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Does Gender Influence Immunization Status for Influenza and Pneumonia Among Older Veterans?

Bevanne Bean-Mayberry, MD, MHS^{1,2}, Elizabeth M. Yano, PhD, MSPH^{1,3}, Maria K. Mor, PhD⁴, Nichole K. Bayliss, BA, MA^{4,5}, Xiangyan Xu, MPH⁶, and Michael J. Fine, MD, MSc^{4,7}

¹ VA Greater Los Angeles Health Services Research & Development Center of Excellence, Center for the Study of Health Care Provider Behavior, Sepulveda, CA

² Department of Medicine, School of Medicine, University of California Los Angeles, Los Angeles, CA

³ Department of Health Services, School of Public Health, University of California Los Angeles, Los Angeles, CA

⁴ Center for Health Equity Research and Promotion, VA Pittsburgh Healthcare System, Pittsburgh, PA

⁵ Department of Sociology, University of Pittsburgh, Pittsburgh, PA

⁶ VA Palo Alto Healthcare System, Palo Alto, CA

⁷ Division of General Internal Medicine, University of Pittsburgh, Pittsburgh, PA

Abstract

Background—While adult immunization rates in the Department of Veterans Affairs (VA) remain higher than national rates in the United States, little is known about immunizations among one of the fastest growing populations of new VA users – women.

Objectives—We compared the prevalence of influenza and pneumococcal immunization rates by gender in a national sample of older veterans in the VA system.

Corresponding Author: Bevanne Bean-Mayberry, VA Greater Los Angeles HSR&D Center of Excellence, Sepulveda Ambulatory Care Center and Nursing Home, 16111 Plummer Street, Sepulveda, CA 91343; (818)895-9449; (818)895-5838 fax; bevanne.bean-mayberry@va.gov. Alternate Corresponding Author: Elizabeth Yano, VA Greater Los Angeles HSR&D Center of Excellence, Sepulveda Ambulatory Care Center and Nursing Home, 16111 Plummer Street, Sepulveda, CA 91343; (818)895-9449; (818)895-5838 fax; elizabeth.yano@va.gov.

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Author Contributions

Dr. Bean-Mayberry – study concept and design, data cleaning, data documentation, interpretation of results, preparation of manuscript and revisions, review and approval of final manuscript

Dr. Yano – study design, interpretation of results, preparation of manuscript, editorial revisions, review and approval of final manuscript

Dr. Mor – study design, data analyses, interpretation of results, preparation of manuscript, review and approval of final manuscript

Ms. Wang – data documentation, cleaning, and analyses, review and approval of final manuscript

Ms. Bayliss – data collection, documentation, and cleaning, review and approval of final manuscript

Dr. Fine – study design, interpretation of results, preparation of manuscript, editorial revisions, review and approval of final manuscript

Design and Setting—We used a retrospective, cross-sectional sample of older veterans (age 65+) in the VA healthcare system eligible for immunization in Fiscal Years 2000-2003. We performed generalized estimating equations to analyze combined chart review and administrative data to determine effect of gender on receipt of each immunization.

Participants—Current veteran VA users age 65 and older (N=48,424 patient records).

Measurements—Receipt of influenza immunization and receipt of pneumococcal immunization.

Results—Unadjusted immunization rates were higher for men compared to women for influenza (73% vs. 69%) and pneumococcal vaccine (87% vs. 83%). Adjusting for demographics, clinical co-morbidities, utilization and region, we found that women had a significantly lower odds of both influenza (OR 0.85, 95% CI 0.79, 0.92) and pneumococcal immunization (OR 0.77, 95% CI 0.71, 0.84).

Conclusion—Older women veterans have lower rates of immunization compared to older men veterans in VA settings. While VA remains above community levels for immunization, older women veterans will benefit from targeted efforts to increase immunization prevalence.

