



Assessing the Quality of Human Immunodeficiency Virus Care in Nursing Homes

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BACKGROUND: Quality of human immunodeficiency virus (HIV) care in nursing homes (NHs) has never been measured.

DESIGN: A cross-sectional study.

SETTING: NHs.

PARTICIPANTS: A total of 203 NHs and 1375 persons living with HIV.

MEASUREMENTS: Medicare claims from 2011 to 2013 were linked to assessments of resident health, prescription dispensing data, and national reports of NH characteristics. Five nationally validated HIV care quality measures (prescription of antiretroviral therapy; CD4/viral load monitoring; frequency of medical visits; gaps in medical visits; and *Pneumocystis pneumonia* prophylaxis) were adapted and applied to NHs. Logistic regression predicted compliance by organizational factors. Random intercept logistic regression predicted if persons living with HIV received care by person and organizational factors.

RESULTS: Compliance ranged from 43.3% (SD = 31.1%) for CD4/viral load monitoring to 92.4% (SD = 13.6%) for gaps in medical visits. More substantiated complaints against an NH decreased the likelihood of high compliance with CD4/viral load monitoring (odds ratio [OR] = 0.846; 95% confidence interval [CI] = 0.726-0.986), while NH-reported incidents increased the likelihood of high compliance with pneumocystis pneumonia prophylaxis (OR = 1.173; 95% CI = 1.044-1.317). Differences between NHs explained 21.2% or less of variability in receipt of care.

CONCLUSIONS: Since 2013, the population with HIV and NH HIV care quality has inevitably evolved; however, this study provides previously unknown baseline metrics on NH HIV care quality and highlights significant challenges when measuring HIV care in NHs. *J Am Geriatr Soc* 68:1226-1234, 2020.

Key words: human immunodeficiency virus and aging; human immunodeficiency virus care quality Medicare Minimum Data Set; nursing homes

The demand for human immunodeficiency virus (HIV) care in nursing homes (NHs) is expected to increase over the next few decades as a result of effective antiretroviral therapy (ART) prolonging life for persons living with HIV/AIDS.¹ Research on HIV care in NHs remains limited. However, a recent study found that NHs with lower overall quality disproportionately serve persons living with HIV/AIDS. NH quality ratings, across domains such as use of antipsychotics or treatment of pressure ulcers, worsened significantly as the number of NH residents with HIV increased.² In addition, a 2015 report found that NHs with more black residents than white—more than 50% of NH residents with HIV/AIDS are black—were generally more resource deprived, had more deficiencies reported, and had lower occupancy.³ Furthermore, NH Medicaid patients, which constitute up to 93% of persons living with HIV/AIDS in NHs, had longer delays in access to necessary care.^{4,5}

Still, experiencing poor-quality NHs is not unique to persons living with HIV/AIDS, but their experience does uniquely include HIV stigma. Enacted HIV stigma—negative actions directed toward persons living with HIV/AIDS and their HIV diagnosis—persists across the healthcare system.⁶ HIV stigma is of particular concern in clinical settings, like NHs, that have less experience in caring for persons living with HIV/AIDS. In fact, NHs with the least experience with HIV have higher 30-day readmission rates for persons living with

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HIV/AIDS.^{2,6,7} To that end, HIV stigma may negatively impact HIV care quality by incorporating neglect, differential treatment, and verbal abuse into the shared beliefs and values making up NH organizational culture.^{8,9}

However, when providers enforce antistigma organizational culture, risk of poor-quality HIV care is significantly reduced in the outpatient setting.⁶ Reconciling outpatient HIV care quality and NH HIV care quality requires a better understanding of the current landscape of HIV care quality in NHs. Understanding clinical care quality is accomplished by the National Quality Forum (NQF), which is contracted by the US government to develop and validate gold-standard measures.¹⁰ In 2012, the NQF updated eight measures of HIV/AIDS care quality for application across diverse clinical settings.¹¹⁻¹⁴ Yet, they have never been applied to NHs, which, as of 2013, serve thousands of persons living with HIV/AIDS.⁵

Purpose

The purpose of this study was to provide the first evaluation of the quality of HIV care in US NHs using NQF HIV care quality measures and to identify NH organizational factors that influence HIV care quality. The Centers for Medicare and Medicaid Services (CMS) (Data Use Agreement RSCH-2017-51615) and the Northeastern University Internal Review Board (No. 14-02-23) approved this study. It was funded by a dissertation grant from the Agency for Healthcare Research and Quality (R36HS025662).

