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## Acoustic Comfort and Sound Preference in the Nursing Home for Blind Older Adults

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### ABSTRACT

There have been many studies exploring the perception of the acoustic environment in older adults, but do blind older adults make a difference? This study conducted a subjective evaluation of the acoustic environment in an all-blind nursing home in China, investigating acoustic comfort and sound preference for different types of sound sources. The study found that 36.7% of the blind older adults were highly satisfied with the acoustic environment in nursing homes; blind older adults preferred natural sound and informational sounds and were more receptive and dependent on artificial sounds than others; the results indicated that blind older adults with light perception were more sensitive to sound and preferred an audible environment than blind older adults with no light perception, and they needed the feeling of having someone around them. This study may help nursing homes to provide environmental support for blind older adults.

Keywords: Blind older adults, Acoustic comfort, Sound preference

### 1. INTRODUCTION

Noise can cause not only mental health problems such as irritability, insomnia and depression, but also physical health problems such as tinnitus, dizziness, heart disease and cognitive impairment. In 1794, Miller systematically reviewed the effects of noise on people and suggested that older adults need a less noisy environment for both communication and sleep(1). In addition, age-related hearing loss causes communication problems with approximately 37% of people aged 61 to 70 and 60% of people aged 71 to 80(2). People can perceive space through their bodies without using their vision in the process of movement(4). The sense of hearing can convey external information and identify the surrounding environment, and blind people outperform normal people in speech perception, auditory memory, sound source localization and speaker recognition(5). Chen summarized the ways in which blind people perceive the external world through auditory perception, suggesting that sound not only directly conveys linguistic information, but is also a major vehicle for entertainment and can help them orient, remember and perceive things, a complement to the absence of vision(6). All of these studies have highlighted the impact and importance of sound on the elderly and blind, but fewer studies have considered the acoustic perception of blind older adults.

It is a case study for the only nursing home in China that provides environmental and service support for the blind older adults. It investigated the perception of blind older adults in the nursing home of different types of sound sources in terms of both acoustic environment comfort and sound source preference, with a view to helping nursing homes provide environmental support for blind older adults.

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## 2. METHODOLOGY

### 2.1 Survey Site

This all-blind nursing home is located in Shenyang, Liaoning Province, Northeast China. The home has five floors, 96 care units, approximately 30-50 elderly residents and 12 staff. The types of sound sources in the home are summarized according to the site location, building layout and user behavior. Inside the building, there are the sounds of talking and walking between blind older adults, the activity sound generated by staff and blind older adults, the prompt sound used by the elevator to indicate the floor and broadcast the notice of dining and other events, as well as the mechanical sound generated by the equipment supporting the operation of the nursing home and household appliances for blind older adults. Outside the building there is talking sound, activity sound and broadcast sound to help orient blind older adults, as well as traffic and nature sounds.

### 2.2 Questionnaire Survey

In this study, the subjective evaluation questionnaire was divided into two parts: background information survey and subjective evaluation, and participants' attitudes were measured using a 5-point Likert scale from 1 to 5, as shown in Table 1. Many previous studies of the acoustic environment have paid particular attention to acoustic comfort(7,8,9,10) and sound preference assessment(11,12,13) and explored the influence of some factors, so the subjective evaluation in this study explored these aspects as well.

Table 1 - Questionnaire and scales

Category	Questions	Scale
Background information	Gender; age; light perception; length of residence	
Acoustic evaluation	Comfort of the acoustic environment	1 being very uncomfortable to 5 being very comfortable
	Preference degree of various sound sources	1 being highly disliked to 5 being highly liked

### 2.3 Participants

In this study, questionnaires were distributed among the field three times in July, October and December 2021, the participants were the blind older adults living in the home, the staff and the students and teachers that took part in the survey. 90 questionnaires were distributed and 89 valid questionnaires were returned, including 60 from the blind older adults and 29 from others, the basic profile of the respondents is shown in Table 2. The reliability coefficient of the questionnaire was 0.83 (Cronbach's alpha).

