The Quality of Nursing Homes That Serve Patients With Human Immunodeficiency Virus

David J. Meyers, MPH,* *Ira B. Wilson, MD, MS,** *Yoojin Lee, MS, MPH,**
Shubing Cai, PhD,† *Susan C. Miller, PhD,** *and Momotazur Rahman, PhD**

BACKGROUND/OBJECTIVES: As the national population of persons living with human immunodeficiency virus (HIV) ages, they will require greater postacute and long-term care use. Little is known about the quality of nursing homes (NHs) to which patients with HIV are admitted. In this study, we assess the association between the number of persons with HIV admitted annually to a given NH (HIV concentration) and that NH's quality outcomes.

DESIGN: A cross-sectional comparative study.

SETTING: NHs in nine states, from 2001 to 2012.

PARTICIPANTS: A total of 46 918 NH-years accounting for 67 301 admissions by patients with HIV.

MEASUREMENTS: We used 100% Medicaid Analytic Extract, Minimum Dataset 2.0 and 3.0, and Medicare claims from 2001 to 2012 from nine states to examine the association between HIV concentration and NH quality. Persons were classified as HIV positive on the basis of all available data sources, and a NH's percentage of new admissions with HIV was calculated (HIV concentration). We then compared differences in star ratings, rehospitalization rates, NH survey deficiencies, and restraint use by a NH's percentage of admissions with HIV, using linear random effects models.

RESULTS: After adjusting for NH characteristics, zip code characteristics, and state and year fixed effects, NHs with greater than 0% to 5% of admissions with HIV had a 0.6 lower star rating (*P* < .001), and a 0.4% percentage point higher 30-day rehospitalization rate (*P* < .01), compared to those with no HIV admissions. NHs with 5% to 50% of admissions with HIV had 7.0 more deficiencies (*P* < .001), a 0.1 lower star rating (*P* < .001), and a 1.5 percentage point higher rehospitalization rate (*P* < .001).

CONCLUSION: Persons with HIV were generally admitted to lower-quality NHs compared to persons without HIV. More efforts are needed to ensure that persons with HIV have access to high-quality NHs. **J Am Geriatr Soc 67:2615-2621, 2019.**

Key words: GINI coefficient; human immunodeficiency virus; nursing home quality

From the *Department of Health Services, Policy, and Practice, Brown University School of Public Health, Providence, Rhode Island; and the †Department of Public Health Sciences, University of Rochester Medical Center, Rochester, New York.

Address correspondence to David J. Meyers, MPH, Department of Health Services, Policy, and Practice, Brown University School of Public Health, 121 S Main St, Providence, RI 02912. E-mail: david_meyers@brown.edu; Twitter: @djmeyers2.

With the success of human immunodeficiency virus (HIV) antiretroviral therapy, persons living with HIV (PLWH) in the United States are living longer, and aging. With this success comes the new challenge of meeting the increasing need for nursing home (NH) care. Caring for PLWH can be complex,[1,2] and NH providers have little experience with HIV. PLWH are also often members of stigmatized groups, who consistently experience disparities in care.[3-6] Little is known about NH care for PLWH, such as what facilities they are admitted to, the quality of the care they receive, and the outcomes of that care. Absent such information it will not be possible to prepare and train NH staff to effectively and efficiently care for the large numbers of aging PLWH who in the next decade will require NHs at increasing rates.

Past work on PLWH and NHs has focused on single facilities or has used older data.[7-10] Two recent studies using Medicaid data have assessed trends in HIV care among long-stay NH residents.[11,12] PLWH were found to have higher rates of dementia than those without in NHs,[11] and older residents with HIV had poorer activity of daily living improvement than younger residents with HIV.[12] We build on this literature by focusing on the NHs that residents with HIV are admitted to, with a focus on new admissions, to get a better understanding of trends across the country.

