

Feasibility of an Automated Bidet Intervention to Decrease Caregiver Burden

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Importance: Informal caregivers often receive limited training and support, especially in providing assistance with toileting, a physically and emotionally demanding activity of daily living. This increases caregivers' risk for physical injury and burnout and jeopardizes older adults' ability to age in place.

Objective: To assess the feasibility, acceptability, and preliminary efficacy of a toileting intervention using an automated bidet to reduce the amount of physical assistance required from caregivers.

Design: Randomized wait-list control feasibility study.

Setting: Caregiver's home.

Participants: Ten informal caregivers.

Intervention: An occupational therapy intervention to educate and train caregiving dyads to use an automated bidet system.

Outcomes and Measures: Feasibility was measured in terms of recruitment and retention, bidet installation, ability to operate the bidet, acceptability (a process evaluation), preliminary efficacy (physical barriers and impact on caregiver outcomes of performance, satisfaction, and self-efficacy), and adverse events.

Results: All bidets were installed successfully. All caregivers reported that the intervention made toileting easier and increased their confidence. Physical barriers decreased for the treatment group. The bidet had a large effect on self-efficacy for the treatment group.

Conclusions and Relevance: The results suggest that the automated bidet intervention is feasible and acceptable and can have a positive impact on caregiver outcomes when assisting with toileting.

What This Article Adds: A toileting intervention using an automated bidet is feasible and acceptable for caregivers of older adults and can reduce the amount of physical assistance required from caregivers.

Every year, informal caregivers (i.e., unpaid family members or friends) provide approximately 30 billion hours (equal to \$450 billion) of care for older adults (Chari et al., 2015). Informal caregivers assist with activities of daily living (ADLs) and instrumental ADLs, enabling older adults to remain at home and age in place (Darragh et al., 2015; National Alliance for Caregiving & AARP Public Policy Institute, 2015). However, informal caregivers often receive limited training and support, especially in providing assistance with toileting, placing them at risk for physical injury and burnout and jeopardizing older adults' ability to age in place (Darragh et al., 2015; National Alliance for Caregiving & AARP Public Policy Institute, 2015). Care recipients are more likely to be placed in a nursing home if they have difficulties completing ADLs such as toileting (Luppa et al., 2010).

Assisting with toileting and managing incontinence are among the most physically and emotionally demanding ADLs (Darragh et al., 2015; King et al., 2018; National Alliance for Caregiving & AARP Public Policy Institute, 2015). Caregivers bend, lift, and twist in confined spaces to assist with toileting and toilet hygiene and help care recipients transfer to and from the toilet repeatedly throughout the day (Darragh et al., 2015; King et al., 2018). Assisting with clothing and posterior perineal care greatly increases caregivers' risk of injury (King et al., 2019). Caregivers with low

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self-efficacy (i.e., lack of belief in their ability to succeed) regarding assistance with toileting and toilet hygiene are at risk for depression and burnout (Bandura, 1982; Gilliam & Steffen, 2006; Grano et al., 2017).

One strategy to reduce or replace the physical support needed from a caregiver for toilet hygiene is the use of an automated bidet toilet system. The system consists of a seat that fits on a standard flush toilet. It has a retractable wand that sprays water for cleaning and is operated using a remote control; some provide warm air for drying and include heated water, a heated seat, or both. Bidets are commonly used in Japan and many European countries, but they have not yet gained popularity in the United States for several reasons, including lack of knowledge and cultural preferences. Research evidence supports the effectiveness of bidets, and they have the potential to be used widely in the United States. Bidets range in cost from \$30 for an attachment to an existing toilet to \$1,400 for an automated bidet system integrated into a toilet.

Although studies on the use of bidet systems in caregiving are scarce, one study found that an automated bidet reduced caregivers' use of nonneutral postures by 15% and severe trunk flexion by 32% (King et al., 2019). Another study found that an automated bidet enabled people in rehabilitation after a stroke to perform toilet hygiene independently 73% of the time (Yachnin et al., 2017). Participants reported increased competence, adaptability, and self-esteem when using the device compared with their regular toileting routine (Yachnin et al., 2017). An automated bidet also has the potential to increase caregivers' self-efficacy, reduce the amount of assistance needed for toileting, and decrease the risk of injury when assisting with toileting. However, whether an automated bidet can be used successfully with older adults and their caregivers at home remains unknown. The objective of this feasibility study was to assess the acceptability and preliminary efficacy of a toileting intervention using an automated bidet system and training by an occupational therapy practitioner to reduce the amount of physical assistance required from caregivers.

