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The relationship between person-centered care in nursing homes and COVID-19 infection, hospitalization, and mortality rates

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ABSTRACT

Objectives: This cohort study compared rates of COVID-19 infections, admissions/readmissions, and mortality among a statewide person-centered model known as PEAK and non-PEAK NHs.

Methods: Rates per 1000 resident days were derived for COVID-19 cases and admissions/readmissions, and per 100 positive cases for mortality. A log-rank test compared rates between PEAK ($n = 109$) and non-PEAK NHs ($n = 112$).

Results: Rates of COVID-19 cases, admission, and mortality were higher in non-PEAK compared to PEAK NHs. The median rates for all indicators had a zero value for all NHs, but in NHs above 90th percentiles, the non-PEAK case rate was 3.9 times more and the admission/readmission rate was 2.5 times more.

Conclusions and implications: COVID-19 case, and mortality rates were lower in PEAK than non-PEAK NHs. Although PEAK and non-PEAK NHs may differ in other ways as well, person-centered care may be advantageous to promote infection control and improve outcomes.

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Introduction

The impact of COVID-19 on nursing home (NH) residents resulted in considerable attention being directed at the organizational structure, practices, and policies associated with NH care. For example, one study by Zimmerman and colleagues explored Green House and other small NH household models in comparison to larger and traditional NHs and found COVID-19 incidence and mortality rates to be lower in the Green House/small home settings.¹ Household models involve more than just redesigned architecture and interiors; they also include operational and organizational approaches to person-centered care which themselves may be beneficial to infection control and resident outcomes. One such model of person-centered NH care being enacted statewide is the Kansas PEAK (Promoting Excellent Alternatives in Kansas Nursing Homes) 2.0 program.

PEAK 2.0 began in 2012 as a tiered payment structure to incentivize Kansas NHs to implement person-centered care. Participation in the PEAK program is voluntary. PEAK is a structured program with

consistent operationalized definitions for 12 core person-centered care practices, and all participating homes are provided training and education about common expectations for implementation.² For example, assigning consistent staff to a reduced number of residents who live in a designated living area is one of the required practices to “get small” and encourage relationship building. After initial training, PEAK homes undergo an annual external evaluation by the PEAK staff to determine the core practices that have been successfully implemented which determines their level in the program. **Table 1.** Levels range from 0 to 5, with 0 representing a foundational year of planning and 5 representing comprehensive and sustained adoption of all of the required domains and cores in the program.³ Research comparing PEAK homes to non-PEAK homes has demonstrated that PEAK homes have higher satisfaction with quality of life and clinical quality of care.^{2,4} It is plausible that person-centered care practices (such as creating dedicated teams of consistent staffing for a smaller group of residents, and decentralized dining) similarly benefit infection control and related outcomes.

Therefore, this study explored the potential influence of person-centered care practices on the incidence and mortality rates of COVID-19 comparing PEAK to non-PEAK homes. Modeling the

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Table 1
Description of levels for PEAK participating homes.

Level	Actions/outcomes/assessment/ evaluation	Description
5 4 3	Sustained adoption and implementation of all 12 core areas. Homes continue their on-going assessment and are evaluated by the PEAK/ KDADs team on a bi-annual schedule once they reach level 4.	Homes move to Level 3 after passing an on-site evaluation conducted by the PEAK team. This evaluation investigates practices within all 12 PEAK core areas. Homes at Level 3 are evaluated two years in a row to ensure that practices have been maintained. If they pass this evaluation, they move onto Level 4, if they do not, they move to Level 2. Once at Level 4, homes focus on sustaining their practices and mentoring other homes. They are evaluated bi-annually. Once a Level 4 home documents a record of mentoring activities and demonstrates sustained practices in all 12 PEAK core areas, it moves onto Level 5. Homes at Levels 4 & 5 are evaluated bi-annually.
2	Identification of PEAK cores for implementation, action plan development, implementation of practices, assessment, external evaluation.	Level 2 is a transition level. Homes must have passed at least 3 of the 12 PEAK core areas. Homes have three years at this level to implement the practices across all 12 of the PEAK core areas. Homes are counselled to select 4 core areas per year until they have met all 12. Homes that pass all 12 core areas move on to Level 3, those that don't move back to Level 1. Homes are reviewed annually.
1	Identification of 4 PEAK cores for implementation, action plan development, implementation of practices, assessment, external evaluation.	Level 1 homes are at the beginning stages of PCC implementation. They select 4 of the 12 PEAK core areas. Homes create action plans that detail how they will implement the practices and receive feedback from the PEAK staff on their action plans and are then evaluated at the end of that year to determine if they have been successful in their PCC implementation on those 4 core areas. Homes that pass, move onto Level 2. Homes that do not pass can stay at Level 1, or they can choose to go through the education and training in the Foundation Level again.
Foundation	Structured education and training on PEAK core PCC practices, team engagement, and leadership including experiential learning with Level 4 and/or 5 mentor homes.	The Foundation level is a structured year of education and training for the staff and leadership in nursing homes who are wanting to move towards PCC practices in their delivery of care services. Participants receive a workbook and training videos that provide detailed content on PCC. The outcome of the training is an action plan that can be implemented as they are ready to move to Level 1.

