



Published in final edited form as:

J Sch Nurs. 2012 October ; 28(5): 328–335. doi:10.1177/1059840512448676.

Coordination Costs for School-Located Influenza Vaccination Clinics, Maine, 2009 H1N1 Pandemic

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Abstract

School nurses played a key role in Maine's school-located influenza vaccination (SLV) clinics during the 2009–2010 pandemic season. The objective of this study was to determine, from the school district perspective, the labor hours and costs associated with outside-clinic coordination activities (OCA). The authors defined OCA as labor hours spent by staff outside of clinic operations. The authors surveyed a convenience sample of 10 school nurses from nine school districts. Eight nurses responded to the survey, representing seven districts, 45 schools and 84 SLV clinics that provided a total of 22,596 vaccine doses (H1N1 and seasonal combined) to children and adolescents. The mean total OCA time per clinic was 69 hours: out of total hours, 22 (36%) were spent outside regular clinic operation time. The authors estimated the mean cost of OCA to be \$15.36 per dose. Survey respondents reported that costs would be lower during non-pandemic seasons and as schools become more proficient at planning clinics.

Keywords

influenza; vaccination; pandemic; H1N1; school nurse; economic evaluation; school-located vaccination clinics

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The content of this report is solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention or the State of Maine.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Introduction

From 1976 to 2007, influenza was associated with an average of 23,607 deaths per year (min 3,349; max 48,614; Center for Disease Control and Prevention [CDC], 2010a). The Advisory Committee on Immunization Practices (ACIP) now recommends influenza vaccination as an effective preventive measure for over 99% of the population (CDC, 2010b). As its recommendation for children has evolved from risk-based to age-based, and, eventually, to a universal recommendation, school-located influenza vaccination (SLV) has been proposed as a potentially viable and cost-effective supplement to vaccinations delivered in health care provider offices (Cawley, Hull, & Rousculp, 2010; Hull, 2011; Hull, Frauendienst, Gundersen, Monsen, & Fishbein, 2008; Schmier, Li, King, Nichol, & Mahadevia, 2008). We define SLV clinics as clinics primarily designed to vaccinate school children, on school grounds, during or outside of school hours (CDC, 2009a).

Prior to the 2009 H1N1 pandemic, influenza SLV clinics were held in some states at the local level sporadically, and state-wide in Hawaii for multiple years (Effler et al., 2010; Hull, 2010; King et al., 2005; King et al., 2006; Schmier et al., 2008; White, Lavoie, & Nettleman, 1999). During the 2009 H1N1 influenza pandemic, SLV clinics were used by states and local jurisdictions to vaccinate school-age children, one of the priority groups for the 2009 H1N1 influenza vaccine (CDC, 2009b). In Maine's 2009 state-wide SLV program for both H1N1 and seasonal vaccines, over 95% of schools conducted or participated in SLV clinics (Lorick et al., 2011). Maine's state health department (Maine Center for Disease Control and Prevention), promoted SLV clinics and offered limited funding and some supplies and materials to schools that conducted SLV clinics (Thomas & Mills, 2010). However, schools and communities were asked to independently organize or form partnerships with other health entities to make the SLV clinics feasible. Maine achieved 60.2% coverage for H1N1 vaccine among children and adolescents 6 months to 17 years (national median coverage, 6 months to 17 years: 36.8%; Lu et al., 2010).

The planning process for SLV can be challenging because of the need to minimize school and classroom disruption. Coordination of SLV clinics also introduced new challenges—bringing in new partnerships and agencies (Figure 1). In Maine, each district's SLV program varied in the types of partnerships between schools, public health, and other community entities (Cawley et al., 2010). Who vaccinated was also left up to the school districts; some districts partnered with other health entities (e.g., Visiting Nurses Associations or hospitals) and at other districts, school nurses vaccinated on their own. Maine's SLV clinics also varied in their implementation approach; the primary approach was onsite vaccination during school hours, although some SLVs vaccinated off-site and outside of school hours (Lorick et al., 2011).

In Maine, many school nurses (66%) serve at more than one school in their district (Oostveen-Buterbaugh, 2009). Maine also has public health nurses who serve schools without designated school nurses in the most rural parts of the state. Consent form processes were primarily handled by school nurses and staff.

