

Costs of Adult Vaccination in Medical Settings and Pharmacies: An Observational Study

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ABSTRACT

BACKGROUND: Community pharmacies are a convenient setting for vaccinating adults against infectious diseases in the United States. Whether the costs paid for vaccination in pharmacies differ from those in medical settings is unclear.

OBJECTIVE: To examine whether the direct medical costs paid for adult vaccination differ by vaccination setting.

METHODS: This was an observational retrospective study using 2010 MarketScan Commercial Claims and Encounters and Medicare Supplemental and Coordination of Benefits databases. Adults receiving herpes zoster or shingles vaccine, pneumococcal vaccine 23-valent, or influenza vaccines were identified using Current Procedural Terminology codes and National Drug Code numbers from medical and pharmacy claims files, respectively, between January 1 and December 31, 2010, in 1 of the following 3 settings: physician offices; other medical settings (e.g., inpatient/outpatient hospitals, emergency rooms); and pharmacies. Patients were adults aged ≥ 60 years on the date of zoster vaccination and aged ≥ 19 years on the date of pneumococcal or influenza vaccinations. The final study samples meeting inclusion/exclusion criteria were 54,042 for zoster vaccine, 154,994 for pneumococcal vaccine, and 1,657,264 for influenza vaccine. The vaccination costs included the health plan and enrollee paid amounts for the product; vaccine administration; dispensing fee; and, where applicable, the visit. The mean (SD) vaccination costs paid per vaccine administration were estimated by vaccine and type of setting, overall, and by geographic region and type of health plan. The costs paid for the same vaccine across vaccination settings were compared using analysis of variance with post hoc tests (Tukey).

RESULTS: Of those receiving zoster, pneumococcal, and influenza vaccines, 25%, 1%, and 7%, respectively, received the vaccines at a pharmacy. Compared with other U.S. regions, pharmacy-based vaccination for these 3 vaccines was generally more frequent in the West and the South. Overall, the mean (SD) costs paid per enrollee per vaccine administration at physician offices, other medical settings, and pharmacies were as follows: for zoster vaccine, \$208.72 (42.10), \$209.51 (50.83), and \$168.50 (15.66), respectively ($P < 0.05$); for pneumococcal vaccine, \$65.69 (27.54), \$72.11 (49.95), and \$54.98 (9.72), respectively ($P < 0.05$); and for influenza vaccine, \$29.29 (15.29), \$24.20 (13.12), and \$21.57 (6.63), respectively ($P < 0.05$). The mean amounts paid also differed by geographic region and type of health plan, with costs usually lower for the vaccinations given at pharmacies.

CONCLUSIONS: The average direct costs paid per adult vaccination were lower in pharmacies compared with physician offices and other medical settings by 16%-26% and 11%-20%, respectively. These results were mostly consistent across geographic regions and types of health plans. These data may help payers and policymakers understand the economic value of adult vaccination in different settings, especially in pharmacies.

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What is already known about this subject

- The rate of vaccination for U.S. adults is highly variable for multiple vaccines, including tetanus, hepatitis A, hepatitis B, zoster, human papillomavirus, and influenza.
- In a 2006 survey, consumers cited a number of reasons for not receiving vaccinations, including absence of regularly scheduled visits, lack of physician recommendations, and mistaken assumptions (most frequently, that healthy people do not need vaccinations).
- Community pharmacies are strategically positioned to increase access to vaccination because they are community based, have extended hours of availability, and are frequented by a large part of the U.S. population. Research has shown improved vaccination rates in regions allowing pharmacists to administer vaccines.

What this study adds

- Pharmacies had lower average direct costs paid per adult vaccination than physician offices and other medical settings—by 16%-26% and 11%-20%, respectively—when both health plan and enrollees' perspectives were considered.
- These results were consistent across geographic regions and types of health plans.

A number of vaccines are currently recommended for adults in the United States.¹ Rates of vaccination with routinely recommended adult vaccines vary considerably.² Based on the most recent data available from nationally representative samples (2011), rates of vaccination of adults aged 19-49 years for tetanus (past 10 years), hepatitis A (ever), and hepatitis B (ever) were 64.5%, 12.5%, and 35.9%, respectively.² Furthermore, 62.3% of adults aged ≥ 65 years and 20.1% of high-risk adults aged 19-64 years had (ever) received pneumococcal vaccination; 15.8% of adults aged ≥ 60 years had (ever) received zoster (shingles) vaccination; and 43.1% of women aged 19-21 years had (ever) received vaccination against human papillomavirus.² Rates of influenza vaccination of adults from nationally representative samples in the 2009-2010, 2010-2011, and 2011-2012 influenza seasons were about 40%.³

