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Longitudinal Psychological Outcomes of the Small-scale Nursing Home Model: a Latent Growth Curve Zero-inflated Poisson Model

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Abstract

Background—This study aims to examine the longitudinal effects of a small-scale nursing home model on the change rates of psychological outcomes by comparing Green House (GH) and traditional nursing home residents.

Methods—A total of 242 residents (93 GH and 149 traditional home residents) who resided at the home least 6 months from admission. Four minimum dataset assessments every six months from admission were included. The main psychological outcomes were depressive mood, and social engagement. The main independent variable was the facility type that the resident resided in: a GH or traditional unit. Age, gender, ADL function, and cognitive function at admission were controlled in the model. A zero-inflated Poisson growth curve model was utilized to compare change rates of two psychological outcomes between the two groups taking into account many zero counts of two outcome measures.

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Conflict of Interest

None.

Description of Authors' Roles

Study concept and design: JY Yoon, RL Brown, BJ Bowers, SS Sharkey, and SD Horn. Acquisition of data: SS Sharkey and SD Horn. Analysis and interpretation of data: JY Yoon, RL Brown, BJ Bowers, and SD Horn. Drafting or revising manuscript for important intellectual content: JY Yoon, RL Brown, BJ Bowers, SS Sharkey, and SD Horn.

Results—A rate of increase in depressive symptoms for GH home residents was higher than that of traditional home residents (β = 0.135, p-value = 0.025). GH home residents had a lower rate of increase of the probability of "not being socially engaged" over time compared to traditional home residents (β = −0.274, p-value = 0.010).

Conclusion—The GH nursing home model had a longitudinal effect on increasing the probability of residents' social engagement over time, but also increasing the recognition of depressive symptoms compared to traditional nursing homes.

Keywords

person-centered care; culture change; Green House nursing home; depression; social engagement; behaviors; nursing home

INTRODUCTION

With increasing concern over quality of life for older adults in nursing homes, many traditional nursing homes have attempted to transform themselves from a model driven by clinical concerns and hospital-like environments toward emphasizing more person-centered care within homelike environments. Representative of these transformations are the various small-scale nursing home models that have been introduced in many countries using diverse labels: Green House (GH) nursing homes in the U.S., group living care in Sweden and the Netherlands, and group homes in Japan and South Korea (Seok, 2010; Verbeek *et al*., 2009). Although there are some cross-national variations, small-scale nursing homes have several common characteristics: (1) architecture that reflects a family home (a private room, living room and dining room), (2) care delivery that incorporates significant values of person-centered care to be more homelike (autonomy, choice and self-care), and (3) individual and socio-cultural continuity (Rabig, 2009). These small-scale nursing home models have an implicit assumption that homelike environments will improve well-being and quality of life for older adults (Molony *et al*., 2011).

The GH nursing home model was developed by several pioneer providers in the United States in the early 1990s emphasizing a homelike environment and organizational changes to enhance quality of life for nursing home residents (Rabig *et al*., 2006). GH homes are skilled nursing facilities working within the current regulations and reimbursement system by the Center for Medicare and Medicaid Services. Some of the characteristics of GH homes in the United States are that they are not dementia-specific settings, whereas small-scale nursing homes in European countries are dementia-specific, long-term care facilities. A GH model for nursing home is also not restricted to ownership type (i.e., for-profit or not-for-profit).

The GH model is an innovative program in its approach to radically redesign nursing home buildings and environments. Most GH homes are in clusters of two or three, situated on a campus with a larger, traditional nursing home (Bowers and Nolet, 2014). Extensive training and consultations are provided for new GH homes such as general principles, architecture, and roles of staff by the National Green House organization since the GH model is standardized (Bowers and Nolet, 2014). Usually 10 residents reside in each home. Each

resident has a private bedroom and bathroom and shared common spaces including a large living room and dining room where residents can gather like a family. GH homes encourage and support residents' choices and autonomy and residents are provided with individualized care (Eliopoulos, 2010). To be more homelike, hospital-like components of traditional nursing homes are avoided in GH homes including no nurse stations, medication carts, or paging systems. A special feature of the GH model is certified nurse aides (CNAs), called Shahbazim, who are highly empowered and self-managed given greater autonomy in daily activities along with greater responsibilities. Unlike traditional CNAs, they integrate diverse roles including meals, shopping, housekeeping, activities, and direct care (Eliopoulos, 2010; Ragsdale and McDougall, 2008).

