

BMJ Open Relationship between environmental factors and responsive behaviours in long-term care homes: a secondary data analysis

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ABSTRACT

Objective Responsive behaviours (eg, wandering, resisting care and verbal abuse) are a continuing issue for staff and individuals living in long-term care (LTC) homes. The LTC environment can influence responsive behaviours and is a factor in determining the quality of life for those living there. The ways in which the quality of the environment might influence responsive behaviours has not been investigated yet. We hypothesised that better quality environments would be associated with reduced rates of responsive behaviours. We used a tool that simultaneously encompasses human and structural elements of the environment, a novel approach in this field of research.

Design Cross-sectional study, using data collected from September 2014 to May 2015 as part of the Translating Research in Elder Care research programme.

Setting A representative, stratified (size, owner-operator model and health region) random sample of 76 LTC homes in British Columbia, Alberta, Manitoba.

Participants 13 224 individuals (67.3% females) living in participating LTC homes.

Outcome measures Quality of care unit work environment was assessed using the observable indicators of quality (OIQ) tool. Responsive behaviours were assessed using routinely collected Resident Assessment Instrument-Minimum Data Set V.2.0 data.

Results Adjusted regression coefficients of overall Aggressive Behaviour Scale score and interpersonal communication were 0.02 (95% CI –0.011 to 0.045), grooming 0.06 (95% CI –0.032 to 0.157), environment-basics 0.067 (95% CI 0.024 to 0.110), odour –0.066 (95% CI –0.137 to –0.004), care delivery –0.007 (95% CI –0.033 to 0.019), environment-access –0.027 (95% CI –0.062 to 0.007), environment-homelike –0.034 (95% CI –0.065 to –0.002) and total OIQ score 0.003 (95% CI –0.004 to 0.010).

Conclusions We found small associations between the environmental quality and responsive behaviours in Western Canadian LTC homes. Higher scores on homelikeness were associated with decreased responsive behaviours. Higher scores on basic environmental quality were associated with increased responsive behaviours.

Strengths and limitations of this study

- The data used in this study are part of a well-maintained and vast database of long-term care (LTC) homes in Western Canada, with rigorous collection standards and maintenance protocols.
- We took into account all individuals living in the LTC homes in our sample, as opposed to just those with a formal dementia diagnosis, as dementia is often under detected in LTC homes.
- The observable indicators of quality was assessed during a single window of time and communications or activities may or may not happen during this time that an observer was present.
- Observers were instructed to complete the assessment during visiting hours in common areas, which leaves out aspects of the environment where care quality could potentially vary (eg, they do not see interactions between staff and residents during morning care in a bedroom or bathroom).

INTRODUCTION

Responsive behaviours¹ from people living in long-term care (LTC) homes continues to be a pervasive issue worldwide. Commonly described as behavioural and psychiatric symptoms of dementia, responsive behaviour is the preferred term by persons with dementia to represent how their actions, words and gestures are a response that expresses something important about their personal, social or physical environment.² A systematic review identified responsive behaviour as a complex and challenging issue³ that involves multiple factors interacting in complex ways, making it difficult to address using one intervention. Thus, the causes of responsive behaviours and goal of understanding, preventing and reducing suffering for the benefit of both staff members and people living in LTC is a large area of research.^{4–13} Characteristics of the individuals living in LTC homes (eg, level of cognitive impairment and depression),¹⁴ as well as those of the staff members (eg, gender,