METHODS

Data Sources

This study used a 2011 to 2013 database of six linked files: (1) an all-payers prescription dispensing database from Omnicare; (2) the Minimum Data Set (MDS) version 3.0; (3) Medicare administrative file; (4) Medicare Part A claims; (5) Medicare Part B claims; and (6) publicly available Certification and Survey Provider Enhanced Reporting (CASPER) data.

The prescription dispensing database is a repository for all prescriptions filled, regardless of payment source (eg, Medicare Part D, private insurance, and out of pocket), in approximately half of the NHs in the United States. Data included approximately 3 million individuals and are greater than 99% complete due to the association with claims. Data elements included state location, resident sex and age, enrollment dates, national drug codes, and source of payment.

The MDS is a nurse-administered survey of physical and mental health of NH patients, including active diagnoses, activities of daily living, and Cognitive Function Scale. MDS data are collected at admission, on discharge, quarterly throughout a year, or for any change of health status. MDS data have demonstrated validity and reliability for assessing health status of NH residents.¹⁵

The Medicare administrative file provided basic demographics, including sex, age, race, Medicaid eligibility, and mortality. Medicare Parts A and B claims data contained details on hospitalizations and outpatient care, respectively,

and included dates and locations of services, diagnoses, and procedures.

CASPER is a repository for federally mandated surveys of all Medicare/Medicaid-certified US NHs, performed every 15 months or in the event a complaint is filed. It included basic NH characteristics, such as the number of beds and residents, as well as data on deficiencies, staffing, and healthcare. Despite documented measurement issues, validity and reliability have been demonstrated in these data.^{16,17} The most recent CASPER information was used with hot deck imputation applied.

Study Population

Our target population was NHs serving at least five persons living with HIV/AIDS between 2011 and 2013. Persons living with HIV/AIDS were identified as anyone with HIV antiretroviral (ARV) prescriptions from 2011 to 2013, or who had two diagnoses for HIV or AIDS in Medicare Part B, or one diagnosis in Medicare Part A (N = 10 445 persons living with HIV/AIDS).^{5,18} NHs were identified as the facility listed on the first MDS assessment per person living with HIV/AIDS that was associated with 30 or more days in an NH (N = 3753 persons living with HIV/AIDS in N = 1980 NHs)¹⁹ (Supplementary Figure S1); HIV viremia can change within 30 days of treatment interruption.²⁰

Adapting the NQF HIV Care Quality Measures to the NH Setting

Five of eight NQF HIV care quality measures were adapted for the NH setting. Three NQF measures were not calculated because required laboratory data were not available. Measures included: (1) CD4 cell count monitoring, (2) frequency of medical visits outside the NH, (3) gaps in medical visits outside the NH, (4) prescription of ART, and (5) prescription of *Pneumocystis jiroveci* pneumonia (PCP) prophylaxis.

At the time these data were collected, the Department of Health and Human Services recommended that persons living with HIV/AIDS see a medical provider every 3 or 4 months, have CD4 cell count and/or viral load monitoring every 3 or 4 months, have ART prescribed at least when CD4 counts were below 200 cells/mm³, and have PCP prophylaxis prescribed when CD4 counts were below 200 cells/mm³ or when persons living with HIV/AIDS were at high risk for PCP.²¹⁻²³ The NQF measures were adapted to reflect these guidelines more closely.

CD4 monitoring, medical visit frequency, and gaps in medical visits were adapted to be based on the number of 90-day intervals a person was in an NH during the study period. Total count of intervals represented the number of opportunities NHs had to deliver care. CD4 monitoring was extended to also include viral load monitoring (Current Procedural Terminology codes: 86361, 86360, 87536, and 87539) performed at least once during each 90-day interval of an NH stay; viral load is commonly used alongside or instead of CD4 cell count.²¹ Medical visit frequency and gaps in medical visits were identified such that for every 90 days spent in an NH there should be at least one medical visit. No medical visit within 90 days of the first MDS

Table 1. Details of the NQF HIV Care Quality Measures, Adapted Measures, and Compliance With Adapted Measures

