

Economic Evaluation of School-Based Health Centers

A Community Guide Systematic Review

Tao Ran, PhD, Sajal K. Chattopadhyay, PhD, Robert A. Hahn, PhD, MPH,
and the Community Preventive Services Task Force



Context: A recent Community Guide systematic review of effectiveness of school-based health centers (SBHCs) showed that SBHCs improved educational and health outcomes. This review evaluates the economic cost and benefit of SBHCs.

Evidence acquisition: Using economic systematic review methods developed for The Community Guide, 6,958 papers were identified for the search period January 1985 to September 2014. After two rounds of screening, 21 studies were included in this review: 15 studies reported on cost and nine on benefit; three studies had both cost and benefit information. All expenditures in this review were presented in 2013 U.S. dollars.

Evidence synthesis: Analyses were conducted in 2014. Intervention cost had two main components: start-up cost and operating cost. All but two of the cost studies reported operating cost only (ranging from \$16,322 to \$659,684 per SBHC annually). Benefits included healthcare cost averted and productivity and other loss averted. From the societal perspective, total annual benefit per SBHC ranged from \$15,028 to \$912,878. From healthcare payers' perspective, particularly Medicaid, SBHCs led to net savings ranging from \$30 to \$969 per visit. From patients' perspective, savings were also positive. Additionally, two benefit studies used regression analysis to show that Medicaid cost and hospitalization cost decreased with SBHCs. Finally, results from seven estimates in two cost-benefit studies showed that societal benefit per SBHC exceeded intervention cost, with the benefit-cost ratio ranging from 1.38:1 to 3.05:1.

Conclusions: The economic benefit of SBHCs exceeds the intervention operating cost. Further, SBHCs result in net savings to Medicaid.

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Context

School-based health centers (SBHCs) provide health services to students at centers in pre-kindergarten through grade 12 schools or at offsite health facilities linked to schools. There are more than 2,300 SBHCs in the U.S. at present.¹ According to a 2010–2011

census of SBHCs, many are located in Western states such as California and Oregon; Northeastern states such as New York, Maryland, Connecticut, and Massachusetts; a few states in the South such as Florida, Texas, and Louisiana; and in some Midwestern states such as Michigan and Illinois. About 83% of the SBHCs serve at least one grade of adolescents (grade 6 or higher).² Most are targeted to students in low-income communities. Services provided by SBHCs in the U.S. include comprehensive physical and mental health assessments (97%); vision, hearing, and other screening services (93%); and immunizations (85%). In addition, a majority of SBHCs provide pregnancy testing (81%), contraceptive counseling (70%), and follow-up services for contraceptive users (59%).³ Since 2008, 340 new centers have been recognized in the School-Based Health Alliance census.²

From the Community Guide Branch, Division of Public Health Information Dissemination, Center for Surveillance, Epidemiology, and Laboratory Services, CDC, Atlanta, Georgia

Names and affiliations of Community Preventive Services Task Force members can be found at: <http://www.thecommunityguide.org/about/task-force-members.html>.

Address correspondence to: Tao Ran, PhD, Community Guide Branch, CDC, 1600 Clifton Road, MS E-69, Atlanta GA 30329-4207. E-mail: xgy2@cdc.gov.

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The Affordable Care Act provided \$200 million in funding from 2010 to 2013 to improve delivery and support expansion of services at SBHCs.⁴

Conceptually, SBHCs can improve children's and adolescents' health status, and reduce healthcare disparities across groups. SBHCs can meet students' physical health and mental health needs, which may not be addressed by a complex and fragmented healthcare system.⁵ SBHCs provide students easier access to health services; this reduces time missed at school and helps parents to avoid losing work time and spending extra time to transport their children to and from healthcare facilities. In addition, SBHCs provide services to students from diverse racial and socioeconomic backgrounds, particularly underinsured/uninsured individuals who may face challenges in accessing primary health care.

