Cost-Benefit Study of School Nursing Services

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**IMPORTANCE** In recent years, across the United States, many school districts have cut on-site delivery of health services by eliminating or reducing services provided by qualified school nurses. Providing cost-benefit information will help policy makers and decision makers better understand the value of school nursing services.

**OBJECTIVE** To conduct a case study of the Massachusetts Essential School Health Services (ESHS) program to demonstrate the cost-benefit of school health services delivered by full-time registered nurses.

**DESIGN, SETTING, AND PARTICIPANTS** Standard cost-benefit analysis methods were used to estimate the costs and benefits of the ESHS program compared with a scenario involving no school nursing service. Data from the ESHS program report and other published studies were used. A total of 477,163 students in 933 Massachusetts ESHS schools in 78 school districts received school health services during the 2009-2010 school year.

**INTERVENTIONS** School health services provided by full-time registered nurses.

**MAIN OUTCOMES AND MEASURES** Costs of nurse staffing and medical supplies incurred by 78 ESHS districts during the 2009-2010 school year were measured as program costs. Program benefits were measured as savings in medical procedure costs, teachers’ productivity loss costs associated with addressing student health issues, and parents’ productivity loss costs associated with student early dismissal and medication administration. Net benefits and benefit-cost ratio were calculated. All costs and benefits were in 2009 US dollars.

**RESULTS** During the 2009-2010 school year, at a cost of $79.0 million, the ESHS program prevented an estimated $20.0 million in medical care costs, $28.1 million in parents’ productivity loss, and $129.1 million in teachers’ productivity loss. As a result, the program generated a net benefit of $98.2 million to society. For every dollar invested in the program, society would gain $2.20. Eighty-nine percent of simulation trials resulted in a net benefit.

**CONCLUSIONS AND RELEVANCE** The results of this study demonstrated that school nursing services provided in the Massachusetts ESHS schools were a cost-beneficial investment of public money, warranting careful consideration by policy makers and decision makers when resource allocation decisions are made about school nursing positions.
During the past few decades, several major changes in our society have greatly increased the demand for school nursing services, including a rise in the number of students with chronic health conditions and mental health problems, an increase in the number of students with special care needs, and improved medical technology. As a result, school nursing services have expanded greatly from their original focus of reducing communicable disease-related absenteeism to providing episodic care, managing chronic health conditions, caring for students with disabilities, promoting health behaviors, enrolling children in health insurance and connecting them with health care providers, tracking communicable diseases, and handling medical emergencies. These services may be provided more promptly if a school nurse is in the school. The National Association of School Nurses states that every school-aged child deserves a registered nurse, and that every school should have a full-time on-site nurse all day, every day; however, many schools across the United States do not meet this recommendation. Only 45% of the nation's public schools have a full-time on-site nurse; 30% have one who works part-time, often dividing his or her hours between several school buildings; and 25% have no nurse.

School nursing services are typically funded with education dollars. When budget cuts occur, school nurses are often the first to be let go because few states mandate a nurse to be in every school. In recent years, across the country, many districts have cut school nursing services by eliminating nurses, reducing their hours, or replacing them with untrained employees. These cuts could have a negative effect on the health of millions of US children, including those who have chronic diseases, have a low socioeconomic status, and depend on medical devices and daily medications.

A growing body of research has examined the effect of school nursing services on students and teachers. On-site school nursing services were effective in improving student health and student attendance, reducing early dismissals and reducing teacher time spent on dealing with student illness or injury. However, to our knowledge, no study has assessed the economic impact of school nursing services. The objective of this study was to conduct a case study of the Massachusetts Essential School Health Services (ESHS) program to demonstrate the cost-benefit of school health services delivered by full-time baccalaureate-prepared registered nurses.