Despite widespread adoption of small-scale nursing home models in many countries, little research evidence is currently available concerning the effects of these models. Furthermore, previous studies have suffered from methodological limitations: the use of cross-sectional design (Lindessay *et al*., 1991; Smit *et al*., 2012), short follow-up time with a quasi-experimental design (Molony *et al*., 2011), small sample sizes (Annerstedt, 1993; Dean *et al*., 1993; Molony *et al*., 2011), or lack of comparison groups (Dean *et al*., 1993; Smit *et al*., 2012). Recently, quasi-experimental studies have examined the effects of small-scale nursing homes: two studies in Europe (de Rooij *et al*., 2012; Verbeek *et al*., 2010, 2014), and one in the United States (Kane *et al*., 2007). However, research findings are mixed. GH home residents reported better quality of life than traditional home residents in the US (Kane *et al*., 2007), but no significant effects were found for quality of life, depression, neuropsychiatric symptoms, and agitation for residents with dementia in the Netherlands and Belgium (de Rooij *et al*., 2012; Verbeek *et al*., 2010).

The direction of nursing home care has changed towards small-scale homelike environments to meet the needs of older adults and family members, but policy makers and nursing homes face the high cost of facility conversions and ongoing questions about economies of scale. Scientific research studies on the effects of small-scale nursing homes are necessary to support evidence-based decision making. The current study examines the longitudinal effects of the GH nursing home model. Specifically, we compared the change rates in reports of two psychological outcomes (depressive symptoms, and social engagement) over time between residents in GH homes and those in a matched set of traditional nursing homes, taking into account many zero counts of outcome measures using a zero-inflated Poisson (ZIP) model.

METHODS

Study Sample

This study was a secondary analysis using minimum data set (MDS) 2.0 data from a parent study: the Study of Changes in ADL Assistant Levels in Traditional Nursing Homes and The Green House Project sties (International Severity Information Systems/Institute for Clinical Outcomes Research and Health Management Strategies, 2010). MDS data were retrospectively collected from nine GH homes and four traditional homes that had agreed to participate in the parent study. A total of 242 residents' MDS data (93 GH home residents from nine GH homes and 149 traditional home residents from four traditional homes who

had resided in the homes for at least six months) were included in the study. Exclusion criteria were residents who had been admitted for short-term rehab or hospice at the start of their stay. MDS data were retrospectively collected from admission to 18 months, which ranged from 2005 to 2009. Four MDS assessments every six months from admission (i.e., admission, 6 months, 12 months, and 18 months) were included in this study to conduct longitudinal analysis. The number of residents by group at each time point is shown in Table 1. This study was approved as exempt by the Health Science IRB of the University of Wisconsin-Madison.

Measures

Outcome variables—Depressive symptoms were measured using the Mood Scale Score (MSS). The MSS is a depression measure used in the MDS, which assesses the presence of eight depressive conditions using ten MDS items. The MSS ranges from 0 to 8 with higher values indicating a more depressed mood. Level of social engagement was measured using the Index of Social Engagement (ISE). The ISE is intended to capture each resident's sense of initiative and involvement in social activities. The ISE score is computed by adding six dichotomous items in the MDS. The ISE scores range from 0 to 6 with higher values representing greater social engagement. The ISE has been shown to have good internal consistency and inter-rater reliability (Mor *et al*., 1995).

Independent variable—The main independent variable was the facility type, GH or traditional home.