Barriers to adult vaccination are numerous.⁴ The absence of regularly scheduled visits to the doctor was the most com-

mon explanation for not receiving tetanus, influenza, and pneumococcal vaccines, cited by 83% to 88% of physicians in a 2006 survey.⁴ In the same survey, lack of physician recommendations and mistaken assumptions (most frequently, that healthy people do not need vaccinations) were among the most common reasons consumers gave for not receiving routinely recommended vaccinations.⁴

Community pharmacies are strategically positioned to increase access to vaccination because they are community based; have extended hours of availability, often without appointment; and are frequented by a large part of the U.S. population.^{5,6} As of 2009, all 50 states, the District of Columbia, and Puerto Rico allowed pharmacists to administer influenza vaccinations, with many states also allowing other adult vaccines,⁷ and as of June 2012, more than 175,000 pharmacists were trained to provide vaccinations, primarily through the American Pharmacists Association's nationally recognized certificate training program.^{5,8} The Centers for Medicare & Medicaid Services recognize pharmacists as providers for adult vaccinations under both Medicare Part B and Part D.⁹ Some private health plans offer a pharmacist-provided vaccination benefit to their enrollees for influenza,¹⁰⁻¹² pneumococcal,¹² and zoster vaccinations.¹²

Pharmacies may be able to provide vaccinations at lower costs than in traditional settings. Prosser et al. (2008) examined costs of delivering influenza vaccination in nontraditional settings (pharmacies, mass vaccination clinics) and physician offices and evaluated the cost-effectiveness in nontraditional settings compared with scheduled office visits.¹³ Researchers conducted telephone interviews with representatives from each setting in 2004 to understand the costs of vaccination delivery in nontraditional settings. They found that vaccination delivery cost less in the nontraditional settings (\$17 in mass vaccination settings, \$12 in pharmacies) compared with physician offices (\$29) and that vaccination in nontraditional settings was projected to be cost saving for healthy adults aged ≥ 50 years and for high-risk adults of all ages.

There are currently no data available on the direct costs paid for vaccination from the payer and patient perspectives in different settings. Also, it is not known whether the lower costs for providers of delivering vaccination in nontraditional settings as estimated by Prosser et al. translate into lower costs for the health plan and its enrollees.¹³ Thus, the primary objective of this study was to compare the direct costs paid for adult vaccination in different settings. Three vaccines—zoster, pneumococcal, and influenza—were selected as examples. This study was performed from the perspective of health plans and enrollees.

Methods

Study Design and Data Source

This was a retrospective cross-sectional study of 2 Truven Health MarketScan databases: (1) the Commercial Claims and Encounters database and (2) the Medicare Supplemental and Coordination of Benefits database. The first represents approximately 100 employer-sponsored private health plans with coverage of approximately 45 million patients. The second is a database of approximately 3.7 million retirees and includes employer, Medicare, and out-of-pocket expenses. Both datasets include enrollees from all 50 states. The databases record patient demographic data, health plan information, and cost data. Institutional review board approval was not obtained because this study was an analysis of de-identified secondary data.