Table 1 Covariates and justifications

Outcome	Variable (RAI-MDS V.2.0 and TREC facility/unit surveys)	
Facility covariates		
Owner operator model	TREC - FVAR011	
Facility region	TREC - VAR004B	
Facility size	TREC - FVAR007	
Resident demographics		
Age	RAI: Difference between assessment date (A3) and birth date (AA3a)	
Sex	RAI - AA2	
Marital status	RAI - A5	
Type of unit	TREC - UVAR001	
Comorbidities		Covariate justification
Alzheimer's	RAI - I1r	Dementia from Alzheimer's disease as well as from other causes (atherosclerosis, stroke, etc.) are underlying causes of responsive behaviour. ³
Dementia other than Alzheimer's	RAI - I1v	
Anxiety	RAI - I1ff	Psychosocial stressors can increase the occurrence of aggressive behaviours. ⁴
Antipsychotic drug use	RAI - O4a	Antipsychotic drug use is associated with all forms of responsive behaviour. ⁶
Manic depressive	RAI - I1hh	Elderly patients with severe mental illness and bipolar disorder living in nursing homes are distinguished by having more behavioural problems. ⁶
Schizophrenia	RAI - I1ii	Responsive behaviours occur in a large proportion of residents with schizophrenia, especially while staff are assisting with ADLs. ⁷
Infections	RAI - I2 'infection'	Underlying infections such as urinary tract infections or tooth abscesses can lead to behavioural disturbances in residents with dementia. ⁸
Hallucinations	RAI - J1i	Depression, delusions, hallucinations, and constipation were associated with physical aggression. ⁹
Delusions	RAI - J1e	
Depression	RAI - I1gg	
Constipation	RAI - H2b	
Pain	RAI - J2 'daily_pain' 'excruciating_pain'	Higher aggression scores found in those with two or more pain causing diagnoses as well as those with arthritis. ¹⁰
Physical dependency	RAI - G1a 'self_care_dependent'	A higher level of self-care dependence is associated with more aggressive behaviour—care workers reported aggressive behaviour occurred most often during personal care. ¹¹
Dual sensory impairment	RAI - C1 – hearing RAI - D1 – vision 'hearing_vision_impaired'	Presence of both visual and hearing impairment, regardless of severity, is associated with higher rates of behavioural symptoms in residents of long-term care facilities. ¹²

ADL, activities of daily living; RAI-MDS, Resident Assessment Instrument-Minimum Data Set; TREC, Translating Research in Elder Care.

age and training)¹⁵ have been examined as causes, but the possible influence of environmental factors (eg, type of unit and how people communicate with each other) on responsive behaviours has received less attention.¹⁶ Focus has also been on the structural elements of the environment, such as size, homelikeness, spatial layout, noise level and temperature.^{17–19} However, other aspects of the environment may be important to consider. Namely, engaging environments that promote both cognitive and physical activity are associated with positive emotional responses from people with dementia.²⁰ Additionally, the human environment (the staff who are providing care to a person) is perceived as more important than the physical environment on the quality of

life for people with dementia living in LTC.¹⁹ Most recently, a 2020 study showed that higher nurse staffing and more staff psychiatric training were associated with lower prevalence of severe aggressive behaviours.²¹

As responsive behaviour has been shown to be influenced by multifactorial causes, it must be addressed through equally multifactorial interventions. To date, there has been less focus on the overall unit context or quality. We sought to investigate whether the quality of the LTC home is associated with responsive behaviours from individuals living in LTC homes. We hypothesised that higher quality environments would be associated with reduced rates of responsive behaviours.

Table 2 Description of LTC home characteristics

Care homes													
	Edmonton, AB		Calgary, AB		Fraser Health, BC		Interior Health, BC		Winnipeg, MN		P value*	Total	
	(n=14)		(n=13)		(n=21)		(n=13)		(n=15)			(n=76)	
Size	N	%	N	%	N	%	N	%	N	%		N	%
Small (<80 beds)	3	21.4	2	15.4	6	28.6	4	30.8	2	13.3	0.071	17	22.4
Medium (80–120 beds)	3	21.4	1	7.7	9	42.9	7	53.8	6	40		26	34.2
Large (>120 beds)	8	57.1	10	76.9	6	28.6	2	15.4	7	46.7		33	43.4
Owner-operator model													
Public not-for-profit	2	14.3	2	15.4	4	19	5	38.5	1	6.7	0.289	14	18.4
Private for profit	6	42.9	7	53.8	11	52.4	6	46.2	5	33.3		35	46.1
Voluntary not-for-profit	6	42.9	4	30.8	6	28.6	2	15.4	9	60		27	35.5
Care units													
	Edmonton, AB		Calgary, AB		Fraser Health, BC		Interior Health, BC		Winnipeg, MN		P value*	Total	
	(n=52)		(n=59)		(n=71)		(n=47)		(n=54)			(n=283)	
Unit type	N	%	N	%	N	%	N	%	N	%		N	%
General long-term care	34	65.4	37	62.7	53	74.6	21	51.2	49	90.7	<0.0001	194	68.6
Secure dementia	9	17.3	17	28.8	12	16.9	11	26.8	5	9.3		54	19.1
Non-secure dementia	4	7.7	1	1.7	2	2.8	0	4.9	0	0		7	2.5
Secure mental health/psychiatric	1	1.9	1	1.7	1	1.4	0	0	0	0		3	1.1
Other	4	7.7	3	5.1	3	4.2	15	36.6	0	0		25	8.8

*P values for count data (N) from LTC homes and units reported as two-sided (asymptotic significance) calculated from Pearson χ^2 test using 95% CI Monte Carlo simulations. P values from mean values (care hours) calculated using one-way ANOVA. ANOVA, analysis of variance; LTC, long-term care.

