

중단적 관찰연구를 통한 치매 요양시설 거주자들의 삶의 질을 위한 물리적 환경의 역할

- 캐나다 및 한국의 요양시설을 대상으로 -

Role of Physical Environment in Quality of Life among Residents in Dementia Care Facilities through a Longitudinal Observational Study

- For Facilities in Canada and South Korea -

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Abstract

This longitudinal observational study aims to examine whether residents with dementia in long-term care facilities with variability in physical environment qualities in Vancouver (N=11), Canada and Seoul (N=9), South Korea had a difference in their quality of life (QoL). Physical environmental assessment was conducted using the Therapeutic Environment Screening Survey for Nursing Homes (TESS-NH). QoL was assessed three times over one year using Dementia Care Mapping tool. The results of the study demonstrated that the residents with dementia living in an institutional large-scale setting showed statistically more withdrawn behavior and spent more time to be negative mood or affect compared to the ones in a small-scale setting. This study also found that the number of potential positive behaviors of residents in a small-scale setting was three times higher than that of residents in an institutional large-scale setting. When looking at the distinction between two countries in the behavior category with a large average time difference, the residents with dementia in Korea had shorter meal/dessert times compared to those in Canada. The study supports that the small-scale homelike environment is intensely associated with a therapeutic environment for older adults with dementia.

Keywords : physical environment, residents with dementia, quality of life, longitudinal observation

주요어 : 물리적 환경, 치매거주자, 삶의 질, 중단적 관찰

I. Introduction

Demographic shifts, particularly population ageing is one of global “mega-trends” exerted a pervasive influence on global community-climate change, urbanization, digital technologies, and lifestyle with Corona (United Nations, 2020; Oh, 2021).

Around the world, 50 million people live with dementia and there are nearly 10 million new cases every year. The symptoms of dementia are difficulties with memory, language, and problem-solving skills that affect a person’s ability to perform daily activities (Alzheimer’s & Dementia, 2020). Therefore, people with dementia often require continual responsive care and support from care providers and institutions and their residential environment to foster quality of life. Approximately 70% of older adults within care facilities have dementia (Canadian Institute for Health Information, 2018), yet traditional models of care facilities with long corridors and large-scale units may associated with challenging behaviors, such as anxiety, irritation, and social withdrawal (Lee & Morelli, 2010; Chaudhury & Cooke, 2014; Lee et al. 2021a). It is necessary to recognize that design strategies to create supportive living environments for older adults with dementia are more important than ever.

The physical environment should be considered as an

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essential element in determining how residents' behavior at any given time in a care home setting (Nightingale, 2019). Nightingale (2019) mentioned that fear and anxiety are the powerful negative emotions experienced by older adults with dementia in an unfamiliar and institutional environment. The reciprocal relationship between the physical environment and older adults can be understood by a complement/congruence model of well-being (Carp & Carp, 1984). The model focuses on the interaction and congruence between a Person's competence and Environment resource/barriers relevant to activities of daily living. Congruence is determined by the degree of complementarity between Person's competence and Environment resource or barrier. When a Person's competence is low, for example, prosthetic/supportive Environment may be necessary to achieve a satisfactory level of complementarity. As the domains of health status, functioning level, and cognitive capacity decline in dementia, the extent of maladaptive behavior and its negative effects will increase. Therefore, as people with dementia are sensitive to the environmental conditions, it is essential that their surrounding setting is responsive to their declined abilities (Brawley, 2005; Calkins, 2009; de Rooij et al., 2012; Pollock & Fuggle, 2013; Chaudhury & Cooke, 2014; Marquardt, Bueter, & Motzek, 2014). Results of numerous studies have demonstrated that purposed-built settings deviating from traditional settings can lead to improve social relationship formation (Calkins, 2009; de Rooij et al., 2012; Lee et al., 2021b), increase interest and engagement with activities (Lee et al., 2021a), enhance the dining experiences (Chaudhury et al., 2017), and reduce anxiety, aggression and withdrawal (Schwarz, Chaudhury, & Tofle, 2004; Lee & Morelli, 2010). However, considering the findings of some studies (Verbeek et al., 2010; de Rooij et al., 2012; Wilkinson et al., 2019) that a small-scale setting compared to a traditional large-scale setting revealed no positive impact on certain domains of residents' behaviors, it is still worthwhile to conduct more evidence-based studies on the role of physical care environment for the older adults with dementia. A lack of long-term follow-up evaluation is another weakness of existing research (Day, Carreon & Stump, 2000). The current study was designed to conduct three time lines of observation for addressing this venture.

In Korea and Canada, the proportion of older adults aged 65 and more has increased; in 2018, 14.3 and 17.2%, respectively (OECD, 2021). In line with this circumstance, approximately 44% of new residents of care facilities in Korea were diagnosed with dementia (Song, Park & Kim, 2013), and in Canada, about one-third of older adults younger than 80 who have been diagnosed with dementia live in long-term care facilities (Canadian Institute for Health Information, 2018).

