

Student Column

COST ANALYSIS OF INFLUENZA VACCINE ADMINISTRATION IN FAYETTE COUNTY, KENTUCKY, 2005–2007

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Influenza is a contagious respiratory illness caused by the influenza virus that affects 5% to 20% of the population every year. Combined, influenza-related pneumonia and influenza are the eighth leading cause of death in the United States.¹ More than 36,000 Americans die annually from influenza; an additional 200,000 are hospitalized annually because of the influenza virus and its complications.² The timing and duration of the influenza season vary. While influenza

outbreaks can occur as early as October, influenza activity usually peaks in January or later. During the past 26 influenza seasons, the months with the heaviest activity (peak months) were February (12 seasons), January (five seasons), December (four seasons), March (four seasons), and November (one season).³

The Centers for Disease Control and Prevention (CDC) groups the prevalence of influenza with pneumonia. Statistically, in the U.S., from October 2, 2005, through June 24, 2006, the World Health Organization (WHO) and the National Respiratory and Enteric Virus Surveillance System (NREVSS) laboratories tested 148,636 specimens for influenza viruses, of which 17,977 (12.1%) were positive. During this same time period, 41 pediatric deaths as a result of influenza infections were reported to CDC from 14 states.⁴

From October 1, 2006, through May 19, 2007, WHO and NREVSS tested 179,268 specimens for influenza virus, of which 23,753 (13.3%) were positive. During this same time period, 68 pediatric deaths resulting from influenza infections were reported to CDC.⁵

Using disease rates per 100,000 population, Kentucky reported 449 influenza viruses isolated in 2005, 742 influenza viruses isolated in 2006, and 1,248 influenza viruses isolated in 2007.⁶ However, the east south central states, which include Kentucky, reported that less than 10% of specimens tested positive for influenza.⁷ During this entire study period, no pediatric deaths reported in Kentucky were due to influenza infections.^{4,5} High-risk groups, which include senior citizens, young children, and people with weakened immune systems, are highly susceptible to infection from influenza.²

Kentucky ranks number one in the nation for current smoking among adults.⁸ Additionally, Kentucky ranks among the top 10 in the nation for high cholesterol. In 2005, more than one-third of adults in Kentucky reported high cholesterol, and most Kentucky adults who have ever had high cholesterol also have other risk factors, including high blood pressure, smoking, diabetes, overweight/obesity, low vegetable/fruit consumption, and physical inactivity.⁹ CDC estimates that for each one million high-risk individuals vaccinated, approximately 900 deaths and 1,300 hospitalizations are prevented during an average influenza season.² The Kentucky Department for Public Health follows CDC recommendations by promoting vaccination to all high-risk individuals. If the vaccine had been in a production shortage year, these high-risk individuals were vaccinated during the first wave of available vaccine.

The role of public health is to prevent the spread of influenza. At present, the most effective prevention against influenza is vaccination. An effective vaccination program needs to target and be sensitive to the particular needs of all people. It should include a combination of strategies to promote vaccination (e.g., flyers, personal invitations, or doctor's recommendation), acknowledgement of lay beliefs, special clinics, and special arrangements for housebound individuals and those living in care homes. Vaccinations are proven to save lives and reduce health-care costs.¹⁰ Several studies have evaluated the economic burden of influenza vs. the cost-effectiveness of the vaccine.¹¹⁻¹³ In addition to the direct costs of medical care, the indirect costs of influenza are substantial and stem largely from absenteeism and loss of work productivity. Estimates of the cost of influenza in the U.S., France, and Germany have shown that indirect costs can be five to 10 times higher than direct costs. Other intangible costs associated with influenza include impaired performance, which can reduce reaction times, and adverse effects on the quality of life of patients and their families.¹⁴

Using 10 years of surveillance data, the WHO

conducted a sensitivity analysis and concluded that lower vaccination costs, higher annual probabilities of influenza, and higher numbers of workdays lost to influenza make vaccination more cost-effective than treatment.¹³ While influenza vaccine distribution is necessary for prevention, a cost-effective means of vaccine delivery is unclear.