Variable	NQF Measure	Adapted Measure
Measure 1	HIV/AIDS CD4 cell count or percentage performed	HIV/AIDS CD4 cell count or percentage or viral load count performed
Numerator	Patients with at least two CD4 cell counts or percentages performed during the measurement year at least 3 mo apart	Sum of all CD4 cell counts or viral load tests ordered in each 90-d interval of the year; more than one CD4 cell count or viral load monitoring per 90 d counts as one or 100% compliance for that 90-d interval
Denominator	All patients aged ≥ 6 mo with a diagnosis of HIV/AIDS, who had at least two medical visits during the measurement year, with at least 90 d between each visit	The number of 90-d intervals patients with a diagnosis of HIV/AIDS were in residence in the NH in a year
Measure 2	Prescription of HIV antiretroviral therapy	Prescription of HIV antiretroviral therapy
Numerator	Number of patients from the denominator prescribed HIV antiretroviral therapy during the measurement year	Number of patients from the denominator prescribed HIV antiretroviral therapy during the measurement year
Denominator	Number of patients, regardless of age, with a diagnosis of HIV with at least one medical visit in the measurement year	Number of patients in the NH, regardless of age, with a diagnosis of HIV/AIDS
Measure 3	Medical visit frequency	Frequency of medical visits with providers outside of the NH
Numerator	Number of patients in the denominator who had at least one medical visit in each 6-mo period of the 24-mo measurement period with a minimum of 60 d between first medical visit in the prior 6-mo period and the last medical visit in the subsequent 6-mo period	Number of medical visits with providers outside of the NH in each 90-d interval of the measurement year PLWH spent in the NH; more than one medical visit per 90 d per PLWH counts as one visit or 100% compliance for that 90-d interval
Denominator	Number of patients, regardless of age, with a diagnosis of HIV with at least one medical visit in the first 6 mo of the 24-mo measurement period	The number of 90-d intervals patients with a diagnosis of HIV/AIDS were in residence in the NH in a year
Measure 4	Gap in medical visits	Gap in medical visits with providers outside of the NH ^a
Numerator	Number of patients in the denominator who did not have a medical visit in the last 6 mo of the measurement year	Number of patients in the denominator who did not have a medical visit within 90 d of the first MDS assessment in the data
Denominator	Number of patients, regardless of age, with a diagnosis of HIV who had at least one medical visit in the first 6 mo of the measurement year	Number of patients with a diagnosis of HIV/AIDS who had at least 90 d of residence in the NH in a year
Measure 5	PCP prophylaxis	PCP prophylaxis
Numerator	Patients who were prescribed PCP prophylaxis within 3 mo of CD4 count of < 200 cells/mm ^{3b}	Number of patients from the denominator who have a prescription for PCP prophylaxis during the measurement year
Denominator	All patients aged ≥ 6 y with a diagnosis of HIV/AIDS and a CD4 count of < 200 cells/mm ^{3b} who had at least two visits during the measurement year, with at least 90 d in between each visit	Number of patients, regardless of age, with a diagnosis of HIV/AIDS, but no diagnosis of PCP
Measure 6	Tuberculosis screening	N/A
Numerator	Patients for whom there is documentation that a tuberculosis screening test was performed and results interpreted (for tuberculin skin tests) at least once since the diagnosis of HIV infection	
Denominator	All patients aged ≥ 3 mo with a diagnosis of HIV/AIDS who had at least two visits during the measurement year, with at least 90 d in between each visit	
Measure 7	Sexually transmitted diseases—screening for chlamydia, gonorrhea, and syphilis	N/A
Numerator	Patients who have received chlamydia, gonorrhea, and syphilis screenings at least once since the diagnosis of HIV infection; results must be documented for all three screenings	

(Continues)

Table 1 (Contd.)

Variable	NQF Measure	Adapted Measure
Denominator	All patients aged ≥ 13 years with a diagnosis of HIV/AIDS who had at least two visits during the measurement year, with at least 90 d in between each visit	
Measure 8	HIV viral load suppression	N/A
Numerator	Patients with an HIV viral load of < 200 copies/mL at last HIV viral load tests during the measurement year	
Denominator	All patients with an HIV diagnosis, regardless of age, with at least one medical visit with a nurse practitioner, physician, and/or physician assistant who provides comprehensive HIV care at an outpatient/ambulatory care setting	

Note. Average compliance calculated based on the adapted measures.

Abbreviations: HIV, human immunodeficiency virus; MDS, Minimum Data Set; N/A, not applicable; NH, nursing home; NQF, National Quality Forum; PCP, *Pneumocystis jirovecii* pneumonia; PLWH, persons living with HIV.