Method

Caregivers for this randomized, wait-list control feasibility study were recruited from a study registry, clinicians, exercise groups, and word of mouth in St. Louis, Missouri. Caregivers were included if their care recipient was willing to participate and if they provided unpaid care and lived with a care recipient age ≥ 55 yr, had assisted with toileting for ≥ 6 mo, did not have an automated bidet, and had a working toilet and electrical outlet in the bathroom. Caregivers scoring ≥ 10 on the Short Blessed Test, indicating possible cognitive impairment, were excluded (Katzman et al., 1983).

Interested caregivers were contacted by phone and screened for eligibility. During the initial in-home study visit, the occupational therapist (Rebecca Bollinger) obtained informed consent, and caregivers provided demographic information, including the number and impact of their own and the care recipient's comorbid conditions by means of the Disease Burden Impact Scale (Bayliss et al., 2005), and they completed pretest assessments, including the In-Home Occupational Performance Evaluation for Providing Assistance (I-HOPE Assist; Keglovits et al., 2015). Next, caregivers were randomized by gender to the treatment or wait-list control group using a 1:1 allocation ratio set up by the study statistician (Yi-Ling Hu) and concealed by a web-based randomization tool (Harris et al., 2009).

Caregivers in the treatment group received an occupational therapy intervention designed to educate and train caregiving dyads to successfully use the bidet. These caregivers completed a posttest assessment (I-HOPE Assist) and a process evaluation at 30 days postintervention. After a 30-day waiting period, caregivers in the control group received a study visit to complete a posttest assessment (I-HOPE Assist). They were then offered the intervention and followed the same procedures as the treatment group. Automated bidets were provided at no cost. This study was approved by the institutional review board at Washington University in St. Louis.

Intervention

The intervention manual detailing the theory, treatment strategies, and visit-by-visit checklist is available from the authors upon request. The intervention included two or three 90-min visits. During the first intervention visit, a licensed

contractor installed the automated bidet (TOTO Washlet S300e with remote control; TOTO USA, Morrow, GA). The occupational therapist then trained the caregiver and care recipient to use the bidet correctly and made modifications to the remote as needed. The therapist completed a second intervention visit 1 to 2 wk after installation to address any new difficulties. Throughout the intervention, the therapist used motivational enhancement and active practice and provided education on programming the remote control for the care recipient's desired temperature, water pressure, and wand position. The therapist offered additional check-in phone calls to the caregiver and care recipient if needed.

Measures

Feasibility was assessed in seven ways: (1) recruitment; (2) number of caregivers retained; (3) ability to install the automated bidets, including any modifications needed; (4) caregivers' and care recipients' ability to operate the bidet; (5) acceptability; (6) preliminary efficacy, including physical barriers to toileting and impact on caregiver outcomes; and (7) adverse events. To measure acceptability, caregivers completed an eight-item process evaluation and rated how much they thought the automated bidet made assisting with toileting easier, improved their confidence, and addressed their concerns about assisting the care recipient with toileting. Caregivers rated their level of agreement with statements about the appearance and ease of use of the bidet, the training provided, and their likelihood of continuing to use the bidet after the study. Caregivers rated items on a scale of 0 (*strongly disagree*) to 4 (*strongly agree*), with higher scores indicating greater acceptance of the intervention.

The physical barriers to toileting and caregivers' self-reported performance, satisfaction, and self-efficacy were measured using the I-HOPE Assist. The occupational therapist observed the caregiving dyad during toileting and identified and rated the physical environmental barriers that impeded the caregivers' ability to assist with toileting and toilet hygiene on a scale from 0 (*independent*) to 5 (*no activity or dependent*). Each caregiver outcome was rated on a scale of 1 to 5, with higher scores indicating better performance, satisfaction, and self-efficacy. The therapist completed the I-HOPE Assist with the caregivers at pretest (enrollment) and posttest (30 days postintervention for the treatment group, 30 days postenrollment for the control group) and at follow-up (30 days postintervention for the control group).

As part of the process evaluation, caregivers completed a qualitative interview to determine whether the number and length of visits were sufficient. Their feedback and suggestions for using automated bidet systems in future studies were audio recorded and transcribed verbatim. The occupational therapist conducted the process evaluation interview during the final study visit.

Data Analyses

Descriptive statistics for demographic information and feasibility outcomes were generated using IBM SPSS Statistics (Version 24.0). Secondary outcomes were evaluated with the Wilcoxon signed-rank test to compare group differences. The standardized effect size was interpreted using [Cohen's \(1992\)](#) criteria; 0.10 indicates a small effect, 0.30 a medium effect, and 0.50 a large effect. Qualitative interviews were analyzed using a grounded theory approach and constant comparative analysis to summarize caregivers' responses. Because of the preliminary nature of this feasibility study, we did not conduct a power analysis.

