 72-hour urinary continence assessment, and the data were used to prepare an individualised care plan. After two weeks of using the new care plan, a second assessment was carried out for each older person, using the telemonitoring system. Results The participants were on average 81 years old and assessed as having high care needs. The statistically significant outcomes were as follows: reduced volume of urine voided into continence aids, reduced number of prescribed toileting visits, increased number of actual toilet visits, increased number of successful toileting events and increased adherence to urinary continence care plans by staff. Conclusions During a 12-week trial, urinary continence assessment and management of older people were improved. This suggests that the introduction of a suitably designed telemonitoring system combined with staff training can improve urinary continence care. Relevance to clinical practice The results suggest that nursing homes can improve continence assessment and management practices by adopting an appropriately designed mobile, wireless telemonitoring system for continence assessment and providing the associated staff training programmes.

Keywords

Care plan, continence, nursing assessment, nursing home care, nursing information systems, telehealth

Disciplines

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An exploration of the effects of introducing a telemonitoring system for continence care planning in a nursing home

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Abstract

Aim. To explore the effects of introducing a telemonitoring system for urinary continence assessment, care planning for older people living in nursing homes and adherence by care staff to care plans.

Background. Few studies have explored the impact of telemonitoring system on urinary continence care for older people in nursing homes. Studies on prevalence rates of urinary incontinence, the cost of urinary continence care, drug therapies and improvement in urinary continence assessment have related to manual practices.

Design. An exploratory pilot study using pre- and post-intervention repeated measures design.

Method. Urinary continence assessments for 32 older people living in a 120 bed Australian nursing home were undertaken for 72-hours using the telemonitoring system and care plans generated (T1). Implementation of new urinary care plans generated from the telemonitoring assessment over 2-5 weeks. A range of effects on urinary continence care were evaluated, including number of successful toileting events and episodes of urinary incontinence, toileting schedules and times older people were assisted to go to the toilet by staff, and staff adherence to care plans (T2). The participants were recruited from a convenience sample of older people living in a nursing home.

Results. The average age of participants was 81 years and their care needs were high for all functional areas. The statistically significant outcomes were: reduction in the volume of urine voided into continence aids, reduction in the frequency of prescribed toileting visits, increased number of toilet visits and successful toileting events and an increased level of adherence to the number of toilet visits prescribed in care plans.

Conclusions. During a twelve week trial, the urinary continence assessment and management of older people were improved after using the telemonitoring system for urinary continence assessment.

Relevance to clinical practice. The results suggest that nursing homes can improve continence assessment and management practices by adopting appropriately designed mobile, wireless telemonitoring system for continence assessment.

Keywords: Urinary incontinence, telemonitoring, continence assessment, care plan, urinary incontinence management, older people, nursing home.

INTRODUCTION

Urinary incontinence (UI) is defined by the International Continence Society as involuntary urinary leakage (Abrams *et al.* 2002). The condition is common among older people and according to a recent cohort study in the UK affects more than a fifth of people aged over 85 years (Collerton *et al*. 2009). Urinary incontinence has both physical and psychological consequences, including damage to skin, urinary tract infections and an increased risk of falls (Coll-Planas *et al.* 2008). Depression, frustration, embarrassment and sadness are often associated with incontinence (Dugan *et al.* 2000). Urinary incontinence has been found to be third of 21 chronic conditions, after dementia and stroke, in its impact on quality of life (Australian Institute of Health and Welfare 2006). Management of UI can also be a challenge for family carers. A study of client records data in Australia from Aged Care Assessment Teams (41,000) and nursing homes (128,900) found that 87% of Registered Nurses recorded UI as a 'significant' or 'very significant' reason for admission to a nursing home (Pearson 2003).

The financial costs of UI for aged and healthcare services are considerable (Deloitte Access Economics 2011). In Australia, the total expenditure for incontinence is projected to increase by 201% between 2003 and 2030 with the greatest increase (220%) occurring in nursing homes (Australian Institute of Health and Welfare 2006). Up to 77% of older people living in nursing homes experience UI (Offermans *et al.* 2009). Pearson (2003) reported that in Australia there were up to 125,000 older people experiencing UI living in nursing homes with a predicted rise to 250,000 by 2030. Despite the high prevalence of UI among older people living in nursing homes, urinary continence (UC) remains poorly assessed and managed (Australian Institute of Health and Welfare 2006) and its widespread impact on the health and quality of life of older people remains an under-studied area of research (Wagg *et al.* 2008).