^aCompliance is included in analyses and reported as one minus calculated compliance. Interpretations are as follows: 92.4% of NHs had no gaps in medical visits outside of the NH.

^bDue to a lack of laboratory data, CD4 cell counts were not available.

assessment associated with the stay of interest was considered a gap in medical visits.

Both ART and PCP prophylaxis were made applicable to any persons living with HIV/AIDS because the NH medical director has prescribing power for all residents, negating the need for an off-site medical visit to receive prescriptions, and NHs are high-risk environments for spreading infection, including types of pneumonia.²⁴ The measure for PCP prophylaxis was limited, however, to those lacking a prior diagnosis of PCP in Medicare Parts A or B. See Table 1 for measure adaptations.

Study Measures

NH Organizational Characteristics

CMS identified five domains of NH organizational culture: decision making, staffing patterns, quality measures-based improvement, provider collaboration, and NH structural characteristics.⁸ Domains were represented by CASPER variables selected based on the literature and author consensus. NH structure variables included whether the facility was dually certified for Medicare and Medicaid, total number of residents, total number of beds, and whether it was a dual-skilled nursing/nursing facility.^{2,4} Decision-making variables included for-profit status and chain membership.²⁵ Staffing pattern variables included hours per resident day with aides, licensed practical nurses, registered nurses, or some combination thereof.²⁵ Quality measures-based improvement variables included CMS care quality rating, number of substantiated complaints, number of deficiencies, and number of NH-reported incidents.^{2,25} Provider collaboration was represented by the presence of a resident or family council that facilitates patient-provider interactions.

Physical and Mental Health

Two binary indicators were created from MDS disease indicators to identify presence of physical health (cancer,

anemia, vascular diseases, cirrhosis, gastroesophageal reflux disease, end-stage renal disease, multidrug resistant infections, pneumonia, septicemia, tuberculosis, urinary tract infection, viral hepatitis, wound infections, diabetes, arthritis, and osteoporosis) and mental health conditions (anxiety, depression, bipolar disorder, closed brain injury, manic depression, posttraumatic stress disorder, schizophrenia, Alzheimer's disease, and dementia).

Medical Visits

Medical visits were any visit in which a person would receive primary care and were identified using an adapted previously published algorithm.²⁶ Eligible visits were with nurse practitioners, physician assistants, or physicians across family and general practice, internal and preventive medicine, geriatrics, pain, and infectious disease providers.

ART

ART was identified as any combination of ARV prescriptions during an NH stay.

PCP Prophylaxis

Based on review of the data by a board-certified advanced HIV/AIDS registered nurse with more than 20 years of experience with HIV prescribing and the National Institute of Health guidelines, we included sulfamethoxazole/trimethoprim (Bactrim), atovaquone (Mepron), diaminodiphenylsulfone (Dapsone), and atovaquone/proguanil (Malarone) as PCP prophylaxis.²⁷

Compliance

Compliance was the proportion of measure-defined care delivered, of the total opportunities that care should have been delivered. Maximum compliance was 100% and represented the highest quality of HIV care. Compliance was dichotomized into low and high compliance, where any NH

Table 2. Descriptive Statistics of PLWH and NHs

Characteristics of PLWH in NHs (N = 1375)	Statistics ^a
Male	983 (72.7)
Age, y	59.7 ± 12.1
Race	
White	355 (25.8)
Black	835 (60.7)
Hispanic	148 (10.8)
Other	37 (2.7)
Marital status	
Never married	812 (59.1)
Married	167 (12.3)
Divorced/separated	201 (14.6)
Widow	114 (8.3)
Unknown	81 (5.9)
Physical health diagnosis	1194 (86.84)
ADL measure of independence	
Independent (ADLs 0-5)	478 (34.8)
Not fully independent (ADLs >5)	897 (65.2)
Mental health diagnosis	745 (54.2)
Positive for delirium	69 (5.0)
Reason for Medicare eligibility (original)	
Aged ≥65 y	303 (22.0)
Disability	942 (68.5)
ESRD/ALS	130 (9.5)
Reason for Medicare eligibility (current)	
Aged ≥65 y	438 (31.9)
Disability	810 (58.9)
ESRD/ALS	127 (9.2)
Eligible for Medicaid	1256 (91.3)
Admitted to NH from	
Acute hospital	1281 (93.2)
Community ^b	40 (2.9)
Other	54 (3.9)
Total time in the NH, d	154.9 ± 201.2
NH characteristics (N = 203)	
NH is for profit	170 (83.7)
NH is part of a chain	134 (66)
Region	
West	16 (7.9)
Midwest	26 (12.8)
Northeast	42 (20.7)
South	119 (58.62)
NH has a resident or family council	
Resident and family	76 (37.4)
Resident only	126 (62.1)
None	1 (0.5)
No. of PLWH in the NH	9.1 ± 11.2
No. of beds in the NH	172.4 ± 96.2
No. of residents in the NH	151.7 ± 90.9
No. of NH reported incidents	1.2 ± 2.5
No. of substantiated complaints	6.2 ± 6.4
Nursing hours per patient day	
RNs	0.71 ± 0.31
LPNs	0.92 ± 0.31
Aides	2.31 ± 0.53
RNs or LPNs	1.63 ± 0.4
RNs, LPNs, or aides	3.94 ± 0.74

