At a Glance

Practical Implications • p 151
Author Information • p 157
Full text and PDF • www.ajpblive.com

Comparison of Pharmacists and Primary Care Providers as Immunizers

John Fontanesi, PhD; Jan D. Hirsch, RPh, PhD; Sarah M. Lorentz, PharmD; Debra A. Bowers, BA; and Jason Shafrin, PhD

A major success of modern public health has been the near-eradication in the United States of most vaccine-preventable diseases. Contained within this public health success are significant operational challenges to an already overtaxed primary healthcare infrastructure. Currently, vaccines are licensed for 27 diseases,[1] with a number of new vaccines at or near licensure and new populations recommended to receive already-licensed vaccines.[2] By way of example, the Advisory Committee on Immunization Practices (ACIP) recently recommended that all children age 6 months to 18 years—as well as their household contacts and out-of-home caregivers—be immunized against influenza.[3] An estimated 83 million children are in this age cohort,[4,5] and the 100 million visits required to immunize all these children would consume, at a minimum, 2.9 million person-hours each influenza season.[6] That figure does not include the costs and person-hours required for indirect support and administrative services, which our research shows far exceeds the direct service costs.[7,8]

Primary care physicians are already reeling under present service demands and cost-containment initiatives, to the point that the American College of Physicians has issued a warning that "primary care, the backbone of the nation's healthcare system, is at grave risk of collapse."[9] Given that vaccination recommendations will further expand over the coming years, it is worth identifying other service providers that have the capacity, competency, and business model to meet this nation's expanding vaccination requirements.

Pharmacists would appear to be excellent candidates to meet this growing demand. There are approximately 243,000 pharmacists (or 79.5 pharmacists per 100,000 Americans), of whom 62% are employed in the 39,000 chain and 24,500 independent pharmacies throughout both urban and rural America.[10,11] Most of them are already coordinating care with the 264,086 primary care providers (or 90 per 100,000 Americans),[12] providing the potential to nearly double the nation's vaccination capacity. Pharmacists are explicitly authorized to

ABSTRACT

Objective: To assess the fiscal viability and potential added capacity of pharmacist-administered vaccination services.

Study Design: System engineering methods were used to analyze the cost, productivity, and efficiency of vaccination services provided at pharmacies, scheduled primary care visits, and mass vaccination clinics.

Methods: Convenience sampling of almost 700 adults eligible for vaccinations during the 2006-2007 and the 2007-2008 influenza seasons was completed at 15 ambulatory primary care settings and 11 pharmacies in San Diego, California. We measured 2 main outcomes: (1) cost of providing the vaccination service and (2) productivity and efficiency of 3 vaccination delivery strategies.

Results: Pharmacist-provided vaccination services had the lowest unit cost, as well as the best productivity and efficiency indexes of the 3 vaccination strategies studied. Pharmacists also proved more consistent in following Advisory Committee on Immunization Practices national guidelines. Given the number of pharmacists in the United States, optimizing their vaccination capacity could double the nation's vaccination capacity.

Conclusions: Pharmacists are well positioned to help meet the growing demand for vaccinations. Pharmacist-administered vaccinations combine both the productivity and efficiency of mass vaccination clinics with the attention to detail and personalization found in scheduled primary care visits. Acceptance of pharmacists as "alternative immunizers" could be further fostered through efforts to document and share immunization records across the healthcare system, potentially through the use of community-based registries.

(Am J Pharm Benefits. 2009;1(3):150-157)

Author affiliations and disclosures provided at the end of the text.

immunize in 49 states,[13] have effectively boosted influenza vaccination rates during past influenza seasons,[14,15] and are trusted by both patients[16-19] and primary care physicians.[20] Practical guidelines exist for establishing vaccination practices for pharmacists,[21,22] and there are national certification programs approved by the Centers for Disease Control and Prevention (CDC) and the American Pharmacists Association.[23]

However, increasing capacity is not enough. If vaccinations provided by pharmacists are more costly, or if pharmacists are less efficient or less productive than primary care providers, then both the sustainability and total potential increase in capacity are constrained. We used traditional systems engineering techniques to assess the fiscal viability and potentially added capacity pharmacists represent relative to primary care.

