The Algase wandering scale: Initial psychometrics of a new caregiver reporting tool

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Abstract

This paper reports on the Algase wandering scale (AWS), a 28-item questionnaire, based on five dimensions of wandering. With factor analysis, an eight-factor solution explained nearly 70 percent of the variance in ratings for 151 long-term care subjects and confirmed three of the structuring dimensions. Reliability of the AWS was examined for internal consistency and for inter-rater reliability. The AWS had an alpha of .86; subscale alphas ranged between .88 (persistent walking) and .57 (routinized walking). Inter-rater reliabilities, estimated through cross-rater comparisons of the AWS and subscales with a four-point judgement of wandering status, were moderately strong and no significant differences existed between two sets of raters. Validity of the AWS and its subscales was supported by examining their ability to differentiate wanderers and nonwanderers, by positive correlation with measures of cognitive impairment and with multiple parameters of observed wandering, and by negative or no correlations with nonwandering locomotion. Although the AWS may be a useful measure of wandering in long-term care settings, validation of its factor structure and evaluation in cross-cultural samples is needed.

Key words: assisted-living, long-term care, psychometrics, wandering, wandering scale

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Introduction

Wandering is an important and complex clinical issue in the care of persons with dementia. Although estimates are clouded due to varying definitions and criteria, as well as by studies with diverse sample characteristics and sampling techniques, the prevalence of wandering among community-residing elders with dementia is as high as 50 percent.[1] In nursing home samples of ambulatory dementia subjects, estimates of up to 100 percent have been reported.[2] The potential impact is staggering, considering the fact that many of those afflicted by wandering are at risk for falls, fractures, and death due to accident or exposure.[3,4]

These prevalence rates have captured the attention of researchers. A recent literature review on wandering included 108 relevant research papers, most published since 1990 and many within the last few years.[5] While this recently increased interest in wandering is certainly welcomed, advances in our understanding of this behavior remain hampered by an unclear view of it. Further, results of these studies are often of uncertain value due to lacking or unknown criteria for delineating wanderers and weak or unvalidated measures for quantifying wandering. In many studies, subjects are simply categorized as wanderers or nonwanderers, without benefit of a clear definition or criteria, and few researchers attempt to describe or otherwise characterize or quantify the nature of wandering behavior itself. In all these studies, no scale specific to wandering behavior was found. Although newer observational methods have strengthened approaches to measuring wandering, these approaches are expensive and time-consuming in both research and clinical contexts. Thus, a valid and reliable measure for wandering is urgently needed if future studies of it are to build a reliable empirical basis for clinical practice.

Therefore, the purpose of this paper is to report on the development and psychometric properties of a new scale designed to address this gap. Specifically, we describe the conceptual basis for the Algase wandering scale (AWS) and report its factor structure and initial estimates of its reliability and validity. Reliability (*i.e.*, consistency or stability of the AWS in measuring wandering) is estimated by examining its internal consistency and comparing AWS scores obtained in one sample of caregiver respondents to those of another. Validity (*i.e.*, the degree to which the AWS and its factors reflect wandering behavior) is demonstrated by comparing these scores to caregiver classifications of wandering status, level of cognitive impairment, and the "gold standard" of direct observation.

Conceptual basis and item generation for the Algase wandering scale (AWS)

Lack of a consensus definition plagues research and theory development on wandering. Surprisingly, many researchers do not define the construct at all. Others often include an unvalidated inference about goal-directedness, or lack thereof, in determinations of wandering. Our aim was to define and measure wandering on the basis of observable aspects or dimensions of ambulation, rather than inferences regarding a subject's goals. Further, we set out to explicate and synthesize such a definition and scale from the multiple and disconnected conceptual and empirical approaches contained in the research literature on wandering.

Thus, the conceptual basis of the AWS is derived from an analysis of published studies that offer an explicit definition of, or alternative term for, wandering. These studies were culled from a larger group of research reports identified in the literature review referenced earlier by eliminating those not containing a definition or synonym for wandering. Identified definitions were parsed into single phrases or ideas and, together with alternative terms for wandering, were sorted into four independent dimensions. Accordingly, wandering was defined as the ambulating behavior of demented persons with dimensions of frequency,[5-11] pattern (lapping, random, or pacing),[2,6,7,9,11-15] boundary transgressions,[7,8,15-20] and deficits in navigation or wayfinding.[14,15,19,21-24] These four dimensions, which do not rely on a judgment regarding the purposefulness of ambulation and may provide for identification of various types of wandering, were the initial framework for the AWS. (See Algase[5] for a more thorough review of studies supporting this definition.)