This study was a comparative two-year cost analysis that entailed reviewing the entire vaccination process to determine the exact expenditure required to administer the vaccine efficiently. We compared the costs of providing vaccine during two seasons, giving administrators factual data to make informed decisions in ordering and using vaccine, while adjusting staff time to fit community needs efficaciously. We performed the study among different clinic types yielding a set of recommendations that produced an efficient and effective method for offering the influenza vaccine in an urban setting.

This research is important because more than two-thirds of people in the U.S. are recommended for annual vaccination. Because influenza vaccine is available seasonally, mass vaccination strategies are well suited to its delivery. Pandemic influenza vaccination will occur primarily through the public sector in mass clinic settings. Exercising vaccination clinics is important for preparedness because vaccination program planning must consider such issues as coordination, staffing, clinic location and layout, security, record-keeping, and communications.¹⁵ These strategies can be perfected in the context of annual influenza vaccination, and recognition of which clinic type is the most efficacious is an important factor leading to the success of mass immunizations.

METHODS

Procedure

We analyzed influenza campaign seasons 2005–2006 and 2006–2007 and selected a random sample stratified by type of clinic. The community influenza clinics were staffed by public health nurses (PHNs) and clerical staff from the Lexington-Fayette County Health Department. Revenue varied by type of reimbursement and was offset by the following costs: manpower on the site, including nursing and clerical; vaccine/supply; and indirect. Each clinic used a form developed by the study to collect the data, which included the number of clients and their pay source, and the number of staff and their work hours. We used these data to calculate the total direct expenditures for each clinic. We estimated direct staff time cost by using the mean hourly salary of the professional and the mean hourly salary

of the clerical staff that worked in the clinics during the influenza season. We considered the vaccine cost to be the rate the health department paid for each dose of vaccine; unit doses were used in 2005–2006, and 10-dose vials were used in 2006–2007. We calculated the salaries and supplies at the same rate for both seasons because these costs remained unchanged. The indirect cost included the labor involved in ordering, stocking, and administrative management for the staff and supplies. This cost yielded a profit/loss for each clinic. Specific cost assumptions are listed in Table 1.

Sample

The sample included five clinic categories: community walk-ins, fourth-floor appointments, private businesses, senior high-rise apartments, and targeted populations.

- Community walk-ins: These clinics required no appointment and had a mean of 209 individuals of all ages who were served at 12 sampled clinics.
- Fourth-floor appointments: These were used during the 2005–2006 influenza season to administer vaccine on the fourth floor of the Lexington-Fayette County Health Department to all age groups. (This clinic type was evaluated as

not cost-effective and was substituted during the 2006–2007 season by a daily walk-in clinic for all ages at an off-site clinic.) For these clinic types, a mean of 52 individuals of all ages were served on 13 sampled days.

- Private businesses: Private businesses requesting a vaccine for a healthy, working population served a mean of 31 individuals at 17 sampled sites.
- Senior high-rise apartments: Residential sites for high-risk senior citizens served a mean of 52 seniors at 15 sampled sites.
- Targeted populations: Nonprofit civic organizations and churches served a mean of 105 individuals at 19 sampled sites.

There were a total of 151 clinic sites in 2005–2006 with 33 sites sampled, and 180 clinic sites in 2006–2007 with 43 sites sampled.

Data analysis

We selected a random, stratified sample. We estimated the profit/loss and cost potential for each sampled site using calculated costs per vaccine, supplies, staff time, indirect costs, and total reimbursement rate. We estimated the mean profit, standard error of the mean, and 95% confidence interval (CI) for the mean per clinic category as well as for the entire population using standard weighing procedures for stratified samples, and accounted for a finite population correction factor. We conducted all analyses using SAS® version 9.1.¹⁶

Table 1. Reimbursement rates and costs for influenza vaccination in Fayette County, Kentucky, during the 2005–2006 and 2006–2007 influenza seasons