METHODS

Study design and setting

This study was a secondary data analysis of a subset of data from the Translating Research in Elder Care (TREC) research programme.²² TREC is a longitudinal (2007–ongoing) programme of applied health services research and its aim is to improve quality of care, quality of life and quality of working life by developing and testing practical solutions to improve these outcomes. TREC's cohort of 94 LTC homes is a random sample, stratified by (a) health region (Calgary and Edmonton Zones in Alberta; Fraser and Interior Health Regions in British Columbia and Winnipeg Region Health Authority in Manitoba), (b) facility size (small, <80 beds; medium, 80–120 beds; large, >120 beds) and (c) owner-operator model (private for-profit, public not-for-profit and voluntary not-for-profit). Facility-level and unit-level data are collected using validated surveys from facility administrators, unit level data from care managers and individual level data from both regulated and unregulated staff engaged in the provision of care.²³ Informed consent is obtained from participants for this data collection on entry to the LTC home. Resident-level data are obtained quarterly from the Resident Assessment Instrument-Minimum Data Set V.2.0 (RAI-MDS V.2.0).²² Resident demographic and outcome data are deidentified at the individual resident level.

Sample

This study used a subset of data collected from September 2014 to May 2015. Our sample included 13 224 residents

living on 283 units in 76 LTC homes. This subset was selected as it contained the Observable Indicators of Nursing Home Care Quality (OIQ) data, a measure of the quality of the environment.²⁴ All residents were included, as opposed to just those with a diagnosis of dementia, because responsive behaviours can be prevalent in nursing home residents with and without dementia.²⁵ Furthermore, recent data from the Canadian Institute for Health Information suggest that almost 90% of all LTC home residents have some form of cognitive impairment, while about 70% have a diagnosis of dementia (Continuing Care Reporting System, 2015–2016, Canadian Institute for Health Information). It is possible more may be affected than are diagnosed since dementia is often under detected in LTC homes.²⁶

Outcomes and measures

Responsive behaviour

Our measure of responsive behaviour was the RAI-MDS V.2.0 Aggressive Behaviour Scale (ABS) and one item measuring wandering. The ABS is a summary scale of the following four RAI-MDS items: verbally abusive (eg, screaming at others), physically abusive (eg, hitting others), socially inappropriate or disruptive (eg, throwing food) and resisting care (eg, pushing caregiver during activities of daily living assistance). The frequency of ABS items is coded over 7 days as not exhibited (0); behaviour occurred 1–3 days in past 7 days (1); behaviour occurred 4–6 days in past 7 days, but less than daily (2) or behaviour