Results

We contacted 55 informal caregivers from December 2016 to April 2017. Twenty-four (43.6%) expressed interest in participating, but 14 were ineligible (7 did not provide toileting assistance; 3 primarily used a commode or absorbent underwear; 2 had paid caregivers; 1 did not meet the age criterion; and 1 care recipient was interested, but the caregiver was not). The most common care recipient comorbidities were arthritis, eye or vision problems, hearing problems, Parkinson's disease, high or low blood pressure, memory loss, muscle aches, fatigue, and decreased

balance or vertigo. Ten caregivers (M age = 66.4 yr, 70.0% female, 70.0% spouses; Table 1) completed the study protocol between December 2016 and June 2017 and were included in the analysis.

It took 5 mo to enroll 10 caregivers, all of whom completed the study. Automated bidets were installed for an average of \$100 per bathroom, with modifications including enlarging holes on existing toilet safety frame brackets to accommodate the depth of the bidet baseplate, using a threaded rod and bolts to install the bidet baseplate to an existing elongated toilet seat riser, installing plug-in ground-fault circuit interrupter (GFCI) converters with surge protection, and using extension cords to provide power to the automated bidet system.

Caregivers and care recipients demonstrated the ability to operate the bidet successfully with minor modifications to the remote control as needed. For example, one caregiver needed numbered stickers corresponding to the steps of the toilet hygiene routine, and another requested enlarged black letters (i.e., S for stop, R for rear wash, F for front wash, D for dryer) to make it easier for the care recipient to see and press the buttons to operate the device. The occupational therapist also created a visual step-by-step instruction sheet for one dyad to increase the care recipient's independence.

Caregivers rated the automated bidet intervention as highly acceptable. They reported that the automated bidet made assisting with toileting easier ($M = 3.80$, $SD = 0.42$), made them feel more confident ($M = 3.50$, $SD = 0.71$), and addressed their concerns about providing assistance at home ($M = 3.40$, $SD = 0.52$). Caregivers also reported that the automated bidet was aesthetically pleasing ($M = 3.80$, $SD = 0.42$) and easy to use ($M = 3.80$, $SD = 0.42$). All caregivers strongly agreed that the training and education were very helpful ($M = 4.00$, $SD = 0.00$) and that they would continue to use the automated bidet ($M = 3.80$, $SD = 0.42$). During the qualitative interviews, all caregivers reported that the number and length of visits were sufficient to meet their needs. Their suggestions for future studies included training on advanced settings and cleaning the bidet, emphasis on practice with the remote to identify optimal settings for the care recipient, and environmental supports to facilitate hip position on the seat. One caregiver suggested adding a second check-in visit prior to posttest.

Regarding the preliminary efficacy of the automated bidet intervention, the number of environmental barriers when assisting with toileting and toilet hygiene decreased for the treatment group (from $M = 10.20$, $SD = 1.66$, to $M = 8.20$, $SD = 1.39$) compared with the control group (from $M = 9.00$, $SD = 1.52$, to $M = 8.60$, $SD = 1.50$) from pretest to posttest.

Table 1. Caregiver Characteristics

Characteristic	n or M (SD)	
	Treatment Group (n = 5)	Control Group (n = 5)
Age	68.40 (10.29)	64.40 (14.19)
Gender, female	3	4
Race, White	5	3
Years of education	16.40 (0.89)	15.60 (1.82)
Marital status, married	5	4
Employment status, employed	3	1
Care recipient, spouse	4	3
Hours of care provided daily		
0–3	2	1
7–10	1	0
11–13	0	2
21–24	2	2
Assistance from others with providing care, including informal (unpaid) and formal (paid)	3	4
Comorbidities		
Caregiver, total no.	5.20 (4.21)	6.60 (2.61)
Care recipient, total no.	9.40 (4.04)	10.60 (4.34)
Caregiver, impact	47.00 (10.00)	50.20 (5.59)
Care recipient, impact	48.80 (6.69)	51.00 (8.69)

Caregivers in the wait-list control group received the intervention and automated bidet after the control period, and the number of barriers decreased for them as well (from $M = 8.60$, $SD = 1.50$, to $M = 6.40$, $SD = 2.70$). In addition, the caregivers in the treatment group reported increases in performance, satisfaction, and self-efficacy when assisting with toileting at posttest compared with pretest. Caregivers in the control group reported decreases in performance and satisfaction and no change in self-efficacy from pretest to posttest, whereas their performance, satisfaction, and self-efficacy scores increased from posttest to follow-up (postintervention). The means, standard deviations, and effect sizes for caregiver outcomes from pretest to posttest and follow-up are listed in Table 2. No adverse events were reported during the study.

