Bath Transfers in Older Adult Congregate Housing Residents: Assessing the Person–Environment Interaction

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OBJECTIVES: To examine environmental feature utilization (EFU) and the types and prevalence of performance difficulties during a videotaped bath transfer and to determine the personal characteristics associated with total EFU and performance difficulties.

DESIGN: Cross-sectional analysis.

SETTING: Two congregate housing facilities in southeastern Michigan.

PARTICIPANTS: Eighty-nine older adults who reported independence in bathing.

MEASUREMENTS: Trained video coders recorded EFU (defined as upper extremity contact with features in the environment) and rated performance difficulties (defined as lack of fluid movement or difficulty negotiating the environment). EFU was measured by determining whether features used were safe (i.e., designed for use as a transfer support) or unsafe and by total EFU (i.e., number of environmental features used during the transfer). Personal characteristics included self-reported medical conditions, bath transfer difficulty, functional mobility, lower extremity strength, range of motion functional impairment, and falls efficacy.

RESULTS: For participants with a tub-shower, safe EFU was higher than unsafe EFU (85% vs 19%; $P < .001$). Participants with shower stalls had the same rate of safe and unsafe EFU (71%). In multiple regression analysis, self-reported bath transfer difficulty was associated with total EFU ($P = .01$). One-third of the sample had performance difficulties. In multivariate analysis, range of motion functional impairment (odds ratio (OR) = 13.49, 95% confidence interval (CI) = 1.11–163.53) and lowest quartile in falls efficacy scores (OR = 5.81, 95% CI = 1.24–27.41) were associated with performance difficulties.

CONCLUSION: Unsafe EFU and performance difficulties were common in independently bathing older adults. Self-reported bath transfer difficulty appears to be a good indicator of high total EFU and may be used as a screening question for clinicians. Important strategies to reduce unsafe EFU and to increase falls efficacy include removing shower sliding glass doors and training older adults in safe transfer techniques. **J Am Geriatr Soc 54:1265–1270, 2006.**

Key words: bathing; disability; activities of daily living; environment

For older adults, bathing is one of the first basic activities of daily living in which disability develops.[1,2] Bathing disability is associated with greater hospital utilization,[3] skilled nursing facility admission,[4] bone fracture incidence,[5] and mortality.[6] Despite these consequences, little is known about bathing disability.

Disability has been characterized as the gap between personal capabilities and environmental demand in which the person or the environment can be altered to facilitate activity performance.[7] Within the rehabilitation field, observing the person–environment interaction during activity performance often guides the intervention strategy to focus on the person, the environment, or both. The better the fit is between these components (person, environment, and activity), the more optimal the performance.[8] Examination of the person–environment interaction in many older adults can help identify how best to intervene and aid in understanding the process of bathing disability.

Only one study has analyzed the observed person–environment interaction in bathing by determining the physical actions needed to bathe (e.g., lifting/lowering and precise finger grips) and then taking environmental measurements (e.g., the reaching distances, room dimensions, grip requirements of water controls).[9] Although this approach may help to generate bathroom design recommendations, the study did not examine safety problems or difficulty experienced while interacting with the environment.

One of the most difficult aspects of bathing reported by older adults is the bath transfer,[10,11] but few studies have examined how bath transfers are performed. Two studies

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have examined how people use their bathroom environmental features to transfer by assessing the home environment and then interviewing participants about their use of bathroom environmental features.[11,12] In both studies, grab bars were the most commonly reported feature used during the bath transfer, although safety problems were detected, such as high rates of use of unsafe environmental features (i.e., ones not designed to be used as a support such as the bathtub perimeter or adjacent sink tops)[11] and low rates of use of safe environmental features by adults with objective transfer deficits.[12]

These studies provide preliminary information about the person–environment interaction involved in the bath transfer that could lead to targeted clinical interventions, but to the authors' knowledge, no studies have examined actual environmental feature utilization (EFU) patterns and physical performance difficulties during the bath transfer. This knowledge would help to identify safety issues and problems with personal ability, the bathroom environment, or bathing strategy that could be remediated. The purpose of this observational study was to examine how independently bathing, older-adult residents of congregate housing facilities perform a typical transfer into and out of their own shower or tub. The specific objectives were to evaluate EFU and performance difficulties during the transfer and to examine personal characteristics associated with these aspects of the person–environment interaction that could potentially be used as identifiers of bath transfer problems or as areas of intervention.

