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School-Based Health Centers: Improving Access and Quality of Care for Low-Income Adolescents

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ABSTRACT

OBJECTIVES. We sought to compare visit rates, emergency care use, and markers of quality of care between adolescents who use school-based health centers and those who use other community centers within a safety-net health care system for low-income and uninsured patients.

PATIENTS AND METHODS. In this retrospective cohort study we used Denver Health electronic medical chart data, the Denver Health immunization registry, and Denver Public Schools enrollment data for the period from August 1, 2002, to July 31, 2003. The cohort included all 14- to 17-year-old Denver Public Schools high school enrollees who were active Denver Health patients and were either uninsured or insured by Medicaid or the State Children's Health Insurance Program. "School-based health center users" were those who had used a Denver Health school-based health center; "other users" were those who had used a Denver Health community clinic but not a school-based health center. Markers of quality included having a health maintenance visit and receipt of an influenza vaccine, tetanus booster, and hepatitis B vaccine if indicated. Multiple logistic regression analysis that controlled for gender, race/ethnicity, insurance status, chronic illness, and visit rate was used to compare school-based health center users to other users.

RESULTS. Although school-based health center users ($n = 790$) were less likely than other users ($n = 925$) to be insured (37% vs 73%), they were more likely to have made ≥ 3 primary care visits (52% vs 34%), less likely to have used emergency care (17% vs 34%), and more likely to have received a health maintenance visit (47% vs 33%), an influenza vaccine (45% vs 18%), a tetanus booster (33% vs 21%), and a hepatitis B vaccine (46% vs 20%).

CONCLUSIONS. These findings suggest that, within a safety-net system, school-based health centers augment access to care and quality of care for underserved adolescents compared with traditional outpatient care sites.

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Key Words

school health services, adolescent health services, health care quality, access, evaluation, immunization programs

Abbreviations

SBHC—school-based health center
DH—Denver Health
DPS—Denver Public Schools
SCHIP—State Children's Health Insurance Program
ED—emergency department
ICD-9-CM—*International Classification of Diseases, Ninth Revision, Clinical Modification*
HMV—health maintenance visit
aOR—adjusted odds ratio
CI—confidence interval

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CHILDREN OF A racial and/or ethnic minority, low-income children, and children who are underinsured or uninsured may lack a usual source of health care.¹⁻³ Children without a usual source of health care may suffer from inadequate access to health care or use an ED rather than a primary care site for regular care leading to increased costs, overcrowding of EDs, and decreased continuity of care.^{1,4-7} In addition to increased ED visits, lack of a usual source of health care is associated with increased school absences and parents' reports of experiencing delays in care and not getting needed medical care for their children.^{1,8} Not receiving needed medical care is a particular problem for adolescents. Four to 18% of adolescents lack a usual source of health care, 12% to 25% have not had a visit to a health care professional in the past year, and 1% to 7% are unable to obtain medical care because of costs. The highest levels for these indicators are for impoverished adolescents.⁹

School-based health centers (SBHCs) were developed as a potential solution to improve children's access to health care. SBHCs are designed to provide primary care services for uninsured, underinsured, low-income, and minority children whose access to care is otherwise limited. SBHCs are usually staffed by health care professionals, such as nurses, nurse practitioners, physician assistants, behavioral health specialists, and physicians, who provide physical and mental health services with an emphasis on prevention.¹⁰ Previous research has shown that SBHCs decrease ED visits and increase adolescents' access to care, number of preventive visits, and screening for high-risk behaviors.¹¹⁻¹⁵ These studies were conducted in the early 1990s before SBHCs were well established and were limited by small samples sizes and inability to control for potential confounding variables, such as chronic illness. Few studies have been published regarding the quality of care provided by SBHCs. Lack of baseline data and problems with study design make it difficult to assess SBHC use and long-term outcomes, such as high school graduation rates or decreased absenteeism. Based on evidence that SBHCs improve access to health care and a belief that they may also result in improved quality of care and better long-term outcomes, the number of SBHCs has increased over the past decade from ~200 centers to 1500 centers nationwide.¹⁰ Approximately one third of these centers are located in high schools, and the majority are in urban locations.¹⁰

The purpose of this study was to examine adolescents' use of health services and to compare the quality of care in SBHCs with other outpatient sites in a safety-net health care system for low-income and uninsured patients. Our specific objectives were to describe visit diagnoses and compare visit rates, emergency and urgent care center use, and markers of quality of care among adolescents who use SBHCs and those who use other

community centers within the Denver Health safety-net system.

PATIENTS AND METHODS

We conducted a retrospective cohort study by using administrative databases maintained by Denver Health (DH) and Denver Public Schools (DPS) located in Denver. We compared use of health care and markers of quality of care for adolescents using DH SBHCs with adolescents using other community care (DH network community clinics). The study was approved by DH, DPS, and the Colorado Multiple Institutional Review Board.