HIV infection varies regionally and even by zip code within the same city.[13] Most PLWH live in low-income

neighborhoods, and NHs near low-income neighborhoods often provide lower quality of care; most people are admitted to NHs in their neighborhoods.[6] It is possible that PLWH may be steered toward NHs with a higher concentration of other PLWH, as has occurred for nonwhite[6] and dual-eligible patients.[14,15] In this article, we describe the concentration of HIV across NHs and compare indicators of overall NH quality for NHs with varying experience caring for PLWH.

METHODS

Data Sources

We used the Medicaid Analytic Extract (MAX) files from 2001 to 2012 from nine states. The MAX files contain complete Medicaid enrollment information from states and 100% outpatient, inpatient, and pharmacy claims for fee-for-service (FFS) Medicaid enrollees and most Medicaid managed care enrollees. To identify NH stays, we used the Minimum Data Set (MDS) versions 2.0 (2001-2009) and 3.0 (2010-2012). The MDS is a federally mandated assessment at admission and quarterly required for all residents in Medicare- or Medicaid-certified facilities regardless of their FFS or managed care enrollment.[16] The reliability and validity of the MDS data are generally high.[17-20] Data from 2012 are the most recent individual-level data available from the Centers for Medicare and Medicaid Services (CMS) on Medicaid across states. We include both Medicaid FFS and managed care enrollees in our analysis. While the MAX files may not always be complete for managed care enrollees, in internal validation checks we did not find substantial differences in reporting of claims in our states and years.

We include data from nine high HIV prevalence states (Florida, Georgia, Louisiana, North Carolina, New York, Ohio, Pennsylvania, Texas, and Virginia) that do not redact HIV diagnosis data from the MDS.[7,21] We combined the MAX data with 100% Medicare Beneficiary Summary Files and Medicare claims data from the same time period and states. These data provided us with detailed claims information for over 85% of all NH admissions in a year in the nine included states.

For descriptive and quality characteristics of NHs, we use the Online Survey & Certification Automated Record (OSCAR), LTCfocus.org, and CMS's Nursing Home Compare, each of which provides NH-level characteristics and quality measures. Finally, we linked enrollee zip codes to local neighborhood characteristics from the American Community Survey.

Classification of Residents With HIV

First, we classified someone as having HIV if the person had a positive diagnosis for HIV on his/her MDS 2.0 or 3.0 record from admission. Second, if there was no HIV diagnosis on the MDS record and the resident had Medicaid coverage, we used a previously developed method to classify patients with HIV on the basis of medical and prescription claims data.[22] Third, if the resident had Medicare coverage, we linked his/her MDS record to available inpatient and outpatient Medicare claims data and checked for a diagnosis of HIV. If any of these three sources yielded an HIV diagnosis, then we considered the resident to be HIV positive.

NH HIV Concentration

We calculated the percentage of all new admissions to each NH in a given year that were for residents with HIV. To restrict our analysis to new admissions, we excluded any enrollee who had an NH admission in the prior 12 months. Our concentration variable can be interpreted as the incident concentration of HIV in an NH within a year. Based on the distribution of these concentrations, we created flags for no HIV (0%), low concentration (>0%-5%), medium concentration (>5%-50%), and high concentration (>50%) (only Florida and New York had any high concentration).

Outcomes

We used four NH-level outcomes: the deficiency count reported in OSCAR, which is an unweighted count of total
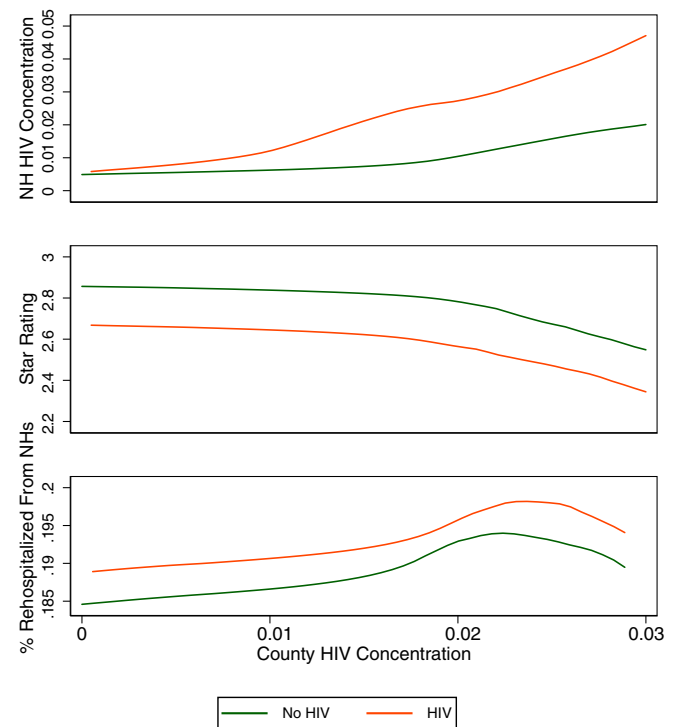

