Exploratory Research in Clinical and Social Pharmacy 9 (2023) 100220

Contents lists available at ScienceDirect

Exploratory Research in Clinical and Social Pharmacy

journal homepage: www.elsevier.com/locate/rcsop

Characteristics of U.S. older adult medicare beneficiaries receiving the influenza vaccination at retail pharmacies

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ARTICLE INFO

Keywords:
Pharmacy
Influenza vaccination
Pharmacy-provided vaccination services
Access to care
Health care disparity.

ABSTRACT

Background: Pharmacy-provided influenza vaccination services have become more prevalent among the older adult population. However, little is known about the characteristics of older adults associated with receiving the influenza vaccination at retail pharmacies and how these associated characteristics have changed.
Objective: To examine characteristics of older adults associated with use of retail pharmacy-provided influenza vaccination services and how the characteristics changed between 2009 and 2015.
Methods: The study used a retrospective, cross-sectional design with data from the 2009 and 2015 Medicare Current Beneficiary Survey. Older adults aged 65 and older who completed a community questionnaire and received the influenza vaccination during the previous winter were identified. Andersen's Behavioral Model of Health Services Use was the conceptual framework for inclusion of the population characteristics. A multivariable log-binomial regression was performed to estimate the association between the population characteristics and use of pharmacy-provided vaccination service, and the relative change in associations between 2009 and 2015. Survey weights were applied in all analyses.
Results: The results showed older adults who were non-Hispanic black (compared to non-Hispanic white), who did not have secondary private insurance (compared to those who had), who did not have physician office visit (compared to those who had) and who lived in non-metro area (compared to those who lived in metro area) had become more likely to use pharmacy-provided influenza vaccination services in 2015 than in 2009.
Conclusions: Pharmacy-provided influenza vaccination services appear to reduce access barriers for racially and socioeconomically disadvantaged older adults. Findings could help inform not only the retail pharmacies that provide vaccination services to better outreach to potential target populations but also policy makers about the disadvantaged populations that would benefit from the vaccination services provided by retail pharmacies.

1. Introduction

Pharmacy-based immunization services have been expanding nationally since the mid-1990s.[1] Counties in the US with available pharmacist-provided vaccination services also grew from 36% to 97% between 2006 and 2010.[2] By 2009, except for Puerto Rico and South Carolina, 49 states in the US and the District of Columbia expanded pharmacists' authority to administer the influenza vaccine.[3] In these states, pharmacists have been legally allowed to administer influenza vaccine to adults through pharmacist-physician collaborative agreements, state-wide protocol agreements or independent pharmacist prescriptive authority without requiring a physician prescription.[3]

Multiple studies showed that pharmacist involvement in vaccination services had a positive impact on vaccination coverage.[2,4–8] Additionally, cost-savings were reported for influenza vaccinations delivered through pharmacies.[9,10] Pharmacists can provide vaccination recommendations, enhance patients' awareness of vaccination, address patients' concerns about vaccination, and administer vaccinations.[11] The retail setting offers pharmacists an advantageous venue to interact and build relationships with patients and thus facilitates the above mentioned pharmacy activities.[6,12] Retail pharmacies reduce access barriers to the influenza vaccine by offering extended business hours, additional numbers of locations, convenience and walk-in services that require no visit fees and waits.[13–17] The accessibility of vaccination services provided by pharmacies may be especially important for older adults, a population that experiences more physical and psychological barriers to accessing health care due to lack of transportation and concerns about provider availability and responsiveness as compared to younger adults. [18,19] With >90% of the US population living within two miles of a community pharmacy,[20] the proportion of vaccinated older adults receiving the influenza vaccination at a retail pharmacy has

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http://dx.doi.org/10.1016/j.rcsop.2023.100220
Received 11 May 2022; Received in revised form 4 November 2022; Accepted 1 January 2023
Available online xxxx

increased from 4.8% in the 2002–2003 flu season to 24.3% in the 2010–2011 flu season, and to 34.5% by the 2014–15 flu season.[21–23]