Variables	Rates/costs	
	2005–2006 ^a	2006–2007
Reimbursement rates		
Private pay	\$20.00	\$20.00
Medicaid	\$3.30	\$14.96
Medicare	\$19.06	\$22.06
Private insurance	NA	\$20.00
Staff time: mean hourly rate		
Public health nurse	\$26.50	\$26.50
Clerical	\$15.54	\$15.54
Temporary nurse	NA	\$45.00
Vaccine		
Cost for one dose	\$13.09	\$10.50
Supplies for one dose	\$0.25	\$0.25
Indirect cost total (percent)		
Labor (supervision)	15	15
Vaccine (order/storage)	15	15

^aDuring the 2005–2006 influenza season, the Lexington-Fayette County Health Department elected not to bill private insurances and chose not to use temporary nursing services to administer influenza vaccine.

NA = not applicable

RESULTS

Profit/loss in administering vaccines in the randomly sampled influenza clinics during the 2005–2006 and 2006–2007 influenza seasons are listed in Table 2. If the upper and lower bounds of the 95% CIs were both >\$0.00, the clinic was declared profitable. Likewise, if the upper and lower bounds of the 95% CI were ≤\$0.00, the clinics were declared to be unprofitable. If the bounds encompassed \$0.00, the clinics were considered to have broken even.

The fourth-floor appointment clinics and the health department walk-ins were not shown to be profitable, as the 95% CIs for both clinic types did not contain \$0.00. By contrast, senior high-rise apartments were profitable during both seasons. Results were mixed for the other clinic categories. Private businesses were profitable during 2005–2006 but not 2006–2007; the same was true for targeted populations. The deficit revenue years for private businesses and targeted populations were due to overstaffing for the populations served. Overall, in 2005–2006, the influenza vaccine

Table 2. Cost of influenza vaccinations by clinic type during the 2005–2006 and 2006–2007 influenza seasons in Fayette County, Kentucky

<i>Clinic category</i>	<i>Sample size (n)</i>	<i>Stratum size (n)</i>	<i>Mean</i>	<i>SE</i>	<i>95% CI</i>
Community walk-ins					
2005–2006	4	4	\$359.50	\$0.00	\$359.50, \$359.50
2006–2007	8	11	–\$13.75	\$73.23	–\$186.91, \$159.41
Fourth-floor appointments 2005–2006	5	41	–\$83.00	\$24.60	–\$151.31, –\$14.69
Health department walk-ins at 805 public health clinics 2006–2007 (substitute site for fourth-floor appointments)	8	53	–\$304.13	\$64.83	–\$457.43, –\$150.82
Private businesses					
2005–2006	10	78	\$27.90	\$9.27	\$6.90, \$48.87
2006–2007	7	78	\$66.14	\$27.39	–\$0.88, \$133.17
Senior high-rise apartments					
2005–2006	7	18	\$49.00	\$14.85	\$12.67, \$85.32
2006–2007	8	18	\$148.00	\$42.74	\$46.93, \$249.07
Targeted populations					
2005–2006	7	10	\$3.86	\$71.04	–\$169.98, \$177.69
2006–2007	12	20	\$182.50	\$68.59	\$31.28, \$333.22
All sites combined					
2005–2006	33	151	\$7.49 ^a	\$9.63	–\$12.24, \$27.23
2006–2007	43	180	\$77.83 ^a	\$36.64	\$3.65, \$151.99

^aThe overall mean is based on a formula for a stratified sample that weighs sites by size of stratum and sampling fraction.

SE = standard error

CI = confidence interval

administered was a break-even program (\$7.49 profit, 95% CI –\$12.24, \$27.23). In 2006–2007, overall profitability was attained with a \$77.83 mean profit for each of the 43 clinics sampled.

DISCUSSION

We examined cost-effective methods for delivering influenza vaccine to the population living in an urban area of Kentucky, which is a mid-sized city-county service area. Because state influenza statistics have been consistent with national figures, the results of this case study could be generalized to a medium-sized urban area in the U.S. Specific recommendations and lessons learned varied for each clinic type.

Community walk-in clinics generated profitable results, although they were overstaffed for the population served. An increase in community walk-in sites was scheduled for 2006–2007, with the analysis yielding a modest loss of \$13.75 per clinic, which was caused by overstaffing. Recommendations for profitability include:

- Be imaginative with ideas for increasing the number of community sites.

