

Literature Review

Racial/Ethnic Disparities in Influenza and Pneumococcal Vaccinations Among Nursing Home Residents: A Systematic Review

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Abstract

This systematic review analyzes research examining racial/ethnic disparities in influenza and pneumococcal vaccination coverage between White and racial/ethnic minority (Black and Hispanic) nursing home residents. A review of the literature for years 1966–2014 using Medline, Web of Science, and PubMed was conducted. The Epidemiological Appraisal Instrument was used to appraise the quality of the 13 included studies. Overall, articles were strong in reporting and data analysis, but weak in sample selection and measurement quality. Disparities between vaccination coverage among racial/ethnic minorities versus Whites ranged from 2% to 20% for influenza and 6% to 15% for pneumococcal vaccination. Researchers reported racial/ethnic minorities were more likely to refuse vaccinations and less likely to have vaccinations offered and their vaccination status tracked compared to Whites. Policies/strategies that focus on ensuring racial/ethnic minorities are offered influenza and pneumococcal vaccinations and their vaccination status are tracked in nursing homes are warranted. Updated evaluation on vaccination disparities is also needed.

Keywords: Vaccines, Health disparities, Long-term care, Immunization, Policy

Several government agencies have prioritized influenza and pneumococcal vaccinations for adults 65 years of age and older (Johnson, Elbert-Avila, Kuchibhatla, & Tulskey, 2012; Poland et al., 2003; U.S. Department of Health and Human Services, n.d.-a). In Healthy People 2020, an initiative to improve the nation's health, the Federal government specifically set target goals of influenza and pneumococcal vaccination receipt among this group at 90% or greater (U.S. Department of Health and Human Services, 2013). Centers for Medicare & Medicaid Services (CMS)-certified nursing homes, which are more than 95% of facilities, are required

to offer influenza and pneumococcal vaccinations to each resident and provide documentation of vaccination status (CMS, 2005). Therefore, vaccines should be readily available to all residents.

Despite this, vaccination receipt rates remains low (U.S. Department of Health and Human Services, 2014, n.d.-b). In the most recent vaccination data for nursing homes using Minimum Data Set (MDS) data and reported by the U.S. Department of Health and Human Services, only 62% of residents were protected by the influenza vaccination (2005–2006) and 75% were protected by the

pneumococcal vaccination (2013); while this is an increase from previous years, it is still short of the federal goal (U.S. Department of Health and Human Services, 2014, n.d.-b). Moreover, vaccination receipt percentages were far lower among racial/ethnic minority nursing home residents (Gorina, Kelly, Lubitz, & Hines, 2008; U.S. Department of Health and Human Services, 2014).

New Contribution

Currently, 1.5 million persons reside in nursing homes, and this number is expected to increase substantially because of the growing elderly population (CMS, 2013; Congressional Budget Office, 2013). The largest increases will be among those of racial/ethnic minority status (Blacks and Hispanics) as more individuals from this group move into nursing homes and Whites increasingly opt for other care settings (e.g., assisted living) (Feng, Fennell, Tyler, Clark, & Mor, 2011).

As a result of population increases in racial/ethnic minorities and the elderly, gaps in vaccination receipt are likely to widen if appropriate action is not taken (U.S. Census Bureau, 2012; Villa, Wallace, Bagdasaryan, & Aranda, 2012). These gaps can potentially exacerbate disparities in diseases such as influenza and pneumonia, which can be prevented. The purpose of this systematic review is to understand the magnitude of the disparity in influenza and pneumococcal vaccination receipt between Blacks and Hispanics compared to Whites over time (Gorina et al., 2008; U.S. Department of Health and Human Services, 2014). To do this, we examine disparities in vaccination receipt between elderly non-Hispanic White and racial/ethnic minority (Black and Hispanic) nursing home residents. We also identify contributing factors to these disparities. A systematic review of this evidence does not presently exist.

Conceptual Framework

The Strategic Framework for Improving Racial and Ethnic Minority Health and Eliminating Racial and Ethnic Health Disparities (The Strategic Framework), developed by the Office of Minority Health, guided this review conceptually (Graham, 2008). The model identifies long-term problems related to health disparities and links them to contributing factors, strategies and practices, and outcomes. Contributing factors consist of individual-, community-, and systems-level factors (hereafter referred to as facility-level factors) that are determined to add to poor racial/ethnic minority health. Strategies and practices are initiatives that may address the contributing factors at each level described. Outcomes are identified as the expected result of established and/or implemented strategies and practices (e.g., improved health for all and decreased disparities in care) or the lack thereof. Examining contributing factors to vaccination receipt and nonreceipt related to racial/ethnic disparities is necessary to address long-term

problems of preventable morbidity and mortality among racial/ethnic minority nursing home residents. This review focuses on these contributing factors.

Methods

The preferred reporting items for systematic review and meta-analysis (PRISMA) guidelines were followed in each phase of this systematic review and its reporting (Moher, Liberati, Tetzlaff, & Altman, 2009).

Search Strategy

Databases were searched in December 2015 and included Medline, Web of Science, and PubMed using the following keywords: (immunization/ or immunization or vaccin* or vaccine/) AND (pneumonia/ or pneumoni* or pneumococ* or influenza or flu vaccination rate or vaccination rates) AND (nursing home/ or long-term care/) AND (racial disparit* or health disparit* or racial difference* or socioeconomic status/ or Blacks/ or Hispanics/ or minorit*/ or minority health/ or Medicaid or rac* or characteristic* or difference* or predictor* or gap*). No limit was placed on the years searched.