Items for the AWS were then generated in two ways. First, existing measures of dementia-related behaviors used in the studies referenced above were reviewed for items specific to wandering. Duplicated items were eliminated and remaining items were then sorted with regard to dimensions of frequency, pattern, boundary transgression, and navigational deficit. In so doing, we identified a fifth dimension, temporal aspects, composed of items that could not be otherwise classified. Second, items within each dimension were reviewed and additional items were developed and added. The intent was to represent each dimension as fully as possible, using the experience of these investigators in observing countless hours of wandering behavior in long-term care settings. Items were compiled into a scale having 29 items, including one used to classify a subject's level of wandering, based on the rater's judgment and knowledge of a subject. Items were then formatted into an instrument, and a four-point ordinal scaling model was applied. Rating options for each item reflected increasing frequency or severity of the behavior represented in the item. After field testing with 47 cases, minor modifications were made in the wording of some rating options and the ordering of items. No significant differences in overall AWS score means ($p = .157$) and variances ($p = .128$) were found between versions (original and post-modification).Thus, data from the original and modified versions are combined in this report.

Methods

Subjects

Subjects were drawn from 23 nursing homes and assisted-living facilities within a three-county metropolitan area of one Midwestern state. Sites were chosen randomly from among nursing homes of 100 or more beds and assisted-living facilities that resembled nursing homes and where cognitively-impaired residents were housed until a sufficient sample size was obtained. Although all subjects within a site were potentially eligible for the study, stringent inclusion and exclusion criteria necessitated by a companion study (see below) substantially narrowed the number of subjects who qualified.

Because subjects were cognitively impaired, consent was obtained from proxies authorized to make medical decisions. In accord with required protections for human subjects, nursing home personnel identified and contacted proxies of potential subjects and determined their willingness to hear about the study. Only willing proxies were approached for consent. Some potential subjects were ruled out when their proxies revealed a subject's failure to meet inclusion criteria. Due to methods required to meet human subject's standards for consent, an accurate consent rate for all eligible subjects cannot be computed.

All assenting subjects for whom informed consent was obtained and that met inclusion criteria were then studied. Inclusion criteria were: having a medical diagnosis of dementia by *DSM-IV* criteria, being independently ambulatory, having English as a primary language, and scoring less than 24/30 on the Mini-Mental Status Exam (MMSE).[25] A gerontological nurse specialist used data from medical records, family interviews, and examinations of subjects to validate that subjects met *DSM-IV* criteria for dementia. Due to the needs of a concurrent study, all subjects were also right-handed, free from any psychiatric or substance abuse history, and educated through at least eighth grade.

The 151 subjects were 74.8 percent female and 86.8 percent Caucasian with an overall mean age of 85.7 (SD = 6.46) years old. Males and African-Americans were slightly younger, 84.08 and 84.25 years old, respectively. While all subjects met *DSM-IV* criteria for dementia, only 89.3 percent had a dementia diagnosis documented in their medical record. Of these, 74 (49 percent) were diagnosed with Alzheimer's disease (AD), 18 (11.9 percent) with multi-infarct dementia (MID), 22 (14.6 percent) with mixed AD and MID, and 19 (12.8 percent) had a nonspecific diagnosis, such as senile dementia or organic brain syndrome.

Respondents

Respondents were nursing home staff with direct knowledge of the observed subjects. An undetermined number of unique respondents completed a total of 532 questionnaires. Because a staff member may have cared for more than one subject, each staff member may have completed more than one questionnaire. Most questionnaires (81.2 percent) were answered by nursing staff. These included 247 by nurse aides or nursing assistants (NAs), 98 by licensed practical nurses (LPNs), and 86 by registered nurses (RNs). A mixture of social workers, therapists (*e.g.,* occupational [OT], physical [PT], etc.), activity personnel, unit administrators, and others completed the remaining questionnaires (n = 101).

On 80.5 percent of the questionnaires, respondents indicated that they had worked with the subject many times. Less than 2 percent of the questionnaires indicated that the respondent had worked with the subject only one or two times. A large majority of questionnaires (86.8 percent) indicated that the respondent had attended at least one class on dementia, with over 30 percent (n = 167) often attending dementia-related classes. NAs that completed questionnaires had most commonly (41.4 percent) attended several classes, while RNs most commonly (42.4 percent) attended classes often. On many questionnaires, respondents judged themselves as being experienced (66.4 percent) or experts (10.4 percent) in dementia care; moreover, distributions did not vary substantially by category of staff.