Methods

Analytical Framework

A societal perspective and standard cost-benefit analysis methods were used to assess the costs and benefits of school nursing services delivered by full-time registered nurses in the ESHS schools compared with a scenario involving no school nursing services. The “no school nursing services” scenario is hypothetical, in which we projected medical procedure costs, teachers’ productivity loss costs associated with addressing student health issues, and parents’ productivity loss costs associated with student early dismissals and medication administrations when no professional nursing services were provided at schools, given that student needs for health services remain unchanged. We also estimated teachers’ productivity loss costs associated with addressing student health issues and parents’ productivity loss costs related to student early dismissals in the ESHS scenario. The differences in those costs between the 2 scenarios were costs averted or savings resulting from school nursing services and were measured as program benefits. Costs of school nursing services incurred during the 2009-2010 school year were measured as program costs, which included school nurse salary, fringe benefits, and costs of medical supplies. Net benefits and the benefit-cost ratio of school nursing services in the ESHS schools were calculated. All costs and benefits were in 2009 US dollars.

The major data source of this study was the 2009-2010 ESHS program report, which provides a detailed summary of school health services that took place in 78 districts during the school year. Between September 1, 2009, and June 30, 2012, a total of 1157 full-time registered nurses in 933 schools reported 4946 757 student health encounters and 99 903 school staff health encounters. School nurses performed 1 016 140 medical procedures and administered 1 191 060 doses of medication. After assessment and/or treatment by a school nurse, 6.2% of students were dismissed from school early due to illness or injury. In addition to the ESHS data, some published estimates from the existing literature also were used in this study. Institutional review board approval was not required for this study.

Medical Procedure Costs

As shown in Table 1, school nurses performed 22 types of medical procedures during the school year. Many of those procedures are customarily provided in a traditional medical care setting (eg, clinic or hospital). These procedures or treatments refer to activities provided for a preexisting condition, which usually requires a physician order. They are an indicator of skilled nursing care and not activities that are part of a nursing assessment to determine nursing interventions. These reported procedures demonstrated the professional services needs that the students had during school hours, and the needs for most of these procedures would not change regardless of whether a school nurse was present. In the scenario involving no school nursing services, we assumed that these procedures would have been performed by physicians or nurses in a medical setting, resulting in medical care costs. Although some procedures or treatments might be addressed by parents outside of school hours when no school nurse is available (eg, nebulizer treatment), most cannot be provided by a nonprofessional during school hours. To estimate medical care costs associated with those procedures, we first identified Current Procedural Terminology or Healthcare Common Procedure Coding codes for those procedures (see code descriptions in the eTable in the Supplement). We then used these codes to obtain medical cost estimates of both Medicaid and non-Medicaid insurance for those procedures (see details in Table 1). On the basis of student insurance information provided in the ESHS report, we calculated the weighted mean costs of Medicaid and non-Medicaid insurance. We used the weighted mean costs for the base-case analysis and the range of the mean costs ±20% for the sensitivity analysis.

Parents’ Productivity Loss Costs Associated With Student Early Dismissal

Several published studies have compared the number or percentage of students sent home by school nurses vs unlicensed personnel. Wyman15 assessed the number of students in a Midwest urban public school district who were dismissed from school early for illness or injury with or without contact with a school nurse. Data were collected for 3½ weeks from 6 schools with 3132 students in kindergarten through grade 12. They compared early dismissals due to illness or injury occurred in the first half of work for all adults is $18. The ESHS program did not collect data on the number of school hours students missed per early dismissal. The study by Wyman15 showed that 42.3% of the dismissal rate when no school nurse was available should be at least higher than the 11.0% experienced in the non-ESHS schools when a part-time nurse was available. If we apply the 3 times difference from the 2 studies mentioned earlier, the dismissal rate without a school nurse contact may well be 18.6% (3 times the dismissal rate of 6.2%). To be conservative, we used the midpoint of 11.0% and 18.6% for our base-case analysis and a range of 11.0% to 18.6% for the sensitivity analysis.

To estimate productivity costs of parents, we used a published estimate of annual mean earnings of $36,205 to calculate the value of a lost hour of work. The value of a lost hour of work for all adults is $18. The ESHS program did not collect data on the number of school hours students missed per early dismissal. The study by Wyman15 showed that 42.3% of the early dismissals due to illness or injury occurred in the first half of the day and 57.7% were in the second half. For simplicity, we used a mean of 3 hours (half a school day) for our base-case analysis, with a range of 2 to 4 hours for the sensitivity
Parents’ Productivity Loss Costs Associated With Medication Administration