Figure 1. Nursing home (NH) concentration and characteristics by county human immunodeficiency (HIV) concentration and HIV status. In each panel, the x axis displays the percentage of skilled nursing facility (SNF) admissions from a given county that were for a patient with HIV. The top panel shows for patients with HIV and patients without HIV, the average HIV concentration of the SNF they are admitted to, arrayed by their residential county HIV concentration. The middle panel shows the average star rating that patients with and without HIV are admitted to, arrayed by their residential county HIV concentration. The bottom panel shows the average 30-day rehospitalization rate of the admitted SNF for patients with and without HIV, arrayed by their residential county HIV concentration.

measured deficiencies at the NH each year; the 2009 to 2012 NH Compare star rating;[23] and quality indicators reflecting the percentage of NH residents with physical restraint use and with 30-day rehospitalizations.

Explanatory Variables

We included in our analysis NH for-profit ownership status, multifacility status, hospital-based status, count of beds, and occupancy rates; and race/ethnicity makeup were additional controls in our analysis. We acquired each of these variables from LTCfocus.[24] From the census, we also include zip code characteristics for demographics, median income, employment rater, home renter rate, rurality, and poverty rate.

Statistical Analysis

At the individual level, we first compare the characteristics of NHs that patients with and without HIV are admitted to. For the remainder of the study, our unit of analysis was the NH-year.

At the NH level, we compare the characteristics of NHs with different concentrations of patients with HIV. In Supplementary Figure S1, we use Gini coefficients to compare the inequality of the distribution of HIV across NHs and states.[25]

To see if any differences in the quality of NHs persisted for patients with HIV after controlling for other NH characteristics, we estimated a linear random effects model with robust SEs for each NH quality of care outcome. In each model, we included dummy variables for the NH's HIV volume (low, medium, and high; with no HIV as the reference), NH characteristics, and zip code demographic characteristics to adjust for local neighborhood characteristics that may be related to quality and state and year fixed effects, and robust SEs. In all models, we included an NH random effect that allows us to account for multiple observations from the same NH over time. New York and Florida were unique in that both states had several NHs with high concentrations of HIV. To ensure that these NHs are not driving the results, we fit sensitivity models in Supplementary Tables S1 and S2, both excluding and only including those two states for comparison.

RESULTS

Sample Characteristics

We identified a sample of 46 918 NH-years made up of 4178 NHs nationally between 2001 and 2012. Of the 6 631 275 admissions, we find 67 301 were by persons we classify as having HIV (1.1%). Supplementary Figures S1 and S2