METHODS

Participants

Participants in this study were residents of two congregate housing facilities, many of whom participated in a larger study of functional mobility.[13] Participants were included in this study if they were aged 60 and older, had no cognitive impairment ($\geq$24 on the Mini-Mental State Examination)[14] and reported being independent in bath transfers. Of 104 older adults interviewed, 15 were excluded; five had inadequate video data, five had a high amount of missing data, four needed assistance (physical or standby) with the bath transfer, and one was accidentally excluded from the coding tapes. The remaining sample consisted of 89 participants.

Data Collection and Measures

Data were obtained during two sessions. The first session took place in the participant's apartment and consisted of documentation of bathroom environmental features, an interview, and a videotaped bath transfer. For the bath transfer, participants, who were fully clothed and wore shoes, were asked to demonstrate how they usually transferred into and out of their shower or tub. A second assessment session was performed in a laboratory space set up at each housing facility to collect data on physical function.

Rating of Bath Transfers

The study research team developed coding categories based on viewing pilot videotapes of bath transfers of older adults. These categories captured the EFU and performance difficulty variables. EFU was defined as contact by any part of the upper extremities with a feature present in the environment during the transfer into and out of the shower or tub. Features included grab-bars, towel bars, shower curtains, glass doors, tub-seats, parts of the tub and walls, and assistive devices. Performance difficulty was defined as lack of fluid movement or difficulty negotiating the environment. Coding categories representing performance difficulties were falling or plopping onto a tub-seat or into the tub, hitting a bath surface (tub-side, shower threshold, tub-seat) with the lower extremities, requiring more than one attempt to move lower extremities into or out of the shower or tub, physically lifting lower extremities over a tub-side or shower threshold, and maintaining contact with (or leaning against) a bath surface with one lower extremity while moving the other in or out.

Videotape coders were three occupational therapy students from a local university. The coders independently rated the videotaped transfers after being trained by the first author (SLM) and achieving high interrater agreement on a separate test video of three transfers. Interrater reliability was calculated using the kappa statistic.[15] Reliability estimates for whether a feature was used were generally good to very good,[16] with kappas ranging from 0.7 to 1.0. Only one feature, use of walls in the tub or shower, had fair agreement (0.3) and was dropped from the analysis. Reliability estimates for performance difficulty categories were good (kappas = 0.6–0.8). To determine the final data when there were disagreements between the two coders, the third coder's data served as a tiebreaker.

Personal Characteristics

Several personal characteristics were examined to determine potential identifiers of bath transfer problems or as areas of intervention. An interview was administered to ascertain demographic information and current health status. Health status variables included the number of self-reported chronic conditions (osteoarthritis, rheumatoid arthritis, osteoporosis, hypertension, myocardial infarction, stroke, seizures), history of joint replacement, and cane/walker use (current cane or walker use at least some times for mobility).

Physical function was measured using self-report and performance-based assessments. Participants were asked whether they had any difficulty getting into or out of their shower or tub (self-reported bath transfer difficulty). Functional mobility was assessed using the Timed Up and Go Test, which requires participants to rise from a chair, walk 3 meters, turn, walk back, and sit down.[17] A time limit was set at 30 seconds. Range of motion (ROM) functional impairment was determined by measuring bilateral passive ROM of knee flexion and extension, hip flexion, ankle dorsiflexion, and shoulder abduction using a handheld goniometer with participants in the supine position. Using previously established cutpoints,[18] a certain degree of ROM limitation at each joint was considered functional impairment. In this sample, 81% had no ROM limitation, and 19% had a functional limitation in one of the eight joints measured. Lower extremity strength (i.e., isometric knee extension, ankle plantarflexion and ankle dorsiflexion) was measured while participants were seated in a specially designed chair described in detail elsewhere.[19] A total

strength score was calculated by first converting each strength measure to a standard score (i.e., subtracting from the sex-specific mean and dividing by the standard deviation) and then summing.[20] Falls efficacy (i.e., confidence in ability to perform 10 activities without falling) was measured using the Falls Efficacy Scale,[21] with a lower score indicating less confidence. Scores were highly skewed, with a mean of 9.1 ± 1.2. A cutoff score of 8.2 was used to compare participants in the lowest confidence quartile with those in all other quartiles.