Keywords

immunizations; preventive health services; women; veterans; elderly

Introduction

Americans 65 years of age and over currently comprise over 35 million persons in the United States (US) and represent 1 in every 8 adults (1). By 2030, population projections suggest that persons 65 and older will nearly double to 72 million Americans (1). With this rapidly expanding older population comes the driving need to optimize health by reducing morbidity and mortality in older adulthood. While six of the seven top causes of death in the elderly occur due to chronic conditions, influenza and pneumonia remain a major, preventable cause of morbidity and mortality for older Americans. These infectious conditions represent the 5th leading cause of death in persons over age 65, rank among the top health indicators nationally, and carry a target goal for immunization of 90% of the community dwelling older adult population annually for influenza and at least once for pneumonia (2,3).

Among adults, influenza immunization is associated with clear benefits in the older population in long term care facilities, however the magnitude of the immunization benefit is debated for community dwelling older adults due to potential bias in the estimates (4,5). Based on recent reviews and meta-analyses focusing on persons age 65 and older receiving influenza immunization, the potential risk reduction ranges from 26 - 33% reduction in hospitalization for influenza and pneumonia, and from 42 - 50% reduction in the risk of death from all causes in the elderly (6-9). Additionally, pneumococcal infections are most severe in the elderly who represent over one-third of the invasive pneumococcal cases and over half of the deaths from this illness. Fortunately, pneumococcal immunization results in a greater than 40% reduction of pneumococcal bacteremia in elderly adults (10). Thus, receipt of these preventive care measures, remains a single therapy that reduces morbidity and possibly mortality in the aged without requiring repeated changes in patient behaviors or major organizational changes in a health care system.

In this aging population, deaths of men continue to outnumber women at every age interval and contribute to the female predominance among the elderly. Community dwelling elderly women remain a vulnerable population because they are more likely to be widowed, living

alone, and living in poverty compared to elderly men (11,12). One segment of this vulnerable aging female cohort includes women who were former military personnel. Women veterans have become one of the fastest growing segment of the VA population (the fastest is older veterans), currently comprise over 10% of the 22.8 million veterans nationally, and are increasing more rapidly than previously projected for VA users (13,14). Thus, it remains imperative to evaluate the current delivery of health care to military women who enter the VA and to prepare appropriately for the growing numbers of middle age and older women veterans that will receive care in the VA.

VA remains the largest national health care system serving a predominantly male population by design. While VA outperforms or equals care in the community or Medicare population for both prevention and chronic disease indicators (15,16), recent data by Jha and colleagues indicate variation by gender in the receipt of four key measures: pneumococcal and influenza immunizations, blood pressure control, and blood glucose control in diabetics (17). Specifically, female VA users had a significantly lower rate of any pneumococcal (5% lower) immunization and influenza (3% lower) immunization in the past year (17). This study builds on the foundational work by Jha and colleagues by evaluating the effect of gender on the receipt of pneumococcal and influenza immunization in an outpatient older population, while adjusting for patient characteristics, clinical co-morbidities, utilization, and geographic region. Since the VA Healthcare System provides an ideal environment for investigating the effect of gender in an aging population due to the presence of a theoretically equal access system for eligible veterans who enroll and use it as a usual source of care, we hypothesized that preventive immunizations among older men and women would not differ after adjustments for these four types of factors.

Methods

Data Sources and Study Population

We identified a national retrospective cohort managed in the VA healthcare system in fiscal years 2001-2003 (October 1, 2000 – September 30, 2003); comprised of general outpatient clinic users. The VA Office of Quality and Performance selected all of these patients for the External Peer Review Program (EPRP). EPRP randomly samples veterans monthly from each VA medical center and uses third party chart review to document whether each veteran has received appropriate and timely preventive care and chronic disease care using quality indicators supported by national and/or VA specific guidelines. All patients selected for review undergo verification of recent use of a VA outpatient general clinic setting and at least one previous outpatient visit within the past 24 months (18-19).