- Invite nursing students with their instructors to assist in the community walk-in clinics for extra hands-on experience and community outreach.
- Schedule community walk-in clinics weekly and bimonthly by supervisor in facilities with personnel appropriate to assist with people/traffic flow. An example would be scheduling senior citizen centers.
- There is always uncertainty as to how many members of the public will attend a community walk-in clinic. The efficiency of such clinics can be increased by scheduling a conservative number of PHNs and clerical staff and placing additional staff on call to assist if the volume exceeds expectations.

Fourth-floor appointments (during 2005–2006) and the alternative on-site health department public health walk-in clinic (during 2006–2007) were unprofitable during both influenza seasons due to the small population served per staff ratio assigned. The problems identified included:

- The appointments provided too many no-shows.
- Fifteen-minute appointment slots proved to be too long between clients to be profitable.

- The public health walk-in clinic was overstaffed for the population seeking vaccine during work hours.

Private businesses usually served clients who paid privately and were, therefore, always profitable. Recommendations include:

- Put one individual in charge of scheduling businesses to eliminate overbooking and to explain the health department policy to make this outreach cost-effective.
- Require businesses to guarantee a minimum number of vaccines at their site.
- Provide the alternative of setting a time frame at the health department for private businesses immediately prior to work or after work hours.
- One PHN giving 20 vaccines with clerical assistance for an off-site clinic for a total of three hours each can break even with a \$20 setup fee.
- Charging a \$50 setup fee could absorb some of the cost of the excess vaccine at the end of the season.

Senior high-rise apartments boast captive elderly populations, which were profitable during both influenza seasons for the following reasons:

- Vaccine was available in a home setting.
- A small number of staff were assigned to give the vaccinations.
- All reimbursement was made through Medicare and Medicaid.

Targeted populations included nonprofit civic or church populations, which showed varied results. Revenue loss in 2005–2006 was due to overstaffing, but comparing and adjusting staffing in 2006–2007 led to profits. Lessons learned included:

- Civic/church populations should be compared with the previous year for the most cost-effective staffing schedule.
- If the site is open to the public, assign staff on-call following the recommendations for community walk-ins.

Overall recommendations

- Inform the public of the service with a news release in early October that outlines the scheduled clinics and the guidelines tailored to specific populations.
- Use a call-in hotline recording to announce the vaccine community walk-in clinics.

- Provide vaccines at as many public places as manageable.
- The manager of the vaccine campaign should review the individual influenza clinic participation from the previous year's statistics prior to assigning staff.
- Provide vaccine to physicians' offices, medical facilities, and other health departments by adding a 15% handling fee above the cost of the vaccine to cover indirect costs.
- Eliminate the use of temporary agency registered nurses due to their high expense.
- Consider reassigning all nurses for a day or so every season to cover the influenza clinics.

CONCLUSIONS

Other states could benefit from this Kentucky public health research analysis, which provides insight regarding the type of influenza clinic that proved to be the most cost-effective for vaccinating large and small populations while remaining efficient to the population's needs. Every state can also use the annual influenza vaccine administration seasons as practice sessions for a pandemic. Local health departments are critical to planning and response, as all disasters and emergencies are initially local. One example is using community walk-in clinic sites as practice for emergency preparedness by providing mass immunizations in a short time period. In fact, on October 21, 2005, the Garrard, Jessamine, and Lexington-Fayette County Health Departments partnered to conduct a point of distribution emergency preparedness clinic. In addition, drive-through clinics in 2007 and 2008 were planned exercises that used preparedness funds to provide influenza vaccine to a larger public on a walk-in/drive-in basis.

In summary, this analysis has proven to be an excellent resource for the Lexington-Fayette County Health Department in preparation for future influenza vaccine seasons. The results of the analysis have been used to make evidence-based recommendations to perform the most positive and efficient methods to administer vaccine to the public while remaining cost-effective for the health department management. The total analysis provides methods that allow local health departments to remain financially stable, while most importantly maintaining the public health mission to preserve the health of the community.

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