Despite the increased trend in the use of retail pharmacies to receive the influenza vaccination, influenza vaccination rates of older adults in the US have remained below the 90% goal set by Healthy People 2020.[24,25] About 1.6 million older adults in the US are homebound and half of them have one or more barriers to accessing vaccination services.[26] This suggests that further outreach activities are required through collaboration between local agencies and community organizations.[27] Although pharmacists' roles in providing vaccination services in their communities have grown, especially during the COVID-19 pandemic,[28] research on characteristics of older adults that are associated with using pharmacy-provided vaccination services is scarce,[23,29,30] and how the associations have changed overtime remains unclear. Thus, to address this gap, this study used Andersen's Behavioral Model of Health Services Use[31] to identify predisposing, enabling and need characteristics associated with influenza vaccination receipt at a retail pharmacy among older adults and the change in these characteristics between 2009 and 2015. Data on these characteristics are essential to understand how older adults are responding to expanded retail pharmacy vaccination services. Understanding the characteristics of older adults that use pharmacies for vaccinations is the first step to help pharmacists develop outreach activities to increase influenza or other types of vaccinations for older adults.

2. Methods

2.1. Data source and study sample

This study used a retrospective, cross-sectional study design. The 2009 and 2015 Medicare Current Beneficiary Survey (MCBS) data were used to examine characteristics associated with older adults receiving the influenza vaccination at retail pharmacies and changes in characteristics between the two study years. As shown in Fig. 1, individuals aged 65 years and older who completed the community component survey questionnaires were identified from the MCBS.[32] Those with age <65 years, with incomplete community questionnaires, and those who did not self-report receiving the influenza vaccination were excluded from the analysis. The study excluded older adults who resided in South Carolina and Puerto Rico, locations that changed regulations to grant pharmacist more vaccination authority in 2010.[3] Case-wise deletion was used to remove observations that had missing values. MCBS survey weights were applied in all analyses to address the complex sampling strategy of the MCBS and to generate nationally representative estimates for Medicare beneficiaries aged 65 years and older for both years. A total of 8148 (weighted = 24,416,579) and 7493 (weighted = 30,103,670) older adults who self-reported receiving the influenza vaccines in 2009 and 2015 were included in the initial study sample. Of them, 1316 (weighted = 4,092,026) and 2546