Instruments

Cognitive impairment. Two measures of cognitive impairment were used: the Mini-Mental Status Exam[25] and the Test for Severe Impairment (TSI).[26] The MMSE yields a global performance score from 11 items that measure orientation, registration, attention and calculation, recall, language, and construction tasks. Scores range from zero to 30; scores below 24 indicate cognitive impairment of increasing severity. Administration time is approximately 10 minutes. Test-retest reliability regularly exceeds .89; inter-rater reliability consistently exceeds .82.[25] Cronbach's alpha in this sample was .77 (n = 110).

The TSI, a short test developed to quantify cognitive impairment in severely impaired elders, was used to compensate for the floor effects of the MMSE. Some people with dementia that are incapable of doing the MMSE can complete the TSI; thus, its use extended the lower limit of cognitive impairment that could be measured. The TSI yields a global performance score from 21 items in six subsections: well-learned motor performance, language comprehension, language production, immediate and delayed memory, general knowledge, and conceptualization. The maximum score for each subsection is four, for an overall maximum score of 24. High scores indicate better performance. Administration time is approximately 10 minutes. Strong test-retest reliability ($r = .96$, $p < 0.0001$) and internal consistency (alpha = .90) have been reported.[26] Cronbach's alpha in this sample was .84 (n = 112).

Wandering. Trained data collectors timed and coded each subject's ambulation episodes. All episodes that occurred in any public space of the nursing home or assisted-living facility were documented by using a portable, hand-held, bar code reader with an internal clock, light-emitting diode (LED) signal, programmable memory, and ability to retain 512K in a computer-readable format. The bar code reader's wand, which can be programmed to any predetermined coding system and has full transmission capabilities, was used to swipe a standardized coding sheet for the start, stop, pattern, and intervening interval of nonlocomotion, for each ambulation episode observed. Use of the bar code reader reduced measurement error associated with stopwatches by eliminating steps in timing, recording, transferring, and entering data.

Two dimensions of wandering were quantified by this method: pattern and rhythm.

Table 1. Factor loadings, explained variance, subscale alpha, and scale score (mean item rating) for two independent respondent samples

AWS item	Persistent walking (PW)		Spatial disorien-tation (SD)		Eloping behavior (EB)		Routinized walking (RW)	
	1	2	1	2	1	2	1	2
1. Walks between lunch and dinner	.91	.88						
2. Walks between breakfast and lunch	.91	.88						
3. Walks between dinner and bedtime	.88	.88						
4. Walks about on own	.76	.77						
5. Walks between waking and breakfast	.73	.56						.45
6. Reduced spontaneous walking*	.68	.72						
7. Increased spontaneous walking	.47	.58						
8. Paces up and down	.47	.56						
9. Walks around restlessly	.38	.59						.45
10. Can't locate dining room			.88	.88				
11. Can't locate own room			.87	.87				
12. Can't locate bathroom			.82	.80				
13. Walks about aimlessly			.58	.61				
14. Gets lost			.52	.66				
15. Walks away from table at meals			.40	.43				
16. Runs off					.81	.72		
17. Returned after leaving authorized area					.76	.79		
18. Attempts to leave authorized area				.45	.73	.54		
19. Enters unauthorized areas					.64	.45		
20. Travels same route over and over							.81	
21. Goes to same location over and over							.75	
22. Checks whereabouts of staff, others								
23. Follows staff, others	.42	.48						
24. Acts like doing former chores								
25. Walks for odd/inappropriate reason		.40	.41					
26. Bumps into obstacles while walking								
27. Walks in circles								.86
28. Gets up and walks during the night		.46						
Percent explained variance	19.1	21.4	13.1	15.2	10.2	7.5	6.1	5.5
N for subscale analyses	108	103	145	141	146	138	145	
Subscale alpha	.88	.88	.83	.83	.80	.77	.61	
Mean item rating	2.24	2.30	2.56	2.60	2.14	2.23	2.90	
Mean item standard deviation	.28	.54	.76	.75	.81	.85	.76	