In October 2014, the Community Preventive Services Task Force recommended the implementation and maintenance of SBHCs in low-income communities, based on sufficient evidence of effectiveness in improving educational and health outcomes. Improved educational outcomes include school performance, grade promotion, and high school completion. Improved health outcomes include the delivery of vaccinations and other recommended preventive services, asthma morbidity, emergency department (ED) and hospital admissions, female contraceptive use, prenatal care and birth weight, and other health risk behaviors (www.thecommunityguide.org/healthequity/education/schoolbasedhealthcenters.html).

Because SBHCs are effective in addressing the aforementioned issues, the economic benefits of implementing SBHCs could be substantial. First, there can be considerable net savings to healthcare payers and society because of reductions in ED use. The overuse of EDs, either for non-emergency purposes or as a result of delayed treatment, can place a huge burden on society.⁶ In particular, Medicaid patients tend to use EDs frequently because of the difficulty in seeing regular healthcare providers.⁷ The establishment of SBHCs can reduce Medicaid expenditure on avoidable ED use. Second, SBHCs can reduce costs of asthma-associated ED use and hospitalization by providing timely and effective care to students with asthma (asthma prevalence for children aged <18 years was 9.5%⁸ in 2010). Third, SBHCs can help in avoiding losses related to missed school time (or missed work time for their parents) and saving transportation expenses of the parents. Fourth, reproductive services provided by SBHCs can lead to savings to students, healthcare payers, and society by reducing unintended teen pregnancy.

Given the effectiveness and potential benefits of SBHCs, systematic assessment of their cost and benefit

is important to examine the economic merits and evaluate the feasibility of implementing this intervention. The objective of this study was to conduct a systematic review of the economic evaluation of SBHCs.

Evidence Acquisition

For the purpose of this review, SBHCs were defined as clinics that provide health services to students in pre-kindergarten through grade 12 and may be offered onsite (i.e., school-based centers) or offsite (i.e., school-linked centers).⁹ SBHCs are often established in schools that serve predominantly low-income communities and have the following characteristics:

- SBHCs must provide primary health care and may also include mental health care, social services, dentistry, and health education.
- Primary care services may be provided by a single clinician, or comprehensive services may be provided by multidisciplinary teams.
- Services may be available only during some school days or hours, and may also be available in non-school hours.
- Student participation requires parental consent, and services provided for individual students may be limited for specific types of care, such as reproductive or mental health.
- Services may be provided to school staff, student family members, and others within the surrounding community.
- Services are often provided by a medical center or provider independent of the school system.

General methods for Community Guide systematic economic reviews are available at www.thecommunityguide.org/about/economics.html. The inclusion criteria for this review followed the standard adopted by the Community Guide for economic evaluation studies.

Studies were included for screening if they met the intervention definition and:

- provided cost or benefit information;
- were primary studies;
- were conducted in high-income countries as defined by the World Bank¹⁰; and
- were written in English.

Multiple databases were used for the systematic search, including PubMed, EconLit, ERIC, JSTOR, Social Sciences Citation Index, databases at the Centre for Reviews & Dissemination at the University of York, and Google Scholar. The search period was January 1985 to September 2014. To identify relevant studies, economic keywords were used in the search strategy ([Appendix Table 1](#), available online), in addition to subject keywords and terms searched in the effectiveness review.⁹

To ensure comparability of the studies, costs and expenditures were adjusted to 2013 U.S. dollars using the Consumer Price Index from the Bureau of Labor Statistics.¹¹ Once the intervention cost and benefit were comparable among studies, major contributors to variations in cost and benefit were identified. When data were available, estimates per SBHC user or per SBHC visit were

calculated by dividing cost or benefit by the total number of SBHC users or visits. Finally, economic evidence was summarized to evaluate the benefit of SBHC with respect to intervention costs. Evidence gaps in the studies were also listed.