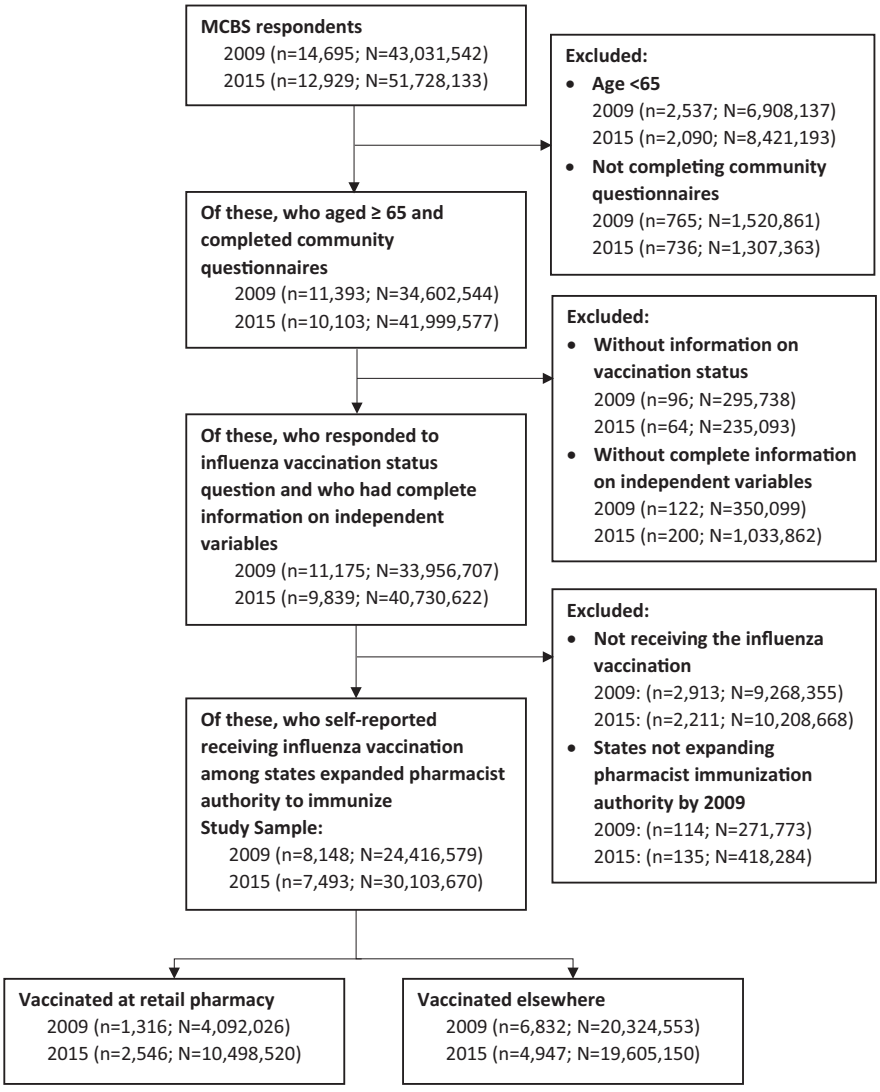

Fig. 1. Study sample.

(weighted = 10,498,520) older adults reported receiving their vaccine at a retail pharmacy in 2009 and 2015 while 6832 (weighted = 20,324,553) and 4947 (weighted = 19,605,150) reported receiving influenza vaccines elsewhere.

2.2. Theoretical framework

Andersen's Behavior Model of Health Services Use was used as a guiding theoretical framework to identify characteristics associated with receiving the influenza vaccination at retail pharmacies among older adult Medicare beneficiaries (Fig. 2).[31] According to the Anderson Model, the determinants of health services use are often categorized into predisposing, enabling and need characteristics. Predisposing characteristics are individual or environmental factors that affect an individual's predisposition and propensity to use health services; enabling characteristics are defined as the community and personal resources that allow and facilitate the use of health services; need characteristics represent an individual's actual or perceived health that necessitates the use of health services. The model is well-suited for this study and has been used to examine specific determinants of health care utilization,[33,34] including utilization of vaccination services.[35,36]

2.3. Variables

The binary dependent variable was defined based on the location older adults received their influenza vaccination among the vaccinated older adults.[22] The dependent variable was set to "1" if the influenza vaccine was received at a "retail pharmacy", defined as a location of vaccine receipt including the "shopping mall/other store" and "other" location categories and "0" if it was received elsewhere. The decision to use the two location categories to represent retail pharmacy was based on recommendation from the MCBS staff.[22] For the independent variables, a binary indicator of the year variable was included to estimate the difference between 2009 and 2015. Predisposing characteristics including gender, race, age, and marital status, enabling characteristics containing education level, metropolitan statistical area, income level, coverage of private secondary insurance and physician office visit during the year, and need characteristics encompassing self-reported health and current smoking status were included in the regression analysis (Appendix A). State dummy variables were added to the model to adjust for the state-to-state variations.

2.4. Statistical analysis

Descriptive statistics were calculated to describe the characteristics of older adults that were vaccinated at retail pharmacies in 2009 and 2015. A balance repeated replication approach was used for variance estimation. A difference-in-difference design with multivariable log-binomial regression model was used to evaluate which characteristics associated with older adults being vaccinated at retail pharmacies significantly changed between 2009 and 2015 by using the adjusted prevalence ratio (PR)[37] of each independent variable:

$$\log(\text{Vaccinated at retail pharmacy}) = \alpha + \beta_1\,\text{YEAR} + \beta_2\,\text{INDEPENDENT VARIABLES} + \beta_3\,\text{YEAR} \times \text{INDEPENDENT VARIABLES} + \varepsilon$$

Interaction terms between the year variable and independent variables (including predisposing, enabling and need characteristics) were added to the model to determine the change in the association between characteristics of older adults and use of pharmacy for influenza vaccination. A stepwise regression was used to backward eliminate the interaction terms that had *p*-values >0.2 from the model. The exponentiated coefficient of the interaction term ($\exp[\beta_3]$), the difference-in-difference estimator, represents how the likelihood of using a pharmacy-provided influenza vaccination service for older adults having a certain characteristic (versus having the reference characteristic) changed from 2009 to 2015.

A sensitivity analysis that altered the definition of retail pharmacy to only include the "shopping mall/other stores" was used to address the uncertainty of the pharmacy categorization (the category of "other" was excluded from the study sample). All statistical analyses were performed using STATA 15 (StataCorp, 2017). This project was exempt from IRB review.