Because of the planning and consent form processes required for SLV clinics, we expect there to be considerable labor hours allocated to outside-clinic coordination activities (OCA). We define OCA as coordination activities conducted outside of the operating hours of the SLV clinic. OCA include planning time, but also time spent reviewing consent forms, contacting parents outside of clinic hours, or billing insurers. OCA costs exclude regular clinic costs, which are the labor, materials, and vaccine needed to run clinics (from setup to breakdown). Past research has focused on regular clinic costs and some studies have evaluated the time spent planning clinics (Carpenter, 2007; Hull, 2010). We build on these studies by conducting a detailed analysis of OCA costs by time period (before, during, and after SLV clinics). We do not include regular clinic costs in this analysis; they were analyzed and reported separately (Cho et al., 2011).

Methods

Design and Survey Instruments

This study was determined to be nonresearch, public health practice: program evaluation by the Centers for Disease Control and Prevention. Nurses were initially contacted about participation in the study by the School Nurse Consultant for the State of Maine and the University of Southern Maine, Muskie School of Public Service. We selected 12 nurses based on the type of partnerships their schools had entered into (vaccination by the school nurse or vaccination performed by a Visiting Nurses Association or hospital) and rural or urban status. In March and April 2010, we interviewed, in person and by phone, a convenience sample of 10 “lead nurses” or “health services coordinators” who played a leading role in planning and implementing the SLV clinics. Most of Maine is rural and the majority of our respondents were from rural areas; however, we also contacted school nurses in urbanized areas. We then used the interviews to create survey instruments designed to record labor hours spent by lead nurses and other staff on OCA. Some of the nurses who were part of the original interviews were also asked to fill out the final survey instrument. In early June 2010, we distributed the surveys via e-mail to the 10 identified respondents. Surveys were completed by respondents and returned via fax, e-mail, or phone interview. Nurses were also asked to report the time spent by staff members in the school district including but not limited to superintendents, principals, administration staff, teachers, non-lead school district nurses, and other support staff. We further asked about outside-clinic costs for materials; however, only one district reported costs for copying, so we excluded materials costs from the analysis. Although staff spent time on planning and billing Medicaid and private insurers, this study was not designed to collect information on reimbursements received from billing.

We asked respondents to estimate the total time they spent on various OCA during the planning, implementation, and post-implementation periods (Table 1). Respondents reported both the time they spent during regular working hours and any additional “extra” hours (information about whether these were compensated was not collected). The planning period included all time from May 1, 2009, to the end of the day prior to the operation of the first clinic. The implementation period included all labor time spent outside of clinic operations between the first and last clinic for the school district (all school districts conducted multiple

clinics). The post-implementation period spanned from the date of the last clinic until April 30, 2010.

We also asked about health-related activities that had to be postponed (e.g., Body Mass Index [BMI] assessment or reviewing student health histories). In Maine, SLV clinics were planned for the 2010–2011 season, so we also asked nurses to estimate the change in time necessary to plan clinics in the next year. Nurses were also asked to report doses administered for their clinics.

Data Analyses

We used one primary measure for lead nurse time: mean number of nurse hours per clinic. We computed mean nurse hours per clinic by taking each nurse's total hours and dividing by that nurse's number of clinics, then averaging over all nurses. To compare the relative time consumption of different activities, we computed the percentage of total time for each activity in each period.

To calculate the value of labor, both regular and “extra” hours, we used the Bureau of Labor Statistics (BLS) wage statistics for the state of Maine (Bureau of Labor Statistics, 2009). For lead nurse respondents, we used the 75th percentile wage of nurses in Maine. For non-lead school nurses, we used the median wage for nurses in Maine. All other salaries (school principals', administrators, physicians, secretaries, etc.) were fit to the most appropriate Maine-specific BLS median wage category. We assume a 30% fringe benefit rate for all employees. We do not include overhead costs in this study.

We performed a simple statistical analysis, where each district was treated as an observation on cost. The analysis was conducted as follows: we computed the mean cost per dose administered for each district by first computing that district's total cost by category (cost of lead nurse time by period or cost of other staff labor hours) then dividing by the number of doses given in that district. We then averaged across districts to obtain the mean cost per dose. We also report the median, minimum, and maximum cost per dose.