*(Continues)***Table 2 (Contd.)**

NH characteristics (N = 203)	
Type of NH	
Dual skilled nursing and nursing facility	7 (3.4)
Separate skilled nursing or nursing facility	150 (73.9)
Unknown	46 (22.7)

Abbreviations: ADL, activity of daily living; ALS, amyotrophic lateral sclerosis; ESRD, end-stage renal disease; LPN, licensed practical nurse; NH, nursing home; PLWH, persons living with human immunodeficiency virus; RN, registered nurse.

^aData are given as number (percentage) or mean ± SD.

^bPrivate home/apartment, board/care, assisted living, or group home.

in the upper quartile relative to other NHs was labeled **high compliance**.²⁸ High compliance with gaps in medical visits meant there were no gaps in medical visits.

Statistical Analysis

This study was a 3-year cross-sectional evaluation of NHs that had five or more residents with HIV during the study period.²⁹

Predicting High Compliance

Logistic regression with robust variance estimators predicted high compliance by domains of NH organizational culture, adjusted for confounding. Included variables were limited to 1 per 10 outcomes that had a $P \leq .25$ in crude associations, consistent with other studies.³⁰ Any variables with insufficient data (less than five observations per cell) were excluded from analysis. A sensitivity analysis confirmed predictor selection by bootstrapping univariate associations.

Analyzing Variability in Access to Measured Care

Random intercept logistic regression produced intraclass correlation coefficients (ICCs), which parsed variability in individuals' receipt of measure-related care across person and NH characteristics. NH characteristics included in the model were those that were significant at the .05 level in the high compliance regression. We selected person-level predictors based on clinical relevance and previous research that evaluated age, sex, marital status, race, presence of a mental or physical health diagnosis, and length of the NH stay.^{5,28} $P \leq .25$ in univariate analysis and bootstrapping confirmed which person-level predictors were eligible for inclusion in final models. Five models were run, one for each measure. All analyses were done with 95% confidence and using SAS 9.4.

RESULTS

Persons Living With HIV/AIDS in NHs Evaluated for HIV Care Quality

We identified 3753 persons living with HIV/AIDS with at least one 30+ day stay in 1980 NHs between 2011 and 2013. Stringent criteria to be included in the denominator of at least one of the measures reduced this to 1375 persons in 203 NHs (Table 2). Most persons living with HIV/AIDS were male (72.7%) and black (60.7%). They were, on

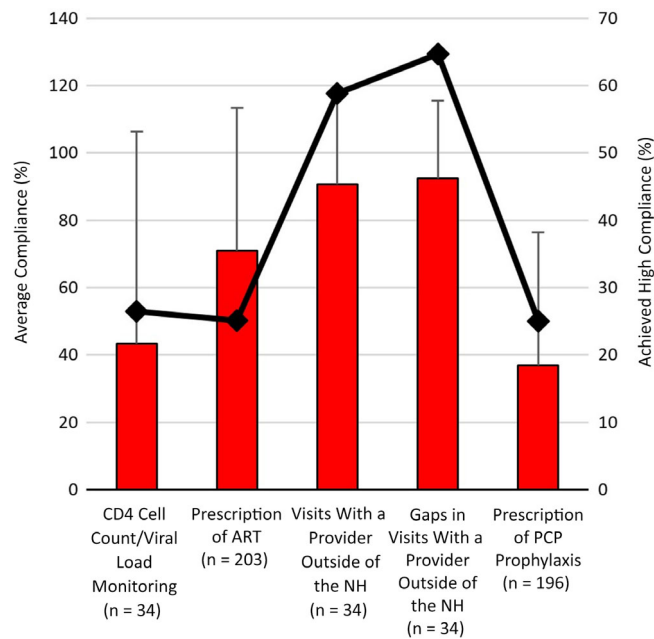


Figure 1. Average compliance and percentage of nursing homes (NHs) that achieved high compliance for each adapted measure of human immunodeficiency virus care quality. ART indicates antiretroviral therapy; PCP, *Pneumocystis jiroveci* pneumonia.