A cross-setting audit of UC practices found that practices within community, acute and rehabilitation care settings showed deficiencies in UC assessment and management for older people in England and Northern Ireland (Coffey *et al.* 2007, Wagg *et al.* 2008). A study of 315 staff working in nursing homes in Zurich found that a specific deficit was the documentation of UC care by Registered Nurses and care workers providing UC care to older people; it was nearly absent (Saxer *et al.* 2008). International UC guidelines have focused on strategies to diagnose and treat UI, including exercises, drug treatment and surgery (Fantl *et al.* 1996, Martin *et al.* 2006, Thüroff *et al.* 2011) rather than strategies to promote UC or manage UI, which is more appropriate for frail older people living in nursing homes.. Only one guideline provided a succinct and conservative approach to UC care applicable to frail older people living in nursing homes (Ministry of Health 2003). Further work is required to provide better UI assessment and management strategies for these older people.

BACKGROUND

In nursing homes, the causes of UI are most likely to be related to mobility problems, co-morbidities associated with frailty and/or cognitive impairment and often cannot be reversed with treatments such as exercises, medication or surgery. A UC care plan is the most common strategy to promote the UC for these people. An appropriate UC care plan underpins the development of individualised care. In Australia, provision of UC care plans for residents within 48 hours of relocation to a nursing home is mandatory for each provider to be eligible for acquiring government funding (O'Connell *et al.* 2011). Accurate UC assessment is crucial for the development of effective UC care plans. Most nursing homes rely on manual UC assessments which typically involve care workers asking older people about their voiding patterns or manually checking clothes or continence aids every 1 to 3 hours to determine the frequency of UI episodes (O'Connell *et al.* 2006, O'Connell *et al.*

2011). The care plan for the older people usually takes the form of a toileting assistance program and allocation of continence aids (Ouslander & Fowler 1985). The most common type of toileting assistance programmes are: habit training, prompted voiding and timed voiding (scheduled toileting or routine toileting) (Eustice *et al.* 2009, Ostaszkiewicz *et al.* 2010).

The current practice of manual UC assessments is intrusive, unreliable, labour-intensive and generally unpleasant for the older person and care staff. Failure to accurately detect the voiding patterns of older people results in the impersonal and undignified practice of regularly taking groups of older people to the toilet at the same pre-determined times. This, together with budgetary constraints, staff shortages and high staff turnover, leads to inadequate UC assessment and management practices. Until recently there was a lack of evidence about best practice UC assessment practices (O'Connell *et al.* 2011) which made it difficult to develop individualised UC care plans and deliver effective UC care to older people living in nursing homes.

In this study the effect of introducing a commercially available telemonitoring system for UC assessment, known as SIM® (Smart Incontinence Management) from Simavita Pty Ltd. in Sydney, on care practices was evaluated for the first time in a nursing home in Australia. The aim of the study was to explore the effects of introducing a telemonitoring system for urinary continence assessment and care planning for older people living in nursing homes, including changes in the number of successful toileting events and episodes of UI and toileting schedules for older people and staff adherence to care plans.

Specifically it was hypothesised that the new system would identify optimum times for toileting, increase the number of successful toileting events and reduce the volume of urine voided into continence aids.

Previous studies have shown a lack of consistency in UC assessment (O'Connell *et al.* 2006, O'Connell *et al.* 2011) and guidelines that have been developed in response are wholly on manual UC assessment practices. This study therefore addressed a gap in current UC care by exploring the possibilities for more effective UC management using a UC telemonitoring system.

METHODS

Design

An exploratory pilot study was undertaken with pre- and post-intervention repeated measures design. The units of analysis were older people and care staff in a nursing home. Four groups of eight older people were assessed using the telemonitoring system during weeks 2-5 during an implementation phase of the new UC care plans over a total of 12 weeks. The base line data (T1) were collected using the telemonitoring system to record the voiding events of 32 older people during a 72-hour UC assessment and recording existing toilet schedules in care plans generated from manual UC assessments and the times older people were assisted with going to the toilet by staff. The telemonitoring UC assessment was used to inform a new UC care plan including prescribing new toileting schedules to provide older people with assistance to use the toilet and recommendations about the allocation of continence aids. The new toileting schedule and continence aid allocation were implemented immediately after the completion of the 72-hour assessment. The effects of the new UC care practices were evaluated once again (T2) using the UC telemonitoring system to record new voiding eventss and manual recording of times when older people were assisted to go to the toilet by staff.