Evidence Synthesis

Search Results

A total of 6,958 papers were found in the initial literature search, of which 6,824 were excluded after the first round of screening titles and abstracts. Another 115 papers were excluded after the second round of full-text screening. In full-text screening, a paper on cost was excluded if it did not provide a reliable source of cost information. On the benefit side, a paper was excluded if it did not explicitly mention any of the benefit components. In addition, a paper was excluded if it mentioned SBHC, but actually focused on other programs, such as asthma management (because the cost would be the asthma management program cost instead of SBHC cost). The final screening yielded 19 articles from the database search. Two additional papers were recommended by the effectiveness review team members,⁹ which resulted in 21 included studies^{3,12–31} (Figure 1). All included papers for this review described SBHC as a single intervention, with the perspectives of the studies implicitly specified. All cost papers provided data source information, and the cost was either based on actual operating cost, or estimated using proxies such as operating budget, grant funding, or operating revenues. Further, all benefit papers mentioned at least one benefit component, such as averted ED use, hospital stay, drug, pregnancy, productivity loss, missed school time, and private clinic time. Details of the included studies are available at www.thecommunityguide.org/healthequity/education/schoolbasedhealthcenters.html. Analyses were conducted in 2014.

Characteristics of the Studies

Of the 21 included papers, 16 papers^{3,13,15–21,23–25,27–29,31} were peer-reviewed journal articles. The non-journal articles^{12,14,22,26,30} were mainly reports of the cost or benefit of SBHC. All studies were from the U.S., with four studies^{3,14,24,25} from the Northwest, six studies^{19,22,26,28–30} from the Northeast, two studies^{20,21} from the Midwest, two studies^{12,13} from the Southeast, and seven studies^{15–18,23,27,31} covering the whole U.S. The geographic locations were based on where the SBHCs were located. For nationwide studies, each study covered many SBHCs, which were not necessarily from the same state. The minimum number of SBHCs in nationwide studies was 14 and the maximum was 202. Fifteen papers^{3,14–19,21–25,27,29,31} of 21 provided cost information, and nine papers^{12–14,20–22,26,28,30} provided benefit information.

Three studies^{14,21,22} provided both cost and benefit information.

Perspectives of the Studies

Benefit studies can take different perspectives. In general, studies from the societal perspective evaluate “the impact of an intervention on the welfare of the whole of society, not just the individuals or organizations directly involved.”³² By contrast, studies from other perspectives only evaluate the impact of the intervention on the welfare of specific individuals or organizations, such as health care payers, schools, or patients. Of the nine benefit studies,^{12–14,20–22,26,28,30} three studies^{14,21,22} took the societal perspective, four studies^{13,20,21,26} took the Medicaid (healthcare payers’) perspective, two studies^{12,28} took the patients’ perspective, and another study³⁰ provided information on savings to taxpayers. One study²¹ examined results from both societal and Medicaid perspectives.

Intervention Cost

The SBHC intervention costs had two main components: start-up cost (one-time, fixed costs associated with setting up a business) and operating cost (annual cost incurred on a continuous process). Table 1 provides detailed information on cost estimates from each study.

Only two studies^{22,25} provided estimates of start-up costs. The first study²² presented start-up costs for the SBHCs in western and central New York State, including the cost of renovating or constructing the school space, the purchase of initial office and medical equipment, and staff salaries in the initial implementation phase. These start-up costs ranged from \$216,402 to \$378,704 per SBHC. The second study²⁵ discussed the start-up cost of 42 SBHCs in Oregon, and found costs ranged from \$41,450 to \$195,324 per SBHC. The minimum of the range was associated with SBHCs that used renovated space at the school, and the maximum was associated with SBHCs that built a medical modular unit on campus.

Fourteen studies^{3,14–19,21,23–25,27,29,31} provided information on annual SBHC operating costs, including recurring costs of additional medical equipment and services and non-medical costs, such as salaries and benefits and utilities. Five studies used actual operating costs^{15,21,24,25,29} and nine studies^{3,14,16–19,23,27,31} estimated costs from proxies, such as operating budget, grant funding, or operating revenues. Operating costs ranged from \$16,322 to \$659,684 per SBHC per year. Operating cost per SBHC user (two studies^{15,16} reported cost per user; five studies^{14,19,21,24,25} had user information, based on which per user cost was calculated) ranged from \$142.79 to \$1,427.4 per year (not necessarily paid by users).