Table 1. NH characteristics by category of HIV concentration

Characteristics	HIV category, %			
	0	0-5	5-50	>50
NH-years, No. (%)	27 198 (58.0)	17 622 (37.6)	1996 (4.3)	102 (0.2)
All patients, No. (%)	2 820 178 (44.5)	3 300 255 (52.1)	203 126 (3.2)	7716 (0.1)
PLWH, No. (%)	0 (0)	38 703 (57.5)	21 604 (32.1)	6994 (10.4)
NH characteristics				
HIV concentration, %	0.0	1.5	10.1	93.7
For profit, %	60.4	72.7	73.2	9.8
Hospital based, %	9.2	8.8	6.4	0.0
Multifacility, %	53.0	58.4	51.1	3.9
Total beds, n	107.8	146.0	161.9	105.9
Occupancy rate, %	86.6	87.0	84.2	95.1
Total RNs, n	4.6	6.1	4.1	7.3
Total LPNs, n	12.5	15.8	27.8	5.1
Those with AIDS unit, %	0.04	0.1	4.2	45.1
MA, %	13.0	17.8	12.6	3.7
Medicare, %	16.8	20.6	11.3	2.3
Medicaid, %	57.3	59.2	77.4	96.3
Female, %	74.1	70.1	56.0	34.2
NH race/ethnicity, %				
Black	12.8	26.4	44.1	54.5
White	88.4	76.2	47.9	10.6
Asian	0.4	0.9	1.1	0.2
Hispanic	2.5	7.1	18.2	42.6
NH quality outcomes				
Deficiency count, n	33.1	38.2	50.6	22.6
Rehospitalization rate, %	18.0	20.1	21.3	35.2
Adjusted successful discharge rate, %	57.5	58.8	50.9	43.2
Overall star rating, stars	3.1	2.8	2.7	4.2

Note: Unit of analysis is NH-year. HIV categories are the percentage of all admissions within that year that are for a patient with HIV.
Abbreviations: HIV, human immunodeficiency virus; LPN, licensed practical nurse; MA, medicare advantage; NH, nursing home; PLWH, persons living with HIV; RN, registered nurse.