Practical Implications

The cost, productivity, and efficiency of vaccination services provided at pharmacies, primary care offices, and mass vaccination clinics were analyzed using a convenience sampling of almost 700 adults during the 2006-2007 and 2007-2008 influenza seasons.

- Pharmacist-provided vaccination services had the lowest unit cost, as well as the best productivity and efficiency indexes of the 3 vaccination strategies studied.
- Given the number of pharmacists in the United States, optimizing their vaccination capacity could double the nation's vaccination capacity.

METHODS

Design and Study Population

The data set is derived from a larger study examining operational issues surrounding expanded recommendations for influenza vaccinations. Following approval by the University of California, San Diego Institutional Review Board, a convenience sample of 15 ambulatory primary care settings and 11 pharmacies in San Diego was used to collect workflow observations of vaccination services. The primary care and pharmacy sites represented a broad range of organization types, ranging from small Federally Qualified Health Centers and independent pharmacies through multispecialty/multisite for-profit organizations, including national chains and military hospitals. All told, the sites provide more than 143,596 vaccinations to more than 20,000 individuals annually. Characteristics of the sites are shown in **Table 1**.

Primary care observations were conducted during the 2006-2007 influenza season, followed by pharmacy data collection the following influenza season. Observations were encoded using the Observational Checklist of Patient/Client Encounters, a standardized workflow data acquisition tool described in earlier publications.[24]

Our study observations were conducted with a convenience sample of subjects eligible for influenza and/or other vaccinations. Patients were observed at primary care sites during routinely scheduled primary care appointments (operationally defined as a visit at which any new or current patient arrives at the clinic for a scheduled appointment) and mass influenza vaccination clinics (operationally defined as a visit at which any new or current patient arrives at the clinic without a scheduled appointment with the sole purpose of receiving an influenza vaccination). Client observations at the pharmacies all occurred during nonscheduled, walk-in vaccination encounters.

Data Collection

Data collection began with research staff approaching potential subjects and seeking permission to observe them throughout the course of their encounter. Patients/clients were followed from the moment they entered the clinic module or pharmacy until they exited all services, using the Observational Checklist of Patient/Client Encounters—a 52-item checklist that captures 3 major domains of information: (1) operational conditions (eg, staffing ratios) present at the time of the observation, (2) whether specific activities that are part of the published standards for vaccinations were present (eg, patients/clients being asked about potential allergies to eggs), and (3) the time patients/clients spent during specific stages of the encounter (eg, time spent in registration, time waiting for the provider). Observations included details such as whether a provider/pharmacist simply asked a patient/client about vaccination status or actually discussed the purpose of immunizing against influenza. The combination of data types permitted triangulation of data analysis in which unit costs, productivity, and the maximum patient/client throughput for a given unit of time and labor could be estimated.

Data Analysis

Analysis began with entering the individual workflow observations into an Excel worksheet and examining data for anomalous findings (eg, data entry error where recorded observation times all occurred in the morning with 1 data point in the middle indicating a time in the afternoon). Each anomalous finding was evaluated to