Data Analysis

The presence of each environmental feature was determined using data recorded by the original interviewer. EFU was determined by examining the prevalence of use of each available feature. To better characterize EFU, features were categorized as safe (designed to be used as a transfer support) or unsafe (not designed to be used as a transfer support). Tub-seats were classified as unsafe overall, because the vast majority did not have a built-in grab-bar that could be used to assist in the transfer (21 of 23). Because of differences in bathroom configurations, the overall use of available safe and unsafe features was calculated as a percentage by dividing the number of environmental features used during the transfer by the number of safe or unsafe features available for each participant. Paired *t* tests were performed to compare differences in safe and unsafe EFU by bathroom configuration. Total EFU was determined by summing all features used during the transfer for each participant. For bivariate and multivariate analyses, total EFU during the transfer was used as the dependent variable. Performance difficulties were also summed for each person. The summary measure of performance difficulty was skewed, with 67% demonstrating no difficulties, 27% with one difficulty, and 6% with two or more difficulties. This variable was dichotomized (0 vs $\geq$1 performance difficulties) in subsequent analyses. Transfers into and out of the shower or tub were rated separately, although because of similarities in EFU and performance difficulties during these two actions, results from the entire transfer are presented.

Personal characteristics independently associated with total EFU and with performance difficulties were determined using multiple regression and logistic regression, respectively. These models were adjusted for age and sex and included personal characteristics significant at $P \leq .10$ from the bivariate analyses. All personal characteristics were examined in these analyses, except for race and education, because of low variability.

RESULTS

Of the sample of 89 participants, who had a mean age $\pm$ standard deviation of 82.6 ± 5.7, 82% were female, 96% were white, 6% did not complete high school, 23% had a history of joint replacement, and 45% used a cane or walker at least some times for mobility. Twelve percent reported having bath transfer difficulty.

For the bath transfer demonstration, 53% of participants (n = 47) transferred to a shower stall, and 47% (n = 42) transferred to a tub-shower. Seventy-two percent of participants had throw rugs, and 24% always kept a towel on the floor or put it down for the bath transfer. Approximately one-quarter of participants (26%) added a tub-seat to their shower or tub and reported using it regularly. Of the types of tub-seats used, the most common was a seat with no back (n = 15), followed by a seat with a back (n = 4). Two participants used a tub bench, and two used other types of seats (a stool and a plastic lawn chair).

Table 1. Environmental Feature Availability and Utilization During the Bath Transfer (N = 89)

Feature	Availability of Feature n (%)	Utilization of Available Feature n/N (%)	Mean Percentage Utilization by Bathroom Configuration
Safe feature*			
Grab-bar on back wall	89 (100.0)	64/89 (71.9)	
Vertical bar by entry	74 (83.2)	62/74 (83.8)	
Assistive device†	5 (5.6)	3/5 (60.0)	
Other grab-bars‡	13 (14.6)	7/13 (53.8)	
Safe EFU§			
Tub-shower			84.5
Shower stall			70.9
Unsafe feature			
Sliding glass door	50 (56.2)	38/50 (76.0)	
Tub (ledges or floor)	42 (47.2)	11/42 (26.2)	
Shower curtain	36 (40.5)	3/36 (8.3)	
Tub-seat	23 (25.8)	7/23 (30.4)	
Towel bar by entry	16 (17.9)	8/16 (50.0)	
Unsafe EFU§			
Tub-shower			19.4
Shower stall			70.9

* Safe environmental features have been designed for use as a transfer support; unsafe features were not designed as a transfer support.
† Assistive devices refer to a cane or a walker.
‡ Other grab-bars may have been located on a side wall inside or outside the tub-shower enclosure or affixed to the tub ledge.
§ For each participant, the number of environmental features used during the transfer was divided by the number of features available. The resulting percentage was averaged across participants to get the mean percentage of safe and unsafe environmental feature utilization (EFU).

Participants used an average of 2.2 ± 0.8 environmental features during the bath transfer. The most prevalent safe features (the grab-bar on the back wall and vertical grab-bar by the entry to the shower or tub enclosure) were also the most used (72% and 84%, respectively) (Table 1). The sliding glass door was the most used unsafe feature (76%), followed by the towel bar by entry (50%). Participants with the tub-shower used significantly more available safe features (85%) than available unsafe features (19%; $P < .001$), whereas participants with the shower stall used available safe and unsafe features equally (71%; $P = 1.0$).