Racial/ethnic disparities were defined as differences in care explained by race and/or ethnicity. Minority was defined as being of Black or Hispanic racial/ethnic background. Studies were included if they examined racial/ethnic disparities in influenza and pneumococcal vaccinations in U.S. nursing home setting(s), were written in the English language, and included a sample of nursing home residents who were 65 years of age or older. Studies were excluded if they were reviews or editorials; took place in another setting (i.e., residential care, skilled nursing, or subacute facility); focused on the vaccination of health care workers, children, or adults younger than 65 years of age; focused on other vaccinations; or focused on infection rates. Facilities that were solely skilled nursing and subacute were excluded because they may behave differently from free-standing nursing homes as a result of their focus on post-acute care. Residential care was excluded because of its potential to differ greatly from nursing home care with respect to the resident's care requirements. Other races/ethnicities were not included (i.e., American Indian/Alaska Native, Asian, and Native Hawaiian/Pacific Islander) because combined, they make up less than 5% of residents residing in nursing homes and are too few to make meaningful interpretations (Harris-Kojetin et al., 2016).

Methodological Quality Assessment of Identified Studies

The Epidemiological Appraisal Instrument (EAI), developed by Genaidy and colleagues (2007), was used to assess the quality (i.e., reporting and methodology) of the eligible studies. This 43-item instrument is rooted in epidemiological principles and validated for use in cohort,

cross-sectional, intervention, hybrid, and case-control studies (Genaidy et al., 2007). The EAI was derived from well-known instruments such as the checklist created by Downs and Black, but lends itself further to the evaluation of cross-sectional studies as opposed to primarily randomized controlled trials (Downs & Black, 1998). The former comprised the majority of this review.

The EAI consists of five sections: (a) reporting (17 items), (b) subject/sample selection (7 items), (c) measurement quality (10 items), (d) data analysis (7 items), and (e) generalization of results (2 items). Reporting falls under the study description domain while the remaining sections assess the study execution. Response to items include: yes (information is described), partial (information is partially described), no (information is not described but should have been provided), or unable to determine. The scores associated with each response are as follows: 2 for yes, 1 for partial, or 0 for no and unable to determine. A “not applicable” response is given to areas that do not pertain. Overall scores are computed by averaging the total scores for each section after excluding the “not applicable” responses. In another review using the EAI, studies were considered of high quality if the overall score was 60% or more (Veenhof, Huisman, Barten, Takken, & Pisters, 2012). The studies were categorized as “good” if the score was 1.4 or greater ($\geq 70\%$), “average” if between 1.1 and 1.4 ($55\%–69\%$), or “poor” if less than 1.1 ($<55\%$). Two researchers (J. Travers, K. Schroeder) assessed each eligible article individually; they then met to discuss their findings and resolve any discrepancies.

Data Abstraction

Data that were further abstracted from the articles included: (a) author, (b) study design, (c) sample size, (d) study years, (e) data source, (f) outcome measure, (g) vaccination coverage percentage by race/ethnicity, and (h) contributing factors to vaccination disparities.

Results

Four hundred seventy-nine potentially eligible articles were retrieved. After removing duplicates, 310 articles remained, from which 271 were then excluded following title and abstract screening. The remaining 39 full-text articles were assessed against the defined eligibility criteria, 27 were deemed ineligible, and 1 article was identified through article references. The final sample consisted of 13 studies. Figure 1 details the article selection process and reasons for exclusion.

Characteristics of the included studies are provided in Table 1. Racial/ethnic disparities in influenza vaccination receipt were solely evaluated in eight studies and racial/ethnic disparities in pneumococcal vaccination receipt were solely evaluated in two. Three studies evaluated racial/ethnic disparities in both. Over two-thirds (69%) of the

studies were either led or co-authored by the same author. Study years ranged from 1995 to 2009.

Data Sources

In all eligible studies, the investigators used large administrative data sets and performed secondary data analysis, although one group of researchers also corroborated their methods with a developed survey and chart reviews (Bardenheier, Shefer, McKibben, Roberts, & Bratzler, 2004). In five studies, researchers used the MDS along with the Online Survey Certification and Reporting (OSCAR) database (Bardenheier, Gravenstein, Furlow, Ahmed, & Hogue, 2013; Bardenheier et al., 2004; Bardenheier, Wortley, Ahmed, Gravenstein, & Hogue, 2011; Bardenheier, Wortley, Ahmed, Hales, & Shefer, 2010; Cai, Feng, Fennell, & Mor, 2011), in one study, the researcher used only the MDS (Bardenheier, Wortley, Shefer, McCauley, & Gravenstein, 2012), and in seven studies the researchers used the National Nursing Home Survey (NNHS) (Bardenheier, Shefer, et al., 2011; Bardenheier, Shefer, Tiggle, Marsteller, & Remsburg, 2005; Li & Mukamel, 2010; Luo, Zhang, Cook, Wu, & Wilson, 2014; Marsteller, Tiggle, Remsburg, Shefer, & Bardenheier, 2006; Marsteller et al., 2008; Strully, 2011). Each data source is described below along with the variables used in the studies reviewed.

Minimum Data Set

MDS is a database of nursing home resident assessment data. All CMS-certified nursing homes are required to collect resident assessment data upon resident admission as well as quarterly, annually, and whenever there

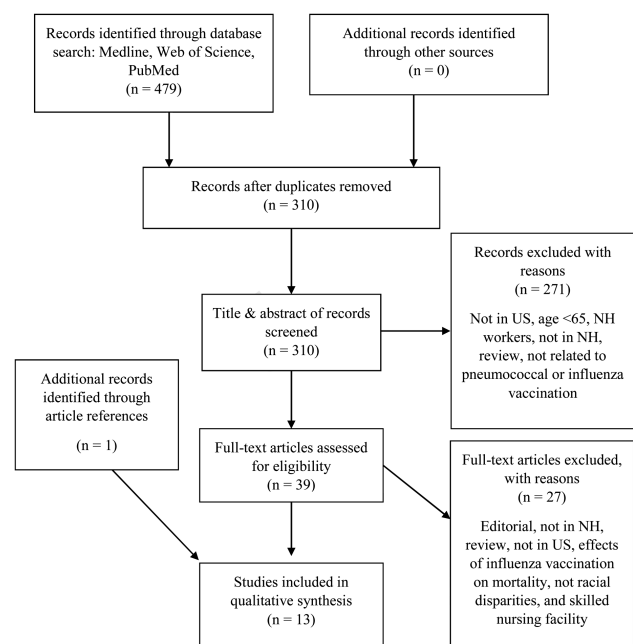


Figure 1. Preferred reporting items for systematic reviews and meta-analyses flow diagram of article selection process. NH = nursing home.