Table 1. Characteristics of Participating Sites

Site and Type of Practice	Location	Insurance/Mix	Clientele	Total Vaccinations Provided Annually (N = 178,333)	Vaccination Services Offered
Primary care					
FQHC	Urban	Medicare/Medicaid/ Medi-Cal, cash	Urban working poor	1903	R, W, M
FQHC	Urban	Medicare/Medicaid/ Medi-Cal, cash	Urban working poor	1207	R, W, M
FQHC	Urban	Medicare/Medicaid/ Medi-Cal, cash	Urban working poor	950	R, W, M
FQHC	Urban	Medicare/Medicaid/ Medi-Cal, cash	Urban working poor	2293	R, W, M
FQHC	Urban	Medicare/Medicaid/ Medi-Cal, cash	Urban, recent immigrant	6749	R, W, M
FQHC	Rural	Medicare/Medicaid/ Medi-Cal, cash	Rural, working poor	124	R, W, M
FQHC	Rural	Medicare/Medicaid/ Medi-Cal, cash	Urban, recent immigrant	32.978	R, W, M
FQHC	Urban	Medicare/Medicaid/ Medi-Cal, cash	Urban, recent immigrant	24,732	R, W, M
FQHC	Urban	Medicare/Medicaid/ Medi-Cal, cash	Urban, recent immigrant	12,670	R, W, M
Private multispecialty	Urban	Private insurance	—	24,743	R, W, M
Private multispecialty	Rural	Private insurance	—	830	R, W
Military regional hospital	Urban	Government employee, CHAMPUS	—	34,297	R, W
IHS	Rural	Private insurance	Native American	570	R, W
Public health department	Urban	Cash	Urban, recent immigrant	1032	W
Public health department	Urban	Cash	Urban, recent immigrant	1794	W
Pharmacy					
Chain	Urban	Medicare/Medicaid/ Medi-Cal, private insurance	Urban, upper SES	9744	W
Chain	Urban	Medicare/Medicaid/ Medi-Cal, private insurance	Urban, upper SES	11,037	W
Chain	Urban	Medicare/Medicaid/ Medi-Cal, private insurance	Urban, upper SES	897	W
Chain	Urban	Medicare/Medicaid/ Medi-Cal, private insurance	Urban, upper SES	579	W
Chain	Urban	Medicare/Medicaid/ Medi-Cal, private insurance	Urban, upper SES	2045	W
Chain	Urban	Medicare/Medicaid/ Medi-Cal, private insurance	Urban, upper SES	1126	W
Independent	Urban	Medicare/Medicaid/ Medi-Cal, private insurance	Urban, upper SES	794	W
Chain	Urban	Medicare/Medicaid/ Medi-Cal, private insurance	Urban, upper SES	3978	W
Chain	Urban	Medicare/Medicaid/ Medi-Cal, private insurance	Urban, upper SES	642	W
Independent	Urban	Medicare/Medicaid/ Medi-Cal, private insurance	Urban, mixed SES	322	W
Independent	Urban	Medicare/Medicaid/ Medi-Cal, private insurance	Urban, mixed SES	297	W

FQHC indicates Federally Qualified Health Center; IHS, Indian Health Service; SES, socioeconomic status; M, mass vaccination clinic; R, vaccination during routine appointment; W, walk-in vaccination only.

Table 2. Comparison of Patient/Client Characteristics

Observation	Visit Type: Primary Care—Routinely Scheduled Visit (n = 151)[a]	Primary Care—Mass Vaccination Clinic (n = 343)	Pharmacy (n = 100)	Likelihood Ratio (Fisher Exact Test for 3-Way Contingencies)
Characteristics				
Mean age, y	66	73	67	
Sex (M/F), %	38/62	42/58	34/66	
Utilization history				
Seeks routine medical care	117/147 (80%)	292/340 (86%)	76/88 (86%)	3.243 (*P* = .198)
Has a primary care provider	100/147 (68%)	170/340 (50%)	81/88 (92%)	64.389 (*P* = .000)
Practices and beliefs				
Got an influenza shot last year	58/147 (39%)[a]	222/338 (66%)	72/82 (88%)	25.559 (*P* = .000)
Influenza can be severe	37/147 (25%)[a]	297/320 (93%)	86/86 (100%)	257.432 (*P* = .000)
Reasons for getting an influenza shot				
Recommended by physician	105/147 (71%)	262/320 (82%)	28/86 (33%)	74.36 (*P* = .000)

