



Using the SOS Tool to Evaluate Outdoor Spaces in Seniors Housing

Eric Bardenhagen, PhD, RLA, ASLA; Susan Rodiek, PhD, NCARB, EDAC

ABSTRACT

Outdoor space that is usable and inviting has been found to increase overall satisfaction and occupancy in seniors housing, while improving the health and well-being of residents. The SOS Tool (Seniors' Outdoor Survey) was developed as a valid and reliable way to evaluate a facility's outdoor spaces based on how well they support the needs and preferences of aging residents. The tool can help industry executives, long-term care administrators, owner-operators, planners, and designers identify the most important outdoor features to prioritize in new facilities and renovations. Developed through a series of research projects, the SOS Tool has been tested extensively and can be downloaded at no cost. This application-oriented tool can be used to consistently assess and compare a wide range of senior facilities and outdoor spaces to support decision-making.

INTRODUCTION

Assessing the Value of Outdoor Space in Seniors Housing

Outdoor space provides benefits. Access to nature and outdoor space can improve quality of life for older adults, especially for those living in seniors housing and long-term care settings. Multiple studies have shown that spending time outdoors can substantially improve the health of seniors, ranging from direct physiological and psychological benefits to behavioral benefits such as increased physical activity. These subsequently lead to physical and psychological benefits. Specific findings include lower blood pressure, reduced stress, improved sleep patterns, overall feelings of well-being, improved absorption of vitamin D and calcium, reduced risk of falling, and increased longevity (Berto, 2007; Cohen-Mansfield & Werner, 1998; Detweiler et al., 2013; Jacobs et al., 2008; Okubo et al., 2015; Takano, Nakamura, & Watanabe, 2002; Ulrich, 1999; Wang & MacMillan, 2013). In addition to health benefits, financial analyses have shown that improved outdoor space can lead to higher resident satisfaction with the overall facility and higher occupancy levels due to word-of-mouth referrals (Rodiek, Boggess, Lee, Booth, & Morris, 2013).

Design problems reduce outdoor usage. Unfortunately, it is widely reported that in seniors housing, the majority of outdoor spaces appear to be underutilized, despite the fact that most residents spend nearly all their time in the facility environment (Cutler & Kane, 2006; Heath & Gifford, 2001; Regnier, 1985, 2002). The question of why more residents don't use the outdoor areas has been a concern for researchers and designers, as well as for facility administrators and executive decision-makers who must prioritize the expenditure of scarce resources to improve outdoor space for the benefit of residents. While lack of outdoor usage is clearly related to resident health, climate, and facility policy, it has also been found to be related to the design and layout of these outdoor spaces (Brawley, 2006; Cooper Marcus & Sachs, 2014; Regnier, 2002; Rodiek, 2009; Rodiek

& Lee, 2009; Rodiek, Lee, & Nejadi, 2014; Zeisel et al., 2003). Outdoor space at a senior living community typically includes features such as seating, walkways, plantings, and shade structures, which are all important in satisfying the preferences and needs of residents. In addition, the location and arrangement of outdoor spaces and features has an important role in affording usage and benefits; however, these aspects are typically difficult for non-designers to evaluate.

Existing tools neglect outdoor space. Although many assessment tools have been developed for evaluating physical environment features at long-term care facilities (AHRQ, 2007; Cutler, 2000), they have focused almost exclusively on the *indoor* environment. Few existing tools contain items related to the *outdoor* environment; those few that include outdoor items ask only minimal information such as "Is there is a usable outdoor space?" without attempting to evaluate the space (Rodiek, Nejadi, Bardenhagen, Lee, & Senes, 2014). This lack of evidence-based tools for evaluating features associated with outdoor usage at long-term care communities has made it difficult for care providers and researchers to clearly assess the important features that can encourage or discourage residents' outdoor usage, *even though spending time outdoors is typically acknowledged as an important health-related behavior*. To address this gap, a preliminary version of the SOS Tool (Seniors' Outdoor Survey) was developed and pilot-tested at nearly 200 outdoor spaces within 68 assisted living facilities in a large multiregional study (Rodiek, 2008). The pilot version of this tool had 63 items organized into seven domains and exhibited fairly high inter-rater *reliability*, showing that different raters independently gave similar ratings to most items. Subsequent testing helped to further develop the *validity* of the tool; i.e., testing ensured it included all the most important features capable of influencing outdoor usage by residents. As shown in **Table 1**, additional data collection and analysis were used to triangulate quantifiable information from diverse sources. The resultant tool was found to show satisfactory psychometric properties in terms of validity and reliability (see **Table 2**).