Table 1. Description of Included Studies

Author	Study design	Sample size	Study years	Data source	Outcome measure	Vaccination coverage	Quality score
Bardenheier et al. (2013)	Secondary Cross-sectional Michigan	66,895	October 2005–March 2006	MDS OSCAR	Influenza vaccination	Whites vs. Blacks 60% vs. 43%	1.52
Bardenheier et al. (2012)	Secondary Cross-sectional	2,359,321	October 2008–March 2009	MDS	Influenza vaccination	Whites vs. Blacks 74% vs. 66% (reported as medians)	1.26
Bardenheier, Shefer, et al. (2011)	Secondary Cross-sectional	12,857	2004	NNHS	Influenza vaccination	Whites vs. Blacks 64% vs. 55%	1.41
Bardenheier, Wortley, et al. (2011)	Secondary Cross-sectional	85,534	October 2005–March 2006	MDS OSCAR	Influenza vaccination	Whites vs. Blacks 64% vs. 43%	1.55
Bardenheier, Wortley, et al. (2010)	Secondary Cross-sectional	1,851,676	October 2005–March 2006	MDS OSCAR	Influenza vaccination	Whites vs. Blacks vs. Hispanics 73% vs. 65% vs. 67%	0.93
Bardenheier et al. (2005)	Secondary	7,374	1995, 1997, 1999	NNHS	Pneumococcal vaccination	Whites vs. Blacks 24% vs. 23% 29% vs. 24% 40% vs. 30%	1.55
Bardenheier et al. (2004)	Cross-sectional	7,399 7,383 20,516	November 2000	OSCAR MDS	Influenza and pneumococcal vaccination	Whites vs. Blacks vs. Hispanics Influenza: 59% vs. 51% vs. 49% Pneumococcal: 34% vs. 24% vs. 19%	1.63
Cai et al. (2011)	Secondary Cross-sectional	886,786 872,592 857,740	January 2001 2006–2007 2007–2008 2008–2009	Chart Review Survey MDS OSCAR	Influenza vaccination	Whites vs. Blacks 83% vs. 75% 83% vs. 77% 84% vs. 78%	1.35
Li and Mukamel (2010)	Secondary Cross-sectional	Influenza: 10,562 Pneumococcal: 12,134	2004	NNHS	Influenza and pneumococcal vaccination	Whites vs. Blacks Influenza: 78% vs. 65% Pneumococcal: 51% vs. 35%	1.4
Luo et al. (2014)	Secondary Cross-sectional	13,507	2004	NNHS	Influenza and pneumococcal vaccination	Whites vs. Blacks vs. Others ^a Influenza: 77% vs. 68% vs. 74% Pneumococcal: 56% vs. 43% vs. 55%	1.31
Marsteller et al. (2008)	Secondary Cross-sectional	14,303	Merged years 1997 1999	NNHS	Pneumococcal vaccination	Whites vs. Blacks 34% vs. 27%	1.35
Marsteller et al. (2006)	Secondary Cross-sectional	7,194	1999	NNHS	Influenza vaccination	Whites vs. Blacks vs. Other 67% vs. 65 vs. 61%	1.50
Strully (2011)	Secondary Cross-sectional	12,501	2004	NNHS	Influenza vaccination	Whites vs. Blacks 69% vs. 62%	1.38

Note: MDS = Minimum Data Set; NNHS = National Nursing Home Survey; OSCAR = Online Survey, Certification and Reporting.

^aOthers consisted of any racial group not categorized as White or Black.

is a significant change in resident status (i.e., decline or improvement in a resident's health) (Wunderlich & Kohler, 2001). The data from the MDS provide individual resident assessments and characteristics. Variables abstracted from the MDS included racial/ethnic status, health information, physical functioning, vaccination administration, and reasons for not receiving vaccinations (resident not in facility during season, received outside of facility, not eligible, offered and declined, not offered, or facility unable to obtain vaccination). MDS data were used for the years 2005–2009.

Online Survey Certification and Reporting

OSCAR is a federal administrative database containing aggregated resident characteristics, survey deficiencies, and facility-level data (Chisholm, Weech-Maldonado, Laberge, Lin, & Hyer, 2013; Veenhof et al., 2012). Data are collected annually and are part of the nursing home CMS certification and recertification process. Variables abstracted in these studies included staffing, bed type, ownership status, source of payment, and location. OSCAR data were used for the years 2005–2008 and were typically merged with the MDS.

National Nursing Home Survey

The NNHS involves a probabilistic sample of 1,174 nursing homes in 2004 and a random sample of up to 12 residents from each nursing home (Centers for Disease Control and Prevention, 2008). Administration of this survey occurred in 1995, 1997, 1999, and 2004 and was delivered to nursing home personnel to complete on behalf of the nursing home residents. Variables on the survey that were of focus in the studies reviewed included racial/ethnic status, health information, vaccination administration, and reasons for not receiving vaccinations which included: (a) unknown vaccination status, (b) resident offered but refused the vaccination, (c) resident not offered the vaccination, (d) medical contraindication, and (e) resident not in the nursing home during the most recent influenza season. One of the reviewed studies (Bardenheier, Shefer, et al., 2011) included the following strategies to increase vaccination: (a) standing, preprinted, advance, and personal physician orders; (b) written vaccination policy; (c) primary care provider immunization reminder program; (d) centralized tracking system for facility-wide influenza vaccination coverage; (e) facility-wide recommendation for health care workers to receive the influenza vaccine; and (f) facility-wide provision of free vaccine to health care workers. All four years of NNHS data were used.