One-third of the sample experienced one or more performance difficulties during the bath transfer. The most common performance difficulty was falling or positioning onto a tub-seat or into the tub (51%, n = 53). The majority of participants who had this performance difficulty lowered themselves into the tub instead of onto a tub-seat (82%, 22/27). Approximately 30% of participants hit a bath surface (e.g., tub-side, shower threshold, or tub-seat) with one or both lower extremities during the transfer. The other performance difficulties of physically lifting lower

Table 2. Personal Characteristics Associated with Total Environmental Feature Utilization

Characteristic	Bivariate Analyses		Multivariate Analysis*	
	Correlation	*P*-value	Parameter Estimate (Standard Error)	*P*-value
Female	0.18	.09	0.13 (0.27)	.23
Age	0.12	.28	0.01 (0.02)	.91
Health status				
Number of chronic conditions	−0.003	.98		
History of joint replacement	−0.12	.24		
Cane/walker use	0.24	.02	0.15 (0.21)	.17
Physical function				
Self-reported bath transfer difficulty	0.32	.002	0.28 (0.30)	.01
Timed Up and Go Test score	0.17	.11		
Range of motion functional impairment†	0.07	.52		
Lower extremity strength‡	−0.26	.02	−0.19 (0.04)	.09
Psychosocial function				
Falls efficacy—lowest quartile	0.12	.26		

* N = 80; multiple linear regression model coefficient of determination = 0.19, F = 3.46, *P* = .007.
† Range of motion limitation denoting functional impairment was tallied and summed across joints. The presence of one or more impaired joints indicates functional impairment.
‡ Standardized composite score of knee extension, ankle plantar- and dorsiflexion. See Methods for exact calculation.

extremities into and out of the enclosure and maintaining contact against a bath surface with one lower extremity while the other was moved in or out were much less prevalent (5% and 2%, respectively) and only seen in participants with the tub-shower.

In bivariate analyses, characteristics significantly associated with total EFU during the transfer were cane or walker use (correlation coefficient (r) = 0.24, P = .02), self-reported bath transfer difficulty (r = 0.32, P = .002), and lower extremity strength (r = –0.26, P = .02) (Table 2). Of these characteristics, only self-reported bath transfer difficulty (P = .01) was independently associated with total EFU in the multivariate analysis. The coefficient of determination for the model was 0.19, suggesting that the factors in the model explained 19% of the variance in total EFU. Characteristics significantly associated with performance difficulties in bivariate analyses were cane or walker use (P = .02), self-reported bath transfer difficulty (P = .03), Timed Up and Go Test score (P = .001), ROM functional impairment (P = .005), and the lowest quartile score of falls efficacy (P = .001) (Table 3). In a logistic regression, ROM functional impairment (odds ratio (OR) = 13.49, 95% confidence interval (CI) = 1.11–163.53) and the lowest quartile score of falls efficacy (OR = 5.81, 95% CI = 1.24–27.41) were independently associated with performance difficulties.

DISCUSSION

In this sample of independently bathing older adults, many safety issues and performance difficulties were detected related to the bath transfer. Twenty-four percent of the sample reported having a towel on the floor for the bath transfer, which could increase the possibility of slipping or tripping, and two participants used chairs in the tub that were not designed to be used as tub-seats and were potentially dangerous. In one case, a participant used a plastic lawn chair in the tub, which is particularly unsuitable for the concave tub floor. A high rate of unsafe EFU was observed during the bath transfer, which was similar to results from a previous study.[11] Based on the classification scheme of unsafe features, participants with the tub-shower had more unsafe features available to them than participants with the shower stall, although participants with the shower stall used more unsafe features than those with the tub-shower. This may be attributable to the high use of the sliding glass door (76%). This unsafe EFU could be remedied by educating older adults not to use the door as a support or replacing the sliding glass door with a shower curtain, because of the low rate of use of shower curtains as a support in this study (8.3%), and adding an alternate support. The best strategy for bathing disability prevention would be to design bathrooms of congregate housing facilities with unsafe environmental features not readily available for use during the bath transfer.

This sample had a lower prevalence of self-reported bath transfer difficulty (12%) than that found in other studies, which reported prevalence rates of 28% to 66% for the various transfer subtasks (e.g., getting into or out of the tub, getting into and leaving the bathing position).[10,11] Despite the low prevalence, only self-reported bath transfer difficulty was significantly associated with total EFU in multivariate analysis. This self-report measure appears to be an indicator that the person–environment interaction should be observed to determine whether intervention should focus on strategy, impairment reduction, or environmental modification.