According to the ESHS report, school nurses in the 78 ESHS districts administered a mean of 119,106 doses of medication to students per month, including 59.9% scheduled prescription medications, 14.5% as-needed prescription medications, and 25.6% nonprescription medications written by school physicians. The fact that those medications were administered during school hours proved that students had to take those medications during school hours regardless of whether a nurse was present. The Massachusetts regulation requires a school nurse to be on duty in the school system while prescription medications are administered by delegated unlicensed school personnel. Thus, it is reasonable to assume that parents have to go to school to administer medications if there is no school nurse in the school system. However, to generate conservative benefit estimates, in the base-case analysis, we assumed that parents only need to come to school to administer prescription medications, thereby using 74.4% of the total number of doses (both scheduled and as-needed prescription medications) for our base-case analysis, with a range of 59.9% (scheduled prescription medications) to 100% (all medications administered during school hours) of the total number of doses for the sensitivity analysis. For the base-case analysis, we assumed that parents have to spend a mean of 30 minutes for each medication administration at school, which includes travel time and time spent at school. For the sensitivity analysis, a range of 15 to 60 minutes was used. The annual costs of parents’ productivity loss associated with medication administration was calculated as the product of the annual number of doses of medication administered, the number of hours parents incur for medication administration at school, and the value of a lost hour (Table 2).

Teachers’ Productivity Loss Costs

Although the ESHS program did not collect information on the time teachers spent on health issues, 2 recent studies provide valuable information on this topic. Baisch et al published the results of a cross-sectional study on the amount of time school
staff spent on student health issues before and after a nurse was assigned to their school. Data were collected from 634 school staff members (565 teachers) of 11 schools (elementary, middle, and high schools) in a large urban school district in a major Midwestern city. Teachers reported a mean decrease of 20 minutes per day (26 minutes before and 6 minutes after having a school nurse). Hill and Hollis 17 conducted a cross-sectional study to assess the association between hours of having a school nurse present and hours the teacher spent on managing health issues. Data were collected from a 2-year survey of elementary school teachers in 1 county of western North Carolina, where nearly 50% of students are eligible for free or reduced meals. In year 1, school nurses spent 2 hours per day and teachers spent 80 minutes per day managing health issues. In year 2, school nurses spent 3.6 hours per day and teachers spent 46 minutes dealing with health issues.

Because our study focused on the difference between having a full-time registered nurse providing health services and having no school nursing services, we used the number of minute estimates from the study by Baisch et al 18 in this analysis. For the sensitivity analysis, we varied the difference of 20 minutes per day (26 minutes before and 6 minutes after having a school nurse) in 78 districts prevented an estimated $20.0 million in medical care costs, $28.1 million in parents' productivity costs, and $129.1 million in teachers' productivity costs. As a result, the program generated a net benefit of $98.2 million to society. For every dollar invested in the program, society would gain $2.20.

Table 3 summarizes the base-case results. During the 2009-2010 school year, at a program cost of $79.0 million, the ESHS program in 78 districts prevented an estimated $20.0 million in medical care costs, $28.1 million in parents' productivity costs, and $129.1 million in teachers' productivity costs. A similar study in 933 ESHS schools generated an estimated net benefit of $98.2 million to society during the 2009-2010 school year. For every dollar invested in the program, society would gain $2.20. Eighty-nine percent of the simulation trials resulted in a net benefit.

**Discussion**

The current study fills a void in the current literature by conducting a case study of an ESHS program to examine the cost-benefit of school nursing services delivered by full-time registered nurses. On the basis of the assumptions made and the data used in this study, school nursing services provided in the 933 ESHS schools generated an estimated net benefit of $98.2 million to society during the 2009-2010 school year. For every dollar invested in the program, society would gain $2.20. Eighty-nine percent of the 10,000 simulation trials resulted in a net benefit. The results of this study demonstrated that school nursing services provided in the ESHS schools were a cost-beneficial investment of public money, warranting careful consideration by policy makers and decision makers when resource allocation decisions are made about school nursing positions.