This study was approved by the Institutional Review Boards at the VA Pittsburgh and VA Greater Los Angeles Healthcare Systems. Our total sample of VA users from EPRP included 96,320 chart reviewed records held by 91,574 unique VA patients sampled at least once during the 2001-2003 fiscal years. We limited the sample to patients aged 65 years and older. This study focused directly on these older veterans for which recommendations for immunization remain the same in surplus or shortage years of vaccination production. We note that influenza (flu) season 2000-2001 was a vaccination shortage year which had revised recommendations to focus on persons age 65 and over first and those under age 65 with a chronic condition instead of all persons aged 50-64 (20).

Using an honest broker for data merging, we linked this VA specific veteran sample via scrambled social security numbers to demographic, clinical, and utilization data from the National Patient Care Database (NPCD) outpatient files at Austin Automation Center, the repository for VA administrative files. To link each patient record to the NPCD, we used the EPRP chart review pull date as the time related link for selecting administrative data.

Demographic administrative information that occurred in the 1 year period prior to the pull date was extracted to obtain the most recent demographic data concurrent with outpatient VA care. To address the issue of missing race data in administrative files, we supplemented with race data from the VA – Medicare cumulative vital summary files. This procedure resulted in a missing race variable count of less than 0.5% for our sample age 65 and above. We then created an analytic file with recoded administrative, clinical, and Medicare variables applicable across the total sample for the complete time period (i.e., all three fiscal years).

Some patients possessed additional chart reviews across fiscal years, and this finding varied by gender. However, no patients were sampled more than once within a fiscal year. We accounted for the repeated sampling of patients across fiscal years by flagging records as the first, second or third chart review date. While nearly all male veterans were reviewed only once (1 review, 98%; 2 reviews, 2%; 3 reviews, <1%), many females were reviewed at least twice during the 3 year period (1 review, 81%; 2 reviews, 18%; 3 reviews, 1%). This step allowed us to perform cluster analyses at the patient level to reassess the effect of gender.

Baseline Data Collection (Measurements)—Our outcome variables included the following measures: 1) receipt of influenza immunization in the prior flu season and 2) ever receipt of pneumonia immunization. We dichotomized the evidence for each immunization to *yes* for completed (whether in VA or outside VA) and *no* for refused or no documentation. We also verified each *yes* response for influenza by checking the date of the immunization so that we only included immunizations which occurred within the prior flu season.

Our independent variable was gender (female versus male). Our control variable for race contained four categories (i.e., white, black, other or unknown). The *other race* category represented veterans of Asian, Pacific Islander, American Indian or Hispanic ancestry. We preferentially used self-identified race from Medicare data which is taken from the enrollment data base populated by the Social Security. We completed the remaining race categories for unique veterans using the VA outpatient and inpatient files in NPCD from fiscal year 1997 to the chart review pull date. To evaluate consistency of the race classification, we examined (1) the mode of all race values prior to chart review and (2) the race category most recently reported in the VA before chart review. Results from these comparisons were similar.

We included other control variables for demographic, clinical and utilization information for each patient record. Demographic data consisted of age in 10-year increments, marital status (married vs. unmarried), income (>\$20,000 per year vs. <\$20,000 per year), insurance status (none, Medicare, or other), VA eligibility status (i.e., greater than 50% service connection status vs. other), VA site, and geographic region. Service connection status indicates whether the VA identifies and recognizes a medical condition or diagnosis as related to the patient's military experience. We classified a group of common clinical co-morbidities based on published methods for administrative databases (21). To ensure appropriate comparisons by gender, we verified that each unique patient was a veteran by VA administrative codes.

To operationalize outpatient utilization, we linked each patient to a home VA site (i.e., medical center) for their outpatient care. We calculated the total number of outpatient visits and primary care/general medicine specific clinic visits using the Department of Veterans Affairs, Fiscal Year 2003 outpatient identifiers for the clinic stop codes (22). We obtained clinic counts for all patients using the common primary care clinic codes (which include primary care, general medicine, or women's health clinic) visit days during the 12 months prior to the medical record review pull date to ascertain outpatient utilization across the

sample. We categorized clinic visits to ordinal values at 0, 1, 2, 3-4, and 5 or more visits to provide better adjustment according to frequency of clinic use.