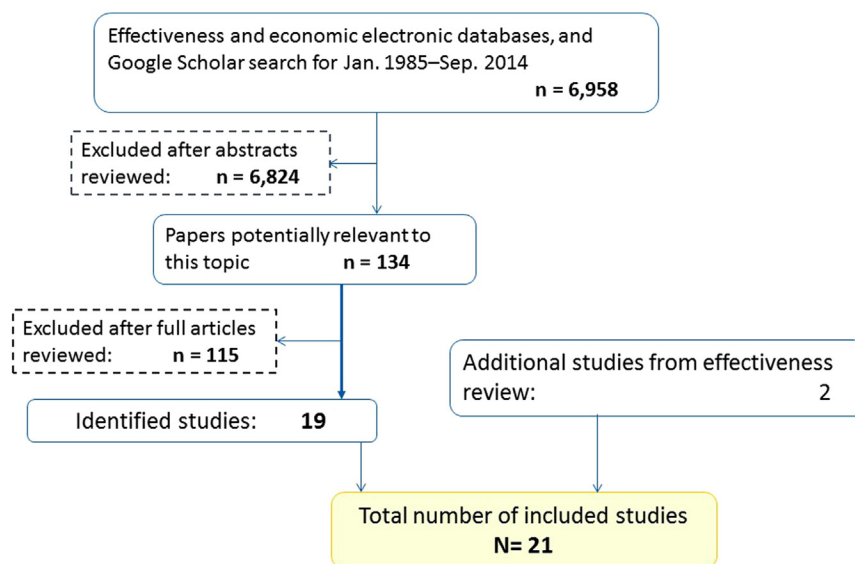


Figure 1. Flowchart showing path from initial search list to included studies.

The wide range of the operating costs can be explained by several factors, including number of users served, hours of work of physicians and staff, local cost of living, nationwide versus state study, and data source. For example, Guo et al.²¹ had relatively low operating cost, ranging from \$118,376 to \$168,700, because the pediatricians worked only 3 hours per week. Further, operating costs varied among the states. For instance, SBHC grant funding for 19 states ranged from \$16,322 to \$306,476 in Schlitt and colleagues.²⁷ Different hours of work of physicians and staff, as well as local cost of living, influenced salaries and benefits, which was considered the major operating cost driver, as it accounted for 80%–90% of the operating cost. Details on physicians and staff, as well as healthcare services provided by them, are in [Appendix Table 2](#) (available online).

Intervention Benefit

For purposes of this review, benefit components were categorized into two groups (benefit components of each study are listed in [Appendix Table 3](#), available online):

- healthcare costs averted (i.e., averted costs associated with hospitalization, ED, drugs, referrals, private clinic visits, and unintended pregnancy); and
- productivity and other loss averted (i.e., averted cost associated with productivity loss, travel cost, school time, and others such as ambulance use or improved health).

For this review, benefit studies from the societal perspective reported treatment cost averted, lost productivity averted, cost of transportation averted, and other relevant benefits. Studies from the Medicaid (healthcare

payers') perspective reported (or calculated by the reviewers using relevant information in the paper) per SBHC user or per visit net savings to Medicaid, which were mainly related to treatment cost averted. Studies from the patients' (including patients' parents') perspective reported (or were calculated by the reviewers) net savings per visit in treatment cost, lost productivity and transportation, and per user net savings in raising a child because of avoided unintended pregnancy. The remaining study reported (or calculated by the reviewers) savings per visit to taxpayers.

[Table 2](#) gives the details on benefit information from different perspectives. Three studies^{13,20,21} used actual data. Of the three, two studies^{13,20} calculated benefit using difference-in-differences, and one²¹ used a pre-post study design. The remaining six studies^{12,14,22,26,28,30} estimated benefits using different methods: Two studies estimated the short-run¹⁴ and long-run¹² benefit from averted teen pregnancies, based on the cost of raising a child or the public cost of pregnancy; another two listed benefits from ED use averted³⁰ or asthmatic hospital inpatients admission averted²²; one compared the cost per visit to SBHC with that of going to a private clinic²⁸; and one²⁶ assumed that 50% of the ED visits were averted.