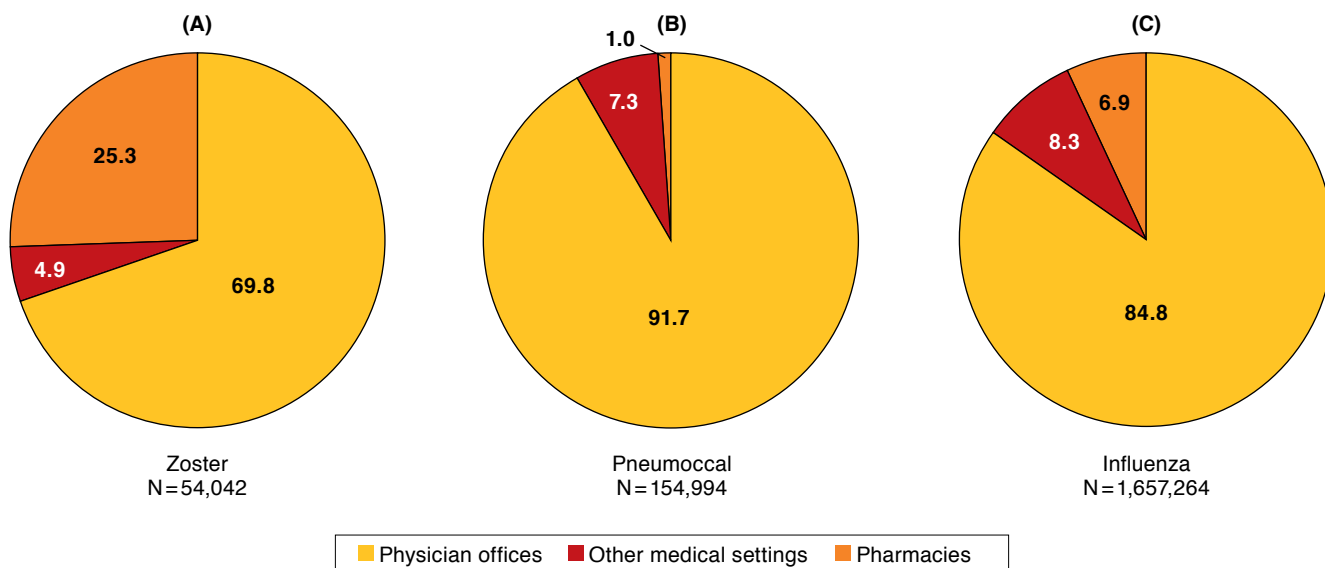
Study Sample

Patients were included in the study if they had a medical or pharmacy claim for any of the 3 vaccines—zoster, pneumococcal, or influenza—between January 1 and December 31, 2010; were continuously enrolled in a health plan for ≥ 1 year before and ≥ 60 days after the vaccination date; and were aged ≥ 19 years of age (≥ 60 years for zoster vaccine) on the vaccination date (Appendix A, available in online article). The 1-year period prior to vaccination was used to calculate subjects' comorbidity index. Patients were excluded from the analysis if they received multiple administrations of the same vaccine in 2010; had claims for the same vaccine from multiple settings within 60 days; had potentially invalid payment data (i.e., negative values or payment amounts greater than 3 times the standard deviation of mean for the entire group); or received the vaccine outside the age range recommended by the Centers for Disease Control and Prevention's (CDC) Advisory Committee on Immunization Practices (aged ≥ 19 years for influenza and pneumococcal vaccines, aged ≥ 60 years for the zoster vaccine). The final study samples meeting inclusion/exclusion criteria were as follows: 54,042 with zoster vaccine, 154,994 with pneumococcal vaccine, and 1,657,264 with influenza vaccine.

Vaccination Settings

Vaccinations were categorized as being administered in the following settings: physician offices, other medical settings (e.g., inpatient and outpatient hospital, emergency department), and pharmacies. Vaccination claims were identified using National Drug Code (NDC) numbers and Current Procedural Terminology, 4th Edition (CPT-4) codes for pharmacy and medical claims, respectively (Appendices B and C, available in online article). Care was taken to assign vaccine administrations to the correct setting. Specifically, for a vaccine administration to be assigned to the pharmacy setting, medical claims were checked for the absence of a claim for the same vaccine in the 60 days postpharmacy claim period. Similarly, pharmacy claims were checked 60 days prior to a medical claim before a

FIGURE 1 Percentages of Patients Vaccinated with (A) Zoster, (B) Pneumococcal, and (C) Influenza Vaccines By Setting



particular vaccine administration was assigned to the medical setting. Further, medical claims with a pharmacy as the place of service were assigned to the pharmacy setting (Figure 1). In the few cases (<1%) where vaccine claims were found across settings (e.g., product claim in a pharmacy and administration claim in a medical setting), these cases were excluded from the analysis.

Vaccination Costs

The costs paid for vaccination included costs associated with the vaccine product, administration, dispensing, and, where applicable, outpatient visit fees. Visit fees for medical settings were included only in those instances where vaccination was determined to be the trigger for the visit, i.e., the only service provided during the visit ($\leq 2\%$ of instances). If multiple vaccines were administered at a physician visit, we divided the administration cost and physician visit fee equally between the vaccines. Vaccination costs included amounts paid by the health plan and enrollee copayments.

Statistical Analysis

For each vaccine sample, we described patient gender; age; geographic region (North Central, Northeast, South, West); type of health plan (health maintenance organization [HMO], point of service [POS], preferred provider organization [PPO]); and Charlson Comorbidity Index by vaccination setting. Categorical variables are presented as frequencies and percentages. Continuous variables are presented as means and

standard deviations (SD). Comparisons between different vaccination settings were performed using χ^2 tests for categorical variables and analysis of variance (ANOVA) for continuous variables. Average costs paid per vaccine administration were assessed for each vaccine overall, by geographic region, and by type of health plan, stratified by vaccination setting. ANOVA with post hoc tests (Tukey) was used to detect significant differences in costs paid across settings, by region, and by health plan. Finally, regression models were fitted to adjust costs for differences in age, gender, comorbidity index, geographic region, and health plan across settings. Since the findings were quite similar to unadjusted analysis, only unadjusted data are presented here. All statistical analyses were performed using SAS version 9.2 (SAS Institute, Inc., Carey, NC).