Results

There were eight respondents to the survey, representing seven school districts, 16,645 students, 45 schools, 84 clinics, and 22,596 doses of vaccine (14,714 of 2009 H1N1 and 7,882 of seasonal influenza vaccine). Of the seven school districts in the sample, one was located in a city, two were in suburbs, two were in towns, and two were in rural areas (U.S. Department of Education). For job titles, four respondents were “lead nurses,” one nurse was a “parttime nurse,” one nurse held the title of “School Nurse Coordinator,” and another nurse had the title of “Health Services Coordinator.” Because one district had a lead and non-lead nurse respond, we included the non-lead nurse's time in the “other district staff” category. School districts varied greatly in size and socioeconomic status. The median school district population was 1606 students (min 838, max 7,023; U.S. Department of Education, 2010). The percentage of students eligible for free and reduced lunch ranged from 7% to 58% (Table 2; Maine Department of Education, 2011).

The mean number of clinics per nurse was 12 (min 4, max 30; Table 2) and the mean total hours per clinic was 51 (Table 3). Of mean total hours, nurses reported a mean of 22 extra hours per clinic (42% of total nurse time). For non-lead nurse district staff, labor hours for all periods averaged 18 hr per clinic. In total, for all school district staff (including lead nurses), the mean time for OCA was 69 hr per clinic (Table 3). Lead nurse time per clinic was greatest during the planning period (27 hr), then the implementation period (17 hr), and last, the post-implementation period (7 hr). Only four school districts reported time spent by other staff. Activities of high level administrators were related to meetings to discuss executive decisions for location of SLV clinics, staffing schedules, and press releases. Secretaries, volunteers, and other staff helped with all aspects of clinic preparation including, but not limited to consent process, Vaccine Information Statement forms, and writing letters to parents.

Planning Period

The most time-consuming activities during the planning period were communication, consent process, and training (Table 3). Planning communication focused on the school district (19% of total planning time) and parents (16% of total planning time). A smaller portion was devoted to communicating with outside health entities (9% of total planning time). In total, communication was the greatest component of planning for the clinics, with a total of 45% of planning time.

Implementation Period

During the implementation period, communication was again the greatest component (62% of total implementation time; Table 3). However, the composition of communication differed from the planning period. During the implementation period, most time was spent communicating with parents (28% of total implementation time), and the remaining time roughly split between the school district and outside health entities (16% and 18%, respectively).

Post-Implementation Period

In the post-implementation period, the largest components of respondents' time was spent on communication and billing (four districts of the seven billed). In two of the four districts that billed, their partner's staff (either a Visiting Nurses Association or the Local Health Department) billed insurers; we were unable to include these partner hours in this analysis. Districts that billed insurers reported spending more time in the post-implementation period than districts that did not bill; 13 and 1.8 hr, respectively (Table 4). Districts that billed reported more time in every activity, with the most time-consuming activities being, in order of greatest to least amount of time spent: billing insurers, reporting, and communication. We did not collect information on the amount reimbursed by insurers.

Value of Time Used for SLV OCA

Total mean lead nurse cost per dose was \$12.03 (median 10.38, min 1.61, max 19.08; Table 5). Adding school district other staff costs (\$3.33; Table 5) yielded a total cost per dose of \$15.36 (median 12.75, min 1.95, max 27.34; Table 5). Respondents reported that on average,

36% of total time spent on the clinics was outside their regular work hours. This amounted to a mean of 22 “extra” hours per clinic. Whether nurses were compensated or not for extra time varied by school district and was not collected in our survey. Nurses reported having to delay hearing and vision screenings, BMI assessments, classroom visits, sports physicals, and had difficulty finding time to review student health histories.

Given that 2009–2010 was a pandemic season and the lack of experience in running SLV clinics, almost all nurses reported expected reductions for the following year’s planning time with an average expected reduction in planning time of 76%.

Respondents suggested that future SLV planning include methods to notify parents electronically (e.g., e-mail) or automated dialing methods to communicate with parents (e.g., to remind them to return consent forms). They also suggested that consent forms be standardized well in advance and suggested hiring administrative staff to help review consent forms and communicate with parents to confirm consent form information. Respondents further suggested that there be a designated person on the day of the clinic to record electronically the clinic vaccination dose information. Finally, because nurses had to report vaccine dose information to many sources, nurses suggested a centralized reporting and billing system for SLV clinics.

Discussion

The State of Maine achieved 60.2% coverage for 2009 H1N1 influenza vaccine among children and adolescents 6 months to 17 years; a level much higher than the national median (36.8%; Lu et al., 2010). It is likely that this high level of coverage was due in part to the success of their SLV program; which was the method by which almost all school-age children received their vaccine in Maine. In fact, literature suggests that SLV programs may vaccinate more children than would have otherwise been vaccinated (Hull, 2011; Humiston et al., 2011). Our results show that school nurses were an integral part of this effort. The majority of their time was spent on critical activities such as communications and consent processes. Further, a large portion of lead nurse time was spent outside of regular working hours, which, although not uncommon during a public health emergency response (CDC, 2011) places significant burden on one individual and can create challenges for the sustainability of SLV clinics during non-pandemic seasons.