From the societal perspective, total annual benefit per SBHC ranged from \$15,028 to \$912,878. The variation in benefit was mainly due to the major benefit driver(s), such as savings related to unintended pregnancies averted. Of note, even though Guo et al.²¹ had six components, it did not include any benefit from averted ED use or unintended pregnancy. In comparison, savings related to unintended pregnancy averted in Brindis¹⁴ were the avoided "public cost of pregnancies," which was

Table 1. Intervention Cost (2013 \$US)

Study ^a	Location	No. of students	No. of users	Start-up cost/SBHC	Operating cost/SBHC (annual)	Operating cost/user	Operating cost/student
Brindis (1993) ¹⁴	CA, School 1	—	462–1,071 ^b	—	659,684	615.74–1,427.4 ^c	—
	CA, School 2	—	389–903 ^b	—	383,995	425.24–987.13 ^c	—
	CA, School 3	—	366–848 ^b	—	448,290	528.64–1,224.84 ^c	—
Dryfoos (1985) ¹⁵	U.S.	—	—	—	194,853 ^d	217	—
21st Century School Fund (2004) ¹⁹	DC, School 1	503	130	—	120,277	925.21 ^c	239.12 ^c
	DC, School 2	968	890	—	253,214	284.51 ^c	261.58 ^c
Dryfoos (1988) ¹⁶	U.S.	—	—	—	393,841	295–492	—
Foch (1995) ¹⁷	U.S.	—	—	—	215,855–539,637	—	—
Fothergill (1998) ¹⁸	U.S.	—	—	—	436,511 ^e	—	—
Guo (2010) ²¹	OH, Rural	1,018 ^f	461 ^f	—	168,700 ^f	365.94 ^c	165.72 ^c
	OH, Urban 1	3,338 ^f	614 ^f	—	165,838 ^f	270.09 ^c	49.68 ^c
	OH, Urban 2	648 ^f	410 ^f	—	143,728 ^f	350.56 ^c	221.8 ^c
	OH, Urban 3	2,604 ^f	829 ^f	—	118,376 ^f	142.79 ^c	45.46 ^c
Horton (2009) ²²	NY	—	—	216,402–378,704	—	—	—
Keeton (2012) ³	CO	—	—	—	291,196	—	—
McKinney (1993) ²³	U.S.	—	—	—	279,779	—	—
Moore (1998) ²⁴	CO	—	1,206 ^g	—	464,706	385.33 ^c	—
Nystrom (2008) ²⁵	OR	—	480 ^h	41,450–195,324 ⁱ	138,367–248,702 ^j	288.26–518.13 ^c	—
Schlitt (2008) ²⁷	U.S.	—	—	—	16,322–306,476	—	—
Silberberg (2008) ²⁹	NJ	—	—	—	194,239–258,985 ^k	—	—
Tereszkiewicz (1986) ³¹	U.S.	—	—	—	212,552–265,690	—	—

^aAll studies are cost-benefit or cost-only studies.^bCalculated by the reviewer by dividing the total number of visits by the mean visits per SBHC user in 1989.^cCalculated by the reviewer by dividing total annual cost by the number of SBHC users or students.^dActual cost for a clinic in St. Paul, Minnesota.^eMean operating budget from a national survey.^fInformation obtained from a related report.³³^gUsers for the whole school district, with 2,170 students.^hCalculated by the reviewer by dividing the total users of 42 SBHCs in Oregon.ⁱThe minimum is the minimum cost for a center based on renovated school space; the maximum is the maximum cost for a center based on a modular unit on campus for health services.^jAssuming 12 months' operation. The minimum is the mid-range cost for the basic (core) center, and the maximum is the mid-range cost for an expanded center.^kNo further explanation for the range was provided.

—, not reported; SBHC, school-based health centers.

the largest contributor to benefit in that study, accounting for >85% of the benefit. Brindis assumed that pregnancies were “avoided” instead of “delayed” as in Hoffman and Maynard.³⁴ Further, the one-time public cost per pregnancy in Brindis was \$42,485, whereas

annual societal cost in Hoffman and Maynard was \$14,937 per teenage mother under age 18 for 15 years. If the method in Hoffman and Maynard was used, undiscounted long-term benefit per delayed teen pregnancy would be \$224,053, higher than the one-time