Covariates—Age, gender, ADL and cognitive functions at baseline (i.e., admission) were controlled in the model. ADL function was measured using the ADL long-form scale, which is the sum of seven items ranging from 0 (complete independence) to 28 (total dependence). It is considered to be a good measure for detecting meaningful changes in ADL function over time (Morris *et al*., 1999). Cognitive function was measured using the cognitive performance scale (CPS) ranging from 0 (intact) to 6 (very severe impairment). The CPS has been used widely in nursing home studies and has good psychometric properties (Morris *et al*., 1994).

Analysis

To examine the longitudinal impact of the GH model on reports of two psychological outcomes, a latent growth curve zero-inflated Poisson (ZIP) model was applied. The growth curve model is a longitudinal analytic method estimating the latent variables: the average level of baseline scores (intercept) and the linear rate of change over time (slope). The growth curve model is a person-centered approach measuring not only the average rate of change but also providing an estimation of variation (Muthén and Muthén, 2000). Latent variables (intercept and slope) can be regressed on covariates to determine the relationship of a particular variable with each latent variable. This study examined the impact of the GH model on the change rates (slope) of two psychological outcomes as reported by nurses at four time points. The ZIP distribution is a mixture of a Poisson distribution of count data with an excess of zero counts. The ZIP model is increasingly used in health service research today to prevent biased estimation of parameters due to extra zeros in the count data (Lee *et*

al., 2006). Vuong's tests were performed for each outcome measure, which demonstrated that a ZIP model is superior to a regular count model for two outcome models. In this study, within the growth curve model framework, a ZIP model was employed to simultaneously estimate a binary model (e.g., probability of not reporting depressive symptoms [reference: reporting depressive symptoms]) and count model (e.g., number [level] of depressive symptoms among those who reported depressive symptoms) of the psychological outcome trajectories. We built two separate ZIP growth curve models (depressive symptoms, and social engagement) using four time points of data (admission, 6 months, 12 months, and 18 months.) Given that the design effect of depressive symptoms by a GH home unit was 3.08 (Muthén and Satorra, 1995), a multilevel analysis (random intercept model) was applied in all analyses to take into account the nested data structure within nursing homes. Descriptive analyses were conducted using SAS 9.4, and Mplus 7 was used for growth curve ZIP models.

RESULTS

Table 1 shows the number of residents at each time point by group. There were dropouts over time, about 25% at 12 months from admission and 62% at 18 months from admission. Table 2 provides the demographic characteristics of the study sample at admission by group. The average age of the residents was more than 85 years old, and the proportion of females was 73% in both settings. About half of the residents were diagnosed with dementia at admission. ADL, cognitive functions, depressive symptoms, and social engagement were not different between the two groups at admission.

Before analyzing the longitudinal data, we examined the impact of dropouts and missingness using a pattern-mixture model (Hedeker and Gibbons, 1997), which demonstrated that it was possible to ignore missing patterns including whether residents in this study 1) dropped out before 18 months and 2) had missing values during the stay. As major study findings, Table 3 indicates that a rate of increase in depressive symptoms for GH home residents was higher than that of traditional home residents ($\beta = 0.135$, p-value = 0.025), but there was no significant difference in the change rates of the probability of "zero depressive symptoms" over time between the two groups ($\beta = -1.020$, p-value = 0.066). Given the small p-value and odds ratio (OR = 0.361), this non-significant result might be due to the insufficient power of these data. Regarding social engagement, GH home residents had less increase in the probability of "not being socially engaged" over time ($\beta = -0.274$, p-value = 0.010); however, it was not associated with the rate of increase of the social engagement level in the Poisson part ($\beta = -0.010$, p-value = 0.913). In the Poisson part, a small incidence rate ratio (IRR = 0.990) in addition to the non-significant p-value (0.913) might indicate no actual clinical difference between the two groups. To help visualize the data, Figure 1 displays the growth trajectories of the Poisson parts for depressive symptoms and social engagement for residents after the four covariates (age, gender, ADL, and cognitive function) were controlled with their means. Figure 1A shows a group difference in depressive symptoms of 0.453 units at admission (GH = 1.021, Traditional = 0.568) and 0.858 units at 18 months (GH = 1.616, Traditional = 0.758) indicating a significant difference in the rate of change. However, Figure 1B demonstrates a trivial group difference in social engagement of 0.063