Given the results of a related evaluation conducted on the labor and materials cost to run SLV clinics in the state of Maine from 2009 to 2010 (\$13.51 per dose; Cho et al., 2011), adding our OCA cost (\$15.36) yields a total per dose cost of \$28.87 excluding vaccine and syringe costs. This cost is higher than other recent studies on SLV clinic costs, which have suggested a range of \$20 to \$27 per dose during non-pandemic seasons (including vaccine costs; Cawley et al., 2010; Hull, 2011). Nevertheless, nurses did report an expected 76% reduction in planning time if they were to conduct SLV clinics in the following year. Assuming other costs stay the same, this would reduce the OCA cost estimate from 15.36 to a total of \$10.08 per dose (the planning period represented \$6.95 per dose, 76% reduction in planning costs implies a reduction of \$5.28 per dose: $15.36 - 5.28 = 10.08$).

During 2009–2010 SLV program, nurses reported delays in “usual” activities such as hearing and vision and BMI screenings. In lower income areas, where primary care doctors are less likely to be present (Shipman, Lan, Chang, & Goodman, 2011), schools may serve as a “public health safety net,” making routine screenings by nurses more important. Finally, because the 2009–2010 H1N1 season was a pandemic influenza year with two influenza vaccines, SLV activities were less predictable than in a regular season. If influenza SLV clinics become routine, other school nurse activities would likely be scheduled more efficiently.

Superintendents, principals, secretaries, and non-lead nurses were also involved in OCA. Though they contributed fewer hours to the SLV clinic effort, according to initial interviews and survey comments, they were also important in making sure that the school district would have a successful vaccination program. Regarding lead school nurses, even if the regular clinic model changed, where school nurses were not the primary coordinators, school nurses can be an important bridge between schools and public health stakeholders.

Our study is subject to several limitations. First, we focus on clinics that were primarily planned and implemented by school nurses and were held during school hours, with parental presence not required; other approaches would likely affect the amount of nurse time required. However, many of the activities would still need to be conducted (e.g., communication and consent form process) regardless of approach used. Second, we evaluated SLV clinics during a pandemic year, which could have increased the coverage in schools (potentially reducing the average cost), but also increased the amount of time necessary to plan clinics (e.g., delays in vaccine shipments, more communication time). Additionally, our cost per dose would be lower if we were able to account for the revenue generated from health insurance reimbursement. Third, the results are subject to recall bias because our survey was detailed and conducted 6 months after the last SLV clinic; however, some nurses kept detailed time logs and/or consulted their payroll records. Fourth, lead nurses reported time for other staff members, which was likely to be less accurate than if other staff members had reported the time themselves. Finally, several districts also reported the need for copy and translation services; however, none of the respondents reported quantities and costs for translation services. For these reasons, we excluded materials costs from the analysis, making our analysis an underestimate. It is reassuring to note that many respondents stated anecdotally that there were no major materials costs associated with planning and coordinating SLV clinics.

Conclusion

The H1N1 influenza pandemic of 2009 was the first time that many practicing school nurses and other partners in Maine conducted or participated in school vaccination clinics. This likely presented a steep learning curve and potentially increased time needed for implementing SLV programs. The 2009 influenza season also included two doses, increasing the complexity.

Our study provides a previously unpublished detailed breakdown of costs related to planning and coordination activities outside of clinic operations. Activities such as consent and

communications processes were very resource intensive; however, these activities can become more streamlined over subsequent, non-pandemic influenza seasons. There are many synergies and benefits that can be gained from collaboration between public health and schools; however, schools, whose primary mission is education, may need additional support in order to run school clinics especially if clinics are held in school, during school hours, with school nurses vaccinating.

