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Longitudinal pressure ulcer rates since the adoption of culture change in Veterans Health Administration nursing homes

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Abstract

Objective—To examine facility-level pressure ulcer development rates and variations in these rates after a system-wide adoption of culture change in Veterans Health Administration (VHA) nursing homes.

Design—4-year retrospective longitudinal design.

Setting—109 VHA facilities representing 132 nursing homes, known as Community Living Centers (CLCs).

Measurements—Pressure ulcers were identified using FY08-11 Minimum Data Set (MDS) data. Pressure ulcer development was defined as a stage 2 or larger pressure ulcer on an MDS assessment with no pressure ulcer on the previous assessment. A risk adjustment model was developed using 105,274 MDS observations to predict the likelihood of pressure ulcers (c statistic = 0.72). A Bayesian hierarchical model that adjusted for differences in the precision of pressure ulcer rates from differently sized facilities was used to calculate smoothed risk-adjusted (SRA) rates for each facility. The statistical significance of the trend over the 4 years was determined by examining the 95% interval estimate for the slope.

Results—Over the 4 year period, the beginning of which coincided with the VHA's system-wide adoption of culture change as a performance measure, median SRA facility pressure ulcer development rates were fairly consistent at approximately 4%. The range in SRA rates declined from 14.8% to 10.1%. Some facilities had significantly improving SRA rates (e.g., declined steadily from 5.5% to 3.9%) and some had significantly worsening SRA rates (e.g., increased steadily from 5.1% to 7.9%). Seven sites had significantly improving rates ($p<.001$) that were below the median across all 4 years.

Conclusion—CLC pressure ulcer development rates were unaffected by a system-wide culture change implementation. There was, however, significant variation in facility rates and some facilities exhibited sustained high performance.

Keywords

pressure ulcer; nursing homes; culture change; veterans health

INTRODUCTION

Pressure ulcers result in significant health problems, including functional impairment, disfigurement, and pain Berlowitz, 1997.[1] Yet thirty years after publication of the first pressure ulcer prevention clinical guidelines, risk-adjusted rates remain high.[2] The annual nursing home pressure ulcer prevalence in 2012 was 5.4%.[3] But implementation of person-centered initiatives consistent with the nursing home culture change movement may affect pressure ulcer development rates. Nursing home culture change refers to shifts in care, organizational, and management practices and modifications to the physical environment designed to deinstitutionalize facilities, transforming them into person-centered homes.[4, 5] Through implementation of culture change, pressure ulcer development rates may decrease due to alterations in care processes such as implementation of consistent assignment, so that staff are better able to individualize care and note early skin changes, and empowerment of

nursing assistants, so that nursing assistants can more easily speak up regarding any relevant skin changes. It is, however, also possible that culture change initiatives may negatively impact pressure ulcer prevention through increased resident autonomy, e.g., residents choosing not to turn or reposition. There have been relatively few studies to date examining the relationship of culture change to pressure ulcer outcomes, and the evidence remains inconclusive.[4, 6, 7] Miller et al., for example, found nursing homes with high adoption of culture change had a significant decrease in the proportion of residents with pressure ulcers,[8] but Grabowski et al. did not.[9]

The Veterans Health Administration (VHA), one of the largest U.S. integrated healthcare systems, began promoting culture change practices in its nursing homes, known as community living centers (CLCs), in 2004. In FY08, the VHA published a national policy on CLC culture change, began nationwide measurement using the Artifacts of Culture Change tool (Artifacts), and implemented culture change performance measurement.[10] The Artifacts is a facility-level self-report instrument developed by the Centers for Medicare and Medicaid Services and designed to capture various aspects of culture change,[11] with particular emphasis on environmental changes. The VHA's performance measurement system focused on quarterly-collected Artifacts data. These culture change efforts have not been widely evaluated to date. The largest study examined the relationship between the Artifacts data and a Minimum Data Set (MDS) quality indicator composite measure, finding greater culture change associated with higher quality.[7] A much smaller study found a sample of 4 CLC staff slightly uncomfortable overall with various culture change scenarios.[12] How the system-wide transformation potentially impacted pressure ulcer development is unknown. Did the VHA's promotion of CLC culture change have any influence? And were there CLCs that exceled at pressure ulcer prevention in this new climate? This study aimed to gain a greater understanding of (1) the impact of culture change on pressure ulcer development and (2) the extent of variation in CLCs' abilities to prevent pressure ulcers.