Table 2 - Respondent Profiles.

Measures	Items	blind older adults	Other people	All respondents
Light perception	light perception	26		26
	No light perception	34		34
Gender	Male	26	12	38
	Female	34	17	51
Age	60-	24	28	52
	60~69	13	1	14
	70+	23	0	23
Duration of residence	3 months-	8	14	22
	3 months~6 months	11	2	13
	6 months to 1 year	15	6	21
	1 year+	26	7	33

### 2.4 Statistical Analyses

The questionnaire data were analyzed with SPSS 25(14). Descriptive statistics were used to determine the distribution of participants' ratings of acoustic comfort and sound preference. Independent sample t-tests were used to determine differences in participants' perceptions of acoustic comfort and the effect of light perception and gender differences on the degree of sound preference.

One-Way ANOVA was used to determine the effect of the blind older adults' age and length of stay on sound preference.

### 3. RESULTS AND DISCUSSION

#### 3.1 Comfort of the acoustic environment

As shown in Figure 1(a), a total of 78.4% of the blind older adults gave positive ratings to the acoustic environment of the nursing home, with 41.7% of them saying that the acoustic environment was relatively comfortable and 36.7% found it very comfortable. 66.0% of the older respondents to Zeng's survey on the acoustic environment of elderly living chose "very good" or "good"(15). Zhan et al. found that 71% of the older adults felt that the acoustic environment in their nursing home was acceptable (acceptable, unacceptable) when they surveyed the indoor air quality of the nursing home(16).

In addition, the blind older adults rated the acoustic environment of the nursing home with a mean score of 4.08 ( $\pm 0.926$ ), while the other participants rated it with a mean score of 3.34 ( $\pm 1.495$ ), as shown in Figure 1(b). After an independent samples t-test, blind older adults rated the acoustic environment significantly higher than others in the nursing home ( $p=0.019$ ). Li found that the older adults rated the acoustic environment with a mean score of 3.37 ( $\pm 1.120$ ) when investigating the acoustic preferences of the older adults in nursing homes(17). The acoustic comfort of the nursing home investigated by Cui et al. was 3.36 ( $\pm 1.120$ )(18). In conclusion, both young and old people rated the acoustic comfort in nursing homes or living environments lower than blind older adults, which may indicate blind older adults are more receptive and accepting of the acoustic environment.

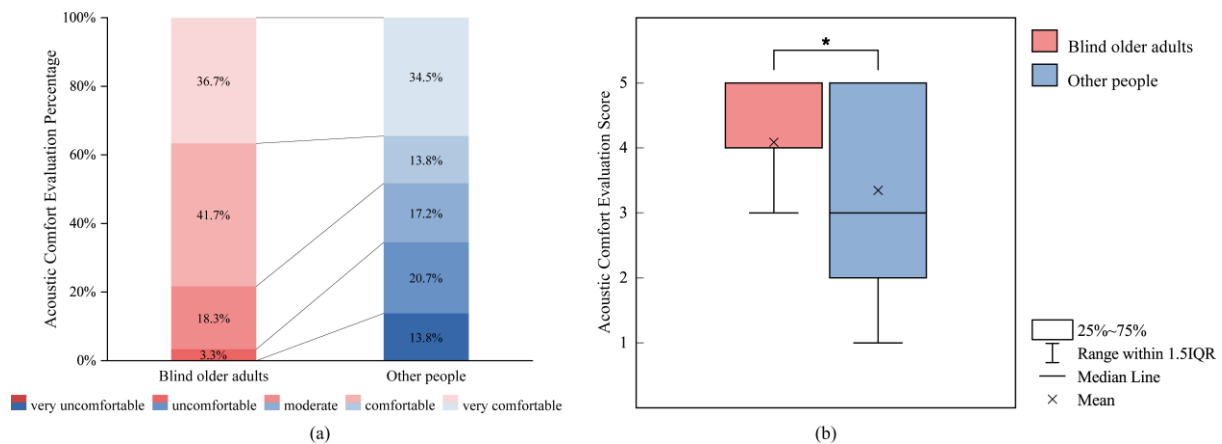


Figure 1 – (a) The percentage of acoustic comfort evaluation for different people; (b) Acoustic comfort evaluation scores for different groups of people (\*p-value < 0.05.)