Due to the rapid increase of these figures in the future, continuing to provide assistance services and appropriate environment for residents with dementia could be challenging for both countries. In Canada, although it is changing into person-centered care culture and small-scale home-like settings, there are still hospital-like institutional care homes with long corridors, large-scale groups and semi-/four-bedrooms. In Ontario and Nova Scotia, for example, about half of care homes have more than 100 beds (Armstrong et al., 2009). The aforementioned study also revealed that ventilation, bathrooms, and outdoor spaces are environmental areas that do not meet the needs of residents seriously. Meanwhile, Chaudhury and Cooke's study (2014), which emphasized the importance of the role of the physical environment for the residents with dementia, mentioned that large unit sizes and inappropriate stimuli such as noise were associated with negative outcomes. Studies (Hung & Chaudhury, 2011; Chaudhury, Hung, Rust, & Wu, 2017) on the impact of dining spaces on dining experiences of care facilities in Western Canada demonstrated that the physical environment supports or hinders social interaction and care practices. However, most of the studies (Armstrong et al., 2009; Banerjee et al., 2012; Smith-MacDonald et al., 2019; Wilkinson et al., 2019) seem to be focused in the factors related to financial resources, e.g., organizational culture, ownership, and/or staffing levels, towards quality-of-care issues of care facilities. Meanwhile, in Korea, studies related to the multi-sensory environment (Choi, Kim, & Yang, 2004; Choi, Yang, & Oh, 2006; Choi & Yang, 2007) have reported that the level of positive stimulation was evaluated as low in care settings, especially in the double-loaded plan facilities. Other studies have investigated the characteristics of floor finishing materials for residents' safety, design attributes of public areas for improving social interaction (Yun & Byun, 2005; Choi & Yang, 2007), architectural characteristics of care homes in Metropolitan, and design consideration for residents' wandering behavior. In both countries, however, studies and knowledge on the physical environment for the quality of life of older adults with dementia are continuously needed.

The longitudinal observational study aims to examine whether residents with dementia in long-term care facilities with variability in physical environment qualities had a distinction in their quality of life (QoL).

II. Method

This longitudinal study was one of a larger study conducted in dementia long-term care facilities in three countries: Canada, Sweden, and South Korea. The findings in Canada

and Sweden were published ahead, and the current paper presents the ones in Canada and South Korea. Due to this research design, the process of selecting sites and their participants and the assessment tools conducted in Vancouver, Canada were mentioned elsewhere (Lee, Hung, Chaudhury, & Morelli, 2021a).

1. Study sites

To select facilities in Vancouver, the following process was carried out: i) among the 56 residential care facilities in Vancouver Coastal Health Authority, 20 dementia care facilities were selected randomly, ii) a primary investigator requested a site visit by e-mail to the administrator of each facility and received the permission from a total of 11 sites, iii) through site visits, the care facilities were classified as a traditional setting and a small-scale setting based on distinct physical features according to three criteria: a) number of beds in a unit (30 or more beds in a unit as a larger unit), b) length of corridor or hallway (>15 meters as a long corridor), and c) building layout (single- or double-loaded floor plan).¹⁾ Two dementia care homes, Vancouver I and II, were selected for the study. Vancouver I is a small-scale care home, with 12 beds for residents with dementia in a unit, a relatively short corridor (14.4 m), and single-loaded floor plan. Vancouver II is a large-scale care home, with 30 residents with dementia in a unit, a long corridor (41.3 m), and double-loaded floor plan.

To select care facilities for the study in Seoul, the following process was carried out: i) a list of 25 dementia care facilities was collected based on the information provided by the Welfare Planning Team of Seoul Metropolitan Government and the Long-term Care Department of the National Health Insurance Service, ii) a primary investigator in the study asked the administrator of each facility for the permission to visit by e-mail and phone, iii) site visits were conducted on eight care facilities that were permitted to visit and requested to cooperate with observation and investigation for the study, iv) permission was obtained in two facilities. Seoul I care home is a medium-scale care home with 16 residents with dementia in a unit and Seoul II care home is a small-scale care home with nine residents with dementia in a unit. The names of all care facilities in the study document were changed to pseudonyms to provide anonymity and confidentiality.

2. Study Samples

The administrator of each facility was asked to identify subjects who met eligibility criteria: aged 60 and older, in the

early-mid stage of Alzheimer's disease or related dementia, and able to ambulate with or without an assistive device. Residents who were bed-ridden or staying in their private rooms during the daytime were excluded because we were interested in observing how residents move and interact with neighbors in their care setting. In each facility, the administrator contacted their family members and assisted in obtaining a written consent from their family members. Twenty residents in Vancouver and nine residents in Seoul met the study criteria. During the observation period, a total of nine residents in Vancouver passed away or moved to other locations. The final data analyses involved 20 residents with dementia: 11 from Vancouver and nine from Seoul.