Sample

Sample sizes ranged from 7,194 to 2,359,321 nursing home residents. The majority of the studies ($n = 9$; 69%) examined only non-Hispanic Black residents and compared them with non-Hispanic White residents. Two studies

examined an "Other" group in addition to non-Hispanic Black residents and non-Hispanic White residents (Luo et al., 2014; Marsteller et al., 2006). "Other" consisted of all residents who were not classified as Black or White. In two studies, Hispanics were examined (Bardenheier et al., 2004; Bardenheier, Wortley, et al., 2010).

Data Analysis Methods

The most common methods used to analyze the data were hierarchical modeling and multinomial logistic regressions. Hierarchical modeling allows examination of factors on multiple levels (e.g., resident, facility) as well as within and between facility characteristics (e.g., racial composition). Multinomial logistic regression allows examination of the effect of race on more than two different outcomes (e.g., receiving vaccination, not receiving vaccination, having unknown vaccination status) while comparing within subgroups. Researchers also used multivariate logistic regression, conditional fixed-effects logit, and general descriptive statistics. Multivariate logistic regression allows researchers to assess the likelihood of receiving either the influenza or pneumococcal vaccination while considering race/ethnicity as the independent variable and controlling for selected covariates. Conditional fixed-effects are similar to multilevel modeling in that they allow researchers to examine how much of the racial inequality in vaccination receipt was attributable to differences within facilities.

Quality Appraisal

Variations in the quality of the 13 studies are presented in Table 2. Overall quality scores ranged from an average of 0.9 (Bardenheier, Wortley, et al., 2010) to 1.6 (Bardenheier et al., 2004) out of two possible points. When divided into sections, the lowest scores were found in the area of sample selection (0.7 [Bardenheier, Wortley, et al., 2010; Li & Mukamel, 2010; Luo et al., 2014; Marsteller et al., 2008; Strully, 2011] to 2.0 [Bardenheier et al., 2004]) and measurement quality (0.0 [Bardenheier et al., 2004] to 1.1 [Bardenheier et al., 2005, 2012; Bardenheier, Wortley, et al., 2010, 2011; Cai et al., 2011; Li & Mukamel, 2010; Luo et al., 2014; Marsteller et al., 2006, 2008; Strully, 2011]), with a total average score of 1.1 and 1.0, respectively.

In regards to sample selection, while there were differences in the racial/ethnic groups compared, most researchers did control for this by adjusting for resident characteristics (e.g., age, gender, health status, and physical functioning). However, many of the authors did not account for attrition or unavailable records after entry into the study. In addition, related to measurement quality, although the methods for assessing the exposure (race/ethnicity) and outcome (vaccination status) variables were similar for each racial/ethnic group and observations were taken over the same time for all groups in all studies, the reliability and validity of the race/ethnicity categorization were not discussed in

Table 2. Quality Assessment of Included Studies Using the Epidemiological Appraisal Instrument

	Reporting	Sample selection	Measurement quality	Data analysis	Generalization of results	Overall ^a
Bardenheier et al. (2013)	1.63	1.50	0.80	2.00	N/A	1.52
Bardenheier et al. (2012)	1.19	1.50	1.14	1.50	N/A	1.26
Bardenheier, Wortley, et al. (2011)	1.63	1.50	1.14	2.00	N/A	1.55
Bardenheier, Shefer, et al. (2011)	1.60	1.50	0.85	1.67	N/A	1.41
Bardenheier, Wortley, et al. (2010)	1.00	0.67	1.14	0.50	N/A	0.93
Bardenheier et al. (2005)	1.73	1.50	1.14	1.67	N/A	1.55
Bardenheier et al. (2004)	2.00	2.00	0	1.33	2.0	1.63
Cai et al. (2011)	1.44	0.75	1.14	2.00	N/A	1.35
Li and Mukamel (2010)	1.69	0.67	1.14	1.25	N/A	1.40
Luo et al. (2014)	1.47	0.67	1.14	1.50	N/A	1.31
Marsteller et al. (2006)	1.81	1.33	1.14	1.00	N/A	1.50
Marsteller et al. (2008)	1.50	0.67	1.14	1.60	N/A	1.35
Strully (2011)	1.60	0.67	1.14	1.50	N/A	1.38

Note: N/A, not applicable.

^aStudies were considered “good” if they were ≥ 1.4 ($\geq 70\%$), “average” if between 1.1 and 1.4 (55%–69%), or “poor” if < 1.1 ($< 55\%$).

the studies. This is also true for the reliability of vaccination status. The study that received a 0 score in measurement quality was a chart review which lacked information on the assessment of the exposure variables and the validity of the main outcomes (Bardenheier et al., 2004). Findings from this study were used when reporting overall ranges in vaccination disparities.

The highest possible scores were found in reporting (1.0 [Bardenheier, Wortley, et al., 2010] to 2.0 [Bardenheier et al., 2004]) and data analysis (0.5 [Bardenheier, Wortley, et al., 2010] to 2.0 [Bardenheier et al., 2013; Bardenheier, Wortley, et al., 2011; Cai et al., 2011]), with a total average score of 1.6 and 1.5, respectively. Many aspects of the studies were clearly reported (e.g., aim, exposure and outcome variables, source of sample population, covariates, statistical methods, study findings, and estimates of statistical parameters). The majority of the studies analyzed the data by exposure levels, outcome levels, and/or subgroups (e.g., race, vaccination status, and racial/ethnic composition of the nursing home).