#### 3.2 Sound preference

Figure 3 shows the preference of the blind older adults for various sound sources in the nursing home. For indoor sounds, 52% of the blind older adults selected "dislike" or "highly dislike" mechanical sound; while most of blind older adults were neutral about the sound of activity and walking. Some participants stated: "We need to hear the voices of others to avoid feelings of isolation". In addition, 45% of the blind older adults "like" or "highly like" talking sound, while only 13% of the blind older adults "dislike" or "highly dislike" Prompt sound. For outdoor sounds, 55% of the blind older adults chose "dislike" or "highly dislike" traffic sound, while they also hold a neutral attitude to activity sound and talking sound; 83% and 92% of the blind older adults chose "like" or "highly like" broadcast sound and nature sound respectively.

In general, blind older adults like natural sound bests, followed by informational sounds such as prompt and broadcast, which is consistent with some previous soundscape studies(19,20). Although some studies have shown that many older adults would like to reduce the amount of talking and activity sounds in elderly facilities(21), blind older adults are more neutral towards artificial sounds such as talking, walking and activity sounds, which may indicate that they are more accepting and dependent on these types of sounds than others. Additionally, blind older adults dislike traffic sound

and mechanical sound, which is consistent with other findings on sound preference(13,17,22).

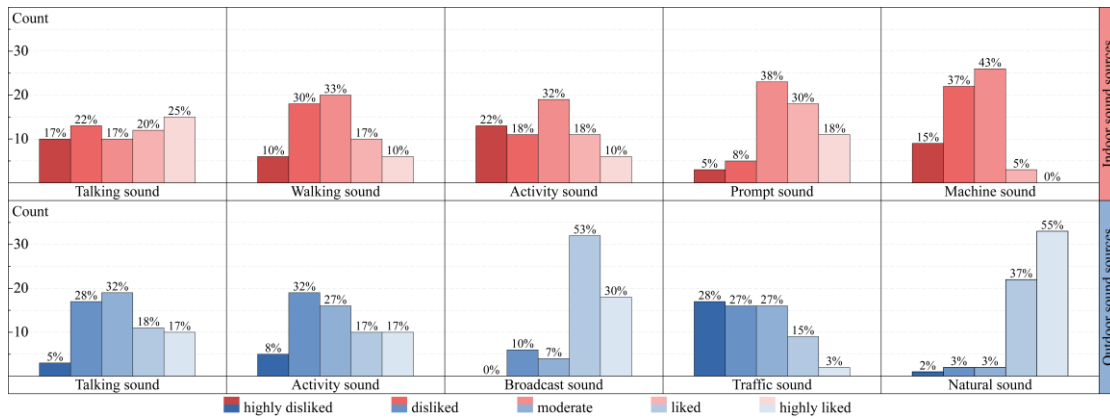


Figure 3 - Evaluation of sound preference for blind older adults

### 3.3 Factors influencing sound preference

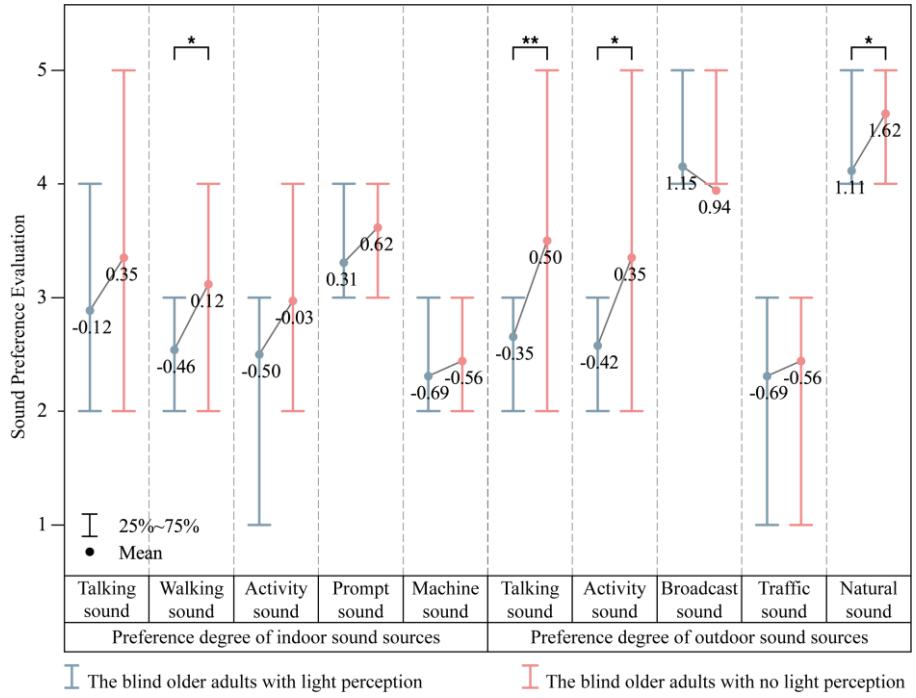
As shown in Table 3, the gender, age and duration of residence of the blind older adults did not have a significant effect on their sound preference, while there was a significant difference in sound preference between the blind older adults with light perception and the blind older adults with no light perception.