Table 2. Intervention Benefit

Study	Location	Major benefit driver(s) (no. of components)	Annual ^a benefit per SBHC	Annual benefit per SBHC user
From societal perspective				
Brindis (1993) ¹⁴	CA, School 1	Pregnancy (3)	912,878	852.36–1,975.93 ^b
	CA, School 2	Pregnancy (3)	769,524	852.19–1,978.21 ^b
	CA, School 3	Pregnancy (3)	843,677	994.90–2,305.13 ^b
Guo (2010) ²¹	OH, Rural	Productivity (6)	361,581	784.34 ^b
	OH, Urban 1	Productivity (6)	361,581	588.89 ^b
	OH, Urban 2	Productivity (6)	361,581	881.90 ^b
	OH, Urban 3	Productivity (6)	361,581	436.17 ^b
Horton (2009) ²²	NY	None (1)	15,028 ^c	—
			Net savings per visit	Net savings per SBHC user
From Medicaid (healthcare payers') perspective				
SBHC users without asthma				
Adams (2000) ¹³	GA	ED (4)	—	404 ^d
MA SBHC Association (2012) ²⁶	MA	ED (1)	203 ^{e,f}	—
SBHC users with asthma				
Adams (2000) ¹³	GA	ED (4)	—	1,166
Guo (2005) ²⁰	OH	ED (2)	969 ^g	—
MA SBHC Association (2012) ²⁶	MA	ED (1)	604 ^{e,f}	—
Users in general				
Guo (2010) ²¹	OH	Drugs (2)	30	46
			Net savings/visit	Net savings/SBHC user
From patients' (including their parents') perspective				
Contraceptive Technology Update (1985) ¹²	MS	Pregnancy (1)	—	23,592 ^h
Siegel (1987) ²⁸	DE	Productivity (3)	90 ⁱ	—
			Savings/visit	Perspective
From other perspective				
Children's Aid Society (2012) ³⁰	NY	ED (2)	1,077 ^j	Taxpayer

Note: 2013 \$US.

^aAnnual benefit was calculated by the reviewer by dividing the total benefit over 3 years by three for Guo (2010); Brindis (1993) implied that the benefit was yearly.

^bCalculated by the reviewer by dividing the total annual benefit by the number of users in Table 1. The corresponding benefit per student was calculated as \$355.19, \$108.32, \$558, and \$138.86 for the four schools.

^cHospital inpatient cost averted from asthmatic students only, not included in benefit–cost results.

^dIf SBHC was the primary provider of the user, the benefit was \$969.42 per person.

^eAssuming 50% of the ED use was avoided because of SBHC usage.

^fFor community health center–sponsored SBHCs. For hospital-sponsored SBHCs, the saving was \$165 for non-asthmatic users and \$565 for asthmatic ones.

^gHospitalization savings only, the saving in ED use was not significant.

^hService was free to students (covered by the program as \$345 per user). Savings are calculated by the reviewer by dividing the total savings by 22, because total savings were from not raising a child to age 22 years.

ⁱService was free to enrolled students (covered by the Division of Public Health as \$43.86 per visit). Cost was compared with that from a private clinic.

^jCalculated by the reviewer by dividing total savings to taxpayers by 248 ED visits.

ED, emergency department; SBHC, school-based health centers; —, not reported.

benefit from avoided teen pregnancy in Brindis. The minimum of the range (\$15,028) was the benefit calculated in Horton et al.,²² which only included inpatient cost averted in students with asthma.

From the Medicaid (healthcare payers') perspective, SBHCs led to net savings to Medicaid (i.e., the difference between total savings to Medicaid because of SBHC use and the Medicaid spending on SBHC services was positive). Among the four studies from the Medicaid perspective, three studies^{13,20,21} used actual data to calculate the net savings, and one study²⁶ assumed that 50% of ED visits were avoided because of the use of SBHCs. Net savings ranged from \$30 to \$969 per visit (based on three studies^{20,21,26} that provided relevant information), and \$46 to \$1,166 per user (based on two studies^{13,21} that provided relevant information). The variation in net Medicaid savings was large because the studies included different benefit components. Studies with more components tended to have had higher net savings. Further, studies reporting averted ED use tended to have higher savings. In addition, studies that focused on students with asthma tended to have higher net savings.