(GH = 1.007, Traditional = 0.944) and 0.075 units (GH = 1.079, Traditional = 1.004) at 18 months.

DISCUSSION

This study examined the longitudinal effects of the GH nursing home model on psychological outcomes. Residents in GH homes had a higher rate of increase of depressive symptoms over time, but they had a lower increase in the probability of not being socially engaged compared to traditional home residents.

The finding that GH nursing home residents reported a greater increase in the rate of depressive symptoms over time seems at odds with Kane's previous quasi-experimental study that reported better quality of life in GH residents (Kane *et al*., 2007). However, this longitudinal study's finding of increasing reports of depressive symptoms over time may provide important practical considerations. An accurate assessment or early recognition of residents' change, particularly in the subjective and psychological aspects (pain, mood), is highly dependent upon the subjects' and assessors' characteristics (Mor *et al*., 2003), and familiarity between assessors and subjects (Power, 2014). GH homes usually consist of 10 residents and a few staff who spend more time together and across a range of activities than is the case in traditional homes. Staff assignments are consistent, and close relationships between staff and residents in small-scale homes enable staff to more easily recognize and monitor changes in residents' moods. Thus, staff are more likely to report these changes in the MDS and provide timely treatment. Residents may be more comfortable expressing their feelings or emotions to close staff within these home-like care environments. This unique atmosphere of closeness in small-scale nursing homes might lead to a significant increase in the recognition and reporting of residents' depressive symptoms over time compared to traditional nursing home residents.

It is, however, possible that GH residents experience increasing depressive symptoms over time, for other reasons. One study reported a concern that the GH model provides fewer organized formal group activities and could lead to lower resident stimulation (Zimmerman and Cohen, 2010), and that the consequences of emphasizing privacy and individual preferences may prevent residents from developing meaningful social relationships. However, the current study revealed less increase in the probability of not being socially engaged in GH homes. This partially positive effect of the GH model on social engagement is consistent with recent Dutch and Belgium studies indicating that small-scale nursing home residents reported higher levels of engagement (de Rooij *et al*., 2012; Verbeek *et al*., 2010, 2014). Considering that more intensive contact between residents and staff as well as environmental stimuli (especially related to real-world tasks and activities that residents were used to doing) can significantly influence residents' social engagement (Cohen-Mansfield *et al*., 2010; de Rooij *et al*., 2012), encouraging residents to be involved in activities in the GH model seemed to be effective in improving the probability of social engagement. Nevertheless, change rates in the level of social engagement were not significantly different between the two groups as determined by the Poisson part. This indicates that the GH model is effective in increasing the probability of residents being socially engaged, but it is possible that the frequency of activities is insufficient over time.

One of the limitations of this study was that the control group (traditional nursing homes) and GH homes were under the same organization. A GH organization usually has one traditional building and more than one GH home. The traditional building and GH homes are physically separate on the same campus, but the overall organizational vision and policies are likely to be shared by both types of homes under the same organization. This may be a source of contamination of the effects of the GH model compared to the control groups. Although the two psychological outcomes (depressive mood and social engagement) are inter-related (Cohen-Mansfield *et al*., 2012), we built two separate models in this study due to the insufficient sample size to build one integrated model. Lastly, this study used MDS data. The MDS has been widely used in research studies and practice, but concerns about data accuracy and potential errors have been raised (Mor *et al*., 2003).