Table 1. Studies Included in Psychometric Testing.

Methodology Type	Facilities in Study (N) ^a	Facility Sample Frame (N)	Participation Rate	Facilities Randomized ^b	Resident Participants (N)	Resident Sample Frame	Resident Response Rate	Residents Randomized	Resident Mean Age
Focus group (prelim. study 1)	1 SN, 2 AL, 2 IL	10	50%	No	76	569	13%	No	77.8
Written survey (prelim. study 2)	1 SN, 1 IL	n/a	n/a	n/a	17	168	10%	No	80.8
Focus group (prelim. study 3a)	7 AL	34	21%	Yes	108	1541	7%	Yes	83.6
Written survey (prelim. study 3b)	14 AL	34	41%	Yes	211	1541	13%	Yes	83.6
Photo survey (prelim. study 4)	14 AL	34	41%	Yes	133	1541	9%	Yes	83.9
Written survey (multiregional)	68 AL	139	49%	Yes	1128	5632	20%	No	83.9
Environmental audit (multiregional)	68 AL	139	49%	Yes	n/a	n/a	n/a	n/a	n/a
Environmental audit (SOS reliability)	4 SN, 5 AL, 3 IL	12	100%	No ^b	n/a	n/a	n/a	n/a	n/a
Online expert opinion survey (SOS validity)	n/a	53	96%	n/a	n/a	n/a	n/a	n/a	n/a

Notes: SOS: Seniors' Outdoor Survey.

^a IL: independent living facilities in the sample were congregate dwellings with communal dining and minimal assistance; AL: assisted living facilities provided assistance with daily activities; and SN: skilled nursing facilities provided assistance with medical needs in addition to daily activities.

^b Exhaustive sample

Table 2. Items of the SOS Tool with Validity Support and Reliability Testing.^a

Domains / Items	Validity			Reliability ^c	
	Levels of Support ^b			Inter-rater ICC (2 Raters)	Test-Retest ICC (Means)
	Preferences	Outcome-Based	Expert Opinions		
1. ACCESS TO NATURE (14)				0.83	0.91
Abundance of greenery	H	-	H	0.58	0.81
Diverse mix of plants and trees	H	M	M	0.64	0.82
Abundant flowers and color	H	-	H	0.91	0.92
Easily reachable or raised plants	-	H	H	0.74	0.84
Hard boundaries screened by plants ^d	-	-	L	-	-
Seating has pleasant views	M	L	H	0.83	0.91
Water features available	M	H	M	0.93	0.92
Features with movement ^d	-	-	L	-	-
Amenities for pets	L	L	M	0.86	0.91
Amenities for birds and wildlife	H	H	M	0.62	0.53
Can see domesticated animals ^d	-	H	M	-	-
Outdoors fairly quiet	L	-	M	0.10	0.60
Privacy from resident rooms	L	-	M	0.55	0.73
Private places to sit ^d	L	-	M	-	-
2. OUTDOOR COMFORT AND SAFETY (15)^e				0.94	0.95
Plenty of seating available	H	L	H	0.93	0.95
Choice of different seating types	L	-	H	0.94	0.97
Some seating easily movable	M	-	H	0.86	0.84
Seats available in sun or shade	H	L	H	0.71	0.79
Seats will not tip over	L	L	H	0.95	0.93
Seating has arms and backs	M	L	H	0.94	0.95
Seats comfortably shaped	H	-	H	0.85	0.92
Seats do not get hot or cold	M	-	H	0.86	0.89
Seats with cushions	M	-	H	0.97	0.92
Swing, glider, rocking chairs	M	-	M	0.97	0.92