Results

Study Population

The majority of subjects in our study sample received vaccines at physician offices: 69.8% of zoster vaccinees, 91.7% of pneumococcal vaccinees, and 84.8% of influenza vaccinees (Figure 1). Only 25.3%, 1.0%, and 6.9% of patients vaccinated, respectively, against zoster, pneumonia, and influenza were vaccinated in pharmacies (Figure 1).

The selected characteristics of 3 study samples receiving zoster, pneumococcal, and influenza vaccines are provided by setting in Table 1. Patients' mean (SD) ages across settings were 65.8 (6.7) years for zoster vaccine, 58.2 (12.2) years for pneumococcal vaccine, and 51.4 (13.8) years for influenza vaccine.

TABLE 1 Sample Characteristics by Adult Vaccine^a

	Zoster				Pneumococcal				Influenza			
	Physician Offices (N=37,736)	Other Medical Settings (N=2,633)	Pharmacies (N=13,673)	P Value	Physician Offices (N=142,102)	Other Medical Settings (N=11,355)	Pharmacies (N=1,537)	P Value	Physician Offices (N=1,405,978)	Other Medical Settings (N=137,428)	Pharmacies (N=113,858)	P Value
Female	21,462 (56.9)	1,449 (55.0)	8,067 (59.0)	^b	75,771 (53.3)	5,513 (48.6)	928 (60.4)	^b	829,070 (59.0)	77,267 (56.2)	69,159 (60.7)	^b
Age (mean, SD)	64.5 (5.8)	65.9 (6.5)	69.4 (7.7)	^b	58.2 (12.1)	58.6 (13.4)	58.6 (13.2)	^b	51.6 (13.8)	51.9 (14.3)	48.2 (13.2)	^b
Geographic region				^b				^b				^b
North Central	9,653 (25.6)	935 (35.5)	2,412 (17.6)		36,208 (25.5)	3,330 (29.3)	119 (7.7)		350,184 (24.9)	58,031 (42.2)	17,463 (15.3)	
Northeast	5,259 (13.9)	404 (15.3)	1,285 (9.4)		20,889 (14.7)	1,061 (9.3)	90 (5.9)		268,779 (19.1)	16,741 (12.2)	10,680 (9.4)	
South	13,296 (35.2)	767 (29.1)	4,016 (29.4)		58,582 (41.2)	5,543 (48.8)	509 (33.1)		577,675 (41.1)	48,517 (35.3)	46,175 (40.6)	
West	9,511 (25.2)	526 (20.0)	5,956 (43.6)		26,338 (18.5)	1,415 (12.5)	819 (53.3)		208,398 (14.8)	14,077 (10.2)	39,477 (34.7)	
Unknown	17 (0.0)	1 (0.0)	4 (0.0)		85 (0.1)	6 (0.1)	0 (0.0)		942 (0.1)	62 (0.0)	63 (0.1)	
Health plan type				^b				^b				^b
HMO	5,860 (15.5)	315 (12.0)	2,513 (18.4)		22,592 (15.9)	2,168 (19.1)	445 (29.0)		213,862 (15.2)	27,797 (20.2)	20,399 (17.9)	
POS	3,865 (10.2)	242 (9.2)	542 (4.0)		14,243 (10.0)	810 (7.1)	202 (13.1)		151,128 (10.7)	8,555 (6.2)	6,066 (5.3)	
PPO	19,367 (51.3)	1,356 (51.5)	7,056 (51.6)		71,004 (50.0)	5,782 (50.9)	779 (50.7)		762,957 (54.3)	70,523 (51.3)	76,577 (67.3)	
Other/unknown	8,644 (22.9)	720 (27.3)	3,562 (26.1)		34,263 (24.1)	2,595 (22.9)	111 (7.2)		278,031 (19.8)	30,553 (22.2)	10,816 (9.5)	
Charlson Comorbidity Index (mean, SD)	0.6 (1.2)	0.7 (1.2)	0.9 (1.4)	^b	1.1 (1.6)	1.8 (2.3)	0.9 (1.4)	^b	0.7 (1.3)	0.8 (1.6)	0.4 (1.0)	^b

^aValues are presented as N (%) unless otherwise indicated.

^bP < 0.05.

HMO = health maintenance organization; POS = point of service; PPO = preferred provider organization; SD = standard deviation.

For all 3 vaccines, pharmacies had the highest proportion of female vaccinees (59.0%-60.7%), and vaccination at a pharmacy was more common in the South and West. The health plan was more often a PPO followed by an HMO for vaccination across all 3 settings.