Table 3 Description of sample characteristics																	
Demographics	Edmonton, AB (n=2952)			Calgary, AB (n=3336)			Fraser health, BC (n=2769)			Interior health, BC (n=1592)			Winnipeg, MN (n=2575)			Total (n=13224)	
	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	M	SD	P value*
Age	84.2	11.5	85.0	10.1	85.8	9.4	85.7	9.4	85.7	9.4	86.5	9.0	85.4	10.0	0.454		
Female	1868		63.3	2166	64.9	1917	68.6	1023	64.3	1925	74.8	<0.0001	8899	67.3			
Marital status																	
Never married	265		9.0	244	7.3	137	4.9	97	6.1	280	10.9	<0.0001	1023	7.7			
Married	813		27.5	884	26.5	756	27.0	288	18.1	651	25.3		3392	25.7			
Widowed	1396		47.3	1698	50.9	1456	52.1	807	50.7	1429	55.5		6786	51.3			
Separated	70		2.4	69	2.1	80	2.9	228	14.3	31	1.2		478	3.6			
Divorced	204		6.9	372	11.2	251	9.0	148	9.3	172	6.7		1147	8.7			
Unknown	204		6.9	69	2.1	89	3.2	24	1.5	12	0.5		398	3.0			
Comorbidities																	
Alzheimer's disease	127		4.3	69	2.1	92	3.3	44	2.8	190	7.4	<0.0001	522	3.9			
Dementia other than Alzheimer's disease	1416		48.0	2035	61.0	1424	51.4	1029	64.6	1432	55.6	<0.0001	7336	55.5			
Anxiety disorder	91		3.1	65	1.9	50	1.8	28	1.8	306	11.9	<0.0001	540	4.1			
Depression	1199		40.6	991	29.7	504	18.2	397	24.9	785	30.5	<0.0001	3876	29.3			
Manic depressive	69		2.3	56	1.7	27	1.0	33	2.1	48	1.9	0.002	233	1.8			
Schizophrenia	81		2.7	101	3.0	38	1.4	29	1.8	89	3.5	<0.0001	338	2.6			
Delusions	135		4.6	118	3.5	57	2.1	101	6.3	72	2.8	<0.0001	483	3.7			
Hallucinations	108		3.7	91	2.7	53	1.9	95	6.0	133	5.2	<0.0001	480	3.6			
Daily pain	198		6.7	197	5.9	413	14.9	265	16.6	401	15.6	<0.0001	1474	11.1			
Excruciating pain	45		1.5	54	1.6	73	2.6	34	2.1	57	2.2	0.015	263	2.0			
Constipation	77		2.6	47	1.4	72	2.6	25	1.6	205	8.0	<0.0001	426	3.2			
Infection	445		15.1	516	15.5	218	7.9	150	9.4	294	11.4	<0.0001	1623	12.3			
Hearing and vision impairment	74		2.5	35	1.0	37	1.3	13	0.8	91	3.5	<0.0001	250	1.9			
Depends on assistance for self-care	2783		94.3	2688	80.6	1990	71.9	1224	76.9	2038	79.1	<0.0001	10723	81.1			
Daily antipsychotic drug use	543		18.4	640	19.2	604	21.8	580	36.4	531	20.6	<0.0001	2898	21.9			
Responsive behaviours†	555		18.8	610	18.3	387	14.0	351	22.0	331	12.9	<0.0001	2234	16.9			

Continued

Table 3 Continued

	N	%	N	%	N	%	N	%	N	%	N	%
Verbally abusive	617	20.9	638	19.1	434	15.7	262	16.5	426	16.5	2377	18.0
Physically abusive	488	16.5	480	14.4	261	9.4	147	9.2	251	9.7	1627	12.3
Socially inappropriate/ disruptive	577	19.5	532	15.9	323	11.7	323	20.3	339	13.2	2094	15.8
Resisting care	1251	42.4	1194	35.8	613	22.1	401	25.2	666	25.9	4125	31.2

*P values for count data (N) reported as two-sided (asymptotic significance) calculated from Pearson χ^2 test using 95% CI Monte Carlo simulations. P values from mean values (age data) calculated using one-way ANOVA.

†Count data for responsive behaviours calculated by adding the totals in each of the following categories: behaviour occurred 1–3 days of the last 7, 4–6 days of the last 7 (but less than daily) and daily of the last 7.

ANOVA, analysis of variance.

occurred daily (3). Scores for the ABS thus range from 0 to 12, with a higher score indicating a greater number of behaviours occurring with greater frequency. The ABS has been shown to be a reliable, valid and clinically relevant measure of aggressive behaviour.²⁷ In addition to the behaviours in the ABS, we also included wandering as a responsive behaviour in our analyses. It is coded in the same way as the ABS items described previously. Our justification for including this measure in addition to the four behaviours in the ABS is that wandering is also a responsive behaviour that has been included as such in a number of other studies looking at behaviours from people living in LTC homes.^{9 13 28 29} The average inter-rater reliability estimates for all behaviour items on the RAI-MDS V.2.0 is excellent, with a κ of 0.72.²⁷

Environmental quality

Our measure of environmental quality was the OIQ instrument score, developed by Rantz and colleagues in 1999²⁴ and subsequently validated.^{30 31} The OIQ is a 30-item questionnaire designed for evaluating the quality of care in LTC homes via direct observation in ≤ 30 min. Observation of behaviours is a common tool for research in this field.³² The OIQ has been used in a study to represent overall nursing home quality and has been adapted for use in Brazil and Korea since its creation.^{33–35} More information about the OIQ from its authors can be found online (<https://nursinghomehelp.org/oiq-guide/>).