3. Results

Table 1 shows the study variables for the vaccinated older adult Medicare beneficiaries in 2009 and 2015. For predisposing characteristics, a

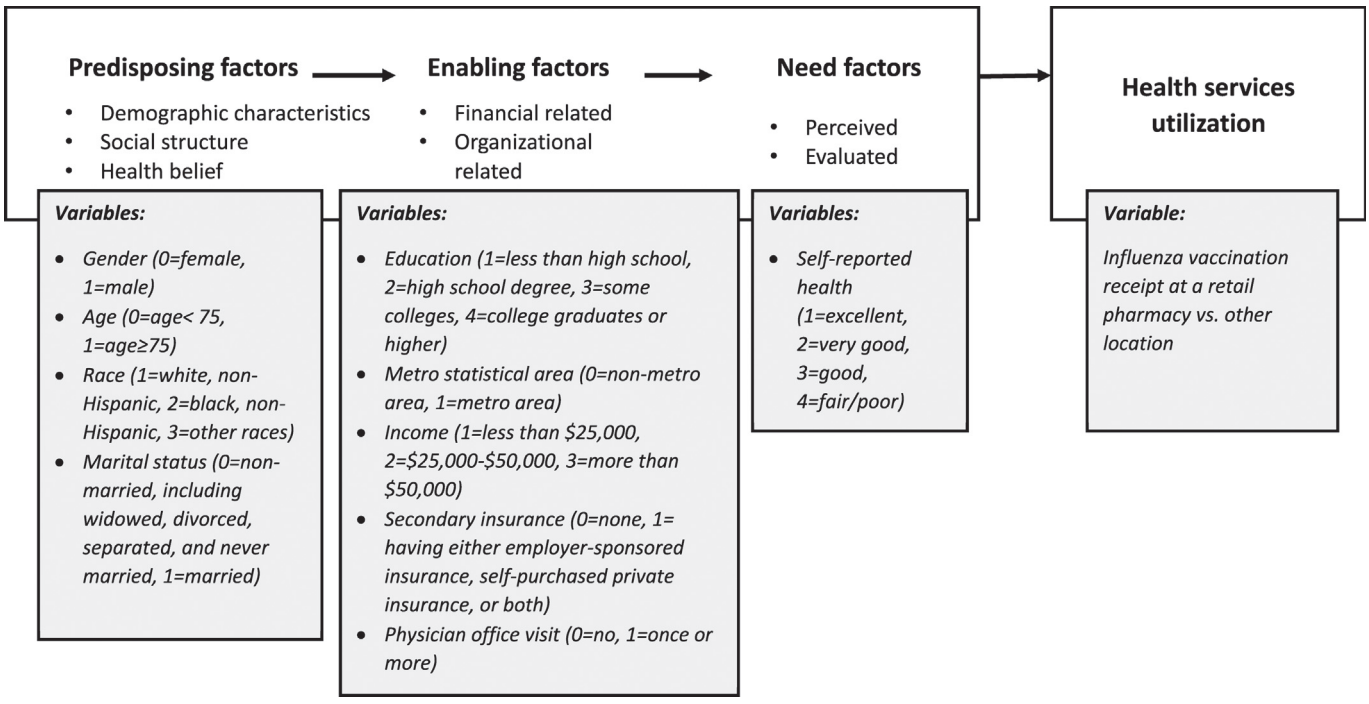

Fig. 2. Theoretical framework —Anderson's Behavior Model.

Table 1
Weighted characteristics of vaccinated older adults.

	2009	2015	
	N = 24,416,579	N = 30,103,670	
	%	%	*P value*
Predisposing			
Gender			
Female	56.8	56.6	Ref.
Male	43.2	43.4	0.82
Age			
65–74	48.3	53.3	Ref
≥75	51.7	46.7	0.00***
Race			
White, non-Hispanic	89.4	86.8	0.00***
Black, non-Hispanic	6.3	7.1	0.12
Other	4.3	6.2	0.00***
Marital status			
Married	57.3	58.0	Ref.
Not married	42.7	42.0	0.51
Enabling			
Education			
<Hight school	20.4	15.9	0.00***
High school	30.0	26.5	0.00***
Some colleges	27.0	28.9	0.03*
College or higher	22.6	28.8	0.00***
Income level			
<$25 K	39.2	32.5	0.00***
$25–$50 K	38.9	28.7	0.00***
>$50 K	21.9	38.8	0.00***
Metropolitan Statistical Area			
Metropolitan	78.3	80.3	Ref.
Non-metropolitan	21.7	19.7	0.07
Secondary private insurance			
Yes	60.9	57.6	Ref.
No	39.1	42.4	0.00**
Physician office visit			
Yes	64.8	56.4	Ref.
No	35.2	43.6	0.00**
Need			
General health			
Excellent	16.3	17.9	0.03*
Very good	31.6	32.6	0.29
Good	32.4	30.6	0.04*
Fair/poor	19.7	18.8	0.29
Current smoking status			
Smoker	8.1	8.3	Ref.
Non-smoker	91.9	91.7	0.58

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 2
Weighted characteristic of vaccinated at retail pharmacy among the vaccinated older adults.