Vaccination Disparities

All studies reported racial/ethnic minorities less likely to receive vaccinations—either influenza, pneumococcal, or both—when compared to Whites or “Others.” The disparity in vaccination receipt varied between racial/ethnic minorities and Whites, with a range of 2%–20% for influenza vaccinations and 6%–15% for pneumococcal vaccinations.

Studies using identical data sources and years reported different vaccination receipt percentages due to varying sample selection criteria, range of months examined (i.e., influenza), and how vaccination receipt was defined. For example, four studies used 2004 NNHS data (Bardenheier, Shefer, et al., 2011; Li & Mukamel, 2010; Luo et al., 2014; Strully, 2011) to analyze coverage of either influenza or pneumococcal vaccinations or both; none of these four used identical sample sizes. Overall, these four studies

reported influenza vaccination receipt ranging from 64% to 78% for Whites and 55% to 68% for Blacks; only two of the four studies reported similar influenza vaccination receipt percentages (78% Whites vaccinated vs. 65% Blacks vaccinated, and the other showing 77% Whites vaccinated vs. 68% Blacks vaccinated) (Li & Mukamel, 2010; Luo et al., 2014). In the same two studies reporting similar influenza vaccination receipt percentages, pneumococcal vaccination receipt differed with 51% Whites vaccinated vs. 35% Blacks vaccinated, compared to 56% Whites vaccinated vs. 43% Blacks vaccinated (Li & Mukamel, 2010; Luo et al., 2014). Studies by Luo and colleagues (2014) and Strully (2011) had an overall quality score that fell in the “average” range while Bardenheier, Shefer, and colleagues (2011) and Li and Mukamel (2010) had an overall quality score that fell in the “good” range. All studies except for Bardenheier, Shefer, and colleagues (2011) received a poor score in sample selection.

Similar heterogeneity was reported in two separate studies that used 1999 NNHS data to examine pneumococcal vaccination receipt (Bardenheier et al., 2005; Marsteller et al., 2008). There was a difference of 481 residents between the two studies. The study conducted by Marsteller and colleagues (2008) only used residents residing in the nursing homes between the months of July and December. Bardenheier and colleagues’ (2005) study had an overall score that fell in the “good” range while Marsteller and colleagues’ (2008) study fell in the “average” range and was weakest in the sample selection. When reviewing two other studies led by Bardenheier, fairly consistent influenza vaccination receipt percentages between Whites and Blacks were reported (60% Whites vaccinated vs. 43% Blacks vaccinated, compared to 64% Whites vaccinated vs. 43% Blacks vaccinated) (Bardenheier et al., 2013; Bardenheier, Wortley, et al., 2011). Both of these studies used MDS 2005–2006 data and had a “good” overall quality rating score but were both weaker in measurement quality.

Contributing Factors to Racial/Ethnic Disparities

Contributing factors were found to add to racial/ethnic disparities in vaccination receipt and were examined in 11 of the 13 studies; significant findings were only reported in nine of these studies. Contributing factors were categorized as: not offered or offered and refused (offering of vaccinations and refusal of vaccinations); population served (nursing home ownership and physical functioning were used as proxies for population served—racial composition, nursing home ownership, nursing home setting, physical functioning, and source of payment); and interventions to increase vaccinations (tracking vaccination status and vaccination strategies).

Not Offered and Refused

Not being offered vaccinations and/or refusing vaccinations when offered were both found to be individual-level contributing factors to racial/ethnic disparities in vaccination coverage. Four studies (Bardenheier et al., 2013; Bardenheier, Wortley, et al., 2010, 2011; Cai et al., 2011) identified Blacks as less likely to be offered influenza vaccinations compared to Whites. Bardenheier, Wortley, and colleagues' (2010) study was the only one of the four to examine Hispanics and found both Hispanics and Blacks less likely to be offered the influenza vaccination when compared to Whites (79%, 79%, 84%, respectively).

Researchers found that Blacks were also more likely to refuse influenza vaccinations compared to Whites in four studies (Bardenheier et al., 2013; Bardenheier, Wortley, et al., 2010, 2011; Cai et al., 2011). In addition to Blacks, Bardenheier and colleagues found Hispanics refused the influenza vaccination more often than Whites (12% vs. 10% vs. 9%, respectively) (Bardenheier, Wortley, et al., 2010). Two of the studies found a 4% difference in refusals of influenza vaccinations between Blacks and Whites (Bardenheier et al., 2013; Cai et al., 2011), with a higher proportion of Blacks refusing the vaccine. Another research team found a 2%–3% difference between these two racial groups (Bardenheier, Wortley, et al., 2011).

Population Served

In six studies, researchers found the nursing home population served to be an individual- and facility-level contributing factor to racial/ethnic disparities in vaccination receipt between racial/ethnic minorities and Whites (Bardenheier et al., 2012, 2013; Bardenheier, Wortley, et al., 2011; Cai et al., 2011; Li & Mukamel, 2010; Marsteller et al., 2008). In four studies (Bardenheier et al., 2012, 2013; Bardenheier, Wortley, et al., 2011; Cai et al., 2011), researchers found that increased racial/ethnic minority composition of the nursing home was associated with decreased vaccination receipt among Blacks compared to Whites. Three of these studies specifically found the largest disparities in influenza vaccination coverage among Blacks in nursing homes, with greater than 50% Blacks (Bardenheier et al., 2012, 2013; Bardenheier, Wortley, et al., 2011). These disparities were

also most prominent in states with the highest overall disparities in influenza vaccination receipt between racial/ethnic minorities and Whites (>10%) (Bardenheier et al., 2012). Cai and colleagues (2011) found a consistent disparity in influenza vaccination receipt between Blacks and Whites over the years 2006–2009; this disparity was also very similar across quintiles—ranged from the lowest proportion of Black residents to the highest proportion—in the last 2 years of that time period (2007–2009). In nursing homes with no Whites, the proportion of Blacks vaccinated for influenza was the lowest; by contrast, in nursing homes with no Blacks, the proportion of Whites vaccinated for influenza was the highest (Cai et al., 2011).