Table 2. NH-year mixed regression models

Variables	Deficiency count		Star rating		Percentage of 30-d rehospitalization		Percentage of restraint use	
	Coefficient	95% CI	Coefficient	95% CI	Coefficient	95% CI	Coefficient	95% CI
HIV category (reference = 0)								
0%-5% HIV	0.6	−0.6 to 1.8	−0.1**	−0.1 −0.0	0.4**	0.3 to 0.5	−0.1	−0.2 to 0.1
5%-50% HIV	7.0**	4.0 to 9.9	−0.1**	−0.3 to −0.0	1.5**	1.2 to 1.8	−0.2	−0.6 to 0.1
>50% HIV	−5.8	−21.5 to 9.9	0.5	−0.2 to 1.3	4.3**	1.7 to 6.9	−0.3	−3.0 to 2.3
State (reference = Florida)								
Georgia	−5.6**	−9.6 to −1.7	−0.3**	−0.5 to −0.2	−0.5	−1.3 to 0.2	0.8*	0.1 to 1.5
Louisiana	2.2	−4.5 to 9.0	−0.5**	−0.8 to −0.1	−1.1	−2.3 to 0.1	2.6**	1.4 to 3.7
North Carolina	−16.4**	−19.7 to −13.2	−0.1	−0.2 to 0.0	−1.8**	−2.4 to −1.2	0.5	−0.1 to 1.1
New York	−8.0**	−11.1 to −4.9	−0.4**	−0.5 to −0.2	0.0	−0.5 to 0.6	−0.1	−0.6 to 0.5
Ohio	−14.2**	−16.9 to −11.5	−0.4**	−0.5 to −0.2	0.9**	0.4 to 1.4	−0.5	−1.0 to 0.0
Pennsylvania	−14.3**	−17.0 to 11.5	−0.4**	−0.5 to −0.2	0.3	−0.2 to 0.8	−1.5**	−2.0 to −1.0
Texas	6.3**	3.2 to 9.5	−0.6**	−0.7 to −0.4	−1.7**	−2.3 to −1.2	1.3**	0.7 to 1.9
Virginia	−7.1**	−11.2 to −3.0	−0.3**	−0.5 to −0.1	−2.2**	−3.0 to −1.5	−1.5**	−2.2 to −0.7
Year (reference = 2001)								
2002	−4.1**	−6.4 to −1.9			0.1	−0.1 to 0.4	−0.5**	−0.7 to −0.2
2003	−7.5**	−9.7 to −5.2			0.7**	0.4 to 0.9	−1.5**	−1.8 to −1.3
2004	−8.3**	−10.5 to −6.0			0.8**	0.6 to 1.0	−2.3**	−2.5 to −2.0
2005	−4.8**	−7.1 to −2.5			1.0**	0.7 to 1.2	−3.0**	−3.2 to −2.7
2006	−2.7*	−5.0 to −0.4			1.1**	0.8 to 1.3	−3.5**	−3.8 to −3.3
2007	−4.2**	−6.5 to −1.9			1.4**	1.1 to 1.6	−4.3**	−4.6 to −4.0
2008	−3.3**	−5.6 to −1.0			1.5**	1.3 to 1.8	−5.4**	−5.6 to −5.1
2009	−3.6**	−5.9 to −1.3			1.5**	1.2 to 1.7	−6.1**	−6.4 to −5.9
2010	−8.4**	−10.7 to −6.2	0.1**	0.1 to 0.2	2.5**	2.3 to 2.8	−6.6**	−6.9 to −6.4
2011	−10.1**	−12.4 to −7.8	0.2**	0.2 to 0.2	1.4**	1.1 to 1.6	−7.0**	−7.2 to −6.7
2012	−8.6**	−13.8 to −3.4	0.3**	0.2 to 0.3	0.4**	0.2 to 0.7	−7.2**	−7.5 to −6.9
Hospital based	−7.3**	−10.0 to −4.6	0.2**	0.0 to 0.3	−3.9**	−4.3 to −3.5	−3.2**	−3.6 to −2.7
Multifacility	0.5	−0.9 to 1.9	−0.2**	−0.2 to −0.1	0.1	−0.0 to 0.3	0.0	−0.2 to 0.2
For profit	5.9**	4.3 to 7.5	−0.5**	−0.6 to −0.4	1.8**	1.5 to 2.0	0.5**	0.2 to 0.7
Total beds	0.0**	0.0 to 0.0	−0.0**	−0.0 to −0.0	0.0**	0.0 to 0.0	0.0**	0.0 to 0.0
Occupancy	0.0	−0.0 to 0.1	−0.0**	−0.0 - −0.0	−0.0**	−0.0 to −0.0	0.0**	0.0 to 0.0
Unemployment rate	−0.0	−0.3 to 0.2	0.0	−0.0 to 0.0	−0.0	−0.0 to 0.0	−0.0	−0.1 to 0.0
% White	−0.0	−0.2 to 0.2	0.0	−0.0 to 0.0	0.1**	0.0 to 0.1	0.1**	0.1 to 0.1
% Black	−0.0	−0.3 to 0.2	0.0	−0.0 to 0.0	0.2**	0.1 to 0.2	0.1**	0.0 to 0.1
% AI/AN	0.1	−0.3 to 0.6	−0.0	−0.0 to 0.0	0.2**	0.1 to 0.3	0.1	−0.0 to 0.1
% Asian	−0.4*	−0.7 to −0.1	0.0*	0.0 to 0.0	0.2**	0.2 to 0.3	0.1*	0.0 to 0.1
% Hispanic	−0.1**	−0.2 to −0.1	0.0**	0.0 to 0.0	0.1**	0.1 to 0.1	0.0**	0.0 to 0.0

	Estimate	CI	Estimate	CI	Estimate	CI	Estimate	CI
% Renter	0.0	−0.1 to 0.1	0.0	−0.0 to 0.0	0.0	−0.0 to 0.0	−0.0**	−0.0 to −0.0
% Rural	−2.8	−6.4 to 0.8	−0.0	−0.2 to 0.2	0.8*	0.1 to 1.4	0.7*	0.0 to 1.3
% In poverty	0.1	−0.1 to 0.3	−0.0*	−0.0 to −0.0	0.0	−0.0 to 0.0	0.0	−0.0 to 0.0
Constant	47.3**	23.1 to 71.4	3.8**	2.7 to 4.9	6.9**	2.7 to 11.2	−0.5	−4.9 to 3.9
Observations	34 980		13 690		34 980		34 980	
No. of groups	4146		3817		4146		4146	