Tables for coffee, food, etc.	M	-	H	0.93	0.94
Restroom, drinking fountain ^d	L	-	L	-	-
Microclimate control	M	-	H	0.72	n/a ^f
Smoking areas well separated ^d	L	-	H	-	-
Outdoor area well maintained	M	-	H	0.69	0.80
3. WALKING AND OUTDOOR ACTIVITIES (14)				0.88	0.81
Abundant walkways of different lengths	H	L	H	0.75	0.68
Roundtrip walkways available	L	H	H	0.90	0.84
Paving level, easy for wheelchairs	H	L	H	0.71	0.54
Paving non-skid and non-glare	-	H	H	0.09	0.53
Handrails along some walkways ^d	-	-	M	-	-
Walkways partly shaded	L	L	H	0.87	0.69
Interesting views from walkways	-	M	H	0.78	0.55
Frequent seating along walkways	M	-	H	0.96	0.90
Some walkway seating in shade	L	-	H	0.91	0.66
Destinations to walk toward	M	M	H	0.78	0.82
Places for social activities ^d	H	-	H	-	-
Places for recreation and exercise	H	L	M	0.62	0.64
Play areas for children	L	-	M	0.91	0.79
Place for gardening, hort. therapy ^d	L	-	M	-	-
4. INDOOR-OUTDOOR CONNECTION (11)				0.84	0.87
Easily reached from indoor commons	-	-	H	0.56	0.80
Visible from main indoor areas	L	M	H	0.63	0.79
Indoor transition space near doorway	-	M	H	0.82	0.70
Outdoor transition space near doorway	-	-	H	0.89	0.93
Multiple ways to reach outdoor area	L	-	M	0.86	0.88
Doors unlocked during daytime	L	H	H	0.80	n/a ^f
Doors open with little effort	H	H	H	0.77	0.77
Doors do not close too quickly	L	H	H	0.86	0.85
Automatic door available, easy to use	H	H	H	0.85	0.79
Can easily cross door threshold	L	H	H	0.83	0.59
Wide paved landing outside doorway	-	M	H	0.39	0.47
5. CONNECTION TO THE WORLD (6)				0.98	0.98
Area is located near main entry	M	H	M	1.00	1.00
View of vehicles arriving at facility	L	M	L	0.99	1.00

Views of front-door activities	M	-	M	0.98	0.96
Views of offsite scenery	M	L	M	0.95	0.91
Views of nearby streets or traffic	L	M	M	0.94	0.98
Views of offsite buildings, activities	L	L	M	0.91	0.93

Overall Tool Reliability

0.91

0.92

Notes: Values for overall instrument and domain names are in bold. ICC: intra-class correlation coefficient; SOS: Seniors' Outdoor Survey

^a The SOS instrument can be accessed at: <http://www.accessstonature.org/resources.html>

^b High, medium, low (H, M, L) support for item validity was estimated from listed resources: preferences reflect quantified open-ended resident responses from multiregional study; outcome-based shows items associated with higher levels of outdoor usage and walking; and expert opinion summarizes their H, M, L ratings of items in the final SOS Tool.

^c Type A intra-class correlation coefficients using an absolute agreement definition

^d Reliability not estimated, as items were added or modified during field-test

^e Exterior fencing was not required for any facility types in this sample

^f Unable to compute statistic because one set of responses had no variation

Using the SOS Tool at Existing Facilities

Overall structure of the SOS Tool. The finalized tool is used to evaluate 60 different features that are organized into five categories or “domains.” The evaluation form is completed on site at each outdoor space, using a 1 to 7 rating scale for each feature, where 7 is “outstanding” and 1 is “extremely poor.” This allows the tool to sensitively measure the range of support that each feature provides to seniors in a given setting. In addition to outdoor features, the tool can be used to evaluate how successfully the outdoor space connects with the interior of the building (Table 2). Collectively, the SOS Tool items are intended to address the most important features relevant to residents’ outdoor usage and satisfaction. The domains are:

1. Access to Nature: greenery, views, water, other aesthetic characteristics (14 items)
2. Outdoor Comfort and Safety: seating, climate control, and comfort issues (15 items)
3. Walking and Outdoor Activities: safe and accessible walkways, destinations (14 items)
4. Indoor-Outdoor Connection: the doorway, physical/visual outdoor access (11 items)

5. Connection to the World: features providing contact with nearby surroundings (6 items)

As an example of real-world features that can be evaluated, **Figure 1** and **Figure 2** show two doorways that provide different levels of support for residents, evaluated under the domain of Indoor-Outdoor Connection.