3. Measurement

1) Physical environmental assessments

Physical environmental assessments were conformed at each selected dementia care unit using Therapeutic Environment Screening Survey for Nursing Homes (TESS-NH) tool (Sloane et al., 2002). TESS-NH contains 84 discrete items and one overall item that cover six domains with 13 sub-domains. These domains comprise: (1) privacy/control/autonomy: unit autonomy, access to outdoors and privacy; (2) safety/security/health: exit control, maintenance, cleanliness and safety; (3) stimulation: lighting, visual/tactile stimulation and noise; (4) socialization: space and seating; (5) personalization/homelikeness: personal and homelike atmosphere; (6) orientation: orientation and cueing. Defining specific physical features were primarily rated on a scale from 0 (distinctly unpleasant attribute) to 3 (more favorable attribute).

2) Quality of life assessment

Quality of life of the residents with dementia was measured with Dementia Care Mapping (DCM) (University of Bradford, 2010) tool. DCM tool is an observational framework devised to systematically record and investigate quality of life from the perspective of the older adults with dementia living in a care facility. The tool is the intensive in-depth, real-time observations over a number of hours of residents living in dementia care units (Brooker & Surr, 2010). During an observation, Behavioral Category Codes (BCCs) and Mood and Engagement (ME) values are used to take notes on what is taken place to each resident. BCCs specify one of 23 category codes of resident's behaviors (Table 1). ME value, which shows how engaged the resident is and whether their mood is positive or negative, provides an index of relative well- or ill-being for an observation time for a resident or a group. ME values for each BCCs are expressed on a 6-level scale (i.e., +5, +3, +1, -1, -3, -5), ranging from 'extreme positive state or deeply engaged' to 'extreme negative state'.

1) Single-loaded plan refers to corridor or hallways that have resident rooms on its one side, contrasted with double-loaded plan where rooms are on its both sides.

Table 1. Behavior Category Codes (BCCs)

Behavior Category Codes	General Description of Category
A. Articulation	Interaction with others
B. Borderline	Being engaged but passively (watching)
C. Cool	Being disengaged, withdrawn
D. Doing for self	Self-care
E. Expressive	Expressive or creative activities
F. Food	Eating/drinking
G. Going back	Reminiscence and life review
I. Intellectual	Prioritizing the use of intellectual abilities
J. Joints	Exercise or physical sport
K. Come and go	Walking, standing or moving activities
L. Leisure	Leisure, fun and recreational activities
N. Nod	Sleeping, dozing
O. Objects	Displaying attachment to or relating to inanimate objects
P. Physical	Receiving practical, physical or personal care
R. Religion	Engaging in a religious activity
S. Sexual expression	Sexual expression
T. Timalation	Direct engagement of the senses
U. Unresponded to	Attempting to communicate without receiving a response
V. Vocational	Work or work-like activity
W. Withstanding	Repetitive self-stimulation of a sustained nature
X. X-cretion	Episodes related to excretion
Y. Yourself	Interaction in the absence of any observable other
Z. Zero option	Fits none of existing categories

Source. University of Bradford (2010). *DCM 8 User's Manual*. P.17

The qualified mapper, who had completed the course 'Learning to use DCM' conducted by Jentle Harts Consulting in U.S.A. and received a certificate, observed unobtrusively the selected residents with dementia continuously for 5-minute time frames during daytime on a weekday - typically between 9:30 and 16:00 - in the primary public areas, e.g. living room, dining room, multi-purpose room or courtyard. In each time frame, the mapper assessed the subjects' mood and engagement (ME) values in context of the BCCs that they accompanied (i.e., E/+3 when showing sustained engagement with music, or singing). Observations in Vancouver and in Seoul were performed by the same mapper to reduce the variability of the assessment. In order to obtain at least 4 hours of non-missing observations per resident, observations were conducted over 2 or 3 days at each unit. The mapper recorded up to four residents simultaneously. To get the rich data, observations implemented at three times over a period of one year at each facility.

4. Data collection and analysis

The unobtrusive observations were held in Canada from

January to February in 1st phase, June-July in 2nd phase, and November in 3rd phase in 2013. In Korea they were held from March to April in 1st phase, August-September in 2nd phase, and December-January in 3rd phase in 2019 and 2020. Data were coded and analyzed using Microsoft Excel (2010 version) and SPSS version 26.0. Descriptive statistics were applied using Excel program. The analysis of variance (ANOVA) test was used to compare the study groups' environmental assessment and the domains of quality of life in SPSS with a level of significance of $p < 0.05$. As an auxiliary analysis, post hoc analysis using the Bonferroni post hoc criterion was performed to identify the differences in means between each group.