Statistical Analyses

To perform univariate comparisons of male and female veterans, we used the two-sided independent t-tests for continuous variables and the chi-square statistic for categorical variables. We calculated unadjusted immunization rates for the veteran subgroups by gender. For each immunization type, we used multiple logistic regressions with generalized estimating equations to account for patient clustering at the VA site level while adjusting for demographic, clinical, and utilization factors in addition to geographic region. We also used models to account for repeated sampling of the same patients across fiscal years (i.e., clustering at the patient level). Finally, we performed the analyses using an interaction term for age and gender and a term for race and gender. Since none of the latter models performed better than the original, we report the first analyses with clustering by VA site in the results section. We used STATA 9.0 (College Station, TX) and SAS version 9.1 (Cary, NC) for all analyses.

Results

We obtained 48,424 records for 46,244 unique VA outpatients age 65 years or older for linkage with VA administrative files. Females comprised 11% of the unique patient sample (N=5217). Demographic and clinical characteristics are summarized in Table 1. Female veterans were significantly older, with a mean age of 75.5 years (SD 5.9) versus 73.9 years (SD 5.6) in males. Female veterans more often reported that they were white, unmarried, had less than \$20,000 income per year, and had a lower rate of VA service connected medical conditions that facilitated their eligibility for VA care ($P<.001$ for each comparison). Male veterans and female veterans had similar numbers of visits in the prior year (See Table 1). Although statistically significant, males and females had similar proportions of insurance coverage. Co-morbidities varied between males and females with hyperlipidemia and hypertension being the most frequent diagnoses for both men and women.

We calculated unadjusted immunization rates for influenza and pneumococcal immunization by gender in our national sample (See Table 1). Compared to males, females had significantly lower rates of influenza immunization (69% vs. 73%, $P<.001$) and lower rates of pneumococcal immunization (83% vs. 87%, $P<.001$).

In the multiple logistic regression analyses, female sex independently predicted lower levels of receipt of influenza and pneumococcal immunization (Table 2). Women showed 15% lower odds of influenza immunization and 23% lower odds of pneumococcal immunization. Other significant covariates included black race which showed a 21% lower odds of influenza and 24% lower odds of pneumococcal immunization. Additional findings indicated that the oldest ages, marriage, insurance, and higher outpatient clinic use significantly predicted pneumococcal immunization, while the 75-84 year old group, higher income, insurance, eligibility >50%, and the highest clinic use (5 or more visits in past year) predicted influenza vaccine receipt among VA users.

Discussion

This study is the first to assess immunization status by gender while adjusting for patient characteristics, clinical co-morbidities, utilization, and geographic region. Older female veterans receive fewer immunizations for the prevention of both influenza and pneumonia. The findings are salient because women comprise a greater proportion of the aging

population and a growing segment of veterans. However, few studies focus on either gender and quality of care among the elderly (outside of the cardiovascular and diabetes measures) or gender and quality of care among veteran VA users. Understanding the factors contributing to an immunization disparity in a theoretically equal access system may provide insight to better immunization strategies for older women in VA.

The prior studies about women veteran healthcare provide favorable support for general VA care including: 1) the historical growth of VA women's health programs and clinics within or separate from traditional primary care programs (23,24), 2) high satisfaction in VA women's clinics (25), 3) similar basic and comprehensive gender-specific services across VA sites (26), and 5) similar prevalence rates of gender-neutral quality indicators (20). However, nominal data exist on patient adjusted quality indicators by gender, especially for prevention measures (e.g., immunizations). Most of the gender disparity discussion focuses on cardiovascular and diabetes quality measures. This paper informs this knowledge gap by providing information to VA about gaps in prevention measures. Unfortunately, these data do not clarify why a gender disparity in immunization receipt exists.