No studies, to the authors' knowledge, have examined the observed performance difficulties during a bath transfer. One-third of participants had at least one performance difficulty. Based on multivariate analysis, participants with ROM functional impairment and low falls efficacy had much higher odds of experiencing a performance difficulty

Table 3. Personal Characteristics Associated with Performance Difficulties

Characteristic	Bivariate Analyses			Multivariate Analysis*	
	0 Performance Difficulties (n = 60)	≥1 Performance Difficulties (n = 29)	*P*-value	Adjusted Odds Ratio (95% Confidence Interval)	*P*-value
Female, %	83.3	79.3	.64	0.53 (0.13–2.18)	.38
Age, mean ± SD	82.4 (6.4)	83.2 (5.6)	.72	0.94 (0.84–1.05)	.26
Health status					
Number of chronic conditions, mean ± SD	1.9 (1.3)	2.4 (1.1)	.11	—	—
History of joint replacement, %	26.7	13.8	.17	—	—
Cane/walker use, %	36.7	62.1	.02	0.39 (0.08–1.91)	.25
Physical function					
Self-reported bath transfer difficulty, %	6.7	24.1	.03	3.77 (0.66–21.37)	.13
TUG score, seconds	16.0	20.5	.001	1.11 (0.97–1.26)	.13
ROM functional impairment, %†	5.0	27.6	.005	13.49 (1.11–163.53)	.04
Lower extremity strength, mean ± SD‡	0.03 (2.80)	−0.06 (2.08)	.88	—	—
Psychosocial function					
Falls efficacy—lowest quartile, %	15.0	48.3	.001	5.81 (1.24–27.41)	.03

Note: For the bivariate analyses, *t* tests were performed on continuous variables, and chi-square tests were performed on dichotomous variables. For the variables of self-reported bath transfer difficulty and range of motion (ROM) functional impairment where there were low cell counts, the Fisher exact test was used. For chronic conditions, n = 83; for Timed Up and Go Test (TUG) score, n = 85; for lower extremity strength, n = 86; for falls efficacy, n = 83.

* N = 80; logistic regression model.

† ROM limitation denoting functional impairment was tallied and summed across joints. The presence of one or more impaired joints indicates functional impairment.

‡ Standardized composite score of knee extension, ankle plantar- and dorsi-flexion. See Methods for exact calculation.

SD = standard deviation.

(OR = 13.49 and 5.81, respectively) than participants without these characteristics. These findings suggest that performance difficulties in this sample may be best remediated by using environmental solutions or strategy training, because ROM functional impairment may not be amenable to change, and practicing strategies to perform in a specific situation is important to improve self-efficacy.[22] Future studies are needed to examine the relationship between ROM functional impairment and performance difficulties with larger samples and to examine whether bathroom configuration (i.e., tub-shower or shower stall) affects the relationship.

Lower extremity strength was not associated with performance difficulties or total EFU. Either the strength to perform the task was sufficient or strength testing at another joint, such as the hip, may be more relevant. The classification of a tub-seat as an unsafe feature refers to its use as a transfer support only. In general, tub-seats are commonly prescribed to increase safety in bathing, but older adults should be trained in their proper use with regard to the bath transfer.

This study had limitations. Participants were a convenience sample who were predominately white, female, well-educated, and did not have cognitive impairment. Future research would need to examine performance of a broader range of older adults. The structure of the environment at the two housing facilities influenced the coding of EFU and performance difficulties. Available environmental features likely differ by housing facility, and it is likely that height of tub-sides and shower thresholds influence performance difficulties. In addition, further specification of how people contacted the feature (e.g., type of grip or how long it was used) would help to better understand EFU. Information on the slip resistance of grab-bars or the general condition of tub-seats would be needed to reveal additional safety issues. Lastly, performance difficulties may be underestimated in this study, because the bath transfer was performed under simulated conditions (i.e., wearing shoes and transferring to dry surfaces).

This study had several strengths. The EFU and performance difficulty variables show promise for use in future bath-transfer assessments in healthy older adults. These variables revealed important information that cannot be gleaned from traditional bathroom hazard checklists or self-report. In addition, the study results call attention to the need to design bathroom environments to promote optimal bath-transfer performance and reveal substantial safety issues. Healthcare professionals could begin to provide interventions for independently bathing older adults, including removal of sliding glass doors and a better focus on safe transfer strategies.

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