Cost of Vaccination by Setting

The mean total, health plan paid, and enrollee paid costs of vaccination with zoster, pneumococcal, and influenza vaccines by setting are presented in Table 2. The mean (SD) total costs paid per vaccine administration at physician offices, other medical settings, and pharmacies were as follows: for zoster vaccine, \$208.72 (42.10), \$209.51 (50.83), and \$168.50 (15.66), respectively (P < 0.05); for pneumococcal vaccine, \$65.69 (27.54), \$72.11 (49.95), and \$54.98 (9.72), respectively (P < 0.05); and for influenza vaccine, \$29.29 (15.29), \$24.20 (13.12), and \$21.57 (6.63), respectively (P < 0.05). For all 3 vaccines, the costs paid were significantly lower in pharmacies than in either physician offices or other medical settings (P < 0.05). For zoster

vaccination, patients paid the least out-of-pocket at physician offices (\$16.95 [43.85], P < 0.05), whereas insurers paid the least at pharmacies (\$145.72 [\$38.54], P < 0.05). For both the pneumococcal and influenza vaccines, patients paid the least at pharmacies (\$3.44 [9.99], P < 0.05, and \$1.18 [4.07], P < 0.05, respectively), while insurers paid the least in other medical settings (\$46.28 [49.71], P < 0.05, and \$19.92 [14.60], P < 0.05, respectively) and the most at physician offices (\$54.0 [35.17], P < 0.05, and \$26.59 [16.21], P < 0.05, respectively).

Table 3 presents the costs paid for vaccination by setting across geographic regions and types of health plan. The findings were mostly consistent with the overall findings.

Discussion

In this study, the total direct costs paid for zoster, pneumococcal, and influenza vaccinations were lower in pharmacies than in physician offices or in other medical settings. From the health plan perspective, costs paid for all 3 vaccinations were lower in pharmacies than in physician offices. From the

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TABLE 2 Mean (SD) Amounts Paid (\$) Per Adult Vaccination by Setting^a

	Zoster			Pneumococcal			Influenza		
	Physician Offices	Other Medical Settings ^b	Pharmacies	Physician Offices	Other Medical Settings ^b	Pharmacies	Physician Offices	Other Medical Settings ^b	Pharmacies
Total paid	208.72 (42.10)	209.51 (50.83)	168.50 (15.66) ^{c,d}	65.59 (27.54)	72.11 (49.95)	54.98 (9.72) ^{c,d}	29.29 (15.29)	24.20 (13.12) ^c	21.57 (6.63) ^{c,d}
Health plan paid	191.77 (56.04)	183.18 (73.90) ^c	145.75 (38.54) ^{c,d}	54.00 (35.17)	46.28 (49.71) ^c	51.62 (15.27) ^{c,d}	26.59 (16.21)	19.92 (14.60) ^c	20.42 (8.03) ^{c,d}
Enrollee paid	16.95 (43.85)	26.33 (43.85) ^c	22.78 (33.06) ^{c,d}	11.69 (21.90)	25.83 (43.12) ^c	3.44 (9.99) ^{c,d}	2.70 (7.26)	4.27 (9.63) ^c	1.18 (4.07) ^{c,d}

^aThis included paid amounts for the product, administration, dispensing fee, and, where applicable, the visit.

^bThis included settings such as inpatient/outpatient hospitals and emergency rooms.

^cSignificantly different from physician offices ($P < 0.05$).

^dSignificantly different from other medical settings ($P < 0.05$).

SD = standard deviation.

TABLE 3 Mean (SD) Total Amounts Paid (\$) for Adult Vaccination by Region and by Health Plan Type^a