* Reverse coded

Table 1 (continued). Factor loadings, explained variance, subscale alpha, and scale score (mean item rating) for two independent respondent samples								
AWS item	**Shadowing (S)**		**Factor 6**		**Factor 7**		**Factor 8**	
	1	**2**	**1**	**2**	**1**	**2**	**1**	**2**
1. Walks between lunch and dinner								
2. Walks between breakfast and lunch								
3. Walks between dinner and bedtime								
4. Walks about on own								
5. Walks between waking and breakfast								.51
6. Reduced spontaneous walking*								
7. Increased spontaneous walking					.43			
8. Paces up and down								
9. Walks around restlessly								
10. Can't locate dining room								
11. Can't locate own room								
12. Can't locate bathroom								
13. Walks about aimlessly								
14. Gets lost								
15. Walks away from table at meals								
16. Runs off								
17. Returned after leaving authorized area								
18. Attempts to leave authorized area								
19. Enters unauthorized areas								
20. Travels same route over and over		.82						
21. Goes to same location over and over		.80						
22. Checks whereabouts of staff, others	.81					.82		
23. Follows staff, others	.70					.57		
24. Acts like doing former chores			.74	.73				
25. Walks for odd/inappropriate reason			.49	.57				
26. Bumps into obstacles while walking					.77			
27. Walks in circles							.89	
28. Gets up and walks during the night							-.40	.62
Percent explained variance	5.7	5.5	5.2	5.1	4.6	5.0	4.4	4.0
N for subscale analyses	146	145				144		
Subscale alpha	.64	.57				.59		
Mean item rating	1.80	2.85				1.74		
Mean item standard deviation	.53	.80				.81		
* Reverse coded								

Table 2. Significance levels for multiple comparisons on AWS and subscales

Resident is a wanderer?		AWS		PW		SD		EB		RW		S	
Sample		**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Definitely not	At times												
	Yes, no problem	.000	.000	.000	.000	.000	.001		.056			.030	
	Yes, a problem	.000	.000	.000	.000	.009	.001	.000	.000				.030
At times	Yes, no problem	.016	.000	.002	.000		.015						
	Yes, a problem	.001	.000	.005	.000		.007	.000	.000				
Yes, no problem	Yes, a problem							.000	.008				

At the conclusion of each walking episode, pattern was discerned on the basis of a typology developed by Martino-Saltzman and associates.[13] From several thousand videotaped episodes of ambulation displayed by nursing home residents, these authors developed definitions and diagrams of four patterns (*i.e.*, random: walking in a haphazard fashion using multiple changes in direction, and no obvious route to the eventual stopping point; lapping: walking in a looping repetitive path having at least three legs; pacing: walking back and forth between two points; and direct: walking directly from point A to B without deviations, hesitations, or direction changes).On a subsample of 231 of these ambulation episodes, Martino-Saltzman *et al.* obtained a kappa of .79 ($z = 13.2$, $p < .0001$) with this typology. Although all ambulation was observed and recorded, wandering was composed of random, lapping, and pacing patterns only; episodes of direct ambulation were not considered wandering, but were observed, counted, and timed for analysis purposes.

Rhythm was measured and timed in terms of a cycle having two phases (locomoting and nonlocomoting), using a methodology developed by Algase and associates.[27] Cycle parameters of interest were: percent of cycles per pattern (*i.e.*, random, lapping, pacing, direct), the frequency of cycles by pattern per hour observed, and the ratio of the average duration of a locomoting phase for each pattern to the average duration of a locomoting phase for all patterns together.

Data collectors, who were graduate and undergraduate students in the health sciences, completed 12 hours of training in the use of the bar code reader to code rhythm and pattern. Wandering videotaped during a previous study and field practice on simulated and actual wandering were the training methods. Data collectors' reliability in identifying direct versus all wandering patterns was equally high, while their reliability in distinguishing among wandering pattern was somewhat lower, ranging between 70 and 80 percent.

Procedures

The MMSE and TSI were completed during week 1, prior to observation, at a pace designed to maximize subject performance. Tests were administered by two technicians: a nurse and a psychology student; technicians were trained by a neuropsychologist with specialization in dementia assessment. A 95 percent standard of agreement was applied and tests were administered by using a standardized protocol. During week 2, the public ambulation of all subjects was observed under naturally occurring conditions. Subjects were randomly assigned to two of three four-hour observation periods (0800-1200, 1200-1600, and 1600-2000 [military time]) and observed 1:1, twice at each assigned time period, for a total of 16 scheduled hours each. Observations for the same time period were separated by at least 48 hours. During observation times, subjects were continuously monitored by data collectors operating from a distance of 30 to 50 feet from the subject.

Staff members from all shifts that were identified by the director of nursing as involved in the daily care of each subject completed the AWS. The number of staff with knowledge of the subjects varied by site and researchers attempted to obtain three to five completed scales per subject. However, only one questionnaire was obtained on four subjects.