Based on the analysis method developed by the Dementia Group of the University of Bradford (Brooker & Surr, 2010; University of Bradford, 2010), DCM data were analyzed using five different analyzing types (see University of Bradford, 2010. pp. 101-113) as follows;

1) High potential engagement: levels of the potential for positive engagement in an environment regarded as one of the key factors to quality of life in dementia was measured by the percentage of time spent in codes such as A (interaction), D (self-care), E (creative activities), F (eating/drinking), G (reminiscence), I (intellectual abilities), J (exercise), K (walking/standing), L (leisure), O (displaying attachment to objects), P (receiving personal care), R (religious activity), T (engagement of the sense), V (work-like activity), and Y (interaction in the absence of any other).

2) Diversity of occupation: as an indicator of the quality of care, the diversity of occupation was assessed by the number of high potential categories excluding 'eating' (code F), 'personal care' (code P), and 'excretion' (code X).

3) Agitation/distress: levels of agitation/distress were measured in terms of the amount of times spent in 'communication without receiving a response' (code U), and 'walking whilst being in a negative mood' (code K with negative ME value), 'repetitive self-stimulation whilst being in negative mood' (code W with negative ME value), and 'interaction with absence of others whilst being in negative mood' (code Y with negative ME value).

4) Withdrawal: when in withdrawn behaviors, a resident is not showing any signs of engagement with oneself or the world surrounding oneself. Withdrawal was evaluated in the amount of time spent in 'being disengaged' (code C) and 'dozing' (code N).

5) Well- or ill-being (WIB): WIB brings an index of whether the preponderance of time was spent in positive or negative mood and engagement.

5. Ethical considerations

Ethical approval and permission to conduct the study were obtained from the Office of Research Ethics at Simon Fraser University, Vancouver, Canada and the Institutional Review Board at Yonsei University, Seoul, South Korea.

The participating residents' families received a consent form, which contained the study objective, detailed observation process, and the confidentiality of residents' identity. The consent forms with the residents' family signature were gathered by the primary investigator through the administrator of each facility.

III. Results

1. General characteristics of the residents

An overview of the general characteristics of the residents in Vancouver and in Seoul is presented in <Table 2>. There was a total of eight males and 12 females, with an average age ranging from 75.5 to 91.2 years. The means of stay length ranged from 19.5 to 28.0 months. The average activities of daily living (ADL) ranged from 44.8 to 65.5 scores. Overall, the participants in Seoul II care home were the oldest, the longest in the stay length, and the lowest in ADL compared to other groups.

2. Physical environment assessment

<Tables 3 and 4> shows general features and results of *F*-test analysis on the physical environmental assessment of the four facilities in Vancouver and in Seoul. Vancouver I care home had 12 older adults with dementia on each unit, all single bedrooms and 1:3.4 staff ratio, that is, one staff member took care of 3.4 residents in the daytime. Vancouver II care home has 30 older adults with dementia on each unit, mixed single/semi-private bedrooms, and a double-loaded floor plan. The staff ratio is 1:6 in the daytimes. Seoul I care home has 16 older adults with dementia on each unit with mixed semi- or four- bedrooms and 1:4.6 staff ratio in the daytime. Seoul II care home has 9 older adults with dementia on each unit.

Bedrooms are mixed semi- or three bedrooms, with 1:3 staff ratio.

The means and *F*-tests of statistical significance on the physical environmental assessment of the four dementia care facilities are shown in the lower part of <Table 4>. There were significant differences in the stimulation ($F_{3,76}=3.99, p<0.05$), while the domains of privacy/control/autonomy, safety/security, socialization, personalization/homelikeness and orientation revealed no significant differences between the care facilities. Post hoc analyses using the Bonferroni post hoc criterion indicated that the domain of stimulation was significantly higher in Vancouver I ($M=1.50, SD=0.67$) than in Seoul II ($M=0.85, SD=0.75$). The results indicate that Vancouver I care home provided significantly more caring physical environmental features in quality of lighting, visual/tactile/acoustic stimuli to the residents with dementia compared to other groups.

3. Dementia care mapping (DCM) for the participants

The distribution of the behavior category profiles and Mood/Engagement values across the three observation time lines (T1-T3) for the residents in the study groups is shown in <Table 5>. Notably in Vancouver I care home, a more caring and personalized/homelike setting, the more frequently observed behavior was 'A: interaction with others' (21.0%), and in Vancouver II care home, 'C: being disengaged' (11.5%) and 'N: dozing' (15.3%) appeared more frequently than other groups. Remarkably in Seoul I care home, the more frequently observed behavior was 'L: leisure/recreational activities' (20.3%) because some residents spent a lot of time playing card game alone. In Seoul II care home, the behavior categories 'B: passively watching' (31.6%) and 'X: episodes related to excretion' (5.2%) were higher than that of other groups. Behavior category 'G: reminiscence and life review' was not observed among all the groups for the observation period.