Additionally, from the Medicaid (healthcare payers') perspective, two benefit studies^{13,20} used regression analysis to show that Medicaid cost related to ED use and to hospitalization decreased with the adoption of SBHCs (details are provided in [Appendix Table 4](#), available online).

From the patients' (including patients' parents) perspective, SBHC use was related to per visit savings of \$90 in Siegel and Kriebel,²⁸ and to annual savings per user of \$23,592 in the Contraceptive Technology Update report.¹² Siegel and Kriebel concluded that students would save money using SBHCs instead of private clinics. The Contraceptive Technology Update reported, from teenage parents' perspective, the annual cost saved (because of unintended pregnancy avoided) from not raising a child until the child was aged 22 years. In

comparison, Hoffman and Maynard³⁴ calculated the societal cost averted because of delayed teen pregnancy. Their annual societal cost averted was \$14,936 (\$12,112 in 2004 dollars in their study) per teen mother under age 18. In both Siegel and Kriebel and Contraceptive Technology Update, the enrolled students received SBHC services for free (per visit cost of \$43.86 in Siegel and Kriebel was covered by the Division of Public Health in Delaware, and per user cost of \$345 in Contraceptive Technology Update was covered by different funding sources). Of note, even though the cost of SBHC services had been covered by the users, net savings would still be positive in both studies. Benefit in the remaining one study (The Children's Aid Society³⁰) was mainly related to ED use averted, which reported \$1,077 savings per visit to taxpayers.

Benefit–Cost Ratios

[Table 3](#) presents benefit–cost ratios from seven schools with SBHCs in two studies.^{14,21} In both studies, the societal benefit per SBHC exceeded intervention cost, with the benefit–cost ratio ranging from 1.38:1 in the first study¹⁴ to 3.05:1 in the second study²¹ for seven SBHCs. Even though the two studies were similar in terms of SBHC services and the number of users, the calculations of benefit were different. Guo and colleagues²¹ calculated benefits in a relatively comprehensive way by including six benefit components, whereas Brindis¹⁴ only included two major benefit components (ED use and unintended pregnancy). Moreover, economic benefit from averted unintended pregnancies, which included the public cost of children born to teenagers, accounted for >85% of the total benefit in Brindis.

Summary of Findings

In summary, evidence in this review shows that the benefit of SBHCs exceeded cost. In addition, SBHCs resulted in net savings to the Medicaid program.

Table 3. Benefit–Cost Ratio and Net Benefit

Study	Location	No. of students	No. of users	Benefit–cost ratio ^a	Net benefit (2013 \$US) ^b
Brindis (1993) ¹⁴	CA, School 1	—	462–1,071	1.38:1	253,195
	CA, School 2	—	389–903	2.00:1	385,529
	CA, School 3	—	366–848	1.88:1	395,387
Guo (2010) ²¹	OH, Rural	1,018	461	2.14:1 ^c	192,880
	OH, Urban 1	3,338	614	2.18:1 ^c	195,742
	OH, Urban 2	648	410	2.52:1 ^c	217,852
	OH, Urban 3	2,604	829	3.05:1 ^c	243,204

^aBenefit–cost ratio is the monetized value of economic benefit divided by the monetized value of economic cost.

^bNet benefit equals the difference between the monetized value of economic benefit and the monetized value of economic cost.

^cCalculated by the reviewer by dividing annual benefit by annual cost.

—, not reported.

Discussion

In conjunction with the findings of the concurrent systematic review on effectiveness,⁹ the results of this economic review provide evidence that SBHCs are an effective and cost-beneficial setting for healthcare delivery. Operating cost ranged from \$16,322 to \$659,684 per SBHC per year, with per user cost ranging from \$142.79 to \$1,427.40 per year. Benefit studies in the economic review focused on health and healthcare-related outcomes. From the societal perspective, annual benefit per SBHC ranged from \$15,028 to \$912,878. From the Medicaid perspective, SBHCs led to positive net savings to Medicaid, ranging from \$30 to \$969 per visit, and \$46 to \$1,166 per user. From the patients' perspective, SBHCs saved them (and their parents') expenses on teenage pregnancy (including child-rearing) and parents' productivity loss avoided. The benefit–cost ratio of SBHCs ranged from 1.38:1 to 3.05:1.