Figures 1 and 2. Flat Thresholds and Automatic Doors Have a Major Impact on Seniors' Ability to Reach and Use Outdoor Spaces (photos courtesy of Access to Nature).

Evaluating from “a resident’s perspective.” Unlike most tools in which users simply evaluate the qualities of each environmental feature (i.e., “How good is this feature?”), the SOS Tool asks users to rate each feature based on

“how well it supports the needs of frail elderly residents, using walkers or wheelchairs.” This may seem like a small difference, but it is an important one for at least three reasons: (a) evaluating the *functional support* the space provides, rather than the inherent characteristics of the space, is intended to reduce the individual bias of different raters by focusing on *benefits for users*; (b) asking raters to *“visualize themselves as an older person”* can help them overcome age-related perception bias they may not be aware of; and (c) asking raters to *actually try using* the features—sit on the benches, walk through the doors, etc., can help them identify usage-related problems that are not obvious by just looking at the space. This approach was based on the “affordance theory” of perceptual psychologist James J. Gibson (1979) to allow the SOS Tool to more accurately reflect how the physical environment in real-world settings impacts people (Rodiek, 2008). The focus here is on supporting desirable resident behaviors and health outcomes, rather than just recording the presence or absence of certain features. For example, when observing walkways, rather than simply asking raters whether or not walkways are available, a series of questions can help the rater ascertain how well these walkways will support usage by residents (Table 2). Walkway-related questions include:

- Can residents choose from multiple walkways of different lengths?
- Are roundtrip walks available?
- Do walks have interesting views?
- Is paving level, smooth, no deep cracks, and easy for wheelchairs?
- Does paving have a non-skid, non-glare surface?
- Are walkways partly shaded from midday or hot afternoon sun?
- Are there handrails along at least a few parts of the walkways?
- Can residents find seating along walkways at frequent intervals (~50 feet)?

Asking users of the SOS Tool to view these spaces and features from the perspective of seniors and within the context of the facility itself reduces the apparent subjectivity of the evaluations. A question such as “Is there plenty of seating available?” may appear to be

inherently subjective and difficult to answer. With an understanding of the resident population and physical context, however, the rater can estimate that for a specific facility with 60 residents, a certain amount of outdoor seating may meet their needs and thus support or “afford” their outdoor usage at an appropriate level.

Who Should Do the Evaluations?

Outdoor space can be evaluated by any number of raters in any role, ranging from administrators and activity directors to direct care staff and outdoor maintenance personnel. Contracted designers and space planners can also conduct evaluations for the facility. While a single individual can do the evaluations, comparing or averaging ratings from multiple people, as shown in **Figure 3**, makes it possible to obtain more reliable results.



Figure 3. Multiple Raters Using the Japanese Version of the SOS Tool to Evaluate an Outdoor Space on Awaji Island, Japan (photo courtesy of Susan Rodiek).

Raters do not need special prior training or expertise, but they should: (a) understand the context of the facility, its residents, and the surrounding community/environment; (b) be able to hypothetically view the outdoor space from the “affordance” perspective of frail seniors (e.g., limited mobility, impaired eyesight, heat intolerance, etc.); and (c) carefully read and apply the brief instructions for the tool, *before doing the evaluation*. During testing, raters typically spent about 15 to 20 minutes evaluating each outdoor space. Because many senior living facilities have two to four main outdoor spaces intended for resident usage, a typical long-

term care community may be able to evaluate all their relevant outdoor areas in less than an hour, after an initial orientation with the tool has taken place, to make sure all raters understand how it is to be done.