[a]Of 255 patients observed at routinely scheduled appointments, 151 underwent an in-depth postexam interview.

determine whether it could be corrected with certainty; if this was not possible, the observation was discarded. Where a specific data field was incomplete for a specific subject observation (eg, whether the receptionist updated patient/client contact information), the specific field from that observation was eliminated from analysis (thus, the numerator/denominator may be different for specific observed activities). However, if several observation points were missing from a particular patient/client observation, the observation was discarded. As a result, 3 of 258 routine primary care, 8 of 349 mass vaccination, and 0 of the 100 pharmacy observations were removed from analysis. Decline-to-participate rates were less than 1% (3 declinations at the primary care sites and 0 at the pharmacies).

Observational data for each of the 3 delivery strategies from the primary care and pharmacy sites were analyzed in a nested fashion to estimate unit costs, efficiency, and productivity.

Direct Unit Costs

Direct unit costs were established by adding labor, material, and overhead costs associated with immunizing a single patient/client. Included in labor costs were all personnel who had direct contact with a patient/client. As routinely scheduled exams in primary care offices include, by definition, a wide array of health issues, only the time directly related to vaccination activity was used in the direct unit costs analysis. This compares with mass vaccination and pharmacist visits (observed pharmacists' vaccinations were all nonscheduled, walk-in visits, in which the only service provided was the vaccination), in which the sole purpose was to immunize; therefore, all the costs were accrued to vaccinations. Time factors were derived either by direct observation (eg, the time required to administer a vaccine) or by calculating the additional time spent in a particular activity by comparing those activities in which a vaccination occurred with those in which they didn't occur (eg, duration of pre-exam when vaccinations occurred vs duration of pre-exam when vaccinations did not occur). Labor costs were established using the hourly pay for each type of healthcare personnel listed by the US Bureau of Labor Statistics for 2007.[25] Similarly, capital or "overhead" costs were established using the Medical Group Management Association's published data for 2005 (for providers).[26,27] Material costs included the average cost of vaccine, syringe, and supplies listed in the CDC *Pink Book*.[28]

Productivity

Productivity is operationally defined as the ratio of services rendered to resources used—in our case, the number

Table 3. Time Spent in Vaccination Activities and Direct Unit Costs

	Activity, min						
Visit Type	Check-in	Health History Review	Time to Administer Vaccine	Time Spent by Provider/ Pharmacist Vaccinations	Total Time Spent in Vaccination Activities	Total Time With Provider/ Pharmacist	Physician ($61.43/h) Pharmacist ($44.95/h)
Primary care—routinely scheduled visit (n = 255)	1.5	0.5	1.0	3.0	6.5	21	3.07
Primary care—mass vaccination clinic (n = 343)	4.0	NA	1.0	2.0	7.0	7.0	NA
Pharmacy (n = 100)	NA	4.0	1.0	6.0	6.0	6.0	3.74

NA indicates not applicable.

of eligible patients/clients immunized per unit of labor, overhead, and materials. Productivity inherently identifies optimal ratio of resources—in our case, receptionists, medical assistants, and providers to desired outputs—in this case, appropriately vaccinated patients.

Productivity was calculated using the following formula:

$$\text{Productivity} = (L + C + M) / N,$$

where L = labor costs, C = capital costs, M = material costs, and N = number of individuals who could be immunized per hour.

Efficiency

Encounters involve more than simply immunizing patients/clients as quickly and cheaply as possible. Educating patients/clients, assessing for valid contraindications, determining true eligibility, and documenting the encounter all are activities recommended by the CDC/National Vaccination Program, ACIP,[29] and by the Joint Commission standards for documenting clinical encounters in ambulatory care settings.[30]

In general, these activities can be considered quality indicators. For purposes of this study, quality indicators were operationally defined as review and documentation of health history (to assess for eligibility, contraindications, and egg allergies); assessment of basic biometrics (eg, height, weight); observation of the patient/client for allergic reaction; and documentation of either vaccine administered or vaccination delay/refusal when recommended.