average, aged 59.7 (SD = 12.1) years and most had at last one physical health diagnosis (86.8%). Half had at least one mental health diagnosis (54.2%). Persons living with HIV/AIDS stayed in the NH, on average, 154.9 (SD = 201.2) days. The most common reason for Medicare eligibility was disability (58.9%).

NHs Evaluated for HIV Care Quality

Of the 203 NHs evaluated, 98 achieved high compliance. NHs had an average of 9.1 (SD = 11.2) persons living with

HIV/AIDS, 151.7 (SD = 90.9) people in residence, and 172.4 (SD = 96.2) total beds. Most were for-profit institutions (83.7%) and part of a chain (66%). More than half (58.6%) were located in the South (Table 2).

Compliance on HIV Care Quality Measures

Average compliance ranged from 92.4% (SD = 13.6%) with gaps in medical visits outside of the NH to 36.9% (SD = 23.3%) with PCP prophylaxis (Figure 1). More NHs achieved high compliance with gaps in medical visits outside the NH (64.7%; 22/34) and frequency of medical visits outside the NH (58.8%; 20/34) than on other measures. The other measures had less than 30% of NHs achieve high compliance—PCP prophylaxis (25%; 49/203), prescription of ART (25.1%; 51/203), and CD4/viral load monitoring (26.5%; 9/34).

Predicting High Compliance

The organizational culture domain, quality measures–based improvement, represented by the number of substantiated complaints and the number of NH reported incidents, was the only organizational culture domain associated with facilities’ achieving high compliance (Table 3). For each additional complaint, NHs were 15.4% less likely to achieve high compliance with CD4/viral load monitoring (odds ratio [OR] = 0.846; 95% confidence interval [CI] = 0.726-0.986). For each additional NH reported incident, there was a 17.3% increase in likelihood the NH would achieve high compliance with PCP prophylaxis (OR = 1.173; 95% CI = 1.044-1.317).

The concentration of persons living with HIV/AIDS in the NH was significantly associated with a small increase in the odds of high compliance with CD4 cell/viral load monitoring and prescription of ART (OR = 1.041 [95% CI = 1.004-1.08] and OR = 1.023 [95% CI = 1.004-1.043], respectively). However more persons living with HIV/AIDS in the NH meant compliance with frequency of medical visits

Table 3. Organizational Culture Domains and Confounders Predicting NH High Compliance

Measure Predictors	Domain of Organizational Culture	OR (95% CI)	P Value
CD4 cell count and viral load monitoring			
No. of substantiated complaints	Quality measures–based improvement	0.846 (0.726-0.986)	.032
No. of PLWH in the NH	Confounder	1.041 (1.004-1.08)	.031
Prescription of ART			
No. of PLWH in the NH	Confounder	1.023 (1.004-1.043)	.019
Frequency of medical visits with a provider outside of the NH			
No. of PLWH in the NH	Confounder	0.968 (0.938-0.998)	.036
Gaps in medical visits with providers outside of the NH			
No. of NH reported incidents	Quality measures–based improvement	0.804 (0.618-1.046)	.105
No. of PLWH in the NH	Confounder	0.946 (0.88-1.017)	.135
Prescription of PCP prophylaxis			
% of PLWH in the NH that are male	Confounder	0.211 (0.042-1.05)	.057
NH is part of a chain	Decision making	1.523 (0.702-3.305)	.287
No. of NH reported incidents	Quality measures–based improvement	1.173 (1.044-1.317)	.007

Note. Bolded values are significant at the .05 level.

Abbreviations: ART, antiretroviral therapy; CI, confidence interval; NH, nursing home; OR, odds ratio; PCP, *Pneumocystis jiroveci* pneumonia; PLWH, persons living with human immunodeficiency virus.