	Zoster			Pneumococcal			Influenza		
	Physician Offices	Other Medical Settings ^b	Pharmacies	Physician Offices	Other Medical Settings ^b	Pharmacies	Physician Offices	Other Medical Settings ^b	Pharmacies
Geographic region									
North Central	213.63 (38.62)	206.13 (50.10) ^c	167.04 (21.69) ^{c,d}	64.81 (21.73)	73.40 (46.87) ^c	52.40 (12.13) ^{c,d}	29.21 (13.35)	25.22 (12.12) ^c	20.63 (6.55) ^{c,d}
Northeast	208.45 (39.56)	227.54 (60.49) ^c	164.46 (14.73) ^{c,d}	62.21 (23.31)	70.65 (51.01) ^c	52.69 (11.52) ^{c,d}	29.66 (16.20)	23.31 (14.34) ^c	16.72 (6.39) ^{c,d}
South	203.49 (36.85)	205.14 (42.58)	164.92 (14.30) ^{c,d}	61.67 (22.11)	70.10 (52.35) ^c	49.04 (6.69) ^{c,d}	28.35 (14.61)	22.86 (13.74) ^c	21.41 (7.00) ^{c,d}
West	211.18 (51.82)	208.10 (52.25)	172.44 (12.84) ^{c,d}	78.59 (41.35)	78.10 (45.85)	59.45 (8.67) ^{c,d}	31.53 (18.39)	25.63 (12.81) ^c	23.57 (5.39) ^{c,d}
Health plan type									
HMO	209.86 (50.51)	210.18 (56.45)	173.35 (19.90) ^{c,d}	80.00 (41.69)	60.55 (46.09) ^c	58.42 (8.34) ^{c,d}	30.67 (17.52)	20.26 (15.08) ^c	26.63 (5.41) ^{c,d}
POS	202.40 (31.07)	237.97 (61.68) ^c	167.45 (15.02) ^{c,d}	63.40 (22.00)	75.99 (47.92) ^c	49.11 (4.86) ^{c,d}	29.28 (15.15)	25.79 (13.75) ^c	23.82 (4.47) ^{c,d}
PPO	207.93 (39.97)	205.67 (43.50)	169.61 (13.30) ^{c,d}	66.15 (23.19)	76.39 (50.58) ^c	55.38 (10.39) ^{c,d}	29.98 (14.59)	26.54 (11.74) ^c	19.70 (6.46) ^{c,d}
Other/unknown	212.54 (44.33)	206.89 (54.01) ^c	163.14 (15.47) ^{c,d}	56.26 (21.37)	70.98 (50.67) ^c	50.18 (11.47) ^{c,d}	26.34 (15.02)	21.94 (12.77) ^c	24.32 (4.34) ^{c,d}

^aThis included paid amounts for the product, administration, dispensing fee, and, where applicable, the visit.

^bThis included settings such as inpatient/outpatient hospitals and emergency rooms.

^cSignificantly different from physician offices ($P < 0.05$).

^dSignificantly different from other medical settings ($P < 0.05$).

HMO = health maintenance organization; POS = point of service; PPO = preferred provider organization; SD = standard deviation.

patient perspective, costs paid were lower in pharmacies than in other medical settings for all 3 vaccinations and lower than in physician offices for pneumococcal and influenza vaccines. These results were mostly consistent across geographic regions and types of health plans.

Given that pharmacists and physicians are reimbursed by Medicare at the same rate for administering routine influenza and pneumococcal vaccines,¹⁴ the underlying reason for

the difference in paid costs is intriguing. This question has received comparatively little attention. Prosser et al. estimated the costs of delivering influenza vaccination in pharmacies and other nontraditional settings in 2004.¹³ The components of costs included the cost of the vaccine and the cost of supplies, administration, labor, overhead, and promotion. Prosser et al. estimated total mean costs of vaccination of \$11.57 (range \$9.79-\$13.35) in pharmacies—less than half the costs

of \$28.67 (range \$22.26-\$52.60) for vaccination in physician offices estimated in a previous study.¹⁵ Our results show that potentially lower costs of delivering adult vaccination in nontraditional settings may translate into lower costs for both payers and patients.

The current study was an analysis of health insurance claims data, and nonmedical settings other than pharmacies were not included. Other nonmedical settings were reported in the CDC's analysis of influenza vaccination rates of adults for the 2010-2011 season based on data collected during January-March 2011 by the Behavioral Risk Factor Surveillance System (BRFSS).⁷ The nonmedical settings reported were community centers (senior or recreation), workplaces, stores (drug stores [pharmacies] or supermarkets), and schools. A doctor's office was the most common place (39.8%) for receipt of the influenza vaccine. A total of 41.4% of adults received an influenza vaccination in nonmedical settings; however, only 18.4% were in stores, while 23.0% received the vaccination in other nonmedical settings, primarily the workplace (17.4%). Although the BRFSS survey did not provide data specifically for pharmacies, it indicated that $\leq 18\%$ of influenza vaccinations occurred in pharmacies in 2010-2011. The proportion of individuals in our dataset accessing influenza vaccination in pharmacies was lower, at about 7%, which may be due to differences in study population from the BRFSS survey.

In the National Health Interview Survey (NHIS) of influenza vaccination coverage in the 2008-2009 season, 81.4% of adults aged 18-64 years had a regular physician, and 18.6% did not.¹⁶ During that season, 31.9% of those who had a regular physician were vaccinated, whereas only 12.61% of those who lacked a regular physician were vaccinated.¹⁶ In the 2011 CDC study, vaccination in a nonmedical setting was significantly more common among those who reported not having a personal doctor (48.5%) than among those with a personal doctor (40.7%).⁷ In addition, a greater percentage of persons whose last doctor visit for a routine checkup was ≥ 1 year ago (53.5%) received their vaccinations in a nonmedical setting than those whose last routine doctor visit was < 1 year ago (38.8%). Results of both NHIS and BRFSS surveys suggest that adult vaccination programs should attempt to increase access to adult vaccination in nonmedical settings, including stand-alone pharmacies and pharmacies located in chain stores.^{7,16} Most physicians (79%) participating in a 2009 national survey reported being willing to refer certain patients to pharmacies or other community vaccinators to improve delivery of vaccine.¹⁷ The most frequently reported barriers to such collaboration were concerns about record transfer and the required time and effort.¹⁷ From the patient's perspective, the amount of time required for vaccination is a barrier,¹⁸ and offering vaccination at a convenient location such as the workplace or a community pharmacy might encourage patient participation.