Researchers examined nursing home ownership status and the setting in which the nursing home was located to identify disparities in vaccination receipt. Li and Mukamel (2010) reported for-profit ownership status as positively associated with increased racial disparities (unvaccinated and undocumented [Blacks compared to Whites]) in influenza (odds ratio [OR] = 2.11, $p < .001$; OR = 1.94, $p < .001$, respectively) and pneumococcal vaccination (OR = 1.64, $p = .001$; OR = 2.01, $p < .001$, respectively). Marsteller and colleagues (2008) found similar findings regarding proprietary status; however, the associations were only significant in the bivariate analysis, not in the multivariate analysis.

When stratified, Blacks residing in nursing homes in nonrural settings (metropolitan and micropolitan) were associated with an increased likelihood of being unvaccinated or undocumented for influenza and pneumococcal compared to Whites in the same settings (OR = 1.78, $p \leq .001$; OR = 1.71 [unvaccinated], $p \leq .001$; OR = 1.83, $p = .002$; OR = 1.94, $p \leq .001$ [undocumented], respectively) (Li & Mukamel, 2010). In rural settings, the OR of Black nursing home residents being unvaccinated for influenza was 3.31 ($p \leq .001$) and having no documentation of pneumococcal vaccination receipt was 2.49 ($p = .016$), compared to Whites (Li & Mukamel, 2010).

Bardenheier and colleagues' (2013) study aimed to understand if frailty (physical functioning) modified the effect of race on influenza vaccinations. Frailty was operationalized using the MDS cognitive performance scale, activities of daily living, and the changes in health end-stage disease and symptoms and signs scale (Bardenheier et al., 2013). Frailty of the residents increased disparities in influenza vaccination receipt between Blacks and Whites in nursing homes where fewer than 5% of the residents were Black.

Compared to Whites, Marsteller and colleagues (2008) found Blacks less likely to be vaccinated for pneumonia and more likely to have unknown vaccination status for pneumonia in Medicaid-only and dually certified facilities. Similarly, Li and Mukamel (2010) reported Black Medicaid residents were less likely to receive both vaccinations and have both vaccinations documented, compared to White Medicaid residents. Among non-Medicaid residents (Medicare, private, other), Blacks were still less likely to

receive the influenza vaccination or have either the influenza or pneumococcal vaccination documented, compared to non-Medicaid White residents.

Interventions to Increase Vaccinations

Interventions to increase vaccinations were facility-level contributing factors to racial/ethnic disparities in vaccination receipt and operationalized as: tracking of vaccinations and vaccination strategies. Two studies (Li & Mukamel, 2010; Marsteller et al., 2008) reported Blacks were less likely to have their vaccination status tracked. In the Marsteller and colleagues (2008) study, both Hispanics and Blacks lacked pneumococcal vaccination receipt status more than Whites (4%, 4%, and 2%, respectively), while in the Li and Mukamel (2010) study, Blacks were 1.85 times less likely to have their influenza vaccination receipt status tracked and 1.95 times less likely to have their pneumococcal vaccination receipt status tracked, compared to Whites.

Adjusting for resident, facility-, state-, and regional-level characteristics, Bardenheier, Shefer, and colleagues (2011) found the lack of vaccination-promoting strategies (e.g., standing orders, permissibility of verbal consent, seasonal influenza vaccination campaigns, centralized tracking systems, and routine review of facility-wide influenza vaccination receipt rates) significantly increased the racial gap in influenza vaccination between Black and White nursing home residents. Additionally, when less than 40% of health care personnel were vaccinated for influenza, the gap in vaccination receipt between Blacks and Whites significantly increased. Marsteller and colleagues (2008) similarly found the lack of organized vaccination programs to be associated with fewer Blacks being vaccinated for pneumonia and more Blacks having an unknown vaccination status, compared to Whites. However, in an earlier study led by the same author (Marsteller et al., 2006), the researchers found that staff vaccination requirements had no relationship to resident influenza vaccination status.

Discussion

Racial/ethnic disparities in influenza and pneumococcal vaccination receipt experienced by Blacks and/or Hispanics, compared to Whites, were evident in all of the reviewed studies. Not offering and refusing vaccinations (individual-level), the population served (community/facility-level), and lack of interventions to increase vaccinations (facility-level) were found to be overall contributing factors to disparities in vaccination receipt. The largest disparities (>10% difference in vaccination receipt) were seen as the result of the following contributing factors: increased racial/ethnic minority composition of the nursing home (nursing homes with no Whites compared to nursing homes with no Blacks), lack of vaccination strategies/policies in nursing homes, and/or nursing home location in a nonurban setting.

The population served by nursing homes greatly influences disparities in vaccination receipt between racial/ethnic minorities and Whites. When Blacks were largely concentrated in nursing homes, vaccination receipt decreased substantially for this racial group while higher concentrations of Whites resulted in a substantial increase in vaccination receipt. Overall, vaccination receipt was the lowest among Black residents in nursing homes with more than 50% Blacks. Findings from other studies confirm that racial/ethnic composition directly influences receipt of care. For example, Haas and colleagues (2004) reported that a high proportion of Blacks (>40%) in a county were more likely to report difficulty obtaining care (e.g., not receiving health care they thought they needed), compared to a low proportion of Blacks (<6%) in a county. Similar results in Haas et al.'s (2004) study were reported with respect to Hispanic proportions.