Note: Estimates are from linear mixed models with a random effect for NH and robust SEs. Unit of analysis is NH-year. NH characteristics come from Online Survey & Certification Automated Record and Certification and Survey Provider Enhanced Reporting (CASPAR) data. Zip code characteristics come from the American Community Survey. Star ratings for NHs were first released in 2009, so the time span for the star rating outcome is 2009 to 2012. We included year fixed effects to adjust for any trends over time and state fixed effects to account for difference in state policy and data reporting. While not all outcomes of interest are strictly linear, we used linear models as they enable us to include fixed effects without the incidental parameter problem.[26]

Abbreviations: AI, American Indian; AN, Alaska Native; CI, confidence interval; HIV, human immunodeficiency virus; NH, nursing home.

*$P < .05$.
**$P < .001$.

show the GINI coefficients and distributions of NH HIV concentration across states and find some variation in the variation and distribution of HIV in NHs.

In Figure 1, we plot, at the county level, the characteristics of NHs that patients with and without HIV were admitted to, arrayed by the county HIV admission concentration. In the first panel, we find that from the same counties, patients with HIV were more often admitted to NHs with greater concentrations of HIV. In the second and third panels, we find that patients with HIV tended to be admitted to NHs with lower star ratings and higher readmission rates than patients without HIV.

In Table 1, we present descriptive NH characteristics by the concentration of new HIV admissions in each NH year. Approximately 45% of NHs did not have a single PLWH admitted during the study years. NHs with higher HIV concentrations tended to be less white, larger, and more often for profit, with the exception of the greater than 50% NHs, which appeared markedly different.

In Table 2, we present the model results. After adjustment, NHs with 0% to 5% HIV had a 0.4% percentage point higher 30-day rehospitalization rate ($P < .001$) compared with NHs with no HIV admissions. NHs with 5% to 50% of admissions HIV positive had 7.0 more deficiencies ($P < .001$), a 0.1 lower star rating ($P < .001$), and a 1.5 percentage point higher rehospitalization rate ($P < .001$). We did not find any statistically significant associations between HIV concentration and restraint use. The sensitivity models in Supplementary Tables S1 and S2 found similar results.

In Supplementary Figure S3, we plot adjusted quality outcomes in increments of NH concentration and find similar results to the models, that as HIV concentration increases, quality indicators worsen, with the exception of several high concentration facilities.

DISCUSSION

We find that residents with HIV tend to be admitted to NHs with higher concentrations of HIV and lower quality than residents without HIV. This remains true when comparing residents who live in the same county as one another. PLWH are admitted to NHs that have higher survey deficiencies, higher readmission rates, and lower star ratings. Additionally, as HIV concentration increases, these quality indicators tend to get worse, with the exception of NHs with high (>50%) HIV concentration, which appear to be systematically different.

While our study design does not allow us to determine if residents with HIV are steered to worse NHs, or if they happen to live near NHs with worse attributes, our county-level analysis and analysis of GINI coefficients are indicative of there being a greater inequality of HIV distribution in NHs than in neighborhoods across states. It may be that when a patient with HIV in a hospital needs to be discharged to a NH, discharge planners may consider NH concentrations when choosing where to send those patients. However, despite whether neighborhood effects or steering is the primary driver of HIV concentration in NHs, it is clear, even after adjusting for NH and neighborhood characteristics, that patients with

HIV are admitted to poorer quality ones. Resident-level research is needed to determine if being in a higher HIV concentration NH conveys any benefits for HIV residents.

We find a subset of high HIV concentration NHs in Florida (N = 3) and New York (N = 10) that have a different profile than those in most of the rest of the country. These NHs tend to be higher quality and have much younger and more Medicaid-eligible enrollees. While further studying these NHs is outside the scope of this study, these NHs are likely a historical artifact of earlier stages of the HIV/AIDS crises.