There is evidence that legislation allowing pharmacists

to vaccinate patients improved vaccination rates.^{19,20} Steyer et al. (2004) analyzed the BRFSS from years 1995-1999 to determine whether influenza vaccine rates increased in states that had legislated to allow pharmacists to administer vaccines.²⁰ These authors found that individuals aged ≥ 65 years who lived in states where pharmacists could provide vaccines had significantly higher vaccination rates ($P < 0.01$) than those who resided in states where pharmacists could not provide vaccines. Similar improvements in influenza vaccination rates were seen in a 1999 mailed survey of adults who had received prescriptions at community pharmacies in a state where pharmacists were allowed to administer vaccines and in a control state where pharmacists could not.¹⁹ In that study, vaccine delivery by pharmacists was associated with higher rates of vaccination among individuals aged < 65 years taking indicator medications for chronic diseases, as well as prescription recipients unvaccinated against influenza in the previous year.

Limitations

This study has several limitations. First, only those encounters captured in the database were analyzed. Second, we assumed that 60 days was a sufficient window in which to observe the correct vaccination setting for patients who obtained the vaccine product in a pharmacy but had it administered in the medical setting. In circumstances where this assumption was not true, we may have underestimated the costs paid for vaccination. However, since this assumption was applied to utilization both in pharmacy and medical settings, we did not anticipate a bias in favor of one setting versus the other. Third, we were not able to determine the components of vaccination costs paid (i.e., vaccine costs vs. administration costs) and thus were not able to determine how those components affected the differences in costs across settings. It is unlikely that physician visit costs resulted in higher observed costs paid for vaccination in a physician setting, since visit costs were applied only in $\leq 2\%$ of vaccination encounters. Fourth, we examined only the direct costs paid and not additional indirect costs such as time and travel. Fifth, this study was designed to assess only the costs paid as described, not the cost to the provider to deliver the vaccines. Finally, the study findings were limited to the commercially enrolled population. The cost distributions may be different in patients without insurance or those with government-sponsored insurance coverage.

Conclusions

The costs paid for vaccinating adults with zoster, pneumococcal, and influenza vaccines at pharmacies in 2010 were only 80.7%, 83.7%, and 73.6%, respectively, of those at physician offices. The results were mostly consistent across geographic regions and types of health plans. The data may help payers and policymakers understand the economic value of adult vaccination in different settings, especially in pharmacies.

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DISCLOSURES

Merck & Co., Inc., provided financial support for this study. Both authors are employees of Merck & Co., Inc.

Singhal and Zhang contributed equally to concept and study design, data collection, and interpretation. The manuscript was written primarily by Singhal, with contribution from Zhang and revised by Singhal.