METHODS

Data Selection

Data from Minimum Data Set (MDS) assessments of residents' pressure ulcers, rated using the standard 4-point scale from stage 1 (superficial) to 4 (deep), were used. For this study, residents were considered free of pressure ulcers when they had no pressure ulcer or a stage 1 pressure ulcer. This is consistent with the usual practice when using databases of considering residents with stage 1 ulcers as ulcer-free, because stage 1 ulcers have no skin break and are difficult to detect reliably.[13–15] Development of a pressure ulcer was defined as follows: records with no pressure ulcer on a first (i.e., "index") assessment that had a stage 2 or larger pressure ulcer on a subsequent (i.e., "outcome") assessment occurring within a window from 45 to 135 days. The chosen window created symmetry around 90 days from the index date. To limit the dataset to CLC-acquired pressure ulcers, records with a hospitalization that (1) occurred between index and outcome assessments and (2) was greater than or equal to 7 days in duration were excluded.

The initial dataset contained 819,112 MDS observations (141,314 CLC residents). First, data from individuals less than 20 years of age were excluded, resulting in 818,982 observations

(140,603 individuals). From these remaining adult observations, 124,247 observations (34,234 individuals) with relevant index and outcome assessments were identified. After records with hospitalizations not meeting study criteria were excluded, 105,274 observations (28,943 individuals) remained in the final dataset. MDS data were augmented using comorbidity data from VHA inpatient and outpatient databases covering the 2 years prior to the index assessment.

Setting and time period

111 VHA facilities were included in the initial database for the retrospective longitudinal examination of pressure ulcer rates. These 111 facilities represented 134 CLCs, because some facilities housed data for multiple geographically-proximate CLCs. Using facility as the unit of measurement allowed for merging of the CLC data with the files used to assess resident comorbidities. Two facilities (each with data for only 1 CLC) were dropped due to incomplete data over various study years. The final dataset comprised 109 facilities with data for each of the study years, representing 132 CLCs. MDS and comorbidity data for FY08-11, augmented by the first two quarters of FY12 to enable inclusion of outcome assessments for index assessments that fell in the latter portion of FY11, were used. The beginning of the study period was chosen to coincide with the VHA's implementation of system-wide CLC culture change performance measurement.

Data Analysis

A risk adjustment model was developed using the 105,274 MDS observations to predict the likelihood of developing a pressure ulcer (c statistic = 0.72). A Bayesian hierarchical model, which adjusts for differences in the precision of pressure ulcer rates of different size facilities, was used to calculate each facility's smoothed risk-adjusted (SRA) pressure ulcer rate under the assumption a linear trend. Specifically, the intercept and slope of the trend line in each facility were estimated. These intercept and slope estimates were then smoothed by giving some weight to the facility-specific estimates and some to the intercept and slope estimates over all facilities. In larger facilities, more weight was given to the facility-specific estimate. Because over 50% of the facilities had 10 or fewer cases of deep pressure ulcers (i.e., stage 3 and 4 only), the analysis was not repeated using this more restricted definition. We used the approximation in Pekoz et al.[16] in the Bayesian model and converted the smoothed estimates in each year to a probability scale and examined the statistical significance of the trend using a generalized linear model for each facility, with the 4 converted SRA pressure ulcer development rates as the dependent variable and year as the independent variable. Facilities with an average number of assessments <50 over the 4-year period (n=13) were excluded from this analysis, because trends for those with small numbers of assessments per year are likely to be unreliable. In addition, the proportion of superficial (stage 2) and deep (stage 3 or 4) pressure ulcers of all new pressure ulcers for each year was calculated and tested for change using a Mantel-Haenzel chi-squre test. For this, records with simultaneous superficial and deep new pressure ulcers were coded as deep. Analyses used WinBUGS and SAS (9.3) software.

RESULTS

The sample consisted mostly of men over the age of 70. Table 1 describes characteristics of residents in each year of the time period.

Median SRA facility pressure ulcer development rates were fairly consistent over the 4 year period at approximately 4%. The median rates for FY08 through FY11, respectively, were 4.1%, 4.3%, 4.1%, and 4.4%. Yearly minimum and maximum rates for individual facilities were 1.2% and 16.0%, 1.2% and 14.5%, 1.1% and 11.4%, and 1.0% and 11.1%, respectively, showing that the range in rates was lower in later years, decreasing from 14.8% to 13.3%, 10.3%, and 10.1%.

Variation in facility pressure ulcer development rates existed. 12 facilities had significantly decreasing (improving) and 12 had increasing (worsening) SRA rates across the years (Table 2). Within these categories, some facilities maintained SRA rates at or below the yearly median. For example, 7 facilities (facility numbers 01–07) began with rates at or better than the median rate in FY08 and significantly decreased their rates over the study period, indicating improvement in facilities that were already doing well. The converse was also true: 2 facilities (facility numbers 17 and 18) with rates below the median rate in FY08 significantly increased to above the FY11 median over the study period.

There was also a significant change ($p<.001$) over time in the proportion of superficial versus deep new pressure ulcers (Table 3). The proportion of new deep ulcers increased across the 4-year period, comprising 27% of all newly detected ulcers in FY08 and 34% by FY11.

