Long-Term Care Facility Variation in the Incidence of Pneumonia and Influenza

Elliott Bosco,[1,2] Andrew R. Zullo,[1,2,3,4] Kevin W. McConeghy,[1,2,4] Patience Moyo,[1,2] Robert van Aalst,[5,6] Ayman Chit,[6,7] Vincent Mor,[1,2,4] Stefan Gravenstein[1,2,4]

[1]Dept. of Health Services, Policy and Practice, Brown University School of Public Health, Providence, RI, [2]Center for Gerontology and Health Care Research, Brown University School of Public Health, Providence, RI, [3]Dept. of Epidemiology, Brown University School of Public Health, Providence, RI, [4]Center of Innovation in Long-Term Services and Supports, Providence Veterans Affairs Medical Center, Providence, RI, [5]Dept. of Health Science, University of Groningen, Groningen, Netherlands; [6]Sanofi Pasteur, Swiftwater, PA, [7]Leslie Dan School of Pharmacy, University of Toronto, Ontario, Canada.

BACKGROUND

- Pneumonia and influenza (P&I) are important public health concerns, with ~90% of deaths in older adults.
- P&I infection and hospitalization risk is highest for older adults residing in long-term care facilities (LTCFs).
- LTCF characteristics may influence P&I hospitalization rates, however risk-factors are unknown.
- Our primary objectives were to:

i) Determine how P&I rates vary across LTCFs.
ii) Identify modifiable LTCF characteristics associated with lower P&I rates.

STUDY DESIGN

- Retrospective cohort study linking Medicare claims to Minimum Data Set (MDS) assessments and LTCF data.
- Inclusion: LTCF residents 01/01/2013 - 12/31/2015
- Exclusion: <65 years old, HMO enrollment, LTCF <180 days person-time (PT), missing covariates.
- Residents classified as short-stay (1-99 days) or long-stay (≥100 days) based on PT.

MEASURES

- Hospitalizations with first diagnosis positions of ICD-9 480.xx-488.xx or ICD-10 J09-J18 identified as P&I.
- Only hospitalizations from the LTCF were evaluated and follow-up (PT) was person-days from LTCF entry to exit.
- LTCF Characteristics: Structural, staffing, and quality covariates derived from LTCFocus and OSCAR/CASPER.
- Resident Characteristics: Demographics and active comorbidities derived from MDS.

STATISTICAL ANALYSIS

- Crude incidence rates (IRs) = P&I hospitalizations divided by PT, scaled to 100 person-years.
- Standardized risk ratio (SRR) for LTCFs found by hierarchical logistic regression: 39 resident covariates (MDS) and LTCF hospitalization rate (LTCFocus).
- SRR x overall crude IR = risk-standardized IR (RSIR).
- Bootstrapped (n=500) for 95% confidence intervals.
- LTCFs stratified by median RSIR, with higher RSIRs meaning higher adjusted P&I rates, and compared.

Table 1. LTCF Characteristics

	Short-stay		Long-stay	
	<Median RSIR (n=6,841)	≥Median RSIR (n=6,842)	<Median RSIR (n=7,248)	≥Median RSIR (n=7,248)
Beds	115.3 (62.6)	108.1 (56.0)	113.7 (63.6)	106.0 (54.9)
Admissions/bed	2.3 (2.5)	1.8 (1.5)	2.3 (2.5)	1.6 (1.3)
Short-stay PT	0.2 (0.1)	0.1 (0.1)	0.2 (0.1)	0.1 (0.1)
Physician extender	3,069 (44.9%)	2,846 (41.6%)	3,433 (47.4%)	2,746 (37.9%)
RN HPRD	0.5 (0.7)	0.4 (0.4)	0.5 (0.7)	0.4 (0.4)
%Antipsychotic use	21.4 (11.6)	23.6 (13.2)	22.2 (14.3)	25.5 (15.0)

Note: Table presents either mean (standard deviation) or count (%). All characteristics above and below median RSIRs are significantly different ($p<0.05$) for short-stay and long-stay residents. Abbreviations: LTCF, long-term care facility; RSIR, risk-standardized incidence rate; PT, person-time; RN, registered nurse; HPRD, hours per resident day.