Acknowledgment

We authors would like to thank the school survey participants and interviewees for their valuable time and input. Also, our special thanks for the guidance, support, and information provided by: Dr. Dora A. Mills, previous Director of Maine Center for Disease Control and Prevention (Maine CDC); Kristine L. Perkins, previously with Maine CDC; Dr. Peter F. Smith and other Maine CDC staff, Maine school nurses and school administrators, staff from the VNA Home Health and Hospice, HomeHealth Visiting Nurses, City of Portland's Health and Human Services Department, and Bangor's Department of Health & Community Services, and Kay Dutram and Dr. Teresa Hubley from the University of Southern Maine, Muskie School; and Dr. Ricardo Basurto-Davila, previously at CDC. The authors would also like to thank their CDC colleagues Drs. Pascale Wortley and Tara Vogt for their input on the analysis and review of the article. The preliminary results were presented at Eastern Economics Association Annual Meeting in New York, 2011 and 45th National Immunization Conference in Washington, DC, 2011 and Maine School Nurse Summer Institute 2011 in Lewiston, Maine.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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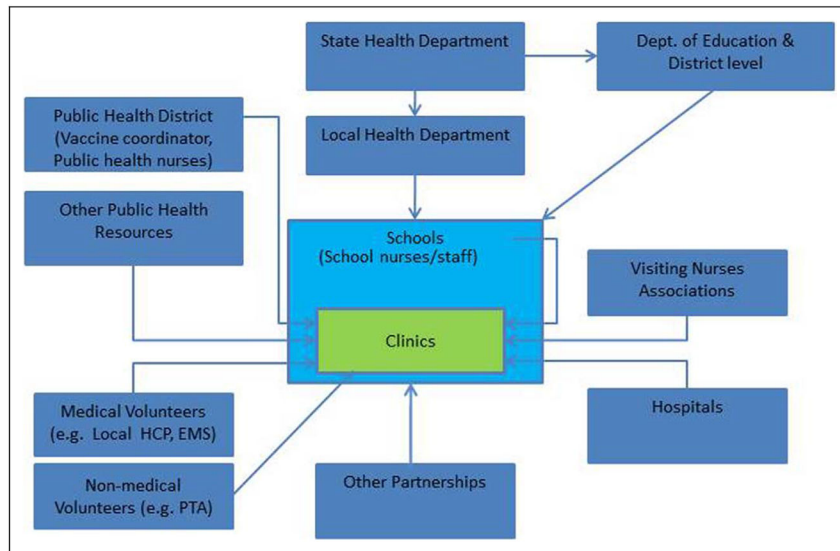


Figure 1. Maine potential SLV partnerships and entities. *Note.* EMS = Emergency Medical Services; Local HCP = Local Health Care Provider; PTA = Parent Teacher Association.

Table 1.

Outside-Clinic Activities by SLV Time Period

Planning	Implementation *	Post-implementation
(May 1st, 2009 – day before first clinic)	(Date first clinic – date last clinic)	(Day after last clinic – April 30th, 2010)
Communication [‡]	Communication [‡]	Communication [‡]
Consent process [‡]	Consent process [‡]	Billing insurers
Training [§]	Training [§]	Reporting (to parents and providers)
Rescheduling clinics	Rescheduling clinics	Data entry & other management
Planning for billing insurers	Billing insurers	Other activities
Data entry & management	Reporting (to parents and providers)	
Other activities	Data entry & management	
	Other activities	

* Implementation time includes all time spent on activities outside of clinic operation hours.

[‡] Communication was divided into three sub-activities: (1) school district personnel, school nurses, school physicians, or school located health center, (2) parents, (3) outside health entities.

[‡] Consent process had two sub-activities: (1) writing, distributing, mailing, collecting, and (2) follow-up and review of consent forms.

[§] Training had two sub-activities: (1) training for the nurse and (2) time the nurse spent training others.

Table 2.

School District Characteristics (N=7 School Districts)

	Mean	Median	Min	Max	Total
# schools	6	5	3	15	45
Enrolled students	2,378	1,606	838	7,023	16,645
% Free and reduced lunch	32	23	7	58	N/A
# clinics	12	10	4	30	84
# doses*	3,136	2,622	1,053	8,729	22,596
Doses per clinic	285	229	105	656	N/A

* Number of doses is the sum of both first and second doses for pandemic H1N1 and seasonal influenza vaccines for the entire district.

Table 3.