	2009	2015	
	N = 4,092,026	N = 10,498,520	
	%	%	*P value*
Predisposing			
Gender			
Female	60.0	56.5	Ref.
Male	40.0	43.5	0.09
Age			
65–74	52.0	56.3	Ref.
≥75	48.0	43.7	0.01**
Race			
White, non-Hispanic	93.9	91.8	0.02*
Black, non-Hispanic	2.7	4.7	0.00**
Other	3.4	3.5	0.84
Marital status			
Married	59.9	59.9	Ref.
Not married	40.1	40.1	0.98
Enabling			
Education			
<Hight school	13.0	10.6	0.05
High school	27.2	25.8	0.40
Some colleges	29.6	29.7	0.96
College or higher	30.1	33.9	0.06
Income level			
<$25 K	30.3	27.4	0.38
$25–$50 K	39.6	28.1	0.00***
>$50 K	30.1	44.4	0.00***
Metropolitan Statistical Area			
Metropolitan	83.0	79.0	Ref.
Non-metropolitan	17.0	21.0	0.16
Secondary private insurance			
Yes	73.1	62.9	Ref.
No	26.9	37.1	0.00***
Physician office visit			
Yes	74.4	59.4	Ref.
No	25.6	40.6	0.00***
Need			
General health			
Excellent	21.8	21.9	0.95
Very good	35.2	34.8	0.82
Good	28.9	29.4	0.77
Fair/poor	14.0	13.8	0.82
Current smoking status			
Smoker	92.5	91.1	Ref.
Non-smoker	7.5	8.9	0.23

Note: * p < 0.05, ** p < 0.01, *** p < 0.001.

significantly lower percentage of adults aged 75 and older, a significantly lower percentage of non-Hispanic white, and a significant higher percentage of other races/ethnicities were seen in the 2015 vaccinated older adults. For enabling characteristics, the percentage of older adults who had higher education attainment (including some college and college or higher education) and who had annual income level greater than $50,000 were also higher in 2015. The population of vaccinated older adults in 2015 consisted of a higher proportion of older adults without secondary private insurance coverage and a higher proportion of those who did not have a physician office visit during the year. For need variables, a significantly higher proportion of older adults with self-reported excellent health and a lower proportion with self-reported good health were found in 2015.

Table 2 reports the weighted characteristics for the vaccinated older adults who received influenza vaccination at retail pharmacies in both 2009 and 2015. Of the older adults vaccinated at a retail pharmacy, there were a significantly lower percentage of older adults aged 75 years and older in 2015, as well as a lower percentage of non-Hispanic white and a higher percentage of non-Hispanic Black older adults. The retail pharmacy users in 2015 tended to have a higher annual income, were more likely to have no secondary private insurance, and were more likely to have no physician office visit compared to older adults vaccinated in a retail pharmacy in 2009.

Table 3 provides the results of the log-binomial difference-in-difference regression analysis examining the relationship between the characteristics of vaccinated older adults and whether an older adult received the influenza vaccine at a retail pharmacy. The final model contained four interaction terms, including the year × race, year × metropolitan statistical area, year × secondary private insurance coverage, and year × physician office visit interactions. Overall, the vaccinated older adults in 2015 on average had a 51% higher chance of being vaccinated at a retail pharmacy than in 2009 (adjusted PR: 1.51 [1.34–1.67]). The exponentiated coefficient of the interaction terms show that vaccinated non-Hispanic Black older adults had a 41% higher chance of receiving the influenza vaccination in a retail pharmacy in 2015 than in 2009 when compared to their White counterparts (adjusted PR: 1.41 [1.02–1.96]). Similarly, a higher likelihood of being vaccinated at a retail pharmacy were seen in older adults living in non-metropolitan areas (adjusted PR: 1.45 [1.03–2.05])), older adults who were not covered by secondary private insurance coverage (adjusted PR: 1.38 [1.16–1.64]) and older adults who did not have a physician office visit (adjusted PR: 1.20 [1.01–1.42]) in 2015 than in 2009.