When productivity includes quality indicators, the resulting analysis is said to quantify the relative efficiency of the service. Efficiency is essentially how much of a service can be provided correctly for a given set of costs. Efficiency was calculated using the following formula:

$$(N * PV * PHHR * PD) / (L + C + M)$$

where N = number of individuals who could be immunized per hour, PV = probability of being immunized, $PHHR$ = probability of health history reviewed, PD = probability of vaccination documented, L = labor costs, C = capital costs, and M = material costs.

RESULTS

A total of 698 subjects were observed in this study (**Table 2**). Compared with patients at primary care or mass vaccination sites, pharmacy subjects were more likely to have received an influenza vaccination the previous year, to have a primary care provider, to perceive influenza as a potentially severe illness, and to seek vaccinations without a physician recommendation.

Unit Costs

Pharmacy vaccination delivery strategies resulted in significantly lower unit costs than the other 2 delivery strategies. In part, this is because of the lower overhead costs, but it also is the result of faster throughput or cycle time. The time devoted to vaccination activities and subsequent unit costs for all 3 strategies are detailed in **Table 3**.

Pharmacists' vaccinations also proved to be relatively more productive and efficient than the other 2 vaccination strategies. Overall production value—where the lower the production costs, the better—were best for pharmacies at $2.03

Costs, $				
Nurse ($21.93/h)	Receptionist ($10.14/h)	Overhead	Prefilled Syringe Cost	Total Unit Costs
0.40	0.25	5.04	13.25	22.01
1.10	0.68	6.30	13.25	21.33
NA	NA	0.23	13.25	17.22

compared with $7.67 for vaccinations provided at routinely scheduled primary care office visits. This difference reflects both the lower unit costs and the relatively higher number of clients that can be seen for a given unit of time and labor. The production value analysis is shown in **Table 4**.

Compared with primary care or mass vaccination clinics, pharmacists also proved to be more consistent in following ACIP national guidelines when vaccinating patients/clients. Patients/clients vaccinated at pharmacies were far more likely to be asked about allergies, have their health history reviewed for contraindications, receive a vaccination information sheet, receive a copy of their vaccination record, and have their contact information collected and verified (**Table 5**). The combination of the high rate of protocol compliance and low production costs results in the best (ie, lowest) efficiency value of the 3 strategies analyzed (**Table 6**).

DISCUSSION

In general, expanding the number of individuals eligible for vaccinations will require new strategies and health delivery partnerships. Based on this limited study, pharmacies appear to be well positioned to reach a large number of individuals, within a fiscally sound business model that also adheres to ACIP and CDC vaccination standards. Indeed, pharmacies seem to combine the strengths of both mass vaccination clinics and scheduled appointments at primary care sites. Strikingly, the pharmacies in our study found it in their interest to provide vaccinations even though pharmacists are not paid a professional fee for administering the vaccine, as primary care providers are. Pharmacists are reimbursed for the vaccine product and receive a dispensing fee under the prescription benefit portion of the patient/client's health plan.

It could be argued that the relative productivity and efficiency advantages seen in pharmacy vaccination services are more a reflection of compliant clientele than internal operational conditions. Demographic data suggested that there were some differences in individuals receiving vaccinations at primary care and pharmacy sites, but that these characteristics would not be expected to account for the differences found in this analysis. Although pharmacy clients were more likely to have received an influenza vaccination the previous year, to have a primary care provider, and to perceive influenza as a potentially severe illness, these are reasons why patients/clients would seek vaccinations, not why the provider/pharmacists would adhere to vaccination standards or have a lower cost-basis for providing the service.