Note: PEAK is the acronym for Promoting Excellent Alternatives in Kansas Nursing Homes. For a comprehensive description of the PEAK program, see Doll et al.³.

methods used in the study of Green House/small NHs by Zimmerman et al.,¹ it was hypothesized that PEAK homes would perform better related to COVID-19 infections, admission/readmission, and mortality rates than non-PEAK homes.

Methods

This cohort study used NH COVID-19 data published by the Center for Medicare & Medicaid Services (CMS).⁵ Beginning May 2020, all U. S. NHs were required to report COVID-19 data to CMS, and the data were made publicly available. COVID-19 data of all Kansas NHs reporting to CMS from January 20, 2020 to July 31, 2020 were downloaded for these analyses (the same dates as in the Zimmerman et al. study); the end date was chosen to precede changes in care such as becoming COVID-19-only NHs.

Sample

To identify providers in the CMS data who had been active in the PEAK program prior to the start of the pandemic, homes with established PEAK level status (0–5) in 2018 and 2019 were identified. The remaining homes were identified as non-PEAK NHs for comparison. Given geographical differences in COVID-19 infiltration, PEAK and non-PEAK homes were matched and paired within counties for analysis. Of the 314 Kansas NHs that reported sufficient analyzable COVID-19 information to CMS, 170 (54%) were PEAK NHs in 2018 and 2019. Of these, only 37 counties had both PEAK and non-PEAK homes, resulting in 109 PEAK and 112 non-PEAK NHs for analysis. The majority of counties had 5 or fewer PEAK homes, the exception being 3 counties that each had 10–12 PEAK NHs.

Variables used from the CMS data included individual NH census (occupied beds), number of residents with confirmed COVID-19

infections (new laboratory positive cases), COVID-19 admission/readmission (person admitted or readmitted or previously hospitalized and treated for COVID-19), and number of resident deaths from COVID-19 (suspected or laboratory positive who died in the NH or another location).

Analyses

COVID-19 cases and admissions/readmissions were calculated per 1000 resident days; COVID-19 mortality was calculated per 100 suspected and confirmed positive COVID-19 cases. The analysis modeled the method used by Zimmerman et al. to derive rates.¹ To calculate the COVID-19 infection rate, COVID-19 case counts were summed for each NH, divided by total case counts per days of exposures (i.e., resident days), and multiplied by 1000. COVID-19 admission/readmission rates were calculated using the same approach. In contrast, the COVID-19 mortality rate was calculated by dividing the sum of COVID-19 death counts by the sum of suspected plus confirmed COVID-19 cases and multiplying by 100. For all three COVID-19 outcomes—cases, admission/readmission, and mortality—a log-rank test was applied to compare rates between PEAK and non-PEAK NHs. Log-rank tests are nonparametric tests used to detect differences among higher values and censored data. The *P*-value of <0.05 was considered statistically significant. Analyses were conducted in R version 4.0 (2020-04-24).

Secondarily, differences in COVID-19 infection, admission/readmission, and mortality rates were analyzed by the extent of person-centeredness among PEAK homes (i.e., PEAK levels). PEAK NHs at levels 0 and 1 are novice and were combined to represent the early stage of person-centered implementation (Stage 1). Homes at the PEAK levels 0-1 (Stage 1) have implemented very few person-centered practices, so it was important to make this group distinct from other

Table 2

Comparison of COVID-19 rates between PEAK and non-PEAK nursing homes.