Study coordinators (one in each region) were trained to complete the OIQ and these study coordinators trained the data collectors (1–2 for each region)—based on instructions developed by the OIQ developers. We conducted calibration exercises and inter-rater reliability assessments. To complete the OIQ, evaluators observed the unit during regular visiting hours for 5–10 min after reading the questionnaire and instructions. They were instructed to observe the living areas without carrying a clipboard or papers and fill out the questionnaire after observation was complete. Items on the OIQ are scored on a Likert scale from 1 to 5. The scores from items are then grouped into the following seven first-order factors:

1. Interpersonal communication, range of 6–30 points (eg, Did residents and staff acknowledge each other and seem comfortable with each other, using smile, eye contact, touch, etc?).
2. Care delivery, 5–25 points (eg, Did staff communicate with confused residents in positive ways, eg, talk, touch, sit with, etc?).
3. Grooming, 2–10 points (eg, Were residents dressed and clean?).
4. Odour, 2–10 points (eg, Were odours of urine or faeces noticeable in the facility?).
5. Environment-basics, 5–25 points (eg, Were hallways and common areas uncluttered?).
6. Environment-access, 4–20 points (eg, Did confused residents have access to outdoor space?).

**Table 4** OIQ item scores across all units

	Interpersonal communications (6–30 points)	Grooming (2–10 points)	Environment-basics (5–25 points)	Odour (2–10 points)	Care delivery (5–25 points)	Environment-access (4–20 points)	Environment-homelike (5–25 points)	Total score (29–145 points)
Median	27	8	20	9	19	12	19	119
Mode	30	8	20	10	20	12	20	110, 123
Range	20	4	13	5	20	14	16	67
Minimum	10	6	12	5	5	5	9	74
Maximum	30	10	25	10	25	19	25	141
Percentiles								
25	24	8	19	8	16	11	16	110
50	27	8	20	9	19	12	19	119
75	30	10	22	10	21	15	21	125

OIQ, observable indicators of quality.

7. Environment-homelike, 5–25 points (eg, Were residents' rooms personalised with furniture, pictures and other things from their past?).

We used these first-order factors and the total OIQ score (range of 29–145 points) from each facility in our analyses. Observations were collected over a 1-month period during the same time as the sample data from 2014 to 2015.

Covariates

See [table 1](#) for all covariates and why we included them.

Statistical analyses

Descriptive analyses

All analyses were completed using SPSS V.26. For the descriptive statistics of individuals and LTC homes, differences across regions for count data (eg, number of females) were reported as two-sided asymptotic significance calculated from Pearson χ^2 test using 95% CI Monte Carlo simulations. One-way analysis of variance (ANOVA) was used to assess differences in mean values across regions (eg, age data). Descriptive statistics for the OIQ scores across all units in our sample were generated using non-parametric techniques including minimum, maximum, mode and independent samples Kruskal-Wallis testing to determine differences in scores across regions.

Regression models

Mixed linear regression modelling was used to assess the association between OIQ score and responsive behaviours in LTC homes. We used a backward, stepwise approach with known covariates for responsive behaviours such as depression status, pain and needing assistance with self-care based on whether they were statistically insignificant to the model fit. For a full list of the covariates that we used, see [table 1](#). We accounted for dependencies of data collected from residents nested within units and units nested within facilities by including random unit-level and facility-level intercepts. We also calculated intraclass correlation coefficients for unit-level and

facility-level variables by dividing either the unit-level or the facility-level variance component by the total variance (sum of individual resident-level, unit-level and facility-level variance components). Five units (1.8%) and the 215 individuals living in them (1.6%) were missing data for their environment-homelike scores. As missing data were minimal, and according to Little's MCAR (Missing Completely At Random) test were indeed missing completely at random, we excluded cases with missing data from the analysis. Our mixed models do not require a strong normal assumption and inference on fixed effects is usually robust to non-normality of random effects.³⁶

RESULTS

Description of facility and sample characteristics

Characteristics for the 76 LTC homes are found in [table 2](#). Sample characteristics for the 13244 participants are found in [table 3](#).

OIQ scores

In general, units scored highly on the OIQ items ([table 4](#)), suggesting the overall quality of the environment was being rated highly by evaluators. Across all units in our sample, the modal scores were as follows: interpersonal communication 30/30, grooming 8/10, odour 10/10, care delivery 20/25, environment-basics 20/25, environment-access 12/20 and environment-homelike 20/25. Total OIQ score had two modal scores that were equally common—110 and 123 of 145.