Table 4. Productivity of Vaccination Strategies

	Visit Type		
Productivity Factor	**Primary Care—Routinely Scheduled Visit (n = 255)**	**Primary Care—Mass Vaccination Clinic (n = 343)**	**Pharmacy (n = 100)**
Mean labor cost	$3.72	$2.45[a]	$3.74
Mean overhead cost	$5.04	$9.90[b]	$0.23
Mean materials cost	$13.25	$13.25	$13.25
Mean number of patients seen per hour	2.87	8.9	8.5
Calculation	($3.72 + $5.04 + $13.25) / 2.87	($2.45 + $9.90 + $13.25) / 8.9	($3.74 + $0.23 + $13.25) / 8.5
Production value	**$7.67[c]**	**$2.88[c]**	**$2.03[c]**

[a]For maximum patient throughput, mass vaccination clinics used 2 receptionists for each allied health professional providing immunizations under standing orders.
[b]Overhead costs were increased because of using the 2 receptionists for each allied health professional in mass vaccination clinics.
[c]The lower the score, the greater the production value.

Table 5. **Compliance With National Standards for Vaccination Services**

Observation	Visit Type: Primary Care—Routinely Scheduled Visit (n = 255)	Visit Type: Primary Care—Mass Vaccination Clinic (n = 343)	Visit Type: Pharmacy (n = 100)	Likelihood Ratio (Fisher Exact Test for 3-Way Contingencies)
Registration				
Contact information verified at check-in	166/255 (65%)	231/343 (67%)	86/90 (96%)	42.206 (*P* = .000)
Insurance information verified at check-in	214/255 (84%)	89/343 (26%)	85/90 (94%)	209.968 (*P* = .000)
Pre-exam				
Health history taken	139/231 (59%)	0/343 (0%)	83/91 (91%)	324.899 (*P* = .000)
Patient/client asked about allergies	139/231 (59%)	0/343 (0%)	83/91 (91%)	324.899 (*P* = .000)
Treatment				
Eligible patient/client is administered vaccine	151/255 (59%)	341/344 (99%)	91/99 (92%)	189.868 (*P* = .000)
Patient/client is provided a copy of his/her vaccination record	105/151 (70%)	154/341 (45%)	64/91 (70%)	35.545 (*P* = .000)

CONCLUSION

Our study suggests that within the context of a changing national healthcare system, pharmacies are well positioned to provide key preventive, non–medication-dispensing services such as vaccinations. We already have seen a transition in which vaccinations provided by public health departments are now provided within a medical setting. Given the already heavily burdened world of primary care and the likely continued increase in demand for vaccination services, it may be time to look more closely at the partnership between primary care and pharmacists. Pharmacists participating in this study proved every bit as diligent in following recommended ACIP and CDC adult vaccination safety guidelines and provided vaccinations at lower cost than primary care providers.

Prescribing physicians and pharmacists already are partners in providing healthcare. Acceptance of pharmacists as "alternative immunizers" could be further fostered through efforts to document and share immunization records across the healthcare system, potentially through the use of community-based registries.

Table 6. **Efficiency Ratio of Vaccination Strategies**

Efficiency Factor	Visit Type: Primary Care—Routinely Scheduled Visit (n = 151)	Visit Type: Primary Care—Mass Vaccination Clinic (n = 341)	Visit Type: Pharmacy (n = 100)
Number of patients/clients who could be immunized per hour	2.87	8.9	8.7
Probability of patient/client being administered vaccine	59%	99%	99%
Probability of health history being reviewed	59%	0%[a]	91%
Probability of patient/client being provided with a copy of his/her vaccination record	70%	45%	70%
Calculation	$\frac{2.87 * 0.59 * 0.59 * 0.70}{\$3.72 + \$5.04 + \$13.25}$	$\frac{8.9 * 0.99 * 0.01 * 0.45}{\$2.45 + \$9.90 + \$13.25}$	$\frac{8.7 * 0.99 * 0.91 * 0.70}{\$3.74 + \$0.23 + \$13.25}$
Efficiency value	**0.032[b]**	**0.002[b]**	**0.319[b]**

[a]We arbitrarily set a minimum value of .01.
[b]The higher the score, the greater the efficiency.