There are several implications for future research that will enhance the findings of this study. First, to improve the quality of health outcome research in this area, more studies are needed to capture the accurate status of residents. Outcome measurements, especially for the psychological aspects are highly influenced by measurement errors. Particularly for residents who are not cognitively intact, it is more difficult to capture the psychological aspects sensitively. Thus, different measurement strategies regarding psychological aspects depending on the cognitive function of residents are needed for future studies. The new MDS 3.0 version includes new tools to measure residents' mood (PHQ-9), which is a well-established and standardized instrument including interviews and observational versions (Saliba *et al*., 2012). Second, further studies to examine care processes are necessary. It is important to provide practical information concerning concrete strategies of care processes to nursing homes to improve residents' health outcomes. Despite limited data sources, the MDS can be the first place to investigate the significant processes that have varying influences on resident health outcomes in GH nursing homes. However, currently all nursing home care provided to residents cannot be documented in the structured MDS data set, so a time-and-motion observation study is necessary to examine more comprehensive care processes in terms of types of care and quantity of care. In addition, different work environments including communication, teamwork, and leadership may influence nursing staff`s care-giving processes differently (Temkin-Greener *et al*., 2009), so qualitative studies to explore these aspects are needed.

CONCLUSION

This study examined the effects of the GH model on two psychological outcomes. Major findings were that GH residents had a higher rate of increase of depressive symptoms, and a lower rate of increase in the probability of not being socially engaged over time relative to those in traditional nursing homes. Despite somewhat mixed findings, the fundamental philosophy of the GH model is innovative and may be associated with an increase in nursing home residents' quality of life. Given that the GH model is continuously evolving with updated and revised educational and support programs (Bowers and Nolet, 2014), further studies are necessary to examine the effects of the GH model and the mechanism to create differences between the two settings that influence residents' psychological outcomes.

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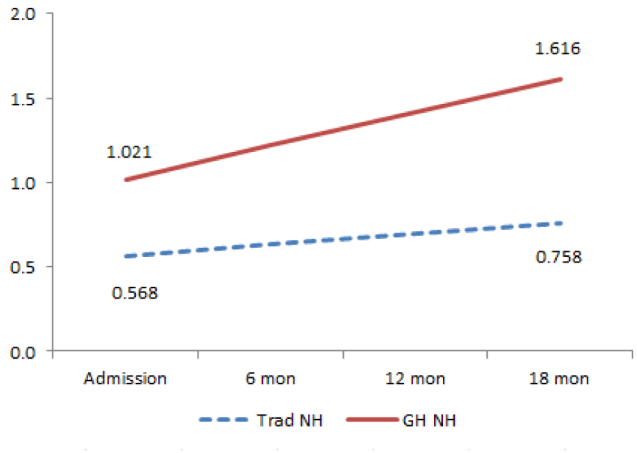
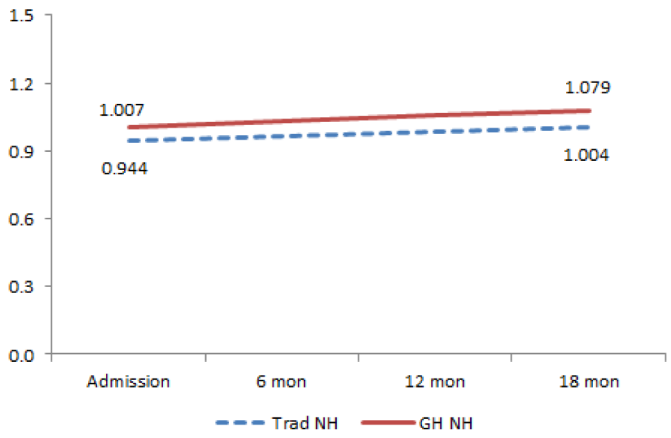


A. Estimated means of depressive symptoms



B. Estimated means of social engagement

Figure 1.