Administration of the AWS also varied by site. The researchers' preferred mode of scale administration was to sit with respondents as they had the AWS in front of them and read each item to respondents for purposes of clarity and response rate. However, staff availability was restricted in some settings. The alternative mode of administration was to demonstrate administration to the director of nursing, leave written directions for administration, and have each staff member complete the AWS individually. Each respondent completed one AWS for each subject for whom they had cared. Respondents were cautioned not to discuss the subject's behavior with other respondents during scale completion. The AWS was completed within two weeks of observation. This was considered a reasonable window of time because AWS ratings were based on the rater's general knowledge of a subject, and raters were not directed to think about the subject's behavior during a specific time period.

Data analysis

All data analyses were performed using *Statistical Package for the Social Sciences (SPSS)* software. A total of 532 useable AWS forms were available for analysis. Because a number of respondents may not have had knowledge of subjects' behavior during the night shift, missing data most often occurred on items related to wandering during the night or before breakfast. Missing data were treated as such and no missing values were estimated. However, in rare instances when respondents marked two answers to one item, responses indicating the lower amount of wandering were retained for analysis so that any bias was in the most conservative direction. As almost all subjects had multiple questionnaires available (range = 1 to 11; mode = 3), two independent random samples of questionnaires, consisting of one per subject (N = 151), were drawn from among those available. Four subjects had only one questionnaire; thus, resulting samples were unequal in number (151 and 147, respectively), as no questionnaire was used more than once. However, because several subjects may have resided on the same nursing unit, some respondents may have rated several subjects and these respondents' ratings may be contained in each sample of questionnaires, although not for the same subject. Respondents comprising each sample were compared by job classification (*e.g.*, nurse, aide, or other), length of knowing the subject, and level of dementia training and experience. Variations in the samples on these characteristics were not significant.

Principal components factor (PCF) analysis with quartimax rotation was applied to assess the underlying dimensional structure of the AWS. Quartimax rotation simplifies interpretation by minimizing the number of factors needed to explain a variable.[28] While this method may result in moderate-to-high factor loadings for a variable on several factors, only a few items in our analyses cross-loaded on more than one factor at a loading value of .40 or greater. To assess the stability of the resulting factor structure, this technique was applied independently to both random samples of respondents.

Internal consistency of the AWS and its subscales was computed using Cronbach's alpha; analyses were repeated for each sample used in the factor analyses. The number (N) for reliability analyses was lowered by the requirement of having no missing data for each evaluated scale or subscale. In any analyses using AWS and subscale scores, they were computed as the mean of the ratings for the items comprising each scale.

To maximize the number of cases available for analyses that use cognitive tests, a composite score for cognitive impairment was calculated from MMSE and TSI results. Neither test alone was ideal, as the MMSE could not measure performance below a certain point and the TSI could not measure performance above a certain point. Thus, MMSE and TSI scores were converted to z-scores and averaged. If only one test was available, the z-score from that test was used in the analysis. The correlation of MMSE and TSI scores among subjects having both tests was .74 ($n = 108$; $p < .001$).

Observational data collected by using the barcode reader was entered into SPSS data files, where extensive error checking and cleaning were performed, based on data collectors' field notes. Occasional problems with the equipment and variations in the subjects' availability for observation reduced the hours of observational data for some subjects.

All ambulation cycles, consisting of both locomoting and nonlocomoting phases, were identified within the data. Partial cycles (*i.e.*, whenever the subject was not locomoting at the beginning of a data collection period or was locomoting at the end of an observation period) were censored and only full cycles were used in these analyses. Locomoting and nonlocomoting phase durations and full ambulation cycle periods were calculated to the nearest second from the times recorded by the barcode reader.

The observed ambulation cycles for each subject were pooled for comparison with the data from the AWS. In order to compare subjects with varying periods of total observation time, the number of cycles per observed hour was computed from the aggregated data by ambulation pattern. Ratios of the cycle frequencies of each pattern to the cycle frequency for all patterns and for total

Table 3. Significant correlations for AWS and subscale scores from two samples (N = 137, N = 133) to parameters of observed wandering