Participants

The study was undertaken in a 120 bed nursing home in Melbourne, Australia during 2011. Older people who experienced UI were identified as potential participants in the study. Inclusion criteria applied to potential participants were: absence of a medical condition which would impact on UC patterns (for example, a urinary tract infection) and little likelihood of relocation to a different facility during the course of the study. The participants were recruited from a convenience sample of all older people living in the nursing home. All were living with a significant level of cognitive impairment (as defined in their nursing notes); only those whose family provided written consent for the older person to participate were recruited. Power analysis was based on an 80% chance of detecting a large ($f = 0.50$) change in voiding eventss, specifically toileting success rates between pre- and post-implementation groups ($p < 0.05$). To achieve this, 32 participants in each group have to complete the study.

Ethical considerations

Ethics approval was obtained from the institutional ethics committee. Access to the nursing home was agreed with the management. Only those residents whose families provided written consent were recruited in the study.

Urinary continence telemonitoring system

Simavita SIM® telemonitoring system is a wireless system which provides care staff with a digital UC assessment about voiding patterns. The best practice guidelines suggest a 72-hour assessment and the telemonitoring system can be used to generate information about voiding patterns during this period. The information generated is used to develop a comprehensive and individualised UC care plan to meet the specific UC care needs of an older person. The telemonitoring system works through a discrete and ergonomically

designed sensor which is placed into a specially designed continence aid. This sensor connects to a wireless network which remotely monitors UI events. When the digital device detects wetness in the continence aid, an SMS message is sent to the mobile phone of a care worker. All voiding events during the 72-hour assessment can be viewed at any time on the telemonitoring software package installed on computers in the nursing home.

A UC training programme, including instructions on using the telemonitoring system, was delivered by Simavita P/L. The programme adopted the 'train-the-trainer' model and the care workers who volunteered to be UC champions completed the programme with consultants from the company. The UC champions further delivered training to other care workers in their nursing home. In this study, ten care workers acted as UC champions. The telemonitoring consultants from the company provided regular updates to the UC champions and ongoing support for care staff using the telemonitoring system, including guidance to develop new UC care plans according to the assessment results generated by the telemonitoring system.

Data collection

Prior to the commencement of data collection, care staff undertook a training session to ensure they had required levels of knowledge, skill and attitude about the telemonitoring system and UC care. These sessions also included training on collection and entering of UC data since this was part of the required UC assessment process completed by staff to generate care plans. The sessions included an observation of care staff using the telemonitoring system and instructions to adjust techniques were made by the company UC consultant who facilitated the training sessions. A company continence consultant was readily available to all staff to provide ongoing assistance with using the telemonitoring system, including collecting and entering UC data.

Data collected included measuring output volume from a UI event by care staff weighing continence aids on a scale; the number of times prescribed in the care plan that a resident should be provided with assistance to use a toilet; the actual number of times when the resident was provided with assistance to use the toilet; the compliance of toileting assistance with the descriptions in the care plan; and the actual number of times an older person successfully used the toilet when assistance was provided. The voiding time data were automatically collected by the telemonitoring system.

Data analysis

The data used for analysis were the aggregated data items for each participant in the 72 hours UC telemonitoring assessment period: total urinary volume in the continence aid in 72 hours; toileting success rate was measured by calculating the total number of times older people voided into the toilet divided the total number of times older people were assisted to go to the toilet; recording the total number of scheduled toileting events in 72 hours in the care plan and staff adherence to care plans was measured using the total number of times an older person was provided with assistance to go to the toilet in 72-hours divided by the number of toileting times prescribed in the care plans.

The aggregated data were imported into IBM SPSS Statistics 19 for statistical analysis. If data were normally distributed, a paired samples t-test was used to identify whether there were significant differences before and after the implementation of the new UC management schedule. The volume of urine voided into continence aids was transformed by the formula ‘volume transformed by the square root of the original data + 1’ to fit with normal distribution for a paired t-test. If data were not normally distributed after transformation, a Wilcoxon test was conducted.