The analysis of variance (ANOVA) test was conducted on four domains of QoL: potential positive engagement, level of agitation/distress, withdrawn behavior, and well- or ill being <Table 6>.

Table 2. General Characteristics of the Residents and the Dementia Care

		Vancouver		Seoul	
		Vancouver I (n=6)	Vancouver II (n=5)	Seoul I (n=4)	Seoul II (n=5)
Age (years)	Mean (SD)/Range	83.8(9.4)/73-95	77.6(9.8)/62-88	75.5(11.4)/64-89	91.2(11.3)/74-102
Gender	Male/Female f(%)	3(50.0)/3(50.0)	2(40.0)/3(60.0)	3(75.0)/1(25.0)	0(0.0)/5(100.0)
Marital Status	Married/Widowed/Others f(%)	1(16.7)/4(66.6)/1(16.7)	1(20.0)/3(60.0)/1(20.0)	1(25.0)/3(75.0)/0(0.0)	0(0.0)/5(100.0)/0(0.0)
Stay length (months)	Mean (SD)/Range	19.5(18.3)/2-54	22.0(5.7)/15-28	21.3(17.9)/10-48	28.0(24.0)/6-55
ADL*	Mean (SD)/Range	63.0 (35.6)/10-94	60.2 (31.3)/17-98	65.5(19.1)/44-90	44.8(24.1)/6-64

*Activities of Daily Living

Table 3. General Features of Physical Environment

	Vancouver		Seoul	
	Vancouver I	Vancouver II	Seoul I	Seoul II
Dementia Care Unit Features				
Type of unit	Segregated with other units	Segregated with other units	Segregated with other units	Segregated with other units
Bedroom type	Single bedrooms	Mixed single and semiprivate bedrooms	Mixed semiprivate and four bedrooms	Mixed semiprivate and three bedrooms
Number of residents in a unit	12	30	16	9
Staff ratio (daytime) ^a	1:3.4	1:6	1:4.6	1:3.0
Photographs				
Dining Room >>>				
Living Room >>>			<Living & Dining Room>	<Living & Dining Room>
Corridor >>>				<Corridor from the bathroom's entrance to the living/private room>

^astaff ratio: ratio of cared for residents per employee

Table 4. Results of F-test Analysis on Physical Environmental Assessment

	Vancouver		Seoul		F value(df)
	Vancouver I	Vancouver II	Seoul I	Seoul II	
TESS-NH	mean (SD)	mean (SD)	mean(SD)	mean (SD)	
Privacy/control/autonomy	2.21 (2.26)	1.43 (1.16)	1.07 (1.07)	1.07 (1.21)	N.S.
Safety/security	1.70 (0.70)	1.30 (0.63)	1.74 (0.69)	1.43 (0.79)	N.S.
Stimulation	1.50 (0.67)	0.95 (0.86)	1.43 (0.59)	0.85 (0.75)	F_(3,76)=3.99*
Socialization	1.25 (1.09)	0.75 (1.30)	0.30 (0.48)	0.40 (0.70)	N.S.
Personalization/homelikeness	1.83 (0.75)	0.50 (0.84)	1.08 (1.11)	0.92 (1.63)	N.S.
Orientation	0.54 (0.52)	0.38 (0.51)	0.46 (0.52)	0.54 (0.52)	N.S.

df: degrees of freedom, N.S.: not significant, *p<0.05

Bold type: significant differences between groups after using Bonferroni post hoc analyses

1) Potential positive engagement

Positive engagement is one of the important indicators to quality of life in dementia. The levels of the potential for positive engagement in an environment was measured by the percentage of time spent in codes A, D, E, F, G, I, J, K, L, O, P, R, S, T, V and Y. The average percentage of potential positive engagement was 59.9% in Vancouver I care home, 43.1% in Vancouver II care home, 66.6% in Seoul I care home, and 56.2% in Seoul II care home. The participants in the study groups except ones of Vancouver II care home spend more than half of their observation times doing positive activities or engagement.

The result of F-test to examine the difference among the study groups revealed no significant difference.

2) Diversity of occupation

The diversity of occupation was assessed by the number of high potential categories with a greater diversity proposing better quality care excluding ‘F: eating’, ‘P: personal care’, and ‘X: excretion’. The number of high potential categories with a positive ME value for 2% or more of the time was 5 behavior categories (i.e., A: interaction with others/D: self-care/E: creative activities/K: walking & standing/L: leisure) in Vancouver I care home, 2 behavior categories (i.e., A: interaction with others/K: walking & standing) in Vancouver II care home, 5 behavior categories (i.e., A: interaction with others/D: self-care/J: exercise or physical sport/K: walking & standing/L: leisure) in Seoul I care home, and 6 behavior categories (i.e., A: interaction with others/D: self-care/J:

Table 5. Distribution of Behavior Category Profiles and Mood/Engagement Values Across Three Observation Time Lines