Wandering parameter	AWS		PW		SD		EB		SH		RW	
Sample	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Random												
Percent of cycles	.35[2]	.39[2]	.32[2]	.40[2]	.23[2]	.24[2]	.19[1]	.24[2]	.20[1]			
Cycles per hour	.42[2]	.46[2]	.35[2]	.43[2]	.33[2]	.24[2]	.29[2]	.39[2]	.22[1]	.25[2]		
Random locomoting phase duration: total locomoting phase duration	.30[2]	.38[2]	.29[2]	.39[2]	.19[1]	.22[1]	.18[1]	.26[2]				
Lapping												
Percent of cycles		.18[1]	.18[1]	.20[1]								
Cycles per hour				.23[2]				.22[1]				
Lapping locomoting phase duration: total locomoting phase duration		.18[1]	.20[1]	.19[1]								
Pacing												
Percent of cycles			.17[1]	.22[1]			.19[1]	.19[1]				
Cycles per hour	.21[1]		.23[2]				.24[2]					
Pacing locomoting phase duration: total locomoting phase duration							.23[2]	.20[1]				
All wandering												
Percent of cycles	.41[2]	.45[2]	.40[2]	.48[2]	.24[2]	.25[2]	.25[2]	.29[2]	.22[1]			
Cycles per hour	.45[2]	.46[2]	.39[2]	.44[2]	.31[2]	.24[2]	.34[2]	.40[2]	.21[1]	.24[1]		
Direct locomoting phase duration: total locomoting phase duration	.39[2]	.46[2]	.39[2]	.49[2]	.23[2]	.27[2]	.24[2]	.32[2]				
Direct												
Percent of cycles	-.41[2]	-.45[2]	-.40[2]	-.48[2]	-.24[2]	-.25[2]	-.25[2]	-.29[2]	-.22[1]			
Cycles per hour												
Direct locomoting phase duration: total locomoting phase duration	-.39[2]	-.46[2]	-.39[2]	-.49[2]	-.23[2]	-.27[2]	-.24[2]	-.32[2]				

[1] $p < .05$; [2] $p < .01$

locomoting phase durations for each pattern to the total locomoting phase durations for all patterns were also computed from aggregated data.

Results

Factor analysis

By use of a minimum eigenvalue of 1.0, PCF analysis with quartimax rotation resulted in an eight-factor solution explaining 68.5 percent of the variance in sample 1 and 69.1 percent of the variance in sample 2. In both samples, data were deemed suitable for factor analysis by Bartlett's test of sphericity ($p < .0001$) and meritorious values (.838 and .844, respectively) on the Kaiser-Meyer-Olin measure of sampling adequacy.[29] Three of eight factors contained between four and nine items each; the remaining factors were composed of one or two items each. Factor labels, factor loadings, explained variance, subscale n, subscale alphas, and scale scores expressed as item means are shown in Table 1.

Six of eight factors were duplicated in each analysis, although the order of extraction was the same for the first three factors only. These six factors constituted items that loaded on a factor at a value of .40 or greater; in only one instance did an item (#9, walks around restlessly) load at a qualifying value in one analysis, but not the other. In the few instances where an item loaded on more than one factor, the item was assigned to the factor with the highest loading. Of these six factors, five corresponded to the original conceptual structure of the AWS and were retained for further analysis, while the sixth factor, containing items #24 (acts like doing former chores) and #25 (walks for odd/inappropriate reason) was discarded. This process resulted in elimination of five items (#24 through #28) that did not load consistently at or above the cut-off value on any retained factor.

Reliability

Reliability of the AWS and five subscales was examined for internal consistency by using Cronbach's alpha and for inter-rater reliability by correlating scores and testing means obtained in samples 1 and 2. The overall AWS (which reduces to 23 items from five factors) had a Cronbach's alpha of .87 on sample 1 ($N = 100$) and .86 on sample 2 ($N = 93$). Across subscales, the alphas ranged from .88 for persistent walking (sample 1, $n = 108$) to .57 for routinized walking (sample 2, $n = 145$). An alpha greater than .70, the acceptable standard for new measures,[30] was obtained in both samples on three subscales: persistent walking (.88, .88), spatial disorientation (.83, .83), and eloping behavior (.80, .77). As would be expected, subscales consisting of only two items had lower alphas, .64 and .59 for shadowing, and .61 and .57 for routinized walking.

Reliability was also examined by correlating scores obtained on the AWS and its subscales between respondent samples 1 and 2. Significant values ranged from .65 ($p < .01$) for the AWS to .44 ($p < .01$) for the shadowing subscale. Only the routinized walking subscale had an insignificant ($r = .075$, $p = .37$) result. As a final test of reliability, differences in AWS and subscales scores were evaluated between samples 1 and 2 by using t-tests. No significant differences were identified.