We may consider national trends that may contribute to this disparity. First, VA use may differ by gender. Nationally, we know that American women obtain more health care services than men on average (27). While we adjusted for outpatient use in VA, we could not adjust for non-VA health care use. Both older men and women that have Medicare may use multiple (non-VA or VA) providers. Our insurance variable may capture some of this effect but will not quantify how much non-VA care occurs. Separately, women veterans did not historically use VA medical centers since they initially did not receive veteran status until post-World War II, and many women veterans still do not know that they qualify for VA benefits or healthcare (28). Both factors may limit the prevalence and frequency of VA use among women veterans.

Second, fragmentation of care may contribute to gender variation in immunization rates in VA. Nationally, women switch providers due to dissatisfaction with care and more often use multiple providers (29). This cross-system or cross-provider behavior may contribute to fragmentation in care among women. Therefore, women may be classified as primary care users in VA, but they really use the non-VA physicians and providers more than VA. However, we did explore the location for immunization receipt using the raw data and did not find a disproportionate number of women obtaining non-VA immunizations. Receipt of immunizations outside the VA was similar between men and women. (Data not shown.) The identifiable differences occurred for receipt of immunization *within* the VA and with a larger proportion of women veterans having *no* documentation of immunization during one of the flu seasons. We also performed analyses by restricting our data to black and white patients only to look for an interaction between race and gender and found no significant interaction. Thus, in spite of our limitations, these findings appear consistent with our conservative analytic measures.

We recognize that the generalizability of our sample is limited to veteran VA users. However VA prevalence rates for immunization during this period still outperform both 2003 Behavioral Risk Factor Surveillance System measures and 2002 Medicare measures for persons age 65 and older (30).

In summary, older women veterans obtain fewer influenza and pneumococcal immunizations compared to their male counterparts. Further studies will be needed to identify whether certain VA organizational features hinder or facilitate the receipt of immunizations among women veterans. Organizational and gender-based analyses adjusted for patient characteristics may allow the identification of key features that may work in

clinic settings with high volumes of women or may inform the development of local interventions to older women to optimize their immunization status and potentially reduce their morbidity and mortality.

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Table 1
Characteristics of Outpatient VA Users by Gender in Fiscal Years 2001-2003 (N=46,244)

Patient Characteristics	Male 41,027 (89%)	Female 5,217 (11%)	P Value
Age (x) sd, years	73.9 (5.6)	75.5 (6.0)	<.001
65-74 years	55%	38%	
75-84 years	42%	58%	
85+ years	3%	4%	
Race			<.001
White	87%	91%	
Black	11%	7%	
Other	2%	1%	
Unknown	0%	0%	
Married	68%	30%	<.001
Income >\$20,000	36%	31%	<.001
VA Eligibility (Service Connected≥50%)*	13%	8%	<.001
Insurance†			<.001
None	23%	24%	
Medicare	59%	56%	
Other	20%	18%	
Clinic utilization (visits in past 1year)			<.001
0	20%	17%	
1	20%	19%	
2	17%	19%	
3 or 4	25%	26%	
5 or more	19%	19%	
Clinical Co-morbidities			
Congestive heart disease	12%	9%	<.001
Chronic pulmonary disease	20%	17%	<.001
Cerebrovascular disease	1%	2%	.062
Dementia	1%	1%	<.001
Diabetes with chronic complications	17%	12%	<.001
Diabetes with mild to moderate complications	67%	57%	<.001
Hyperlipidemia	49%	48%	<.001
Hypertension	75%	76%	.792
Any malignancy	14%	9%	<.001
Myocardial infarction	3%	2%	<.001
Peptic ulcer disease	3%	2%	.001
Peripheral vascular disease	11%	7%	<.001
Renal	5%	2%	<.001

Patient Characteristics	Male 41,027 (89%)	Female 5,217 (11%)	P Value
Rheumatologic disease	2%	3%	<.001
Geographical Region [‡]			<.001
East	29%	30%	
Central	28%	26%	
South	24%	22%	
West	18%	22%	
Immunization Status			
Any pneumonia immunization	87%	83%	<.001
Influenza immunization in past year	73%	69%	<.001

* VA eligibility indicates whether the patient has a documented condition that is associated with military duty or exposures.