Author Affiliations: From the Department of Pediatrics (JF, DAB), the Department of Family and Preventive Medicine (JF), the Skaggs School of Pharmacy and Pharmaceutical Sciences (JDH, SML), and the Department of Economics (JS), University of California, San Diego, La Jolla, CA.

Funding Source: This study was supported by Centers for Disease Control and Prevention grant number 5U01IP000094-02: Analysis of Childhood Influenza Provider Vaccination Strategies (ACIP-VS).

Author Disclosures: The authors (JF, JDH, SML, DAB, JS) report no relationship or financial interest with any entity that would pose a conflict of interest with the subject matter of this article.

Authorship Information: Concept and design (JF, JDH, SML); acquisition of data (JF, JDH, DAB); analysis and interpretation of data (JF, JDH, JS); drafting of the manuscript (JF, DAB, JS); critical revision of the manuscript for important intellectual content (JF, JDH, SML); statistical analysis (JF, JS); provision of study materials or patients (JF); obtaining funding (JF); administrative, technical, or logistic support (SML, DAB); supervision (JF).

Address correspondence to: John Fontanesi, PhD, Department of Pediatrics, University of California, San Diego, 9500 Gilman Dr, #0821, La Jolla, CA 92093. E-mail: jfontanesi@ucsd.edu.

REFERENCES

1. Centers for Disease Control and Prevention. List of vaccine-preventable diseases. http://www.cdc.gov/vaccines/vpd-vac/vpd-list.htm. Accessed July 9, 2009.

2. Committee to Study Priorities for Vaccine Development. *Vaccines for the 21st Century: A Tool for Decisionmaking.* Washington, DC: National Academies Press; 2000.

3. Department of Health and Human Services. CDC's advisory committee recommends influenza vaccination for children 6 months through 18 years of age [press release]. February 27, 2008. http://www.cdc.gov/media/pressrel/2008/r080227.htm. Accessed July 9, 2009.

4. US Census Bureau. *Table 2a. Projected Population of the United States, by Age and Sex: 2000 to 2050.* http://www.census.gov/population/www/projections/usinterimproj/natprojtab02a.pdf - 2008-07-31. Accessed April 18, 2008.

5. Cherry DK, Burt CW, Woodwell DA. National ambulatory medical care survey: 2001 summary. *Adv Data.* August 11, 2003;(337):1-44.

6. Fontanesi J, Hill L, Olson R, Bennett NM, Kopald D. Mass vaccination clinics versus appointments. *J Med Pract Manage*. 2006;21(5):288-294.

7. Fontanesi J, De Guire M, Holcomb K, Sawyer MH. The cost to immunize during well-child visits. *Am J Med Qual.* 2001;16(6):196-201.

8. Coleman MS, Fontanesi J, Meltzer MI, et al. Estimating medical practice expenses from administering adult influenza vaccinations. *Vaccine.* 2005;23(7):915-923.

9. American College of Physicians. *The Impending Collapse of Primary Care Medicine and Its Implications for the State of the Nation's Health Care: A Report from the American College of Physicians.* January 30, 2006. http://www.acponline.org/advocacy/events/state_of_healthcare/statehc06_1.pdf. Accessed July 9, 2009.

10. US Department of Labor. *Occupational Outlook Handbook, 2008-09 Edition. Pharmacists*. http://www.bls.gov/oco/ocos079.htm. Accessed July 9, 2009.

11. Gershon SK, Cultice JM, Knapp KK. How many pharmacists are in our future? The Bureau of Health Professions projects supply to 2020. *J Am Pharm Assoc (Wash).* 2000;40(6):757-764.

12. Department of Health and Human Services. *Projected Supply, Demand, and Shortages of Registered Nurses: 2000-2020.* Washington, DC: Department of Health and Human Services; 2002.