Outside-Clinic Activity Time Spent per Clinic by Time Period (N=7 school districts) *

	Planning		Implementation		Post-Implementation		All periods	
	Mean hours	% time	Mean hours	% time	Mean hours	% time	Mean hours	% total time
A. Lead nurse labor time								
Communication								
w/ school district personnel	5.1	19%	2.8	16%	1.1	15%	9.0	13%
w/ parents	4.3	16%	4.9	28%	0.2	3%	9.4	14%
w/ outside health entities	2.5	9%	3.1	18%	0.7	10%	6.3	9%
sub-total communication	11.9	45%	10.8	62%	2.0	28%	24.7	36%
Consent process								
writing, distributing, mailing	4.0	15%	1.9	11%	0.0	0%	5.9	9%
follow-up and review	4.3	16%	2.4	14%	0.0	0%	6.7	10%
sub-total consent process	8.3	31%	4.3	25%	0.0	0%	12.6	18%
Training								
for nurse	2.1	8%	0.5	3%	N/A	N/A	2.6	4%
for others	2.3	9%	1.1	6%	N/A	N/A	3.4	5%
sub-total training	4.4	17%	1.6	9%	0.0	0%	6.0	9%
Reporting								
to parents	N/A	N/A	0.0	0%	1.8	25%	1.8	3%
to providers	N/A	N/A	0.1	1%	0.1	2%	0.2	0%
sub-total reporting	0.0	0%	0.1	1%	1.9	27%	2.1	3%
Rescheduling clinics	0.1	0%	0.1	1%			0.3	0%
Data entry and management	1.2	5%	0.2	1%	0.5	6%	1.9	3%
Billing insurers	0.4	1%	0.0	0%	2.7	38%	3.1	5%
Other activities	0.3	1%	0.2	1%	0.0	0%	0.5	1%
Sub-total lead nurse labor time	26.7	100%	17.3	100%	7.2	100%	51.1	74%
B. Other staff time (N=4 school districts) †								
Total time per clinic (A+B)							18.0	26%
							69.1	100%

* Mean time per clinic was calculated by taking total time and dividing by the number of clinics for that district, then averaging over all districts. One school district received assistance from a local health department (LHD) to coordinate the clinics. We did not capture LHD time in this survey.

Other staff includes principals, superintendents, secretaries, substitute school nurses, janitors, etc. Other staff hours were only collected as an aggregate and not during each period.

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Table 4.

Post-Implementation Period Mean Hours per Clinic by Activity

Activity	Billing districts (N = 4) ^a		Non-billing districts (N = 3)		All districts (N = 7)	
	Mean hours	% Total	Mean hours	% Total	Mean hours	% Total
Communication	2.6	20	1.2	67	2.0	25
Consent process	0.5	4	0.0	0	0.0	0
Reporting	4.4	34	0.4	22	2.7	34
Billing insurers	4.8	37	0.0	0	2.7	35
Data entry	0.7	5	0.2	11	0.5	6
Other	0.0	0	0.0	0	0.0	0
Mean total hours/clinic	13.0	100	1.8	100	7.9	100

Note. ^aIn two districts, a VNA or LHD billed for the vaccinations administered. The remaining districts billed independently.

Table 5:

Outside-Clinic Activities Cost per Dose (N=7 school districts) *

	Mean (\$)	Median (\$)	Min (\$)	Max (\$)	% total
A. Lead nurse labor cost					
Communication					
w/ school district personnel	2.34	2.02	0.31	7.36	15.2%
w/ parents	2.07	1.65	0.16	6.42	13.5%
w/ outside health entities	1.46	1.51	0.17	2.02	9.5%
sub-total communication	5.87				38.2%
Consent form process					
writing, distributing, mailing	1.49	1.65	0.15	2.85	9.7%
follow-up and review	1.48	1.13	0.30	4.41	9.6%
sub-total consent forms	2.96				19.3%
Training					
for nurse	0.71	0.69	0.00	1.55	4.6%
for others	0.83	0.69	0.00	1.77	5.4%
sub-total training	1.53				10.0%
Reporting					
to parents	0.39	0.02	0.00	2.61	2.6%
to providers	0.08	0.00	0.00	0.30	0.5%
sub-total reporting	0.47				3.0%
Rescheduling clinics					
Billing insurers	0.53	0.20	0.00	1.91	3.5%
Data entry	0.45	0.22	0.00	1.84	3.0%
Other	0.11	0.00	0.00	0.79	0.7%
Sub-total nurse labor cost per dose	12.03	10.38	1.61	19.08	78.3%
B. Other staff cost (N=4 school districts) †	3.33	2.37	0.34	8.26	21.7%
Total cost per dose (A+B)	15.36	12.75	1.95	27.34	100.0%

* US 2009 \$. Cost includes 30% fringe benefit rate.

† Other staff includes principals, superintendents, secretaries, substitute school nurses, janitors, etc. Other staff mean hours were calculated over the four staff who reported other staff hours.