Additionally, racial/ethnic minorities more commonly pay for their nursing home stay with Medicaid and reside in Medicaid-serving facilities and for-profit facilities (CMS, 2013; Mor, Zinn, Angelelli, Teno, & Miller, 2004). Medicaid and for-profit facilities have been associated with poorer performance, increased deficiencies, and decreased quality (Mor et al., 2004). This review revealed that Blacks were less likely to receive vaccinations in Medicaid-only facilities and dually certified facilities (Medicare and Medicaid) along with for-profit facilities (Marsteller et al., 2006). It is plausible that facility resources are unevenly distributed when considering these disparities in care associated with location of nursing homes, proportions of racial/ethnic minorities in nursing homes, primary source of payment, and ownership status of the nursing home (Chang Yishih, Siegel, & Wilkerson, 2012). Lower staffing and increased workload in these nursing homes, for example, can affect health care providers' perceptions of time to offer vaccinations and to educate residents on the benefits and efficacy of influenza and pneumococcal vaccinations, thus affecting quality of care.

Social and cultural factors may also explain a portion of the disparities in vaccination receipt, particularly related to higher refusals of vaccinations among racial/ethnic minorities compared to Whites. Historically, African Americans and Hispanics have had limited to no access to formal health care leading them to depend on traditional remedies to treat illness and injury (Kennedy, Mathis, & Woods, 2007). Because of this acquired disengagement with formal health care services, it is no surprise that in a national telephone survey of 3,875 adults aged 65 years and older, Blacks and Hispanics were found to be less likely to believe the influenza vaccine was very effective in the prevention of illness when compared to Whites, less likely to report susceptibility to illness if not vaccinated, and more likely to attribute the influenza vaccine to influenza-like side effects (Wooten, Wortley, Singleton, & Euler, 2012). Alternatively, these researchers found that high vaccination receipt was associated with positive beliefs about the vaccine.

These individual-level findings support the need to address negative beliefs and attitudes along with disengagement with the health care system among racial/ethnic minority elderly to close gaps in vaccination receipt and improve overall vaccination receipt rates. Policies related to increasing engagement among older adults may be beneficial to reducing health and economic disparities (Gonzales, Matz-Costa, & Morrow-Howell, 2015).

Discrimination towards racial/ethnic minority residents and provider mistrust must additionally be considered when examining racial/ethnic disparities in care processes such as vaccination administration. In this review, Blacks were less likely to be offered vaccinations compared to Whites and more likely to refuse vaccinations when offered them. Prior research has shown that providers perceived racial/ethnic minority patients as less engaged in their care and, as a result, spent less time in communication and education activities with them (Cohen et al., 2012; Ferguson & Candib, 2002). Subjection to medical experimentation and acts of deception in the past, however, may explain a majority of noncompliance and mistrust Black nursing home residents portray towards health care providers and the health care system (Spector, 2002). Blacks have been found, by contrast, to have increased compliance with care and be more likely to accept recommendations when they are informed (Harris, Miller, & Davis, 2003).

While every resident has a right to refuse vaccinations (or other treatment), each resident must receive the information necessary to make decisions. Auditing the interactions between provider and resident may provide greater insight to the depth of information that is provided to racial/ethnic minorities and the manner in which it is delivered. This information may then inform future steps towards closing gaps in vaccination refusals and not being offered vaccinations. Furthermore, our individual-level findings emphasize the need to involve racial/ethnic minorities fully in their care plans, provide appropriate education, and identify targeted interventions to address racial/ethnic bias among health care providers. Additionally, activities to increase cultural and linguistic competence among health care providers are needed to meet the needs of this growing diverse racial/ethnic elderly group effectively.

Interventions to increase vaccination coverage have been important in addressing challenges associated with vaccination adherence in nursing homes. Vaccination mandates have been instrumental in increasing the compliance of health care workers (Babcock, Gemeinhart, Jones, Dunagan, & Woeltje, 2010), and standing orders have increased vaccination receipt among nursing home residents (Bardenheier, Shefer, Lu, Remsburg, & Marsteller, 2010; Stevenson, McMahon, Harris, Hillman, & Helgersen, 2000). One study in this review found certain facility-level vaccination policies (i.e., standing order, centralized tracking systems, vaccination campaigns) decreased disparities among racial/ethnic groups (Bardenheier, Shefer, et al., 2011), while a second study

found general organized immunization programs increased vaccination receipt and decreased disparities (Marsteller et al., 2008). Thus, facility-level factors such as these described play an important role in encouraging and managing vaccination receipt particularly related to closing gaps in care among racial/ethnic groups. All nursing home facilities should also consider implementation of such strategies to assist with challenges in meeting federally recommended health care worker and resident vaccination receipt goals.

To note, all pneumococcal vaccination data in this review were over a decade old and all influenza vaccination data were over 5 years old. The majority of the studies were appraised to be average or good quality. Studies were weakest in measurement quality and sample selection. This finding was mainly due to no researchers from any of the studies discussing the reliability and validity of the main exposure variables and reliability of the main outcome variables: race/ethnicity and influenza and pneumococcal vaccination, respectively. We did find evidence showing these variables from the MDS to be reliable and valid with high percent agreement ranging from 0.993 to 1.000 for race/ethnicity and 0.978 to 0.994 for the influenza and pneumococcal vaccination (Grosholz et al., 2014; Hawes et al., 1997; Saliba & Buchanan, 2008). We found no information that clearly describes the reliability and validity of these variables for the NNHS. Because the NNHS is based on a sample, however, the statistics presented in the results are expected to be different than what would have been presented if the entire population was surveyed (Jones, Dwyer, Bercovitz, & Strahan, 2009).

A similar systematic review examining factors associated with influenza and pneumococcal vaccination in the general elderly community population across the world was conducted in 2005. The researchers found vaccination receipt varied across studies, and factors for not being vaccinated included lack of recommendation or information, absence of risk perception, costs, disbelief in efficacy, and fear of side effects. Increased age, presence of chronic disease, and doctor's recommendation were found to be predictors for receipt of vaccinations (Kohlhammer, Schnoor, Schwartz, Raspe, & Schäfer, 2007). Both the Kohlhammer and colleagues' review as well as the present review reported that vaccination receipt differed among studies, and lack of recommendation/offering of vaccination to specific racial groups was a contributing factor to vaccination nonreceipt.