[†] Insurance status indicates whether the patient reported any other type of health coverage outside the VA Healthcare System.

[‡] Geographical region is one of the 4 major regional areas of the United States designated by the U.S. Census Bureau.

Table 2
Predictors of Receipt of Immunization in Outpatient VA Users Age 65+ years

Characteristic	Influenza Immunization Adjusted OR (95% CI) [†]	Pneumococcal Immunization Adjusted OR (95% CI) [†]
Gender, Male	Referent group	-
Female	0.85 (0.79-0.92)	0.77 (0.71-0.84)
Age, 65-74 years	Referent group	-
75-84	0.85 (0.81-0.90)	1.00 (0.85-1.16)
85+	0.93 (0.81-1.06)	1.16 (1.00-1.34)
Race, White	Referent group	-
Black	0.79 (0.71-0.87)	0.76 (0.67-0.86)
Other	1.01 (0.84-1.20)	1.20 (0.90-1.60)
Unknown	1.12 (0.82-1.54)	1.04 (0.67-1.63)
Married	1.11 (1.06-1.16)	1.09 (1.03-1.15)
VA Eligibility <50%	Referent group	-
VA Eligibility ≥50%	1.16 (1.07-1.25)	1.09 (1.00-1.19)
Insurance, None	Referent group	-
Medicare	1.23 (1.16-1.31)	1.34 (1.22-1.47)
Other Insurance	1.20 (1.10-1.31)	1.24 (1.12-1.37)
Income >\$20,000	1.07 (1.02-1.12)	1.01 (0.96-1.06)
Clinic utilization (visits in past 1 year)	Referent group	-
1	0.99 (0.91-1.07)	0.97 (0.88-1.08)
2	0.98 (0.89-1.07)	0.88 (0.76-1.01)
3 or 4	1.02 (0.93-1.12)	0.86 (0.75-0.98)
5 or more	1.17 (1.05-1.30)	0.85 (0.72-0.99)
Clinical co-morbidities	-	-
Congestive heart failure	1.09 (1.01-1.08)	1.08 (0.99-1.18)
Chronic pulmonary disease	1.20 (1.14-1.27)	1.47 (1.35-1.60)
Cerebrovascular disease	1.04 (0.97-1.12)	1.08 (0.97-1.19)
Dementia	0.92 (0.77-1.11)	0.90 (0.71-1.13)
Diabetes with chronic complications	1.20 (1.13-1.29)	1.26 (1.14-1.40)
Diabetes with mild or moderate complications	0.97 (0.92-1.02)	0.99 (0.91-1.07)
Hyperlipidemia	1.17 (1.12-1.22)	1.26 (1.19-1.33)
Hypertension	1.21 (1.15-1.27)	1.19 (1.11-1.27)
Any malignancy	1.16 (1.09-1.24)	1.14 (1.04-1.24)
Myocardial infarction	0.95 (0.83-1.08)	0.98 (0.81-1.18)
Peptic ulcer disease	1.14 (0.96-1.36)	1.06 (0.88-1.28)
Peripheral vascular disease	1.04 (0.96-1.13)	1.01 (0.92-1.12)
Renal	0.94 (0.85-1.04)	1.24 (1.07-1.43)
Geographical Region (South) [‡]	Referent group	-

Characteristic	Influenza Immunization Adjusted OR (95% CI) [‡]	Pneumococcal Immunization Adjusted OR (95% CI) [‡]
East	0.84 (0.74-0.95)	1.04 (0.86-1.24)
Central	0.79 (0.68-0.92)	0.87 (0.71-1.07)
West	0.97 (0.84-1.11)	1.12 (0.91-1.38)

* Confidence interval.

[‡] The full logistic model includes adjustment for age, race, marital status, VA eligibility, income, insurance, outpatient utilization, clinical co-morbidities, geographical region and clustering by site.

[‡] Regions are divided into the 4 major areas of the United States designated by the U.S. Census Bureau.