With moderate costs, SBHCs have generated considerable savings to society, especially to the Medicaid program. Net savings were obviously seen from the ED use averted and from services provided to asthmatic users. Also, productivity loss averted was nontrivial given the convenient location of SBHCs. Additionally, other reports have credited SBHCs with providing more-sensitive care (e.g., for reproductive health and mental health) than other settings, and for improving quality of care and patients' satisfaction with and acceptability of care. Services were also provided to community members, which may complement rather than replace or duplicate those existing in the community.⁹ Moreover, benefit is anticipated to extend beyond SBHC users at school, as many SBHCs offer health education and promotion activities to the entire student body, and non-users may adopt some of the promoted health behaviors (e.g., abstaining from drugs and alcohol).³⁵ Finally, as discussed in the effectiveness review,⁹ SBHCs improve an array of educational outcomes besides health-related outcomes. They also increase adolescents' responsibility for their health and academic performance.

Limitations

From the cost side, only two studies^{22,25} reported start-up cost. This might cause the annual total cost to be underestimated. However, once the one-time start-up cost was amortized, it would be much lower than annual operating cost. Further, only five studies^{14,19,21,24,25} reported the number of SBHC users, and only two studies^{19,21} provided information on the number of students, which limited the ability to estimate cost per

user or per student. Thus, the calculation of cost per user or per student had many missing values. In addition, nine studies^{3,14,16–19,23,27,31} used proxies, such as operating budget, grant funding, or operating revenues to estimate cost, or simply quoted from other studies. However, the range of the estimated costs was similar to the range of the actual costs in the remainder^{15,21,24,25,29} of the cost studies.

From the benefit side, only three studies^{13,20,21} used actual data. The remaining studies estimated benefits using different methods. For instance, the Massachusetts Association of SBHCs' 2012 report²⁶ assumed that ED use was reduced by 50%, an estimate higher than the median decrease of 15.8% identified in the systematic effectiveness review.⁹ Further, only five studies^{13,20,21,28,30} clearly specified the benefit time horizon. Others were somewhat ambiguous, with one study's¹⁴ time horizon implied by the context and methodology. This can cause complications in calculating annual benefit. In addition, the perspectives of the studies were not explicitly specified by the authors. Therefore, the classification of perspectives was conducted by the reviewers. Finally, benefit studies^{12,14} concerning teenage pregnancy avoided could have calculated the benefits based on teenage pregnancies delayed,³⁴ which is a more reasonable way to estimate benefit accurately.

Evidence Gaps

More complete and comprehensive reporting of benefit and its components is needed, including clear reporting of the study time horizon. Additional economic assessments are needed to examine the broader range of outcomes considered in the concurrent effectiveness review.⁹ Despite the effectiveness of SBHCs in improving academic performance, for example, none of the economic studies incorporated these outcomes in their benefit assessments. Further, there was no calculation of the averted missed school days, an important component of productivity loss averted for students. Economic assessments or models based on longer-term assessments of outcomes might be needed to capture the full range of benefits attributable to SBHC services.

Finally, none of the studies identified in this review provided cost-effectiveness assessments of SBHCs. Future studies should include cost-effectiveness analyses, and provide evidence on cost per quality-adjusted life year gained. Cost-effectiveness studies of overall SBHCs and focused studies of specific services (such as reproductive health) would be useful to program planners and decision makers.

Conclusions

Regardless of the limitations and evidence gaps, there is clear evidence that SBHCs contribute meaningful economic benefits to society and to healthcare payers (especially Medicaid). In fiscal year 2011, \$95 million was awarded through the Affordable Care Act to 278 SBHCs to create new sites and expand preventive and primary care service at the existing sites. Another \$14.5 million was targeted for an additional 45 SBHCs the next year.⁴ Establishment of more SBHCs would benefit the society as a whole, and bring more savings to the Medicaid program, as well as savings to the students (including their parents).

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Appendix

Supplementary data

Supplementary data associated with this article can be found at <http://dx.doi.org/10.1016/j.amepre.2016.01.017>.