Indicators		Including outlier nursing homes (N = 221)		
		PEAK nursing homes (N = 109)	Non-PEAK nursing homes (N = 112)	P-value [†]
COVID-19 case per 1000 resident days	Median	0.00	0.00	0.09
	75th percentile	0.00	0.00	
	90th percentile	0.08	0.31	
	Range	0–3.74	0–4.81	
COVID-19 admission/readmission per 1000 resident days	Median	0.00	0.00	0.09
	75th percentile	0.00	0.00	
	90th percentile	0.11	0.28	
	Range	0–3.55	0–1.71	
COVID-19 mortality per 100 positive cases [§]	Median	0.00	0.00	0.03*
	75th percentile	0.00	0.00	
	90th percentile	0.00	0.00	
	95th percentile	0.00	10.70	
	Range	0–16.7	0–56.9	

[†] P value calculated using log-rank test.[§] Number of suspected or laboratory positive resident deaths from COVID-19 divided by number of laboratory positive resident cases of COVID-19 times 100.* P value significant at ≤ 0.05 .

PEAK participating homes. PEAK NHs at levels 2–5 are those with moderate to advanced experience of person-centered implementation and were combined to represent the more advanced stage (Stage 2). PEAK NHs at levels 2–5 (Stage 2) have demonstrated implementation of a broad array of PCC practices, such as creating dedicated teams of consistent staffing for a smaller group of residents, and decentralized dining. This strategy resulted in three groups for purposes of comparison: non-PEAK NHs, Stage 1 PEAK NHs, and Stage 2 PEAK NHs.

Results

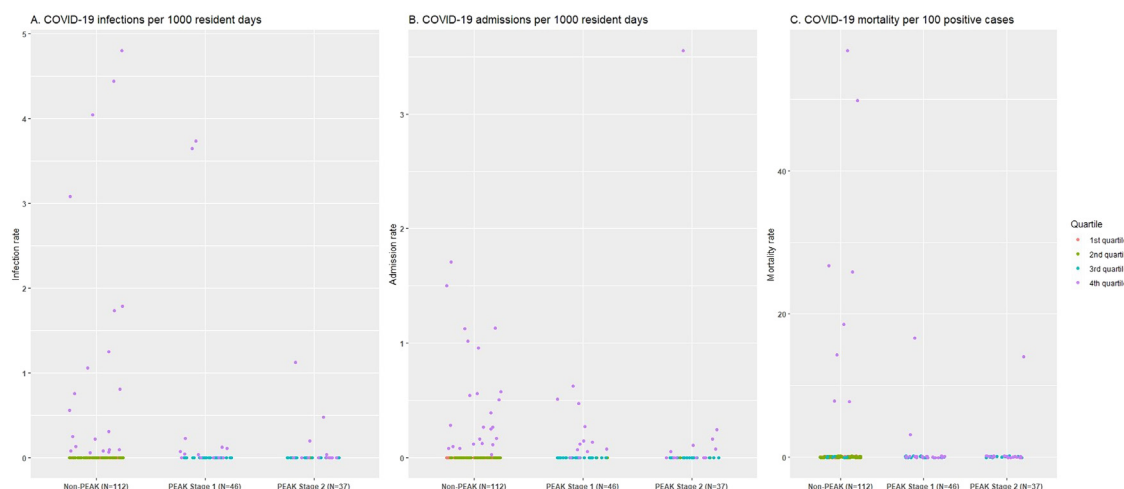
Table 2 displays COVID-19 rates of PEAK and non-PEAK NHs, including median rates of COVID-19 cases, COVID-19 admission/readmission per 1000 resident days, and COVID-19 mortality per 100 positive cases; it shows that the median rates and rates at the 75th percentile are 0 in all NHs (PEAK and non-PEAK). Comparatively non-PEAK NHs have higher COVID-19 cases, admission, and mortality than PEAK homes. In NHs that lie above 90% (90th percentile), non-PEAK NHs had 3.9 times more COVID-19 cases than PEAK NHs (31 COVID-19 cases for every 1000 resident days in non-PEAK homes compared to 8 COVID-19 cases in PEAK homes). Similarly, the COVID-19 admission/readmission rate was 2.5 times more in non-PEAK than

PEAK NHs. In terms of mortality rates, at the 90th percentile both non-PEAK and PEAK NHs had zero COVID-19 mortality. Above the 95th percentile, however, non-PEAK NHs had a 10.7 COVID-19 mortality rate per 100 positive cases, compared to a PEAK NH rate of 0; the maximum mortality rate in non-PEAK homes was 56.9 per 100 positive cases compared with 16.7 in PEAK NHs.

Figure 1 displays lower COVID-19 case rates, admission/readmission rates, and COVID-19 mortality rates among NHs with increased levels of PEAK participation. Each dot represents COVID-19 case, admission, and mortality rates. The majority of the rates fall below the third quartiles, and PEAK homes at levels 2 to 5 (Stage 2) have significantly fewer dots in the fourth quartile compared to NHs that never participated in PEAK. Non-PEAK NHs had scattered and higher rates (case, admission, and mortality) than PEAK NHs levels 0–1 (Stage 1) and levels 2–5 (Stage 2).