DISCUSSION

The changes in care processes and resident autonomy associated with nursing home culture change are theorized to have potential impacts on pressure ulcer prevention. Grabowski et al. identified the mechanism for this as the strength of the complementary nature between quality of life and quality of care.[9] If a facility's adoption of culture change, for example, results in better and closer relationships between nursing home residents and staff, then staff should be more able to work with residents to implement effective pressure ulcer prevention measures. Implementation of culture change that promotes resident quality of life through increased resident autonomy, however, may result in residents making decisions, such as lying only on one side to face a window or remaining seated to watch television, that ultimately increase the likelihood for pressure ulcer development. Culture change is a wide and multi-faceted endeavor, and what VHA promotes at a systems-level differs little from what is taking place in community nursing home settings. This study's results indicate the VHA's implementation of CLC culture change did not have a significant system-wide impact on CLC rates of pressure ulcer development. But there was, over the study period, an increase in the proportion of new deep pressure ulcers.

Berlowitz et al. found a similar average-risk adjusted pressure ulcer development rate as this study, 3.8% across 8 years in the 1990s, with higher rates in the later years (1996=4% and 1997=4.4%).[17] That study found a significant trend over time for ulcers to be less severe,

although the proportion of new deep pressure ulcers increased in the study's final two time periods. Care must be taken when drawing comparisons between this study's results and prior VHA work, because pressure ulcer development rates were obtained with different data sources and different times between assessments. But results from the Berlowitz et al. study allow extrapolation indicating that VHA pressure ulcer development rates may have remained relatively stable from before VHA began any large scale culture change initiative. The impact of culture change initiatives on the proportional severity of new ulcers, however, is unclear.

Other factors may account for these findings, and how organizational culture change initiatives affect pressure ulcer care on a facility- or individual-level remains unknown. This deserves further investigation. In addition, culture change involves multiple components that are often implemented incrementally and with varying intensity,[5, 18] underscoring the need for in-depth data collection and evaluation that takes context into account.[19]

The identification of significant variation in CLC SRA pressure ulcer development rates that existed across the study years may also provide a useful stepping stone to future work. This study identified, for example, significant improvement in the performance of some facilities, although the improvement of a few, while statistically significant, may be too small to be clinically meaningful. A number, however, maintained performance better than the median in all study years, suggesting the presence of positive outliers. Research shows that staffing, staff knowledge, and staff cohesion, as well as management's monitoring care delivery, can all contribute to the provision of high quality preventive care.[20] And quality improvement approaches to preventing pressure ulcers exist.[21] Systematic reviews focusing on the hospital setting identify numerous strategies employed in pressure ulcer prevention.[19, 22] The reviews also highlight the many methodological flaws in the literature and the continuing uncertainty as to whether the interventions lead to sustained improvements. How care is organized into delivery teams, and the function of these teams, is likely to be critical in successful prevention efforts.[23, 24] Because this study supports the existence of positive outliers in a large healthcare system, future nursing home research may do well to focus on organizational and individual factors affecting sustained pressure ulcer prevention in high performing facilities such as these and the mechanisms by which these facilities achieve their results, including the impact of local context.[19, 25]

This study has strengths and limitations. It is the first longitudinal examination of CLC SRA pressure ulcer rates. It therefore gives a more accurate picture of the performance of pressure ulcer prevention in a large, nation-wide system than has been available to date. Further, the use of smoothed estimates from the Bayesian model reduces the chances of being misled by large random fluctuations associated with relatively rare events, particularly from smaller facilities. The types of smoothed estimates used in this study have been shown to better predict the future than the use of raw rates.[26]

The use of observational data in this study limits the ability to draw causal associations. The evaluation of trends, however, has been used in prior research to infer the effectiveness of specific interventions and system-wide changes.[17, 27, 28] But the possibility remains that the results reflect influences outside the scope of the study. Indeed, because this study was

designed to present a system-wide perspective, it did not examine influences at the facility-level, and it is unclear whether the presumed change mechanism—culture change—was actually enacted in each facility. Examination of pressure ulcer development rates in CLCs in the years prior to the 2008 VHA adoption of culture change might also shed useful light on change practices. Future research should examine these issues.