Codes	Vancouver									Seoul								
	Vancouver I			Vancouver II			Seoul I			Seoul II								
	mean %	(T1	T2	T3)	mean %	(T1	T2	T3)	mean %	(T1	T2	T3)	mean %	(T1	T2	T3)		
A	21,0 ^a	(22,0	18,9	22,1)	13,2 ^b	(20,3	10,1	9,1)	12,8	(11,8	11,1	15,6)	10,5	(10,2	12,1	9,2)		
B	17,6	(20,5	18,9	13,5)	26,5	(22,7	26,3	30,4)	18,9	(18,9	19,6	18,2)	30,9	(29,4	32,9	30,4)		
C	5,1	(3,1	11,4	0,6)	11,5	(18,4	9,5	6,7)	2,7	(1,5	2,0	4,5)	1,4	(1,8	2,3	0,0)		
D	2,4	(1,6	2,6	3,1)	0,7	(0,0	0,6	1,5)	2,8	(2,7	1,8	3,8)	4,5	(5,8	3,0	4,6)		
E	3,7	(2,8	6,6	1,8)	1,4	(0,0	2,1	1,9)	0,9	(2,2	0,6	0,0)	0,3	(1,0	0,0	0,0)		
F	18,4 ^c	(19,7	14,0	21,5)	18,7	(22,7	18,7	14,7)	9,9	(9,8	9,4	10,5)	14,7	(12,6	14,6	17,1)		
G	0,0	(0,0	0,0	0,0)	0,0	(0,0	0,0	0,0)	0,0	(0,0	0,0	0,0)	0,0	(0,0	0,0	0,0)		
I	1,2	(0,0	0,0	3,7)	0,0	(0,0	0,0	0,0)	0,4	(0,0	0,0	1,3)	0,7	(0,6	1,5	0,0)		
J	0,0	(0,0	0,0	0,0)	1,2	(0,0	3,1	0,6)	2,5	(0,0	2,9	4,5)	8,1	(6,0	9,8	8,4)		
K	6,7	(9,8	5,3	4,9)	6,3 ^d	(1,0	7,0	11,0)	6,5	(6,9	6,7	6,1)	3,6	(4,4	2,0	4,3)		
L	4,4	(5,9	0,4	6,7)	1,4	(1,4	0,3	2,4)	25,3	(35,3	19,9	20,7)	6,2	(7,6	1,8	9,2)		
N	12,3	(7,9	13,2	16,0)	15,3	(10,6	19,6	15,7)	9,6	(4,7	19,0	5,1)	5,5	(6,2	3,5	6,8)		
O	0,5	(0,4	0,4	0,6)	1,2	(0,5	0,6	2,6)	1,0	(2,2	0,9	0,0)	3,4	(2,8	7,3	0,0)		
P	1,3	(0,0	2,2	1,8)	1,4	(1,0	1,2	1,9)	2,7	(2,2	3,8	2,2)	3,7	(3,4	3,0	4,6)		
R	0,3	(0,0	0,9	0,0)	0,0	(0,0	0,0	0,0)	0,0	(0,0	0,0	0,0)	0,0	(0,0	0,0	0,0)		
T	0,0	(0,0	0,0	0,0)	0,0	(0,0	0,0	0,0)	0,3	(1,0	0,0	0,0)	0,1	(0,0	0,3	0,0)		
U	0,4	(0,4	0,9	0,0)	0,4	(0,0	0,0	1,3)	0,3	(0,2	0,0	0,6)	0,1	(0,0	0,0	0,3)		
V	1,2	(2,0	0,9	0,6)	0,4	(0,5	0,6	0,2)	0,7	(0,2	0,6	1,3)	0,4	(0,4	0,5	0,3)		
W	3,2	(3,5	3,1	3,1)	0,3	(1,0	0,0	0,0)	0,7	(0,2	0,6	1,3)	1,1	(2,4	0,5	0,3)		
X	0,3	(0,4	0,4	0,0)	0,1	(0,0	0,3	0,0)	1,1	(0,2	1,2	1,9)	5,0	(5,4	5,0	4,6)		
Y	0,0	(0,0	0,0	0,0)	0,0	(0,0	0,0	0,0)	0,8	(0,0	0,0	2,5)	0,0	(0,0	0,0	0,0)		
Total	100,0	(100,0	100,0	100,0)	100,0	(100,0	100,0	100,0)	100,0	(100,0	100,0	100,0)	100,0	(100,0	100,0	100,0)		