Discussion

Studies across the U.S. and Canada have examined data associated with the incidence of COVID-19 infections, extent of infections, and mortality rates in NHs. In the study by Zimmerman and colleagues,¹ the median (middle value) rates of COVID-19 cases per 1000 resident days were 0 in both Green House/small NHs and NHs <50 beds, while

**Fig. 1.** Differences in COVID-19 infection, admission, and mortality rate by PEAK stage.

they were 0.06 in NHs >50 beds. This study sought to conduct a comparative analysis using the same research design and time frame, given the related focus on person-centered care and recognition of the low rates and geographic clustering.

In other studies, characteristics examined in relation to COVID-19 include design standards and NH size,^{1,6,7} profit status,⁷ CMS quality measures,^{6,8–12} geographic factors (e.g., urban versus rural),^{6,7,13} population variables (e.g., racial and ethnic characteristics),^{10,11,13} and staffing levels and mix.^{9,11,13} To affect change, providers must be able to translate results into actions that are within their control to implement and sustain with available resources. Characteristics such as the design of the building (e.g., standalone households versus traditional buildings) are not actionable change for an individual provider, nor is location or numerous other salient characteristics. Person-centered care practices, however, have been shown to be implemented in a broad cross-section of environments, settings, provider types, and geographic locations.^{14,15} The outcomes of these person-centered efforts have had positive impacts on both quality of health⁴ and quality of life.² This study suggests that person-centered care may also benefit infection prevention and related outcomes, as witnessed through the COVID-19 data.

The PEAK practices most likely to be related to infection prevention and outcomes include changes associated with “getting small.” These changes entail consistent staffing approaches, no more than 30 residents in designated work areas (architecturally defined), removal of large-centralized nursing desks in exchange for dispersed and integrated places to chart, and expectations that these work areas have all the necessary supplies and equipment needed by staff. Additionally, PEAK practices emphasize leadership approaches that engage all staff in decision making and problem-solving.

Of course, the design of this study does not allow for a causal examination of the association between person-centered practices and improved infection control and outcomes. These findings are preliminary and more research on infection prevention outcomes are needed. Such research should include co-variables that were not available for these analyses. One confounder relates to the nature of the NHs that adopt PEAK. Of the 314 NHs in the sampling frame for this study, 54% were PEAK homes. Other studies have shown that homes that adopt culture change (typically synonymous with person-centered care) differ from other homes such as by being non-profit and having fewer Medicaid residents,¹⁶ both of which also relate to higher quality care.^{17,18} Similarly, early PEAK adopters tend to be non-profit and have higher occupancy and quality ratings than non-PEAK homes, but these differences lessen and are nonsignificant over time.⁴ Other limitations are that this study is restricted to a sample of homes in one state—although a strength is that it is a state-wide sample—and that the findings may not reflect Kansas NHs that did not report data to CMS. The timeframe for this study is also fairly narrow, but it provides a comparative analysis to the study on Green House/ small house which uses the same window of observation and was not confounded by homes choosing to purposefully serve COVID-19 residents. Consequently, the findings remain valid despite the limited window of observation.

Conclusions and implications

Addressing the quality of NH care has gained renewed attention due to the devastation caused by COVID-19. Solutions for safer and more effective care must address a spectrum of approaches because NHs across the country represent a range of settings.

Providers around the world are turning their attention to different models of care and operational behaviors that reduce characteristics associated with cross-contamination and other problems with infection control.¹⁹ New building, remodeling, and organizational practices should be carefully considered in response to a continued

understanding of how the physical and social environment support improved operational practices and resident outcomes.¹ Addressing the needs of existing skilled care settings may require attention to person-centered practices and re-conceptualizing the use of existing buildings in a manner that answers the call for continuous quality improvement and better outcomes.²⁰

PEAK homes share similar cultural and environmental priorities found in the household / small house models of care, and results from this analysis demonstrate that there may also be positive implications for managing contagious infections in these settings. The implications are that improved outcomes, particularly around infection control, may perhaps be achieved through affordable adaptations to NH policy and practice promoting person-centeredness. Doing so could improve care that is more broadly accessible to diverse resident populations.

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Declaration of Competing Interest

MK is the Co-Principal Investigator on the PEAK Project contracted with the Kansas Department for Aging and Disability (KDADs) and LC is the Program Director. Other authors declare no conflict of Interests.

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