Where the same care provider network or corporation operate several facilities, several options are possible. One alternative is for administrators or other staff members at each facility to independently evaluate their own outdoor spaces; this method is inexpensive and quickly produces results that can be shared with the provider organization as desired. Although results can be compared to other facilities in the network, having the evaluations done by different people will necessarily introduce some level of bias due to individual differences among raters. Another alternative is to have a designated individual or team systematically evaluate outdoor spaces at multiple facilities across a network (see **Figure 4**); using the same raters makes the results more comparable across facilities. In any case, when outdoor spaces are to be compared to each other and not only evaluated for their own benefit, it can help reduce confounding variables if they can be evaluated at a similar time of day and in similar weather conditions. Although drastically different weather conditions may yield somewhat different evaluation results on certain items, the tool is intended to be usable at any season of the year, even in cold weather when many of the plants are dormant. The tool asks the rater to estimate what the level of greenery or other features would be *in different seasons*, recognizing the year-round need for residents to have access to nature, and for designers and providers to plan strategies appropriate for different climate conditions.



Figure 4. A Team of Trained Raters Using the SOS Tool at a Skilled Nursing Facility in Milan, Italy, in a Systematic Evaluation of All 67 Nursing Facilities Within the City Limits (photo courtesy of Giulio Senes).

Psychometric Testing of the SOS Tool

Establishing validity of the SOS Tool. Validity support for the tool was initially derived from the existing literature and from a series of preliminary studies conducted to learn which environmental features were important to the outdoor usage and satisfaction of residents. The methods used in preliminary studies included focus groups, brief written surveys, and photographic comparison studies (Table 1, preliminary studies). The findings from literature reviews and preliminary studies contributed to a knowledge base showing which environmental features appeared to be important. These features were then used to generate a preliminary version of the tool, which was tested in a multiregional study with nearly 200 outdoor spaces at 68 randomly selected assisted living facilities (Table 1, multiregional study). Information collected in this large study was combined with feedback obtained from subject matter experts and included:

1. *Resident preferences* from written surveys with 1,128 residents, who responded to open-ended questions about what was *important to their outdoor usage and/or satisfaction*; comments were examined and categorized to identify relevant environmental features.
2. *Outcome-based findings*: The *level of outdoor usage at each facility was compared to the quality of the outdoor space* and evaluated with the pilot version of the SOS Tool (Rodiek, 2008). Results were weighted according to how much usage the different outdoor areas received. Correlating the level of outdoor usage with the quality of the physical plant provides a way to link behavior-related health outcomes with the physical environment and justify making future improvements based on these design guidelines.
3. *Expert opinion*: In addition to the validity support provided by the multiregional study, the tool developers also obtained digital survey feedback from 53 acknowledged experts on this topic (Table 1, SOS validity). Experts were asked to indicate the relevance and impact of each item, *“in terms of resident outdoor usage and satisfaction,”* and asked if any important items were missing from the tool.

The findings from these three sources (resident preferences, correlation with residents' outdoor usage, and expert opinion) were quantified and combined to develop the final version of the tool (Table 1, validity sources). The strength of support for each item is shown in Table 2 as being approximately high, medium, or low from each of the three main sources. The purpose of combining these diverse sources for the validity of items on the tool was to generate a balanced instrument that would reflect the direct input of users, the opinions of experts in the field, and empirical evidence on health-related outcomes of which residents may not be consciously aware.

Testing the reliability of the SOS Tool. In 2013, the finalized version of the tool was tested by trained researchers in a single region of the U.S., in 22 outdoor spaces located at 12 senior living and care facilities that ranged from assisted living to skilled nursing (Table 1, SOS reliability; **Figure 5**). The results showed high levels of inter-rater reliability, ranging from .83 to .98 for the five domains, and .91 for the overall instrument, as shown in Table 2 (reliability above .65 or .70 is generally considered acceptable; see Portney & Watkins, 1993). As shown in Table 2, when the same outdoor spaces were rated seven weeks later, comparable results were found for test-retest reliability, ranging from .81 to .98 for the domains, and with a mean of .92 for the overall instrument.