The results for the sensitivity analysis are shown in Appendix B. Changing the definition of pharmacy had little impact on the magnitude and direction of the variables.

Table 3
Results of log-binomial regression analysis to assess changes in characteristics associated with use of pharmacy-provided influenza vaccination services.

	Adjusted PR	[95% CI]
Difference-in-difference estimators/ Interaction effects		
Black, non-Hispanic × year	1.41*	[1.02–1.96]
Other race × year	0.62	[0.38–1.00]
Non-metropolitan × year	1.45*	[1.03–2.05]
Not-privately insured × year	1.38***	[1.16–1.64]
Without physician office visit × year	1.20*	[1.01–1.42]
Predisposing		
Male	0.81*	[0.71–0.93]
Age 75 and over	0.92**	[0.86–0.98]
Race categories (ref: White, non-Hispanic)		
Black, non-Hispanic	0.50***	[0.37–0.69]
Other	0.98	[0.66–1.46]
Married	0.96	[0.89–1.04]
Enabling		
Education categories (ref: < High school)		
High school	1.24**	[1.10–1.40]
Some colleges or vocational	1.26**	[1.08–1.46]
College graduate or higher	1.34***	[1.17–1.55]
Income categories (ref: > 50 K)		
<25 K	0.89*	[0.80–0.98]
25–50 K	0.91*	[0.82–0.99]
Non-metropolitan	0.69	[0.47–1.03]
Not-privately insured	0.73***	[0.62–0.85]
Without physician office visit	0.78***	[0.68–0.89]
Need		
Self-reported health categories (ref: Excellent)		
Very good	0.87*	[0.80–0.97]
Good	0.81*	[0.73–0.91]
Fair/poor	0.69***	[0.63–0.77]
Current smoker	1.10	[0.95–1.27]
Year	1.51***	[1.34–1.67]
Constant	0.22***	[0.17–0.28]
State (ref: California)		
Alabama	1.27	[0.99–1.63]
Arizona	2.55***	[2.04–3.19]
Arkansas	1.60*	[1.06–2.40]
Colorado	1.46*	[1.09–1.95]
Connecticut	1.37	[0.95–1.99]
District of Columbia	1.01	[0.57–1.77]
Florida	1.61***	[1.26–2.06]
Georgia	1.52*	[1.04–2.20]
Illinois	1.68***	[1.35–2.09]
Indiana	1.89**	[1.22–2.91]
Iowa	2.08***	[1.47–2.93]
Kansas	1.28	[0.75–2.18]
Kentucky	1.66***	[1.36–2.03]
Louisiana	1.15	[0.60–2.22]
Maryland	1.80***	[1.47–2.20]
Massachusetts	0.99	[0.69–1.42]
Michigan	1.19	[0.93–1.53]
Minnesota	1.56**	[1.19–2.04]
Missouri	1.26*	[1.01–1.57]
Nebraska	0.75	[0.38–1.47]
Nevada	1.56***	[1.23–1.98]
New Jersey	1.23	[0.93–1.64]
New Mexico	1.67**	[1.20–2.32]
New York	1.22	[0.89–1.68]
North Carolina	1.34*	[1.02–1.76]
Ohio	1.86***	[1.34–2.60]
Oklahoma	2.08***	[1.57–2.76]
Pennsylvania	0.93	[0.68–1.26]
Tennessee	2.15***	[1.69–2.74]
Texas	1.93***	[1.60–2.33]
Virginia	2.15***	[1.67–2.77]
Washington	2.03***	[1.63–2.53]
West Virginia	1.79**	[1.28–2.49]
Wisconsin	1.38	[0.95–1.99]
Wyoming	1.94**	[1.22–3.09]
Other sates	0.00***	[0.00–0.00]

Note: PR: prevalence ratio; 95% CI: 95% confidence interval; Other states: Except for South Carolina and Puerto Rico (excluded), other states with $n < 10$ were aggregated; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4. Discussion

This novel study examined how characteristics of older adults associated with using a retail pharmacy for receiving the influenza vaccination have changed. Findings from this study could help inform not only the retail pharmacies that provide vaccination services to better outreach to potential target populations but also policy makers about the disadvantaged populations that would benefit from the vaccination services provided by retail pharmacies.