Table 4. ICCs From Models Predicting if Individuals Received Care for Each Measure

Variable	OR (95% CI)	P Value	ICC	P Value
CD4 cell count and viral load monitoring			0.198	.030
Eligible for Medicaid	0.843 (0.343-2.075)	.7094		
No. of substantiated complaints	0.969 (0.914-1.028)	.2967		
No. of PLWH in the NH	1.023 (1.008-1.038)	.0021		
Prescription of ART			0.204	<.001
Patient has a mental health diagnosis	0.962 (0.748-1.238)	.7647		
Male	1.473 (1.129-1.922)	.0043		
Deceased by end of 2013	0.895 (0.691-1.16)	.4005		
Marital status				
Never married	1.095 (0.649-1.85)	.7331		
Widowed	1.406 (0.854-2.314)	.1804		
Separated/divorced	2.013 (0.993-4.083)	.0524		
Unknown	1.13 (0.732-1.744)	.5819		
Married				
Eligible for Medicaid	0.822 (0.445-1.519)	.5315		
ESRD eligible	0.819 (0.551-1.218)	.3231		
Reason for Medicare eligibility (current)				
Aged ≥65 y	0.946 (0.539-1.662)	.8482		
Disability	1.215 (0.708-2.085)	.4794		
ESRD/ALS				
No. of PLWH in the NH	1.018 (1.004-1.031)	.0094		
Frequency of medical visits with providers outside of the NH			0.212	.110
ADL measure of independence				
Independent (ADLs 0-5)	0.582 (0.273-1.238)	.1588		
Not fully independent (ADLs >5)				
Patient has a mental health diagnosis	1.92 (0.925-3.987)	.0798		
Patient has a physical health diagnosis	1.376 (0.518-3.654)	.5205		
No. of PLWH in the NH	0.993 (0.975-1.012)	.4603		
Gaps in medical visits with providers outside of the NH			0.180	.173
ADL measure of independence				
Independent (ADLs 0-5)	3.595 (1.243-10.395)	.0184		
Not fully independent (ADLs >5)				
Patient has a mental health diagnosis	0.42 (0.159-1.113)	.081		
Prescription of PCP prophylaxis			0.129	<.001
Race				
Other	1.67 (1.152-2.42)	.0068		
Black	1.35 (1.049-1.737)	.0198		
White				
Eligible for Medicaid	0.692 (0.438-1.094)	.1152		
Age	0.978 (0.97-0.987)	<.0001		
No. of incidents reported by the NH	1.067 (1.011-1.126)	.0177		

Note. Bolded values are significant at the .05 level.

Abbreviations: ADL, activity of daily living; ALS, amyotrophic lateral sclerosis; ART, antiretroviral therapy; CI, confidence interval; ESRD, end-stage renal disease; ICC, intraclass correlation coefficient; NH, nursing home; OR, odds ratio; PCP, *Pneumocystis jirovecii* pneumonia; PLWH, persons living with human immunodeficiency virus.

outside of the NH (OR = 0.968; 95% CI = 0.938-0.998) and gaps in medical visits outside of the NH were less likely, the latter being a nonsignificant association (OR = 0.946; 95% CI = 0.88-1.017).

Analysis of Variability in Access to Measured Care

The ICC captures the amount of variability in the findings attributable to the NH, and the rest, one minus intraclass correlation coefficient, accounts for the amount of variability

attributable to differences among persons living with HIV/AIDS in NHs or residual confounding. Only 21.2% and 18.0% of variability in seeing a physician outside of the NH and gaps in medical visits outside of the NH, respectively, were explained by NH level factors. Despite significant differences between NHs, only 12.9% of variability was attributable to the NH effects on PCP prophylaxis. Approximately 20% of variability in access to both CD4 cell/viral load monitoring and prescription of ART was attributable to the significant differences between NHs (Table 4).

DISCUSSION

As far as we are aware, this is the first application of NQF HIV care quality measures to the US NH setting and the first baseline metrics of NH HIV care quality. Despite finding considerable variability in NH HIV care quality, our results were similar to research on general NH quality in that organizational structure explained little about NHs' ability to achieve high compliance on HIV care quality measures.³¹

In the current study, the strongest driver of compliance was the number of persons living with HIV/AIDS in the NH. This important finding began to address the question recently raised by Meyers et al: do persons living with HIV/AIDS benefit from higher concentrations of people with HIV in the NH?^{2,7} Having more persons living with HIV/AIDS, NHs were more likely to be highly compliant with monitoring tests and ART, but were less likely to be highly compliant with sending persons living with HIV/AIDS outside of the NH for medical visits.