The findings of this study suggest that from a societal perspective (not the perspective of the school system or payers), the benefits of school nursing services may well exceed the costs of those services. School nursing services can be a benefit to schools, families, the health care system, and the community at large through increased student attendance, im-

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**Table 3. Base-Case Analysis Results**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Nurse</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>School nursing services costs, $</td>
<td>76 902 415</td>
<td>0</td>
</tr>
<tr>
<td>School nurse salary and fringe benefits</td>
<td>2 145 293</td>
<td>0</td>
</tr>
<tr>
<td>Parents' productivity loss costs, $</td>
<td>14 437 432</td>
<td>34 520 467</td>
</tr>
<tr>
<td>Due to early dismissals</td>
<td>0</td>
<td>8 030 722</td>
</tr>
<tr>
<td>Due to giving medications at school</td>
<td>0</td>
<td>169 417 864</td>
</tr>
<tr>
<td>Teachers' productivity loss costs due to dealing with students' illness or injury, $</td>
<td>40 319 125</td>
<td>20 009 129</td>
</tr>
<tr>
<td>Procedure costs if performed by physicians and nurses in a medical setting, $</td>
<td>0</td>
<td>79 047 709</td>
</tr>
<tr>
<td>Total costs of school health services, $</td>
<td>98 173 915</td>
<td>98 173 915</td>
</tr>
<tr>
<td>Total benefits, $</td>
<td>98 173 915</td>
<td>98 173 915</td>
</tr>
<tr>
<td>Net benefits, $</td>
<td>98 173 915</td>
<td>98 173 915</td>
</tr>
<tr>
<td>Benefit-cost ratio</td>
<td>2.24</td>
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</tbody>
</table>

* All costs were estimated in 2009 US dollars. The difference between the sum of the first two sets of numbers in the last column and the total cost is due to rounding.
Table 4. Multivariate Sensitivity Analysis Results*

<table>
<thead>
<tr>
<th>Costs and Benefits</th>
<th>Results of 95% of Simulation Trials</th>
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<tbody>
<tr>
<td>School nursing services costs, $</td>
<td>76 902 415</td>
</tr>
<tr>
<td>School nurse salary and fringe benefits</td>
<td>2 145 293</td>
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<tr>
<td>Medical equipment and supply costs</td>
<td>12 081 820 to 29 647 080</td>
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<tr>
<td>Reduced parents’ productivity loss, $</td>
<td>5 190 689 to 15 984 340</td>
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<tr>
<td>Due to reduced early dismissals</td>
<td>6 438 192 to 251 742 200</td>
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<tr>
<td>Due to reduced medication administration by parents at school</td>
<td>19 068 550 to 20 945 790</td>
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<tr>
<td>Total costs of school health services, $</td>
<td>79 047 709</td>
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<tr>
<td>Total benefits, $</td>
<td>56 269 360 to 302 059 400</td>
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<tr>
<td>Net benefits, $</td>
<td>22 778 350 to 223 011 700</td>
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<tr>
<td>Benefit-cost ratio</td>
<td>0.7 to 3.8</td>
</tr>
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</table>

*The difference between the sum of the first two sets of numbers in the last column and the total cost is due to rounding.

This study has several limitations. First, the benefits of the ESHS program were projected, not directly measured. Second, the cost-benefit estimates generated for the Massachusetts program may not be generalizable to other states because of the differences in teacher salaries and other costs. Third, because we derived the estimate of teacher time spent on addressing health issues from a large urban school system, our base-case result might be an overstatement for a rural school system. Fourth, we made some assumptions when no data were available for certain input parameters, such as the mean number of hours parents spent in administering medications at school when no school nurse was present. Fifth, we were not able to quantify the volume and associated costs for any procedures or treatments that might have been addressed by parents outside of school hours when no school nurse was present. Because of these limitations, we have been cautious in our approach and have carefully conducted a multivariate sensitivity analysis by varying those major parameter estimates over a plausible wide range.

Conclusions

To our knowledge, this is the first economic study of school nursing services, providing results that will allow policy makers and decision makers in all sectors to better understand the value of school nursing services. The analytical approach developed in this study can be used by any state or district to assess the cost-benefit of its school nursing programs. School nurses can regularly record their service activities, such as the number of encounters, medications administered, medical procedures, and other types of services provided. The success of data reporting in Massachusetts suggests that school nurses can do this with a minimal burden or negative effect on the delivery of services. They can also work with other school staff members to regularly collect data on school absence, early dismissals, and 911 calls related to illness or injury. As these data are collected, future research could incorporate these variables to strengthen the cost-benefit estimates of school nursing services.
REFERENCES