Associations between responsive behaviours and OIQ scores

Small but statistically significant associations were found between responsive behaviours and two of the OIQ scores ([tables 5 and 6](#)). Higher scores for environment-homelike ($B=-0.034$, $p=0.036$) were associated with decreased responsive behaviours. Higher scores for environment-basics ($B=0.067$, $p=0.024$) were associated with increased responsive behaviours. Interpersonal communication ($B=0.017$, $p=0.221$), grooming ($B=0.063$,

Table 5 Associations of unit-level environmental factors (OIQ scores) with resident responsive behaviours (ABS score), adjusted for facility, care unit and resident characteristics, based on hierarchical mixed models

Variable	Estimate (95% CI)	Std. error	P value
Intercept	0.09 (−0.76 to 0.95)	0.43	0.83
OIQ: Interpersonal communications	0.02 (−0.01 to 0.05)	0.01	0.22
OIQ: Grooming	0.06 (−0.03 to 0.16)	0.05	0.19
OIQ: Odour	−0.07 (−0.14 to 0.004)	0.04	0.06
OIQ: Care delivery	−0.01 (−0.03 to 0.02)	0.01	0.6
OIQ: Environment basics	0.07 (0.02 to 0.11)	0.02	0.003
OIQ: Environment access	−0.03 (−0.06 to 0.01)	0.02	0.12
OIQ: Environment homelike	−0.03 (−0.07 to −0.002)	0.02	0.04
Sex (ref=male)			
Female	−0.17 (−0.25 to −0.08)	0.04	0
Marital status (ref=never married)			
Married	−0.05 (−0.20 to 0.11)	0.08	0.55
Widowed	−0.01 (−0.16 to 0.13)	0.07	0.85
Separated	−0.10 (−0.32 to 0.15)	0.12	0.48
Divorced	0.15 (−0.03 to 0.33)	0.09	0.1
Unknown	0.33 (0.06 to 0.60)	0.14	0.02
Bowel elimination pattern (ref=no constipation)			
No bowel elimination	−0.001 (−0.10 to 0.10)	0.05	0.98
Constipation	0.22 (0.00 to 0.44)	0.11	0.05
Self care dependent (ref=not dependent)			
Daily pain (ref=no daily pain)	0.31 (0.19 to 0.43)	0.06	0
Hearing and vision impairment (ref=no impairment)			
Hallucinations (ref=none)	0.37 (0.15 to 0.59)	0.11	0.001
Delusions (ref=none)	1.02 (0.80 to 1.24)	0.11	0
Schizophrenia (ref=no)	−0.65 (−0.89 to −0.40)	0.12	0
Manic depressive (ref=no)	−0.28 (−0.56 to −0.003)	0.14	0.05
Dementia other than Alzheimer's disease (ref=none)			
Depression (ref=none)	0.10 (0.02 to 0.18)	0.04	0.02
Receiving antipsychotic medication			
Type of unit (ref=general LTC)	0.12 (0.11 to 0.14)	0.01	0
Secure dementia	1.08 (0.88 to 1.28)	0.1	0
Secure psychiatric	0.21 (−0.48 to 0.91)	0.35	0.55
Other	0.21 (−0.08 to 0.51)	0.15	0.16
Non-secure dementia	0.81 (0.31 to 1.31)	0.25	0.002
Ownership (ref=private for-profit)			
Public not for profit	0.43 (0.18 to 0.67)	0.12	0.001
Voluntary not-for-profit	−0.16 (−0.33 to 0.02)	0.09	0.081
TREC 2 region (ref=Winnipeg)			
Edmonton	0.29 (0.03 to 0.55)	0.13	0.03
Calgary	−0.22 (−0.49 to 0.04)	0.13	0.1
Frasier health	−0.56 (−0.82 to −0.31)	0.13	0
Interior health	−0.79 (−1.10 to −0.48)	0.15	0

Continued

Table 5 Continued

Estimates of covariance parameters*

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% CI	
						Lower bound	Upper bound
Residual		4.33344	0.054343	79.743	0	4.228229	4.441269
Intercept (subject=TREC 2 facility ID)	Variance	0.005151	0.017409	0.296	0.767	6.84E-06	3.880978
Intercept (subject=TREC 2 facility ID * Unit Code)	Variance	0.251895	0.034833	7.231	0	0.192093	0.330315

*Dependent Variable: Overall_ABS_Score.

ABS, Aggressive Behaviour Scale; OIQ, observable indicators of quality; TREC, Translating Research in Elder Care.

$p=0.191$, environment-access ($B=-0.027$, $p=0.120$), care delivery ($B=-0.007$, $p=0.566$), odour ($B=-0.066$, $p=0.064$) and total OIQ score ($B=0.003$, $p=0.414$) were not associated with responsive behaviours in a statistically significant way.