The results are consistent with previous findings suggesting White individuals were more likely to use vaccination services provided through non-traditional settings.[38] We extended the findings to show such racial difference also exists among older adult Medicare beneficiaries in the retail pharmacy setting. Non-Hispanic Black older adults were less likely to obtain the influenza vaccination at retail pharmacies in both 2009 and 2015 relative to non-Hispanic White older adults. Such a trend is supported with the finding of one study using another data source from 2018, which showed no significant racial differences in using vaccination services provided through non-traditional settings.[30] However, our results showed that the likelihood for non-Hispanic Black older adults to use pharmacy-provided influenza vaccination services has increased to a greater extent from 2009 to 2015 relative to non-Hispanic White, suggesting a narrowed racial gap in the use of retail pharmacy-provided influenza vaccination services.

Further, while previous studies showed the presence of certain enabling resources may be important for receipt of influenza vaccinations,[39,40] this study found that older adults without certain enabling resources (i.e., secondary private insurance coverage, one or more physician office visit and metropolitan area residence) had become more likely to use pharmacy-provided vaccination services in 2015 compared to 2009. The change in trends among older adults who were not privately insured, and those without a physician office visit could be partly explained by the increasing number of pharmacies offering vaccination services that do not require an appointment, or the lack of office visit fees that typically need to be paid for medical appointments at a physician's office.[13] It may also partly be due to the increase in marketing and awareness among patients and non-pharmacy providers that retail pharmacies are a vaccination point. This messaging is especially important for patients that do not have a usual source of care and do not visit physicians regularly. Similarly, the increase in use of retail pharmacies among older adults living in non-metropolitan areas could result from the lack of primary care providers in suburban and rural areas.[41,42] Being more geographically dispersed compared to primary care providers, retail pharmacies may be the primary source where rural residents seek primary care services, including influenza vaccination services.[43,44] Along with the evidence in previous studies, our findings indicate that the pharmacist is an increasingly crucial immunization provider over time that can reach populations lacking access to primary care providers, both due to geographic or financial reasons, and complement the vaccination services provided by physician offices.

Several limitations should be considered. First, the information on whether older adults received influenza vaccination and the location for receiving the vaccination were based on self-report. There could be recall bias due to the lengthy recall period (up to 12 months), and there may be social desirability bias. Each of these problems could affect the accuracy and precision of the estimates based on self-report. However, the survey data have been found to be more complete than claims data, suggesting small effects on the estimates.[45] Second, the use of pharmacy location categorization may result in some degree of misclassification in the direction of overestimating the number of older adults who used a pharmacy to receive the influenza vaccination. The sensitivity analysis also showed that our results are robust to the approach used to define the pharmacy location. Third, although the study limited the sample to states that relaxed the pharmacist immunization law by 2009, there could still be variation in the degree of pharmacist authority to vaccinate across states. It is unclear how different levels of pharmacist immunization authority impact the characteristics of older adults using pharmacy-provided influenza across the study years. For instance, states that granted pharmacists prescriptive authority

for influenza vaccination may have attracted more older adults living in rural areas using the retail pharmacy-provided influenza vaccination services than states that granted pharmacist immunization authority through pharmacist-physician collaborative agreements since it likely was easier for pharmacists to provide vaccinations without entering into a collaborative practice agreement. Finally, this study used a case-wise deletion approach to account for missing data in the dependent variables and independent variables and our results may be biased if the occurrence of the missing data is not completely random. However, given that <3% of cases were removed due to missing data, the degree of bias is limited.

5. Conclusion

A retail pharmacy provides an additional access point for older adults to receive influenza vaccinations. This study suggests the expansion in pharmacy-provided vaccination services may lower access barriers for older adults who were non-Hispanic Black and older adults who lack enabling resources to access care, indicating the distinct position that retail pharmacy may play in closing these disparity gaps.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Dr. Hayney is a consultant for GSK Vaccines and Seqirus and has received research support from Takeda Pharmaceuticals, Dynavax, and Sanofi. Other authors declare no conflict of interest.

Acknowledgements

We thank University of Wisconsin-Madison Writing Center for providing writing assistance.

Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.rcsop.2023.100220.

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