RESULTS

The assessment record for one participating resident was incomplete. That record was excluded, and analysis was conducted on the records from 31 older people. The majority of the participants were female (78%). The mean age was 81 with a standard deviation (SD) of 8 years. In Australia, the Aged Care Funding Instrument (ACFI) is used by nursing homes to assess dependency levels of older people and allocate funding according to the associated care needs of individuals living in care homes (Department of Health and Ageing 2012). Each ACFI question is answered using a 4-point Likert Scale. The scores are used to categorise an older person as: "1" independent; "2" supervision required; "3" physical assistance needed and "4" requiring mechanical lifting equipment. The mean ACFI scores for participants within Category 4 'Toileting' and Category 5 'Continence' were 3.94 (SD 0.24). This score indicated that participants required a high level of care to promote and manage their continence. The ACFI score also indicated that all participants had a high level of cognitive impairment which had an impact on their daily lives (Psychogeriatric Assessment Scale mean 3.53, SD 0.91) and required assistance to use toilet (mobility score: mean 3.75, SD 0.56).

The findings showed a significant reduction in the volume of urine voided into the continence aids. This may be attributed to the significant increase in the number of times an older person was assisted to go to the toilet. In the new UC management regime, the median number of actual toileting visits in 72 hours was 16 times for an older person, equating to 5 to 6 visits in 24 hours, a reasonable number. The baseline number was 6 times, equating to two visits to a toilet per day; a number that suggests reliance was being placed on the use of incontinence aids rather than on toileting. These data reflect a low level of UC care at the baseline (T1) and substantial improvement in the level of continence care after the

implementation of the care plan based on the assessment results generated from the telemonitoring system.

There was a significant reduction in the urine volume voided into the continence aids during the 72-hour UC telemonitoring re-assessment period when compared with baseline data (1,678mL from 2,048mL; $p = 0.015$). The new UC care plans developed after the implementation of the telemonitoring system prescribed a much lower frequency of toilet visits by the older person in comparison with that defined by the baseline UC care plans (median 15 times, interquartile range (i.q.) 3 times; baseline median 18 times, i.q. 6 times; $p = 0.015$). There was a significant increase in the total number of actual toilet visits for an older person when compared with the baseline (median 16 times, i.q. 6 times; baseline median: 6 times, i.q. 5 times, $p < 0.001$). There was also a significant increase in the number of successful toileting events for an older person after the new UC care plans were generated and implemented by care staff (median 8 times, i.q. 9 times; baseline median 3 times, i.q. 5 times; $p = 0.011$).

There was poor compliance with the UC care plans by the care staff before the introduction of the telemonitoring system. Only 43.9% of the prescribed toilet visits for the older person in the baseline UC care plans were implemented by the care staff (SD 32.8%). After the implementation of the telemonitoring system and the development of UC care plans based on the data gathered by it, a substantially higher level of adherence by the care staff to UC care plan was achieved with care staff providing assistance to older people to use the toilet beyond what was prescribed in the care plans (mean 108.2%, SD 18.7%; baseline mean 43.9%, SD 32.8%; $p = 0.033$).

Discussion

International UC guidelines have focused on strategies to diagnose and treat, rather than manage UI, including exercises, drug treatment and surgery (Fantl *et al.* 1996, Martin *et al.* 2006, Thüroff *et al.* 2011). Only one guideline provided a succinct and supportive approach to UC care applicable to frail older people living in nursing homes (Ministry of Health 2003). Most intervention studies focused on people living in the community with UI (Deloitte Access Economics 2011). There is a paucity of high quality studies evaluating UC management in nursing homes (Eustice *et al.* 2009, Ostaszkiewicz *et al.* 2010). More specifically, only a few studies were found that explored telemedicine or e-Health solutions for UC assessment, care planning and management for older people (Ostaszkiewicz *et al.* 2010, Lancioni *et al.* 2011, Koutsojannis *et al.* 2012). It was therefore difficult to compare the findings of this study with the other studies of UC for older people in nursing homes and specifically evaluating the outcomes from implementing a new telemonitoring system.