Our study is subject to several limitations. First, the data used in this study are from 2012, and it is unknown whether the patterns we describe have changed in the past several years. We cannot rule out the possibility of unmeasured confounding of our results by other NH factors, so the results of this study can only be interpreted as associational. Second, we only include data from nine states. While these states represent a large proportion of the national PLWH population, we cannot assure that our results will generalize to all states in the country. Third, while we believe that the data used from our states and years are largely complete for managed care enrollees, for patients who are not enrolled in Medicaid, we may be undercounting cases of HIV among Medicare Advantage enrollees, where claims data are not available.

Using a large nine-state population-based sample of NH residents from 2001 to 2012, we find that NH residents with HIV appear to be admitted to NHs with poorer quality. As the concentration of HIV in a NH increases, NH quality appears to be lower, with the exception of a subset of NHs with high HIV concentrations. Given increasing aging among the national population of patients with HIV, more efforts are needed to ensure PLWH are admitted to higher-quality NHs.

ACKNOWLEDGMENTS

Conflict of Interest: The authors declare no financial or personal conflicts of interest.

Author Contributions: All authors were involved in the study concept and design and acquisition of the data. D.J.M. and M.R. were involved in the analysis. All authors were involved in the interpretation of data and the preparation of the manuscript.

Sponsor's Role: The funders had no role in the design, methods, recruitment, data collection, analysis, or preparation of the data.