Figure 1. Short−stay Risk−standardized P&I Hospitalization Rates, per 100 Person−years

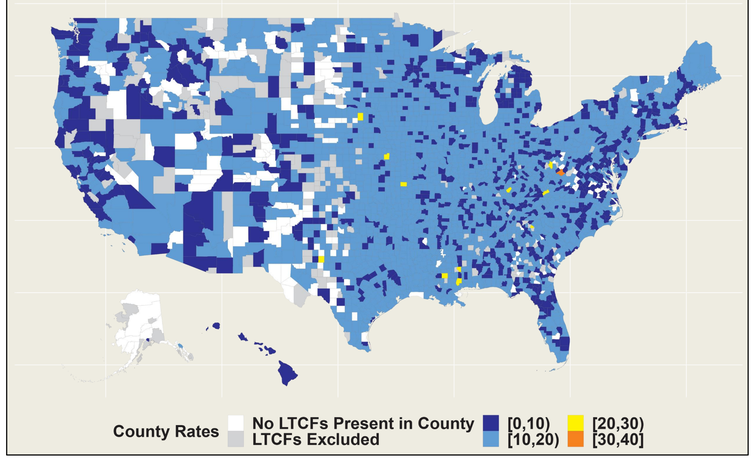
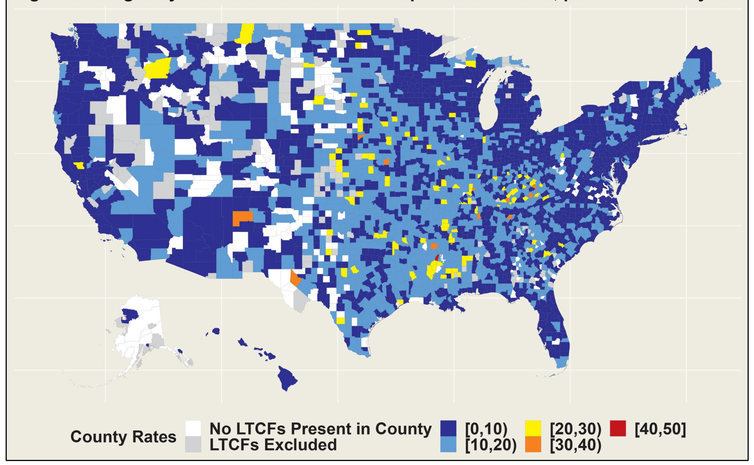


Figure 2. Long−stay Risk−standardized P&I Hospitalization Rates, per 100 Person−years



RESULTS

- From 7.2 million residents (15, 887 LTCFs), the final cohort was 1,767,241 short-stay (13,683 LTCFs) and 922,863 long-stay residents (14,495 LTCFs).
- The median RSIR per 100 person-years was 10.16 (IQR: 9.37-11.82) for short-stay residents, and 8.51 (IQR: 6.87-10.92) for long-stay residents.
- Non-significant factors: chain, for-profit, SLP (short-stay).

Figure 3. LTCFs Ranked by RSIR

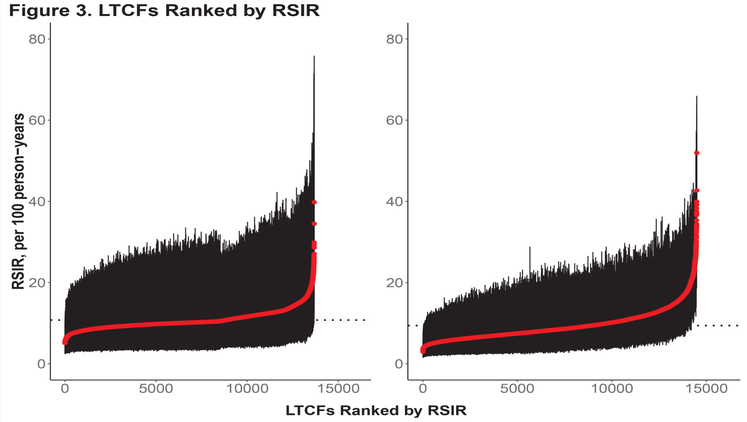


Figure 3: LTCF ranked from lowest (rank=1) to highest by RSIR. Red dots are the point estimate RSIR for LTCFs. The black bars are 95% confidence intervals calculated by the bootstrap percentile method with 500 replications. The dashed line is the overall LTCF average RSIR.

LIMITATIONS

- Resident demographics derived from MDS assessments that occurred after admission, which may induce over-adjustment.
- LTCF payments not accounted for. Increased revenue could lead to improved services and outcomes.

CONCLUSIONS

- Rates varied widely across LTCFs and counties when adjusting for resident characteristics.
- Hiring more RN's or physician extenders, increased staffing hours, and high quality care practices may reduce P&I hospitalization rates.
- Improving these factors may reduce the burden of P&I for older adults and address a major public health issue.

FUNDING

Research was supported by Sanofi Pasteur.