Successful implementation of another UC telemonitoring system in nursing homes found that the staff were more likely to adhere to the recommended assessment guidelines and implement UC care plans (Ostaszkiewicz *et al.* 2010); an important positive finding repeated in this study. Possibly, the UC care training and the experience of conducting hands-on telemonitoring assessment for UC resulted in care workers being more willing to attend to the care needs of older people. This was a positive change in meeting the UC care needs of older people in comparison with the previous practice in the nursing home where the study was undertaken in which low adherence to the toileting regime in UC care plans was found.

The findings demonstrated that using the telemonitoring system for UC assessment and management resulted in a significant reduction of the number of prescribed toilet visits. However, in practice there was a significant increase in the number of toilet visits

implemented by care staff and an increase in the number of successful toileting events by the older people in the study. The reason for the increased number of toilet visits may be that care staff members had increased awareness of residents' UC care needs after receiving the UC training and the personal experiences of entering resident toileting, pad weight and pad change data into the telemonitoring system during the period of telemonitoring assessment. This increase awareness had led them paying more attention to and providing increased number of toileting assistant to meet residents' UC care needs. This was not a finding reported in previous studies where few statistically significant changes were achieved. These studies did not show statistically significant changes in the number of successful toileting events (Ostaszkiewicz *et al.* 2010) or reductions in incontinent urinary voids (Eustice *et al.* 2009, Ostaszkiewicz *et al.* 2010).

One outcome which can sometimes be a concern with the introduction of assistive technologies for the care of older people is that its introduction results in a reduction in contact between staff and older people (Magnusson & Hanson 2003, McCreadie & Tinker 2005). There was a contrary finding in this study, as contact between older people and care staff at appropriate times of need was increased. As mentioned above, the increased awareness among care staff about the UC care needs of older people made them more willing to attend to their needs. This was a significant positive change in meeting the UC care needs of older people in comparison with the previous practice of low compliance with toileting recommendations defined in the care plan.

Limitations of the study

The study had a small sample size and data were obtained from a single nursing home for only five weeks after the implementation of the telemonitoring system. Data entry relied on manual recording of toileting activities by care staff and this increased the risk of data errors.

This was addressed by the whole research team meticulously reviewing all data entry until it was clear that the data entered were accurate.

Conclusion

During the five week trial of the new UC telemonitoring system there were improvements in the UC assessment and management of older people living in a nursing home. There were reductions in the volume of urine voided into continence aids and in the number of prescribed toileting events. There were increases in the adherence to the prescribed UC care plan; and in the number of toileting events and successful toileting events by the older persons. These outcomes suggest that there is the potential for a significant change in UC assessment and management practices in nursing homes away from predominantly manual to automated processes using a telemonitoring system.

RELEVANCE TO CLINICAL PRACTICE

After receiving urinary continence training and hands-on experience with the telemonitoring system for urinary continence assessment, the compliance of care staff's urinary incontinence management practice with care plan was significantly improved; and there was substantial improvement in the level of continence care.. These findings suggest that nursing homes can improve continence assessment and management practices by adopting appropriately designed mobile, wireless telemonitoring systems for continence assessment and care plans.

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REFERENCES

Abrams P, Cardozo L & Fall M (2002) The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. *Neurourology and Urodynamics* 21, 167-178.

Australian Institute of Health and Welfare (AIHW) (2006) Australian incontinence data analysis and development. AIHW cat No. DIS 44, Canberra, Australia, ISBN: 1-74024-546-6.

Collerton J, Davies K, Jagger C (2009). Health and disease in 85 year olds: baseline findings from the Newcastle 85+ cohort study. *British Medical Journal* 339, b4904.

Coll-Planas L, Denkinger MD, Nikolaus T 2008 Relationship of urinary incontinence and late-life disability: implications for clinical work and research in geriatrics. Z Gerontol Geiratr 41(4), 283-290.

Coffey A, McCarthy G, McCormack B, Wright J & Slater P (2007) Incontinence: assessment, diagnosis, and management in two rehabilitation units for older people. *Worldviews on Evidence-Based Nursing* 4, 179-186.

Deloitte Access Economics (2011) The Economic Impact of Incontinence in Australia. Available at: http://www.continence.org.au/data/files/dae_report_2011_final.pdf (Accessed 13 August 2012).

Department of Health and Ageing (2012) Aged Care Funding Instrument. Available at: http://www.health.gov.au/internet/main/publishing.nsf/Content/ageing-acfi-aboutacfi.htm (Accessed 29 November 2012).