In 2005, the Federal government issued requirements for all CMS-certified nursing homes to offer influenza and pneumococcal vaccinations to each resident; documentation of vaccination receipt and nonreceipt was also mandated (CMS, 2005). Around the same time, influenza and pneumococcal vaccination rates were included as CMS quality measures and tracked by certified nursing homes quarterly. The purpose of this publicly available data was to provide information to the consumer about the quality of care in nursing homes as well as assist nursing homes in

quality improvement efforts (CMS, 2016). Because of these initiatives, one might expect the gap in vaccination receipt to close between racial/ethnic minorities and Whites while overall vaccination receipt to increase. Influenza receipt post-CMS requirements examined in two studies in this review did show an increase in vaccination receipt and a decrease in the gap among groups vaccinated between 2006 and 2009 (Bardenheier et al., 2012; Cai et al., 2011). These results suggest possible progress towards meeting CMS requirements in the area of improving influenza vaccination. However, the data examined in this review are either old (influenza) or prior to CMS policy (pneumococcal); therefore, can only be used as comparison data to needed updated research examining the effects of CMS policy.

Strengths and Limitations

The use of the PRISMA guidelines strengthened this review and helped to ensure methodological rigor, careful planning, and clear reporting (Moher et al., 2015). Additionally, the EAI used to appraise the quality of the studies in this review was comprehensive, developed exclusively to evaluate epidemiological studies, and has been determined valid and reliable (Genaidy et al., 2007). Further, it allowed for the evaluation of important areas specific to epidemiological studies (e.g., sample selection, comparison groups).

When performing the literature search, the researchers made every attempt to ensure its completeness, but some studies may have been missed. Additionally, publication bias must be considered because results of negative findings may have not been published and more than half of the studies reviewed were authored or co-authored by the same researcher.

Recommendations

This review exposed important gaps in racial/ethnic disparities related to receipt of vaccinations among nursing home residents. Critically, little to no information exists that provides evaluation of the effectiveness of the 2005 CMS vaccination mandate and a majority of the studies reviewed were weaker in sample selection and measurement quality. Without current evidence, strategies and practices developed to improve vaccination receipt and preventable illness may be poorly directed. Only contributing factors to vaccination disparities and not available strategies and practices and/or outcomes as a result of lack of vaccination were examined in this review. It is necessary for researchers to examine trends of vaccination receipt post-CMS requirements along with reasons for vaccination nonreceipt, strategies and practices, and consequential outcomes of decreased vaccination receipt among racial/ethnic minorities (e.g., influenza, pneumonia, hospitalization, and mortality). When performing this investigation, researchers may use Nursing Home Compare as an additional data source providing current facility-level vaccination data that can be aggregated into national data.

Additionally, across the studies reviewed, there was variation in how vaccination receipt was defined by the researchers. For example, some researchers included those who were vaccinated outside of the facility in the same category as those who were endorsed as vaccinated on the MDS (Bardenheier, Wortley, et al., 2011); whereas other researchers kept this group in the category of those who were originally endorsed as not vaccinated (Cai et al., 2011). Similar variation is also seen in how federal entities define vaccination receipt (National Quality Measures Clearinghouse, n.d.-a, n.d.-b; U.S. Department of Health and Human Services, 2013). Such variation prevents consistent reporting and evaluation of vaccination coverage and poses important policy implications related to the need to implement clear and consistent vaccination definitions to identify the true state of vaccination disparities.

Furthermore, only two studies in this review examined Hispanics. This group warrants additional attention because their residency status in nursing homes is increasing and the need to understand disparities occurring among Hispanics is more urgent compared to a decade ago. Even more so, American Indians and Alaskan Natives were not included in the existing research because of their low representation in nursing homes, but necessitate further inquiry as they lead all racial/ethnic groups in pneumonia mortality (Centers for Disease Control and Prevention, 2015).

Implementing and increasing the number of vaccination policies/strategies in nursing homes—particularly focused on racial/ethnic minorities and among facilities that are for-profit, located in rural settings, and/or house a large proportion of racial/ethnic minority residents—may help to close gaps in vaccination care processes among vulnerable racial/ethnic minority groups. Additionally important, however, is identifying the characteristics of the communities in which these nursing homes are located to better provide support (e.g., funding, resources) to poorly performing facilities (Grabowski, Elliot, Leitzell, Cohen, & Zimmerman, 2014). Researchers have previously found increased residential segregation of the community to result in lower care quality provided in the nursing home and higher nursing home closures (Feng, Lepore, et al., 2011). None of the studies in our review examined this critical detail beyond the nursing home setting. Finally, as this review only focused on disparities among long-stay nursing home residents, further research is needed on potential disparities occurring among short-stay residents in post-acute facilities.

Conclusion

Across all studies examined in this review, racial/ethnic minorities received influenza vaccinations as much as 20% less and pneumococcal vaccinations as much as 15% less than Whites; no group had a vaccination receipt of more than 84%. While decreasing, disparities still exist in influenza vaccination receipt post-CMS requirements (2005). Nothing is known about pneumococcal vaccination receipt

after this time. Eliminating disparities among racial/ethnic minorities and increasing influenza and pneumococcal vaccination coverage to 90% or more among nursing home residents are two national priorities (U.S. Department of Health and Human Services, n.d.-a; Williams, 2007). Several contributing factors on an individual, community, and facility-level have been identified that may be addressed to alleviate these disparities and improve overall vaccination receipt. Yet, without updated data on vaccination receipt, we are unable to gauge where our nation stands in confronting inequities in care. Immediate research is warranted that reports on the status of these priorities and shortfalls.

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