Intraclass correlation coefficients (ICCs) were calculated based on each of the statistical models by dividing the unit-level variance component by the total variance (unit plus facility). For the individual OIQ scores, unit-level ICC=0.057 (95% CI 0.045 to 0.07). For the facility-level, ICC=0.005 (95% CI 0.001 to 0.034). For the total OIQ scores, unit-level ICC=0.055 (95% CI 0.044 to 0.068) and facility-level ICC=0.007 (95% CI 0.002 to 0.028).

DISCUSSION

Only two of the seven OIQ scores were associated at statistically significant levels with responsive behaviours. A more homelike atmosphere was associated with decreased responsive behaviours. This is consistent with existing research. For example, Chaudhury *et al.*¹⁷ reported that having a more homelike environment reduces responsive behaviours such as wandering. Higher basic environment quality scores (hallways free from clutter, well lit, etc) were associated with more responsive behaviours. This could be explained by the fact we included wandering as a responsive behaviour in our analysis, and there is a higher likelihood for wandering to occur in areas that are brightly lit as well as hallways.^{28 37}

We found no association between having access to safe spaces to wander and the outdoors and responsive behaviours, despite previous literature that showed this reduces wandering behaviours in LTC homes.^{17 37} Higher scores on interpersonal communication were not associated with decreased responsive behaviours, although optimised communication is a well described strategy for reducing responsive behaviours, specifically communicating empathetically and adopting a person-centred approach.³⁸ These elements are part of the interpersonal communication section of the OIQ (eg, Did staff appear caring/compassionate/warm/kind?). Better scores on odour were not associated with reduced responsive behaviours although odours from faeces, urine, chemicals and food have been reported to be an important

antecedent condition for ‘catastrophic reactions’ in people with dementia.³⁹

We expected that in a setting where residents are better groomed, they may have staff in their personal space more often for help with hygiene, and would have higher rates of responsive behaviours. This is because entering someone’s personal space, such as during times of assisting a person with toileting or personal hygiene, is known to be a trigger for increased responsive behaviours.⁵ Despite this we did not find a statistically significant association between grooming scores and responsive behaviours. Finally, the care delivery scores were also not significantly associated with responsive behaviours. This is unexpected because a component of the care delivery OIQ score encompasses staff communicating with confused residents/helping residents move about the facility, which as mentioned previously would put them into someone’s personal space and possibly trigger responsive behaviours.⁵

The findings of this study suggest that including individually tailored items that make a person feel at home could reduce responsive behaviours, and that responsive behaviours are associated with cleaner, clutter-free environments, possibly because these areas are more accessible for people who wander. Ensuring a homelike environment is a feasible step that the people living in LTC homes can take, as well as their caregivers and facility management bodies. We did not find any other significant associations between environmental quality and responsive behaviours. One explanation could be that we are not capturing an important aspect of the environment in our analysis—the work environment. Lack of time was identified as barrier to getting to know patients and providing person-centred service.⁴⁰ Additionally, having a team-based approach to identify underlying needs of residents is effective to reduce agitated behaviour.⁴¹ Both studies provide evidence that adequate levels of staffing and ample time for staff to provide tailored care for residents⁴² is a way to decrease responsive behaviours, something that our study did not consider. Examining the quality of the work environment would be an important avenue for future research in this field.

Table 6 Associations of unit-level environmental factors (total OIQ score) with resident responsive behaviours (ABS score), adjusted for facility, care unit and resident characteristics, based on hierarchical mixed models