REFERENCES

1. Justice AC. HIV and aging: time for a new paradigm. Curr HIV/AIDS Rep. 2010;7(2):69-76. https://doi.org/10.1007/s11904-010-0041-9.
2. Braithwaite RS, Justice AC, C-CH C, et al. Estimating the proportion of patients infected with HIV who will die of comorbid diseases. Am J Med. 2005;118(8):890-898. https://doi.org/10.1016/j.amjmed.2004.12.034.
3. Fredriksen-Goldsen KI, Jen S, Bryan AEB, Goldsen J. Cognitive impairment, Alzheimer's disease, and other dementias in the lives of lesbian, gay, bisexual and transgender (LGBT) older adults and their caregivers: needs and competencies. J Appl Gerontol. 2018;37(5):545-569. https://doi.org/10.1177/0733464816672047.
4. Hooyman NR, Gupta S. Addressing the intersectionality of race, gender and immigration status in long-term care. Innov Aging. 2017;1(suppl 1):1383-1383. https://doi.org/10.1093/geroni/igx004.5091.
5. Feng Z, Fennell ML, Tyler DA, Clark M, Mor V. The care span: growth of racial and ethnic minorities in US nursing homes driven by demographics and possible disparities in options. Health Aff (Millwood). 2011;30(7):1358-1365. https://doi.org/10.1377/hlthaff.2011.0126.
6. Rahman M, Foster AD. Racial segregation and quality of care disparity in US nursing homes. J Health Econ. 2015;39:1-16. https://doi.org/10.1016/j.jhealeco.2014.09.003.
7. Buchanan RJ, Wang S, Huang C. Analyses of nursing home residents with HIV and dementia using the minimum data set. J Acquir Immune Defic Syndr. 2001;26(3):246-255. https://doi.org/10.1097/00042560-200103010-00006.
8. Selwyn PA, Goulet JL, Molde S, et al. HIV as a chronic disease: implications for long-term care at an AIDS-dedicated skilled nursing facility. J Urban Health. 2000;77(2):187-203. https://doi.org/10.1007/BF02390530.
9. Pearson WS, Hueston WJ. Treatment of HIV/AIDS in the nursing home: variations in rural and urban long-term care settings. South Med J. 2004;97(4):338-341. https://doi.org/10.1097/01.SMJ.0000118901.22061.EE.
10. Buchanan RJ, Wang S, Huang C. Profiles of nursing home residents with HIV. J Health Care Poor Underserved. 2002;13(3):379-391. https://doi.org/10.1353/hpu.2010.0698.
11. Miller S, Cai S, Daiello L, Shireman T, Wilson IB. Nursing home residents by HIV status: characteristics, dementia diagnoses and antipsychotic use. J Am Geriatr Soc. 2019;67:1353-1360.
12. Cai S, Miller S, Wilson IB. Trajectory of physical functioning among persons living with HIV in nursing homes. J Am Med Dir Assoc. 2019;20:497-502.
13. Nunn A, Yolken A, Cutler B, et al. Geography should not be destiny: focusing HIV/AIDS implementation research and programs on microepidemics in US neighborhoods. Am J Public Health. 2014;104(5):775-780. https://doi.org/10.2105/AJPH.2013.301864.
14. Rahman M, Tyler D, Thomas KS, Grabowski DC, Mor V. Higher Medicare SNF care utilization by dual-eligible beneficiaries: can Medicaid long-term care policies be the answer? Health Serv Res. 2015;50(1):161-179. https://doi.org/10.1111/1475-6773.12204.
15. Rahman M, Grabowski DC, Gozalo PL, Thomas KS, Mor V. Are dual eligibles admitted to poorer quality skilled nursing facilities? Health Serv Res. 2014;49(3):798-817. https://doi.org/10.1111/1475-6773.12142.
16. Centers for Medicare and Medicaid Services. MDS 2.0 for Nursing Homes. 2015. https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/NursingHomeQualityInits/NHQIMDS20.html. Accessed September 1, 2018.
17. Mor V, Angelelli J, Jones R, Roy J, Moore T, Morris J. Inter-rater reliability of nursing home quality indicators in the U.S. BMC Health Serv Res. 2003;3(1):20. https://doi.org/10.1186/1472-6963-3-20.
18. Hawes CH, Morris JN, Phillips CD, Fries BE, Murphy K, Mor V. Development of the nursing home resident assessment instrument in the USA. Age Ageing. 1997;26(suppl 2):19-25. https://doi.org/10.1093/ageing/26.suppl_2.19.
19. Mor V, Intrator O, Unruh MA, Cai S. Temporal and geographic variation in the validity and internal consistency of the nursing home resident assessment minimum data set 2.0. BMC Health Serv Res. 2011;11(1):78. https://doi.org/10.1186/1472-6963-11-78.
20. Rahman M, Tyler D, Acquah JK, Lima J, Mor V. Sensitivity and specificity of the minimum data set 3.0 discharge data relative to Medicare claims. J Am Med Dir Assoc. 2014;15(11):819-824. https://doi.org/10.1016/j.jamda.2014.06.017.
21. Buchanan RJ, Wang S, Huang C. Analyses of nursing home residents with human immunodeficiency virus and depression using the minimum data set. AIDS Patient Care STDS. 2002;16(9):441-455. https://doi.org/10.1089/108729102760330281.
22. Youn B, Shireman TI, Lee Y, et al. Ten-year trends in antiretroviral therapy persistence among US Medicaid beneficiaries. AIDS. 2017;31(12):1697-1707. https://doi.org/10.1097/QAD.0000000000001541.

23. Cornell P, Grabowski D, Norton E, Rahman M. Do report cards predict future quality? the case of skilled nursing facilities. Innov Aging. 2018;2(suppl 1):143-144. https://doi.org/10.1093/geroni/igy023.521.

24. LTCFocus. Long-Term Care: Facts on Care in the US - LTCFocus.org. 2018. http://ltcfocus.org/. Accessed May 3, 2017.

25. Gastwirth JL. The estimation of the Lorenz curve and Gini index. Rev Econ Stat. 1972;54(3):306-316. https://doi.org/10.2307/1937992.

26. Greene W. Fixed effects and bias due to the incidental parameters problem in the Tobit model. Econ Rev. 2004;23(2):125-147. https://doi.org/10.1081/ETC-120039606.

SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article.

Supplementary Figure S1. GINI coefficients of HIV in zipcodes and NHs by state.

Supplementary Figure S2. Histograms of HIV concentration in NHs by state.

Supplementary Figure S3. SNF quality outcomes by HIV concentration.

Supplementary Table S1. Regression results with NY and Florida removed.

Supplementary Table S2. Regression results with only NY and FL.

Supplementary Table S3. Regression results without SNF characteristics.