Discussion

This study demonstrated that an automated bidet intervention is feasible for reducing the physical assistance required from caregivers for toileting and toilet hygiene. Feasibility was demonstrated by successful recruitment over 5 mo, high retention, and successful installation and use of the bidets with minor modifications. All caregivers and care recipients were interested in receiving an automated bidet: Caregivers were enthusiastic about the potential to facilitate assistance with toileting (Darragh et al., 2015), and care recipients were excited about the possibility of completing toileting and toilet hygiene independently.

Caregivers encountered fewer barriers in the physical environment after the automated bidet was installed. Using the bidet may reduce caregivers' need to bend and reach to assist with toilet hygiene and thereby decrease their risk of musculoskeletal injury and burden (Darragh et al., 2015; King et al., 2019). All caregivers reported that the automated bidet system increased their confidence and ability to assist with toilet hygiene. All caregivers also agreed that the education and training over multiple visits facilitated their use of the automated bidet. These results indicate that the automated bidet system is a feasible solution to reduce the physical assistance needed for toilet hygiene.

To our knowledge, this is the first study to test the feasibility of an automated bidet system and training to facilitate caregiver assistance with toileting and toilet hygiene in the home. Although interventions are needed that reduce caregiver burden in physically and emotionally demanding ADLs such as toileting, studies are limited (Darragh et al., 2015). No studies have investigated the use of an automated bidet system by caregivers and care recipients.

This study is a crucial first step in demonstrating the feasibility of this intervention. Additional research is needed to establish the effectiveness of the intervention with a larger, more diverse sample to detect differences between groups. Future occupational therapy studies should also focus on developing clinical reasoning guidelines to help occupational therapy practitioners determine the appropriate type of bidet for their client on the basis of the individual's diagnoses and health status. If efficacy is demonstrated in future studies, implementing bidet systems has the potential to reduce caregiver burden and may be a viable option to delay or prevent nursing home placement. Automated bidets may also reduce the physical and emotional demand and amount of time needed to assist with toilet hygiene and improve self-efficacy and quality of life for the caregiver and care recipient.

Table 2. Caregivers' Performance, Satisfaction, and Self-Efficacy Scores on the I-HOPE Assist at Pretest, Posttest, and Follow-Up

Subscale	Treatment Group ($n = 5$)			Wait-List Control Group ($n = 5$)			
	Pretest, M (SD)	Posttest, M (SD)	Effect Size	Pretest, M (SD)	Posttest, M (SD)	Follow-Up, ^a M (SD)	Effect Size
Performance	3.20 (1.30)	4.20 (0.45)	0.41	4.20 (0.84)	3.40 (0.89)	4.40 (0.55)	0.45
Satisfaction	3.20 (1.48)	4.40 (0.55)	0.48	3.40 (1.14)	3.00 (0.71)	4.60 (0.55)	0.32
Self-Efficacy	3.20 (1.30)	4.60 (0.55)	0.60	3.60 (1.52)	3.60 (0.55)	4.80 (0.45)	0.12

Note. Effect sizes (Cohen's d) of 0.10 indicate a small change, 0.30 a medium change, and 0.50 a large change. I-HOPE Assist = In-Home Occupational Performance Evaluation for Providing Assistance.

^aFollow-up scores for the control group are postintervention scores.

Limitations

Although these results are promising, this feasibility study has some limitations. First, the small sample was not representative of the general population, affecting the generalizability of the results. Another limitation is the lack of long-term follow-up, which could provide information about caregivers' acceptance and outcomes over time as their comfort with the automated bidet increases. In the future, process evaluations should be administered by a blinded rater to lower the potential for biased feedback regarding education and training. Finally, we did not examine acceptability among care recipients, which might affect both adherence to the intervention and caregiver burden.

Implications for Occupational Therapy Practice

The results of this study have the following implications for occupational therapy practice:

- An automated bidet intervention can increase caregivers' performance of, satisfaction with, and self-efficacy in assisting with toilet hygiene.
- The automated bidet also has the potential to reduce the amount of physical assistance needed from caregivers for toileting and toilet hygiene.

Conclusion

This study demonstrates that an automated bidet intervention is feasible and acceptable and has the potential to reduce the amount of physical toileting assistance provided by caregivers. It can also contribute to improvements in caregiver outcomes such as performance, satisfaction, and self-efficacy while reducing caregiver burden and risk of injury. Although these results are promising, future research with larger samples is needed to examine the long-term effects of automated bidets for caregivers and care recipients. ■

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