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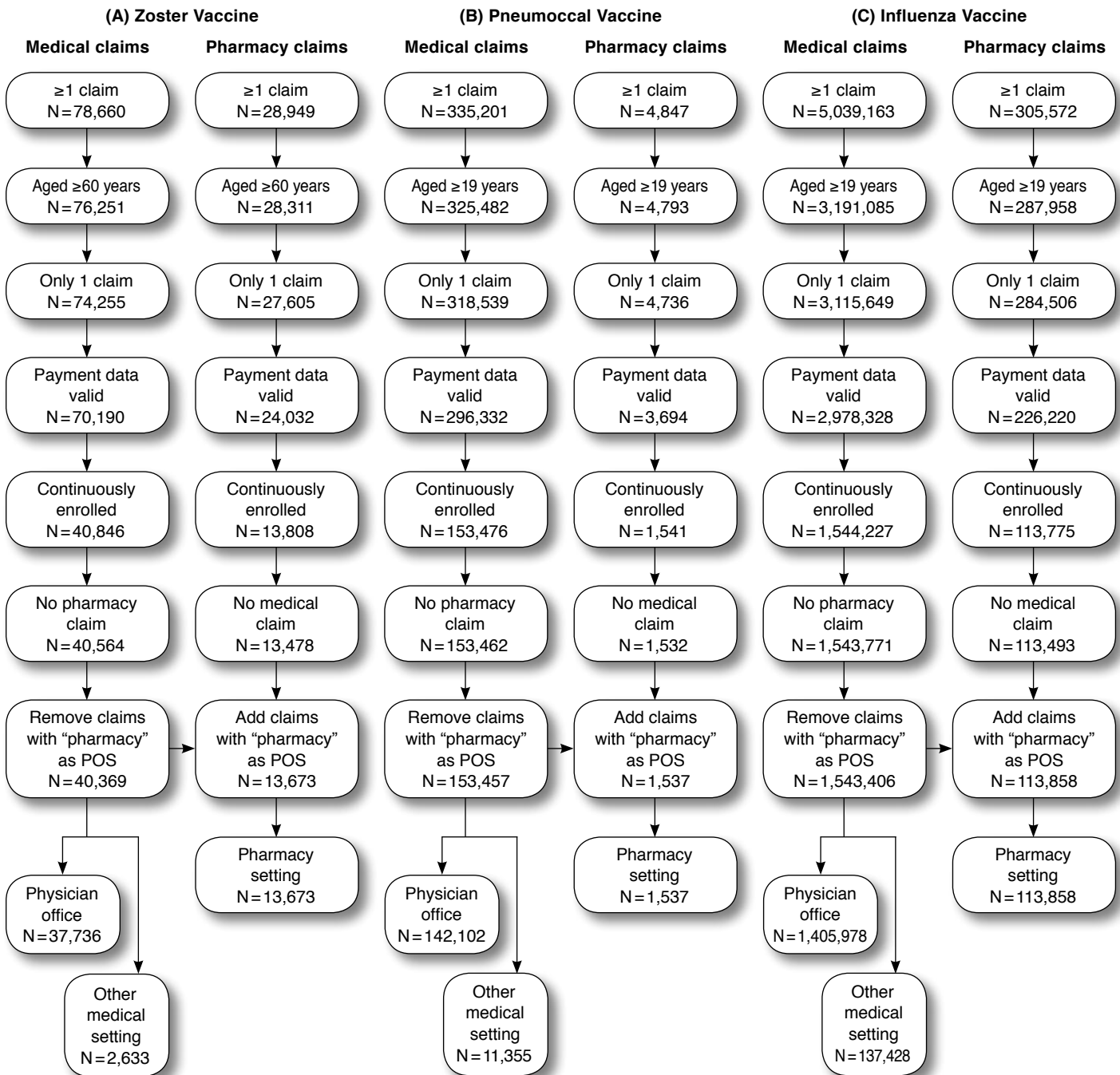
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APPENDIX A Construction of Study Cohorts from Medical and Pharmacy Claims for (A) Zoster, (B) Pneumococcal, and (C) Influenza Vaccines



POS=point of service.

Costs of Adult Vaccination in Medical Settings and Pharmacies: An Observational Study

APPENDIX B NDC Numbers and CPT Codes of Adult Vaccines of Interest

Vaccine Type	NDC Number	CPT Code
Zoster	00006-4963-00	90736
	00006-4963-41	90736
	54868-5703-00	90736
Pneumococcal	00006-4739-00	90732
	00006-4943-00	90732
	54868-3339-01	90732
	54868-4320-00	90732
Influenza	19515-0886-07	90658
	19515-0887-07	90658
	19515-0888-07	90658
	33332-0009-01	90656
	33332-0010-01	90656
	33332-0011-01	90656
	33332-0109-10	90658
	33332-0111-10	90658
	49281-0009-10	90656
	49281-0009-50	90656
	49281-0010-10	90656
	49281-0010-50	90656
	49281-0011-10	90656
	49281-0011-50	90656
	58160-0876-46	90656
	58160-0877-46	90656
	58160-0878-52	90656
	66019-0107-01	90660
	66019-0108-10	90660
	66019-0109-10	90660
66521-0112-02	90656	
66521-0112-10	90658	
66521-0113-02	90656	
66521-0113-10	90658	
66521-0114-02	90656	
66521-0114-10	90656	

CPT = Current Procedural Terminology; NDC = National Drug Code.

APPENDIX C Administration CPT Codes for Adult Vaccines

CPT Code	Description
90471	Immunization administration (includes percutaneous, intradermal, subcutaneous, or intramuscular injections); 1 vaccine, single or combination vaccine/toxoid. Not reported in conjunction with 90473.
90472	Each additional vaccine (single or combination vaccine/toxoid). Listed separately in addition to code for primary procedure. Reported 90472 in conjunction with code 90471 or 90473.
90473	Immunization administration by intranasal or oral route; 1 vaccine (single/or combination vaccine/toxoid). Not reported in conjunction with 90471.
90474	Each additional vaccine (single or combination vaccine/toxoid). Listed separately in addition to code for primary procedure. Reported 90474 in conjunction with 90471 or 90473.

CPT = Current Procedural Terminology.