In an independent sample t-test, the blind older adults with no light perception showed a significantly higher preference for indoor walking sounds and outdoor talking, activity and nature sounds than the blind older adults with light perception. In terms of preferences for walking, talking and activity sounds, the blind older adults with no light perception preferred artificial sounds, possibly because they need more reassurance through artificial sounds that they are in a social environment. In addition, although the difference in preference for other sounds was not significant, it can be seen from Figure 4 that the mean values of preference for other sounds were higher for the blind older adults with no light perception, except for broadcast sounds. It indicates that the blind older adults with no light perception are more sensitive to sound and prefer an audible environment.

Table 3 - Significance of different factor categories on sound preference

		Preference degree of indoor sound sources				
Factors	Sound sources	Talking sound	Walking sound	Activity sound	Prompt sound	Machine sound
	Light perception		0.217	<b>0.048*</b>	0.156	0.260
Gender		0.465	0.903	0.675	0.529	0.991
Age		0.587	0.296	0.688	0.929	0.392
Length of residence		0.848	0.771	0.098	0.817	0.433
		Preference degree of outdoor sound sources				
Factors	Sound sources	Talking sound	Activity sound	Broadcast sound	Traffic sound	Natural sound
	Light perception	<b>0.004**</b>	<b>0.014*</b>	0.359	0.660	<b>0.022*</b>
Gender		0.744	0.454	0.533	0.817	0.159
Age		0.746	0.879	0.507	0.681	0.722
Duration of residence		0.982	0.956	0.346	0.727	0.102

note: \*p-value < 0.05; \*\*p-value < 0.01



note: \*p-value < 0.05; \*\*p-value < 0.01

Figure 4 - The relationship between sound preference and light perception

#### 4. CONCLUSIONS

This study investigated the acoustic comfort and sound preferences of the only all-blind nursing home in China. 78.4% of the blind older adults gave positive ratings of the acoustic environment of the nursing home, of which 36.7% thought it is very comfortable, the blind older adults had a higher level of acceptance and approval of the acoustic environment. In addition, they preferred natural and informational sounds, dislike traffic and machine sounds, and have a higher acceptance of artificial sounds than others. The blind older adults with no light perception are more sensitive to sound and prefer an audible environment, they need sound to be sure that they are in a social environment. Staff should reasonably arrange rooms according to the situation of blind older adults, so as to meet the needs and expectations of blind older adults in an acoustic environment that is conducive to their lives and health.

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