Mean trajectories of Poisson parts of depressive symptoms and social engagement

Note. Trad NH = traditional nursing home residents; GH NH = Green House nursing home residents; All these trajectories are the estimated mean trajectories in the Poisson part with the means of four covariates (age, gender, ADL function, and cognitive function).

Table 1

Number of residents at each time point

	Admission	6 months	12 months	18 months
GH homes	93 (100%)	93 (100%)	64 (69%)	37 (40%)
Traditional homes	149 (100%)	149 (100%)	117 (79%)	55 (37%)
Total	242 (100%)	242 (100%)	181 (75%)	92 (38%)

Note. Numbers in parenthesis indicate the residents who resided at the home at each time point.

Table 2

Demographic characteristics of the study sample at admission (N=242)

Variable	GH (n=93) M (SD)/n (%)	Trad (n=149) M (SD)/n (%)	Group difference (t/X^2 value)	p-value
Age	87.2 (7.2)	85.8 (9.7)	−1.27	0.206
Female	68 (73.1%)	110 (73.9%)	0.02	0.903
ADL function (ADLLF, 0 – 28)	14.5 (6.7)	14.5 (7.4)	0.01	0.989
Cognitive function (CPS, 0 – 6)	2.5 (1.0)	2.2 (1.2)	−1.51	0.132
Depressive symptoms (MMS, 0 – 8)	1.2 (1.9)	0.8 (1.5)	−1.63	0.104
Social engagement(ISE, 0 – 6)	1.0 (1.5)	0.8 (1.5)	−1.33	0.184

Note. GH = Green House home residents; Trad = Traditional home residents; M = mean; SD = standard deviation; ADLLF = activities of daily living long form; CPS = cognitive performance scale; MSS = mood scale score; ISE = index of social engagement; Higher scores of ADL, CPS, and MSS indicate worse status, but higher scores of ISE indicate better engagement status.

Table 3

Results of multilevel ZIP regression to examine the impact of the GH model on the change rate of psychological outcomes (N=241)

Variable	Depressive symptoms				Social engagement			
	Zero inflated part(zero vs. non-zero)		Poisson part(level of symptoms)		Zero inflated part(zero vs. non-zero)		Poisson part(level of engagement)	
	Estimate (SE)	p	Estimate (SE)	p	Estimate (SE)	p	Estimate (SE)	p
Age	−0.018 (0.017)	0.270	0.005 (0.003)	0.061	−0.009 (0.005)	0.079	−0.001 (0.002)	0.607
Female[#]	−0.045 (0.553)	0.935	0.008 (0.072)	0.916	−0.034 (0.177)	0.847	0.142 (0.047)	0.002
ADL function	−0.015 (0.026)	0.568	0.000 (0.005)	0.954	0.004 (0.012)	0.767	−0.004 (0.003)	0.250
Cognitive function	0.187 (0.217)	0.389	−0.042 (0.038)	0.369	0.015 (0.076)	0.842	0.002 (0.016)	0.898
Green House[#]	**−1.020 (0.554)**	**0.066**	**0.135 (0.060)**	**0.025**	**−0.274 (0.106)**	**0.010**	**−0.010 (0.093)**	**0.913**
	OR (95% CI)		**IRR (95% CI)**		**OR (95% CI)**		**IRR (95% CI)**	
	0.361 (0.122, 1.069)		**1.145 (1.017, 1.288)**		**0.760 (0.618, 0.936)**		**0.990 (0.824, 1.189)**	

Note.

[#]Reference group: male and traditional nursing home residents, respectively; Higher scores of depressive symptoms indicate worse status, but higher scores of social engagement indicate better engagement status; SE = standard error; p = p-value; OR = odds ratio; CI = confidence interval; IRR = incidence rate ratio; The zero-inflated part provides information that variable “A” is associated with a higher (or lower) rate of increase in the probability of “zero” to “non-zero,” and the Poisson part provides information that variable “A” is related to a higher (or lower) rate of increase in the “level of symptoms.”