Mood & Engagement Values ^e	Vancouver I			Vancouver II			Seoul I			Seoul II		
	T1 f(%)	T2 f(%)	T3 f(%)	T1 f(%)	T2 f(%)	T3 f(%)	T1 f(%)	T2 f(%)	T3 f(%)	T1 f(%)	T2 f(%)	T3 f(%)
+5	7(3.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
+3	49(20.9)	20(10.1)	10(7.3)	33(17.8)	6(2.3)	18(4.6)	41(10.5)	6(2.1)	14(4.8)	15(3.2)	15(3.9)	18(5.2)
+1	168(71.1)	147(74.1)	125(91.2)	107(57.8)	217(82.5)	320(81.8)	342(87.9)	268(95.4)	264(90.4)	448(94.9)	360(93.8)	325(94.5)
-1	10(4.3)	31(15.7)	2(1.46)	40(21.6)	35(13.3)	37(9.5)	6(1.5)	7(2.5)	14(4.8)	9(1.9)	9(2.3)	1(0.3)
-3	0(0.0)	0(0.0)	0(0.0)	3(1.6)	5(1.9)	8(2.1)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
-5	0(0.0)	0(0.0)	0(0.0)	1(0.5)	0(0.0)	8(2.1)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
GroupWB score ^f	1.34	0.78	0.94	0.76	0.49	0.59	1.18	0.99	1.00	1.03	1.01	1.10

^{a-b}Percentage of code A with negative ME value=1.2%, 2.8% included respectively

^cPercentage of code F with negative ME value=0.5% included

^dPercentage of code K with negative ME value=0.6% included

^e+5: very happy/very absorbed, +3: content, happy/concentrating but distractible, +1: neutral/intermittent engagement, -1: small signs of negative mood/withdrawal, 3: considerable signs of negative mood -5: very distressed

^fGroup WB score= $\frac{\text{sum of relevant ME values for all participants}}{\text{total number of time frames for all participants}}$

exercise/K:walking & standing/L:leisure/O: displaying attachment to inanimate objects) in Seoul II care home. The data showed that the residents in Vancouver II care home spent their time doing relatively monotonous activities during the observation period.

3) Level of agitation/distress

Levels of agitation or distress were measured in terms of the amount of times spent in ‘U: communication without receiving a response’, and ‘-K: walking’ (negative ME value),

‘-W: repetitive self-stimulation’ (negative ME value), and ‘-Y: interaction with absence of others’ (negative ME value). The average time to spend in behaviors related to agitation or distress was 0.4% in Vancouver I care home, 1.0% in Vancouver II care home, 0.3% in Seoul I care home, and 0.1% in Seoul II care home. There was no statistically significant difference among the study groups as a result of *F*-test.

4) Withdrawn behavior

The withdrawn behavior was evaluated in the amount of

Table 6. Results of F-test Analysis on Domains of QoL

	Vancouver		Seoul		F(df)-value
	Van-cou- ver I	Van-cou- ver II	Seoul I	Seoul II	
	mean (SD)	mean (SD)	mean (SD)	mean (SD)	
Positive Engagement	4.0(6.4)	2.8(6.0)	4.2(6.8)	3.5(4.4)	N.S
Agitation	0.3(0.4)	0.3(0.5)	0.2(0.3)	0.7(0.1)	N.S
Withdrawn Behavior	8.7(6.0)	13.4 (5.2)	6.1(6.5)	3.4 (2.6)	$F_{(3,20)}=3.87^*$
WIB	1.0(0.3)	0.6 (0.1)	1.1 (0.1)	0.9(0.2)	$F_{(3,8)}=4.78^*$

df: degrees of freedom, N.S.: not significant, * $p<0.05$

Bold type: significant differences between groups after using Bonferroni post hoc analyses

time spent in ‘C: being disengaged’ and ‘N: dozing’. The average of withdrawal overall T1~T3 observation times was 17.4% in Vancouver I care home, 26.8% in Vancouver II care home, 12.3% in Seoul I care home, and 6.9% in Seoul II care home. There was significant difference in the withdrawn behavior ($F_{3,20}=3.87$, $p<0.05$) among the study groups. Post hoc analysis using Bonferroni post hoc criterion indicated that the withdrawn behavior of the participants in Vancouver II care home ($M=13.4$, $SD=5.2$) was significantly higher than that of the participants in Seoul II care home ($M=3.4$, $SD=2.6$) <Table 5>. The result means that the residents in Vancouver II showed significantly less any signs of engagement with themselves or the world around them, compared to the ones in Seoul II.

5) Well- or ill-being (WIB)

To identify levels of the resident’s WIB, their mood and engagement (ME) was measured according to each of their behavior category codes <lower part of Table 4>. In the group WIB, the participants in Vancouver II care home showed less than +1 score throughout T1~T3 (0.76, 0.49, 0.59), indicating that there was a small sign of negative mood/withdrawal overall during the observation period.

There was statistically significant difference in the group WIB ($F_{3,8}=4.78$, $p<0.05$) among the study groups <Table 5>. Bonferroni post hoc analysis revealed that the residents’ WIB scores in Vancouver II care home ($M=0.6$, $SD=0.1$) were statistically lower than those in Seoul I care home ($M=1.1$, $SD=0.1$). The result indicates that the residents in Vancouver II care home spent more time to be negative mood or affect compared to the ones in Seoul I care home.