Figure 5. A Trained Rater Using the SOS Tool at One of 22 Outdoor Spaces in 12 Facilities Tested in Bryan/College Station, Texas (photo courtesy of Access to Nature).

In addition to testing in the U.S., the reliability of the SOS Tool was also tested in Milan, Italy, by trained researchers who evaluated 94 outdoor spaces at all 67 skilled nursing facilities in the city (reported in Senes et al., 2013). Both main types of reliability (inter-rater and test-retest) at the Italian facilities were found to be comparable with those found in the U.S. and ranged from 0.91 to 1.0 for the items, with a mean of 0.97 for the overall instrument. These results show that the SOS Tool can be used to consistently and reliably assess the quality of outdoor space in diverse real-world settings.

Weighting and Scoring the Results

Toward the goal of increasing the instrument's usability in real-world settings, a differential weighting scheme is currently being developed, with summary scores intended to reflect the estimated relative importance of different features. While all 60 items in the SOS Tool were found to have merit, some items are likely to be more important than others in terms of residents' outdoor usage and satisfaction. For example, "ease of opening the door" would likely have more overall impact than "amenities for pets." To reflect these differences, the weighting system is based on metrics calculated from the three main sources used to validate the tool (resident preferences, outdoor usage, and expert opinion). Analysis of the numeric findings from these sources, classified as having high, medium, or low potential impact on residents' outdoor usage and satisfaction, are being combined into a *weighting factor* for each item. After evaluating an outdoor space, the rating for each item will be multiplied by that item's specific weighting factor and further converted to a 100-base scale using a simple arithmetic formula that can easily be done by hand or with a calculator. The resultant summary scores will provide an intuitive way to grasp the implications of the evaluations and compare different spaces with each other. Microsoft Excel and PDF files with embedded scoring formulas are being developed to further simplify the process, along with a hand-held mobile application to provide multiple options for the process of conducting evaluations. The current format of the SOS Tool can be downloaded and printed at no charge at www.accesstonature.org. The SOS Tool has also been translated into Japanese, Italian,

and Mandarin Chinese; these versions are also available for free download.

CONCLUSION

The SOS Tool fills an important gap in the evaluation of health-promoting senior living and care settings by making it possible for the first time to systematically evaluate access to nature for residents, using a reliable and valid instrument. Care providers can use the tool independently to gain a better understanding of the strengths and weaknesses of their own community's outdoor access. Public health officials (e.g., the city long-term care administration in Milan, Italy) can use the tool to evaluate a network of outdoor amenities available within their domain and plan large-scale improvement programs. Researchers can use the tool as a standardized instrument to compare across facilities, and to compare levels of outdoor usage and satisfaction with qualities of the facility environment. Future studies could further test the psychometric properties of the tool in additional settings and levels of care, as well as in different regional, climatic, and cultural conditions. The further development of the SOS Tool with weighting and 100-base scoring will contribute to the overall usefulness of this evaluation instrument.

The use and enjoyment of outdoor courtyards, gardens, and patios carries benefits to residents of senior living facilities in their social lives and their physical and emotional health. This, in turn, translates to greater levels of satisfaction among residents and can also serve as an inviting draw for potential future residents. With the ability of the SOS Tool to more easily communicate the successes or shortfalls of outdoor spaces in seniors housing, decision-makers can weigh the costs and benefits of various improvement proposals. The use of this tool is expected to contribute substantially to improved outdoor access for older adults.

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AUTHORS

Eric Bardenhagen, PhD, RLA, ASLA
Assistant Professor, Landscape Architecture and Urban Planning
Faculty Fellow, Center for Health Systems and Design
Texas A&M University
College Station, TX 77843-3137
bardenhagen@tamu.edu
979-458-3414

Susan Rodiek, PhD, NCARB, EDAC
Associate Professor, Department of Architecture
Faculty Fellow, Center for Health Systems and Design
Texas A&M University
College Station, TX 77843-3137
rodiek@tamu.edu
979-862-2234
www.accessstonature.org

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