We suspect that the latter finding does not reflect a lack of HIV guidance compliance, but rather facility care delivery adaption, given the relative volume of HIV-related patients. Research has linked patient volume and provider experience with better HIV care quality.⁷ NHs with more persons living with HIV/AIDS may have more confidence regarding the provision of medical care for this population and may prepare staff for, or hire staff experienced in, HIV care provision, thus reducing the need for medical visits outside of the NH.

However, few NHs have had high enough volume of persons living with HIV/AIDS to acquire such experience and confidence to provide HIV care. We excluded 877 NHs that only had one person living with HIV/AIDS and previous research found only approximately 0.2% of NH residents in the United States have HIV,⁵ which may explain why 60% of NHs were highly compliant with medical visits outside of the NH. More research is needed to better understand NH HIV care delivery adaption as it relates to the volume of persons with HIV.

The variability in compliance may be further complicated by the characteristics of persons living with HIV/AIDS in each NH. Facility characteristics explained no more than 21.2% of variability in our outcomes, meaning differences among persons living with HIV/AIDS are important factors to consider. Older persons living with HIV/AIDS have complex health profiles: nearly 90% had at least one physical health condition and more than 50% had a mental health condition in addition to HIV. The diverse healthcare needs of this population thus drive variability in facility response; the contribution of this clinical complexity may be a target for future research.

Ultimately, we found that there may be limitations in the application of the NQF measures in the NH environment. We encountered numerous barriers in their application, and could only assess five of eight measures, even with adaptations. Among the problems contributing to this difficulty was the fact that NQF measures have been developed for and applied primarily to outpatient clinical settings and their care utilization profiles; NHs see patients, generally, for truncated periods of time that are usually less than a year (average length of stay for our population = 154.9 days;

SD = 201.2 days). Even though we adapted the measures to the period over which the NH would have continuous patient contact, there may be more appropriate measures or adjustment strategies. Additionally problematic was that the NQF measures assume that a medical visit is necessary for access to prescriptions and healthcare. In NHs, there is at least one full-time prescribing authority and around-the-clock nursing staff, negating the need to have as many medical visits outside of the NH as are needed for community-dwelling persons living with HIV/AIDS. Thus, our adaption of the measures to make all persons living with HIV/AIDS in NHs eligible for ART and CD4/viral load monitoring was an effort to recognize the continuous access to medical oversight in the NH; this too may be an adaptation worthy of further review. Therefore, while we believe our work provides important insights into measuring the quality of HIV care in NHs, we also believe it requires future analysis and potentially new measurement recommendations. This is particularly true due to the age of the data and how persons living with HIV and NH HIV care quality have inevitably evolved over time.

Further Study Limitations

There are several limitations to this study. First, the adapted HIV care quality measures are not validated. Second, the sample excludes private-pay persons living with HIV/AIDS and is limited to records linking to the nationwide prescription dispensing database. The prescription dispensing database reflects only prescriptions filled at the NH pharmacy. Also, we considered the presence of any ARVs as ART compliance, although most current regimens include three drugs. The sample is nationwide but not nationally representative, which reduced generalizability. However, a 2006 study showed comparable distributions of NHs in the prescription dispensing data compared to CASPER.³² Finally, the MDS has been validated as a tool for determining the health status of NH residents, but may underreport certain characteristics not linked to mandated reporting.¹⁵

CONCLUSIONS

This study provides previously unknown baseline metrics on NH HIV care quality, but highlights gaps in understanding the degree to which NH characteristics affect NH HIV care quality and in understanding how HIV care quality is evaluated in the NH setting.

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Author Contributions: All coauthors were members of Dr Olivieri-Mui's dissertation committee and participated in study design and analysis planning, helped with data interpretations, and edited the manuscript. Dr Olivieri-Mui conducted all analyses. One consultant, Debra Winters, APRN-BC, AACRN, the clinical director of the New England AIDS Education and Training Center, provided clinical expertise throughout the study. Her input included review of medications identified, review of findings related to medications, and suggestions for language in the interpretation of clinical findings.

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SUPPORTING INFORMATION

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

Supplementary Figure S1: Flowchart identifying the population of nursing homes (NHs) with Medicare-eligible persons living with HIV.