IV. Discussion

This is the first longitudinal study to directly investigate

whether residents with dementia in long-term care facilities with variability in physical environmental characteristics in Vancouver, Canada and Seoul, Korea had a difference in their quality of life. QoL was assessed using DCM tools three times over one year for obtaining rich data. The results of the study demonstrated that the participants residing in Vancouver II care home showed statistically more withdrawn behavior compared to those in Seoul II care home. That is, the residents with dementia in the institutional large-scale setting showed less any response or signs of engagement with themselves or their environment, either actively or passively compared to those in the small-scale setting. Due to reducing abilities to engage independently with neighbor or their surroundings, the withdrawn behavior of the residents may result from an unsupportive environment which is not bring adequate support for engagement. This may ultimately affect residents’ ill-being, resulting in more negative mood and engagement. The result of the study actually has proven this; WIB score of participants in Vancouver II care home was significantly lower than Seoul I care home. It is highly likely that the residents with dementia living in an institutional large-scale care home may not be provided with adequate support to improve their quality of life. Consistent with previous studies (Jung & Lee, 2021; Marquardt et al., 2014), our findings support that the quality of life of residents with dementia was remarkably associated with their encompassing environment. As insisted in the studies of Lee and her colleagues (2021a, b, 2010), the care homes with small-scale homelike and positive visual/tactile/acoustical stimulating environment could directly/indirectly ameliorate the well-being of residents with dementia who appear to be more vulnerable to the environmental circumstances.

Another noteworthy finding of this study was that the participants in Seoul II care home, a small-scale setting, showed significantly lower withdrawn behavior and also demonstrated various potential positive behavior categories. Their number of potential positive behaviors (6 behavior categories) was three times higher than that of residents in Vancouver II care home (2 behavior categories). Although the physical environment of Seoul II was rather dull ambience (statistically lower level in the domain of stimulation), it seems possible in a small-scale setting to provide a caring environment that enables responsive care and support for residents with dementia. Interestingly, during the observations, the behavior category ‘X: episodes related to excretion’ of residents in the care home (5.2%) was relatively very high compared to other study groups (i.e., 0.3% in Vancouver I, 0.1% in Vancouver II, and 1.1% in Seoul I). The high frequency of this behavior was influenced by spatial

arrangements, that is, the location of the bathrooms near the living room in Seoul II care unit. This is due to the residents with dementia being able to easily come and go when viewing the bathroom while staying in the living room.

When looking at the distinction between two countries in the behavior category with a large average time difference, it can be found in the behavior category 'F: eating & drinking'. The residents with dementia in Korea had shorter meal/dessert times compared to those in Canada, which could be interpreted as a socio-cultural approach. In Western countries, including Canada, it is common to enjoy a meal time while having a conversation each other, whereas in Korea, the food culture seems to focus on the act of eating itself. Residents with dementia and their care aids in Korea seemed to be more interested in whether they were swallowing food without spilling and what to do after a meal rather than enjoying mealtime.

Taken as a whole, these findings of the study are consistent with previous studies (Day et al., 2000; Husberg, 2007; Kane et al., 2007; Hung & Chaudhury, 2011; Joseph et al., 2016; Kok et al., 2018) that small-scale care setting is intensely associated with a therapeutic environment for older adults with dementia, intended to serve a more person-centered care in long-term care facilities. In particular, a recent study on the built environment from the experience of the front-line staff (Lee et al., 2021b) suggested the supportive environmental qualities to improve the quality of life of residents with dementia: small-scale units, spatial arrangement, and optimal level of stimulation to avoid boredom and helplessness. This study also insisted that these environmental features are associated with providing responsive care and meaningful activities. Future research should further identify how to plan the physical environmental characteristics for better quality of life of residents with dementia and for the effectiveness of staff's care practice.

The current study has a few limitations to generalize the results of the study. Although participants were carefully selected to make comparable groups, it was not possible to match health conditions and other factors (e.g. medications, social support, coping abilities, etc.), and these conditions could have influenced the outcomes of the study. Another limitation is that a small number of participants in the study were involved and they could not speak for the overall population of older adults with dementia. In addition, a limited number of care facilities has constrained to exemplify each city or country. However, despite these limitations, the strength of the study is that it evaluated the quality of life of residents with dementia using in-depth and longitudinal observational data.

V. Conclusion

The results of this study support that residents in a small-scale homelike setting had a higher quality of life compared to a large-scale institutional setting, measured by Dementia Care Mapping tool at three times over one year in two countries, Canada and Korea. The longitudinal data also indicated that the residents in the large-scale institutional setting spent their time doing relatively monotonous activities with a little negative mood and engagement. Research is needed to examine the distinct aspects of how the physical environment and socio-cultural factors may influence residents' quality of life.

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