Variable	Estimate(95% CI)	Std. error	P value
Intercept	0.33 (−0.51 to 1.17)	0.43	0.44
Total OIQ score	0.003 (−0.004 to 0.009)	0.003	0.41
Sex (ref=male)			
Female	−0.17 (−0.25 to −0.08)	0.04	0
Marital status (ref=never married)			
Married	−0.03 (−0.18 to 0.12)	0.08	0.71
Widowed	−0.02 (−0.17 to 0.12)	0.07	0.78
Separated	−0.10 (−0.34 to 0.14)	0.12	0.42
Divorced	0.15 (−0.03 to 0.33)	0.09	0.11
Unknown	0.34 (0.08 to 0.61)	0.14	0.01
Self care dependent (ref=not dependent)	0.24 (0.14 to 0.34)	0.05	0
Daily pain (ref=no daily pain)	0.32 (0.20 to 0.44)	0.06	0
Hearing and vision impairment (ref=no impairment)	0.33 (0.06 to 0.60)	0.14	0.02
Hallucinations (ref=none)	0.37 (0.15 to 0.59)	0.11	0.001
Delusions (ref=none)	1.03 (0.81 to 1.25)	0.11	0
Schizophrenia (ref=no)	−0.65 (−0.89 to −0.40)	0.13	0
Manic depressive (ref=no)	−0.27 (−0.55 to 0.01)	0.14	0.06
Dementia other than Alzheimer's disease (ref=none)	0.27 (0.20 to 0.35)	0.04	0
Depression (ref=none)	0.10 (0.01 to 0.17)	0.04	0.03
Anxiety (ref=none)			
NA	−0.02 (−0.12 to 0.07)	0.05	0.64
Anxiety	0.12 (−0.07 to 0.31)	0.1	0.22
Receiving antipsychotic medication	0.12 (0.11 to 0.14)	0.01	0
Type of Unit (ref=general LTC)			
Secure dementia	1.13 (0.93 to 1.33)	0.1	0
Secure psychiatric	0.18 (−0.54 to 0.89)	0.36	0.63
Other	0.26 (−0.04 to 0.56)	0.15	0.09
Non secure dementia	0.65 (0.16 to 1.14)	0.25	0.002
Ownership (ref=private for-profit)			
Public not for profit	0.39 (0.14 to 0.65)	0.13	0.003
Voluntary not for profit	−0.12 (−0.32 to 0.07)	0.1	0.21
TREC 2 region (ref=Winnipeg)			
Edmonton	0.37 (0.08 to 0.66)	0.14	0.01
Calgary	−0.15 (0.44 to 0.14)	0.13	0.29
Frasier health	−0.42 (−0.68 to −0.15)	0.13	0.003
Interior health	−0.63 (−0.95 to −0.31)	0.16	0

Estimates of covariance parameters*

Parameter	Estimate	Std. Error	Wald Z	Sig.	95% CI	
					Lower bound	Upper bound
Residual	4.37981	0.054475	80.401	0	4.274333	4.487891
Intercept (subject=TREC 2 facility ID)	Variance 0.032907	0.024208	1.359	0.174	0.007782	0.139145
Intercept (subject=TREC 2 facility ID * Unit Code)	Variance 0.256778	0.036006	7.131	0	0.195074	0.337999

*Dependent variable: Overall_ABS_Score.

ABS, Aggressive Behaviour Scale; OIQ, observable indicators of quality; TREC, Translating Research in Elder Care.



The findings of this article are important for potentially changing clinical practices since it focuses on something modifiable—the care unit environment as measured by the OIQ. The TREC programme has largely measured the work environment using the Alberta Context Tool (https://trecresearch.ca/alberta_context_tool), and the OIQ is a complementary and slightly different tool to measure unit context. Given the complexity involved with studying responsive behaviours in LTC homes, where care teams and residents interact and where quality of care is created, measures of the overall unit context such as with the OIQ will prove helpful to build on our knowledge base.

Limitations

Our study was cross-sectional, so no causal conclusions from the associations can be drawn. Another limitation is that there is a ceiling effect when using the ABS as reports are limited to a score of 3 (behaviour occurred daily), so behaviours that are persistently expressed or repeated multiple times a day are not captured. It is possible given this ceiling effect that we were unable to capture those associations between more persistent responsive behaviours and the environmental quality.

The OIQ data also has limitations; first, it depends on individual observers doing data collection during a single window of time. Communications or activities may or may not happen during this time that an observer was present. Observers were instructed to complete the assessment during visiting hours in common areas, which leaves out aspects of the environment where care quality could potentially vary (eg, they do not see interactions between staff and residents during morning care in a bedroom or bathroom).

Conclusion

We found two small associations between the environmental quality and responsive behaviours in a diverse population of people living in Western Canadian LTC homes. We used a tool that simultaneously encompasses human and structural elements of the environment, a novel approach in this field of research. Specifically, higher scores on homelikeness were associated with decreased responsive behaviours. Higher scores on basic environmental quality were associated with increased responsive behaviours. Future research could examine other potential influencers of responsive behaviours in LTC, such as staff rushing tasks, and should include measures of responsive behaviours that reflect the diversity with which responsive behaviours are expressed.

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Data availability statement Data are available upon reasonable request. The data generated and analysed in this study are not publicly available due to ethical regulations around accessing the TREC database. Data could be made available to reasonable requests based on approval from TREC.

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