In conclusion, over time system-wide CLC SRA pressure ulcer development rates after culture change implementation remained stable in facilities, with a decrease in the range of rates in later years, but with an increase in the proportion of new deep pressure ulcers. Significant facility-level variation in rates existed and included facilities that significantly improved. These results should, in future, be augmented by research that explores how culture change is implemented across a healthcare system and the facility- and individual-level interactions between culture change and pressure ulcer prevention. The organizational- and individual-level factors that facilitate consistent, high-quality care also remain to be explored.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Selected characteristics of CLC residents for fiscal years 08–11

Characteristics	FY'08 (%)	FY'09 (%)	FY'10 (%)	FY'11 (%)
Age (mean) +/− SD[a]	74(12.3)	74(12.4)	74(12.5)	74(12.4)
Gender (% men)	96.5	96.5	96.5	96.5
Body mass index (mean) +/− SD[a]	23.5 (2.3)	23.6 (2.3)	23.6 (2.3)	23.7 (2.2)
Bedfast all or most of time	4.1	3.0	2.6	3.2
Bladder incontinence correction (bladder incontinence or indwelling catheter)	39.7	40.3	40.2	39.8
Cancer	21.9	22.3	21.9	20.0
Diabetes mellitus	42.3	43.7	44.2	43.9
Edema (present in last 7 days)	13.3	15.1	15.7	15.7
End-stage disease (6 or fewer months to live)	5.5	5.7	6.3	6.8
Functional foot limitation on both sides	18.9	18.9	18.9	19.3
Hip fracture	7.1	6.2	5.4	4.2
History of resolved pressure ulcer	5.0	7.9	7.7	8.1
Paraplegia or quadriplegia infection	5.6	6.1	5.8	5.9
Peripheral vascular disease	5.3	5.2	5.0	5.0
Transfer, total dependence	22.6	22.2	22.6	22.7
Urinary tract infection	45.1	42.9	37.3	30.3

[a]Standard deviation

Table 2

Facilities with Significant Increases or Decreases in Smoothed Risk-Adjusted (SRA) Pressure Ulcer Development Rates over 4-Year Period[a, b]

Facility	Average Eligible Assessments (FY08-11)	SRA Rate FY08 (%)	SRA Rate FY09 (%)	SRA Rate FY10 (%)	SRA Rate FY11 (%)	Model Coefficient	P-value
Facilities with Significant Decreases in SRA Rates over 4-Year Period							
01	424	1.2	1.2	1.1	1.0	−0.053	0.03
02	298	1.9	1.8	1.5	1.4	−0.186	0.013
03	309	2.3	1.8	1.6	1.5	−0.247	0.041
04[b]	422	2.8	2.8	2.5	2.3	−0.173	0.046
05	260	2.8	2.8	2.7	2.7	−0.058	0.003
06	575	4.0	3.7	2.8	2.7	−0.464	0.034
07	362	4.1	3.6	2.9	2.7	−0.471	0.017
08	197	4.2	3.9	3.5	3.2	−0.339	<.001
09	250	5.6	5.0	4.0	3.9	−0.604	0.033
10	751	6.0	5.8	5.1	4.6	−0.486	0.009
11	158	7.7	7.4	6.8	6.0	−0.581	0.021
12	86	16.0	14.5	10.3	8.6	−2.645	0.019
Facilities with Significant Increases in SRA Rates over 4-Year Period							
13	574	1.7	1.8	1.8	1.9	0.085	0.025
14[c]	378	1.8	2.1	2.4	2.6	0.287	0.003
15	677	2.4	2.7	3.3	3.4	0.366	0.04
16	83	2.8	3.2	3.8	4.2	0.501	0.005
17[c]	440	3.1	3.4	4.1	4.7	0.551	0.006
18	268	3.2	3.5	4.0	4.6	0.45	0.011
19	352	3.3	4.0	4.2	4.4	0.356	0.041
20[d]	1083	3.5	3.7	3.8	3.9	0.124	0.047
21	90	4.7	5.0	6.0	7.1	0.83	0.025
22	179	5.1	6.1	6.4	7.9	0.864	0.029

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Facility	Average Eligible Assessments (FY08-11)	SRA Rate FY08 (%)	SRA Rate FY09 (%)	SRA Rate FY10 (%)	SRA Rate FY11 (%)	Model Coefficient	P-value
23	142	6.1	6.5	7.0	7.3	0.381	0.004
24	167	6.9	7.1	7.8	8.2	0.455	0.021

[a] Significance calculated using a generalized linear model per facility, with 4 data points (FY08-11 SRA rates) as dependent variable and year as independent variable

[b] Median SRA rates for each year FY08 to 11 were, respectively, 4.1, 4.3, 4.1, and 4.4

[c] Facility represents 2 CLCs

[d] Facility represents 6 CLCs

Table 3

Percent of Community Living Centers (CLC) Residents' New Pressure Ulcers That Were Superficial (stage 2) or Deep (stages 3 and 4) over 4-Year Period

	FY'2008	FY'2009	FY'2010	FY'2011	Mantel-Haenszel Chi-Square
Stage 2 Ulcers (%)	72.9	71.0	71.1	66.0	<.001
Stage 3&4 Ulcers (%)	27.1	29.0	28.9	34.0	