Dugan E, Cohen SJ, Bland DR, Preisser J, Davis CC, Suggs PK, McGann P 2000 The association of depressive symptoms and urinary incontinence among older a**dults.** *Journal of American Geriatrics Society* 48, 413-416.

Eustice S, Roe B & Paterson J (2009) Prompted voiding for the management of urinary incontinence in adults (Review). Cochrane Collaboration, Oxford.

Fantl JA, Newman DK, Colling JC, DeLancey J, Keeys C, Loughery P, McDowell B, Norton P, Ouslander J, Schnelle J, Staskin D, Tries J, Urich V, Vitousek S, Weiss B & Whitmore K (1996) Urinary incontinence in adults: acute and chronic management. Clinical practice guideline, No.2. Department of Health and Human Services, Public Health Service, Agency for Health Care Policy and Research, Rockville. AHCPR Publication No. 96-0682

Koutsojannis C, Lithari C & Hatzilygeroudis I (2012) Managing urinary incontinence through hand-held real-time decision support aid. *Computer Methods and Programs in Biomedicine* 107, 84-89.

Lancioni GE, Singh NN, O'Reilly MF, Sigafoos J, Bosco A, Zonno N & Badagliacca F (2011) Persons with mild or moderate Alzheimer's disease learn to use urine alarms and prompts to avoid large urinary accidents. *Research in Developmental Disabilities* 32, 1998–2004

Magnusson L & Hanson E (2003) Ethical issues arising from a research, technology and development project to support frail older people and their family carers at home. *Health and Social Care in the Community* 11, 431–439.

Martin J, Williams K, Abrams K, Turner D, Sutton A, Chapple C, Assassa R, Shaw C & Cheater F (2006) Systematic review and evaluation of methods of assessing urinary incontinence. *Health Technology Assessment* 10, 1-132

McCreadie C & Tinker A (2005) The acceptability of assistive technology. *Ageing & Society* 25, 91–110.

Ministry of Health (2003) *Nursing Clinical Practice Guidelines 1/2003: Nursing Management of Patients with Urinary Incontinence.* Singapore Ministry of Health, Singapore. Available at: http://www.moh.gov.sg/content/dam/moh_web/HPP/Nurses/cpg_nursing/2003/nursing_management_of_patients_with_urinary_incontinence.pdf (Accessed 13 August 2012).

O'Connell B, Fonda D, Day K, Ostaszkiewicz J, Hawkins M, Gaskin C & Pinikahana J (2006) *Development of screening and assessment tools for continence management in*

residential aged care. Prepared for the Department of Health and Ageing. Available at: http://www.bladderbowel.gov.au/doc/RESI.pdf (Accessed 13 August 2012).

O'Connell B, Ostaszkiewicz J & Hawkins M (2011) A suite of evidence-based continence assessment tools for residential aged care. *Australasian Journal on Ageing* 30, 27–32.

Offermans MPW, Du Moulin MFMT, Hamers PH, Dassen T & Halfens RJG (2009) Prevalence of urinary incontinence and associated risk factors in nursing home residents: a systematic review. *Neurourology and Urodynamics* 28, 288–294.

Ostaszkiewicz J, Chestney T & Roe B (2010) *Habit retraining for the management of urinary incontinence in adults (Review).* Cochrane Collaboration, Oxford.

Ouslander JG & Fowler E (1985) Management of urinary incontinence in veteran administration nursing homes. *Journal of the American Geriatrics Society* 33, 33-40.

Pearson J (2003) *Incidence of incontinence as a factor in admission to aged nursing homes.* Australian Government Department of Health and Ageing, Canberra.

Saxer S, de Bie RA, Dassen T & Halfens RJD (2008) Nurses' knowledge and practice about urinary incontinence in nursing home care. *Nurse Education Today* 28, 926–934.

Thüroff JW, Abrams P, Andersson KE, Artibani W, Chapple CR, Drake MJ, Hampel C, Neisius A, Schröder A & Tubaro A (2011) EAU Guidelines on Urinary Incontinence. *European Urology* 59, 387–400.

Wagg A, Potter J, Peel P, Irwin P, Lowe D & Pearson M (2008) National audit of continence care for older people: management of urinary incontinence. *Age and Ageing* 37, 39-44.