Validity

Validity was evaluated in several ways. First, ability of the AWS and its subscales to differentiate nonwanderers from wanderers at various levels of wandering was examined. Two techniques were used. First, the AWS and subscale scores were correlated with subjects' classification on the item: "This resident is a wanderer." Four possible ratings were progressively ordered: "definitely not"; "at times"; "yes, but it is not a problem"; and "yes, and it is a problem." Item ratings obtained from sample 1 were correlated with AWS and subscale scores obtained from sample 2 and vice versa. The AWS and all but one subscale (routinized walking) correlated significantly ($p < .01$) at moderate values ranging from .59 (AWS) to .21 (shadowing).

Second, analyses of variance (ANOVAS) were used to evaluate for differences in AWS and subscale scores at each rating level ("definitely not"; "at times"; "yes, but it is not a problem"; and "yes, and it is a problem"). Again, ratings produced for sample 1 were crossed with AWS and subscale scores produced for sample 2 and vice versa. Scores for all except one subscale (routinized walking) were significantly ($p < .001$) different between rating levels in both sets of analyses. Post-hoc analyses on the AWS and its subscales using multiple comparisons were conducted to reveal where these differences were significant. The results are summarized in Table 2.

In sample 2, AWS scores differed significantly ($p < .005$) across rating levels and two homogenous subsets were identified: wanderers (composed of both "yes" ratings) and nonwanderers (the "definitely not" rating). The picture was less clear in sample 1, where post-hoc differences between wanderers (both "yes" ratings) and nonwanderers were also found, but no homogenous subsets were identified, indicating some overlap in the scores of subjects at each rating level.

Post-hoc analyses were also conducted for each subscale of the AWS. In both samples 1 and 2, eloping behavior had a homogenous subset for the "Yes, and it is a problem" rating, but there was overlap in the eloping subscale scores of subjects at other rating levels. Similarly, both samples revealed two homogenous subsets for the persistent walking subscale: both "yes" ratings together formed one subset, while the "at times" and "definitely not" ratings formed another. Results for the spatial disorientation subscale were not consistent across samples. In the analysis that used the rating level produced for sample 1, the "definitely not" rating yielded the only homogenous subset for spatial disorientation. However, when the analysis was repeated by using the ratings from sample 2, two homogenous subsets were identified with the same groupings occurring as for persistent walking. Neither the shadowing nor the routinized walking subscales had an identifiable subset for any rating or combination of ratings in either sample.

Validity of the AWS and its subscales was further evaluated by comparison of the scores obtained from both samples to the composite cognitive impairment score. Seven of 12 possible correlations were significant or approached significance. For both respondent samples, correlations were significant ($p < .01$) for the AWS (-.23, -.37), spatial disorientation (-.39, -.52) subscales, and eloping behavior (-.24, sample 2 only). Correlations for persistent walking and composite cognitive impairment approached significance (sample 1: $r = -.15$, $p = .1$; sample 2: $r = -.16$, $p = .09$). Neither shadowing nor routinized walking were significantly correlated to cognitive impairment in either sample.

Finally, validity of the AWS and its subscales was evaluated by comparison to parameters of wandering obtained through direct observation. Significant correlations for AWS and subscale scores to parameters of wandering and nonwandering (direct) are shown in Table 3. For all wandering (*i.e.*, random, lapping, and pacing together), all parameters correlated moderately with the AWS and with the persistent walking, spatial disorientation, and eloping behavior subscales, as obtained from both samples, and most parameters also correlated with the shadowing subscale. Correlations were strongest for the overall AWS and the persistent walking subscale. However, no observed parameters of wandering correlated with the routinized walking subscale in either sample. When examined by individual wandering patterns, the correlations obtained for parameters of random wandering were similar to those obtained for parameters of all wandering. However, correlations obtained for lapping and pacing patterns were limited primarily to the subscales of persistent walking and eloping behavior. The AWS and its subscales either correlated negatively or only insignificantly with any parameter of direct, nonwandering locomotion.

Discussion

Although factor analyses revealed an eight-dimensional structure for the AWS, only five factors were consistent across analyses and reflective of the conceptual basis of the scale. Three of these factors confirmed the original conceptual dimensions used to structure the instrument: persistent walking (frequency); eloping behavior (boundary transgressions); and spatial disorientation (navigational deficits). The remaining two factors, shadowing and routinized walking, could be seen as elements of the original pattern dimension. However, the temporal dimension was not confirmed by factor analysis.