13. Chan S. Should pharmacists give flu shots? *New York Times.* March 5, 2008. http://cityroom.blogs.nytimes.com/2008/03/05/should-pharmacists-give-flu-shots/. Accessed September 4, 2009.

14. Kamal KM, Madhavan SS, Maine LL. Pharmacy and immunization services: pharmacists' participation and impact. *J Am Pharm Assoc.* 2003;43(4):470-482.

15. Neuhauser MM, Wiley D, Simpson L, Garey KW. Involvement of immunization-certified pharmacists with immunization activities. *Ann Pharmacother.* 2004;38(2):226-231.

16. Nau DP, Ried LD, Lipowski EE, Kimberlin C, Pendergast J, Spivey-Miller S. Patients' perceptions of the benefits of pharmaceutical care. *J Am Pharm Assoc (Wash).* 2000;40(1):36-40.

17. Grabenstein JD, Guess HA, Hartzema AG. People vaccinated by pharmacists: descriptive epidemiology. *J Am Pharm Assoc (Wash).* 2001;41(1):46-52.

18. Ernst ME, Bergus GR, Sorofman BA. Patients' acceptance of traditional and nontraditional immunization providers. *J Am Pharm Assoc (Wash).* 2001;41(1):53-59.

19. Blake EW, Blair MM, Couchenour RL. Perceptions of pharmacists as providers of immunizations for adult patients. *Pharmacotherapy.* 2003;23(2):248-254.

20. Haxby DG, Weart CW, Goodman BW Jr. Family practice physicians' perceptions of the usefulness of drug therapy recommendations from clinical pharmacists. *Am J Hosp Pharm.* 1988;45(4):824-827.

21. Beavers N. Vaccinations, pharmacy style. *Drug Topics.* 2000;144:56-58, 61-62.

22. Gardner JS. A practical guide to establishing vaccine administration services in community pharmacies. *J Am Pharm Assoc (Wash).* 1997;NS37(6):683-692; quiz 692-693.

23. Kamal KM, Madhavan SS, Maine LL. Impact of the American Pharmacists' Association (APhA) Immunization Training Certification Program. *Am J Pharm Educ.* 2003;67(4):article 124.

24. Fontanesi J, De Guire M, Chiang J, Holcomb K, Sawyer M. Applying workflow analysis tools to assess immunization delivery in outpatient primary care settings. *Jt Comm J Qual Improv.* 2000;26(11):654-660.

25. US Department of Labor, Bureau of Labor Statistics. National compensation survey. 2008. http://www.bls.gov/ncs/home.htm#data. Accessed July 10, 2009.

26. Medical Group Management Association. *Cost Survey: 2006 Questionnaire Based on 2005 Data.* http://www.mgma.com/work-area/showcontent.aspx?id=11450. Accessed July 10, 2009.

27. US Government Accountability Office. *Medicare: Information Needed to Assess Adequacy of Rate-Setting Methodology for Payments for Hospital Outpatient Services.* September 2004. GAO-04-772. http://www.gao.gov/new.items/d04772.pdf. Accessed July 10, 2009.

28. Centers for Disease Control and Prevention. *Epidemiology and Prevention of Vaccine-Preventable Diseases: The Pink Book.* Waldorf, MD: Public Health Foundation; 2008.

29. Postema AS, Breiman RF; National Vaccine Advisory Committee. Adult immunization programs in nontraditional settings: quality standards and guidance for program evaluation. *MMWR Recomm Rep.* March 24, 2000;49(RR-1):1-13.

30. Joint Commission. Standards and elements of performance (EP) applicability table for all ambulatory care services/settings. 2006. http://www.jointcommission.org/NR/rdonlyres/2BC06362-B4BF-4196-B22F-9425E02EA1CB/0/07_amb_stds_applicability grid.pdf. ajpb