Reduced to five factors, the overall AWS has solid reliability and three of its subscales meet or exceed the standard for internal consistency for new instruments.[30] Only very short subscales (two items each) had reliability estimates in the moderate range, which, given their brevity, is not an unexpected finding. Correlations revealed moderate agreement between raters (except for routinized walking), and t-tests indicated that scores were not significantly different in two samples of raters on the overall AWS and all of its subscales.

Analyses using the single classification item support a claim for validity of the overall AWS and three of its subscales (*i.e.*, spatial disorientation, eloping behavior, and persistent walking). The AWS overall and these three subscales are useful for differentiating wanderers from nonwanderers and for detecting increasing levels of wandering behavior. Further, post-hoc analyses provide insight into the behaviors that are most indicative of staff's classification of a resident as a wanderer. Across respondent samples, subjects scoring the highest on the eloping behavior subscale represent problem wanderers. Those with higher scores on persistent walking and spatial disorientation were rated as wanderers, though not necessarily problematic ones. However, scores on routinized walking and shadowing subscales were not clearly indicative of wandering status.

Since wandering is associated with advancing levels of cognitive impairment,[5] significant correlations of the AWS to cognitive impairment also lend support to a claim for the scale's validity. Among subscales, spatial disorientation was the only one consistently related to cognitive impairment. However, all subscales, with the exception of routinized walking, varied in the expected direction.

Finally, correlations of the AWS and its subscales, with the exception of routinized walking, to observed parameters of wandering provide further evidence to support a claim for their validity. These correlations reveal that the AWS captures wandering behavior and is not unduly contaminated by the frequency, duration, or proportion of ambulation that is not wandering. Further, the pattern of relationships obtained suggests that the AWS and two subscales (*i.e.*, persistent walking and eloping behavior) are sensitive to each wandering pattern, while the spatial disorientation subscale is particularly sensitive to random wandering.

On the basis of these findings, and particularly on the behavior of the individual subscales across analytic techniques, some conclusions about the nature of wandering behavior can be proposed. Spatial disorientation and persistent walking likely constitute the core dimensions of wandering. Of these, spatial disorientation is more likely than persistent walking to be mediated by cognitive loss. A designation of wandering as problematic by caregivers owes primarily to the presence of eloping behavior (whether purposeful or accidental). This aspect of wandering also may be a function of cognitive impairment, but less so than spatial disorientation.

Finally, these analyses offer some insight into the meaning of various wandering patterns. Those patterns expressed in subscales of the AWS (*e.g.*, shadowing, routinized walking) neither contribute substantially to differentiating wanderers from nonwanderers nor correlate well with cognitive impairment. However, patterns of wandering patterns expressed in observational data (random, lapping, and pacing) reveal a pattern of relationships with subscales of the AWS. All patterns were reflected in persistent walking and eloping behavior, but random wandering was uniquely correlated with spatial disorientation and shadowing subscales.

Recommendations

This study supports the AWS as a promising new instrument for describing and quantifying wandering behavior in long-term care settings. Nonetheless, some refinement may strengthen the instrument further. Three subscales (*i.e.*, persistent walking, spatial disorientation, and elopement behavior) also have good reliability and validity as dimensions of wandering.

While the shortest subscales (*i.e.*, routinized walking and shadowing) have weaker reliability estimates and also are not as robust as the remaining subscales for differentiating levels of wandering, they are conceptually and clinically meaningful as wandering patterns because they represent behaviors associated with wandering in clinical contexts. However, these items, particularly those for routinized walking, are not sufficiently sensitive to differentiate wanderers from other cognitively impaired nursing home residents. Explanations may lie in unnamed physical and social factors that limit choice and influence behavior patterns of all cognitively impaired residents in institutional settings. Thus, additional items should be identified and evaluated for inclusion in these subscales. With additional development, these two subscales may operate similarly to the others comprising the AWS.

Further, validation of the AWS in a second independent sample of long-term care residents and evaluation of test-retest reliability of raters remain to be done. Also, because the AWS characterizes wandering as expressed by long-term care residents in the US, validation in other cultures and settings may prove useful for differentiating those aspects of wandering that are attributable to underlying brain pathology from those that are more environmentally driven.

Finally, studies of the AWS should also be designed to address issues of clinical as well as scientific utility. Little information is currently available to assist clinicians in making judgments as to which patients may wander or who among them may develop problematic wandering. By adapting the AWS for use by caregivers outside of institutions and establishing norms for the scale, such applications may be possible.

Note

This work was supported by grant number NIH R01AG11501 awarded to Donna L. Algase as principal investigator.

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