Study Setting

The DH safety-net system is designed to provide high-quality health care services for people who may otherwise lack access to care and serves ~25% of Denver County, CO, residents each year. It is composed of 11 SBHCs, 9 community clinics, 2 urgent care centers, and a tertiary care hospital with an ED. Sixty-three percent of total DH services are provided to patients who are uninsured or insured by Medicaid.¹⁶ Another study in the DH system showed that children using this system obtained >85% of their care within the system, because lack of insurance coverage limited their access to other health care sources.¹⁷

The SBHCs are operated by DH in cooperation with DPS. At the time of this study, SBHCs existed in 7 of the 11 Denver public high schools targeted to those serving racial and ethnic minorities and/or low-income families. All of the students are encouraged to use the SBHC; however, parents must provide consent for their children to enroll to use the SBHC. According to the Denver SBHC 2002-2003 annual report, 94% of students attending a school with a SBHC were enrolled, and 35% to 60% of those enrolled actually used the center during a typical school year.¹⁸ Although the SBHCs bill students' insurance if possible, they do not require a copayment or out-of-pocket payment from the student or family. The SBHCs provide preventive and primary health care services including immunizations, mental health services, referrals to specialty services, and access to after-hours telephone advice, urgent care, and emergency services in the DH system. They are designed to provide primary care for those students who do not have a primary care provider and to augment care for those who do. The SBHCs do provide pregnancy testing, diagnosis and treatment of sexually transmitted infections, and family planning and birth control counseling, but students are referred to DH community clinics for prenatal care and contraception management. The SBHCs are open during hours of school operation and are closed during school holidays.

The 9 DH community clinics are open weekdays from 8:30 AM to 5:30 PM and provide primary health care and

preventive services, including contraception management, obstetric services, and access to after-hours services, as described above. Some of the community clinics also provide specialty services, including mental health care. Insured patients are often required to provide a copayment, depending on the type of insurance, whereas uninsured patients pay out of pocket based on a sliding scale system.¹⁹ The SBHCs and community clinics use the same immunization schedule and follow the same DH immunization protocol.

Data Sources

Our data sources included DH administrative systems, the DH immunization registry, and DPS enrollment data. The administrative database for visits at both the SBHCs and community clinics includes information about age, insurance status, race/ethnicity, visit date and location, and diagnostic codes associated with each visit. Because visits to mental health care providers at SBHCs are not recorded in the administrative database because of concerns about student confidentiality, we were unable to specifically examine mental health care. A comprehensive immunization registry assures accurate immunization up-to-date status by recording all of the immunizations received, regardless of whether the immunization was received inside or outside of the DH system. Compared with a chart review, 97.7% of immunizations were accurately captured in the DH registry.²⁰ School enrollment data from DPS were matched with DH data using students' first and last names and birth dates, after which the study data were deidentified.

Patient Population

Using these data sources, a cohort of 14- to 17-year-olds seen at any DH outpatient facility (SBHC, community clinic, urgent care center, ED, or specialty clinic) from January 2001 to August 2002 (the 20 months before the study period) was identified. Students were included if their insurance status was listed as either uninsured or insured by Medicaid or the State Children's Health Insurance Program (SCHIP) and there was a match to 2002–2003 DPS high school enrollees. We limited our study population to those who were uninsured or insured by Medicaid or SCHIP because these adolescents are less likely to seek care outside of the DH system. Age in years was determined at the first visit that occurred during the study period. Insurance status was determined at the adolescent's most recent visit during the study period, because it is the standard for most DH administrative database queries. This cohort of 3599 adolescents represented 21% of all 2002–2003 DPS-enrolled public high school students and 41% of all 14- to 17-year-olds who used any DH outpatient clinic during the study period. The 59% of 14- to 17-year-olds who had used a DH outpatient clinic during the study period but were not included in the study were excluded be-

cause they had not used a DH outpatient clinic in 20 months before the study period, were insured by private or military insurance, or were not enrolled in a regular DPS high school.

Definitions

Study Period

The study period was from August 1, 2002, to July 31, 2003. We chose to include the summer months when SBHCs were not open to account for preventive care received at community sites during the summer.

Source of DH Care

"SBHC users" were cohort members who had ever used a SBHC during the study period. SBHC users may have used a DH community clinic, urgent care center, or ED (urgent/ED) in addition to an SBHC. "Other users" were cohort members who had ever used a DH community clinic during the study period but did not use SBHCs. Other users may have used an urgent/ED site in addition to a community clinic.

Chronic Illness

The presence of chronic illness was identified using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes defined by the National Association of Children's Hospitals and Related Institutions Classification of Congenital and Chronic Health Conditions occurring in the 20 months before August 1, 2002.²¹

Quality-of-Care Markers

Markers used to examine quality of care were receipt of a health maintenance visit (HMV) and receipt of needed immunizations (hepatitis B, tetanus booster, and/or influenza among adolescents with asthma). Receipt of an HMV was determined by the occurrence of V20.2, V21.1, V21.2, V70.0, V70.3, V70.5, or V70.9 ICD-9-CM codes during the study period. Adolescents with <3 hepatitis B vaccine doses recorded in the immunization registry before the study period were identified. Among those identified, receipt of ≥ 1 hepatitis B vaccine during the study period was compared between SBHC users and other users. Similarly, adolescents needing a tetanus booster were identified, and receipt of a tetanus booster during the study period was compared between SBHC users and other users. Adolescents with asthma were identified based on the occurrence of an ICD-9-CM-coded 493 encounter consistent with asthma in the 20 months before the study period. Among adolescents with asthma, receipt of influenza vaccine during the 2002–2003 influenza season was compared between SBHC users and other users.

Analysis

Descriptive statistics were used to describe age, gender, race, insurance status, presence of chronic illness, and enrollment at a school with a SBHC for the entire cohort by source of DH care. SBHC users were compared with other users using χ^2 tests for categorical variables and t tests for age. Visit rates were examined using descriptive statistics and were grouped into 2 categories based on the median visit rate. Visit rates among SBHC users and other users were compared using bivariate and multiple logistic regression analyses as described below. The primary diagnosis (ICD-9-CM code) for each visit during the study period was classified into 1 of the following broad diagnostic categories: acute; chronic; preventive, immunizations, and screening; contraception; injuries; and other. Definitions of these diagnostic categories are included as footnotes to Table 3. The frequency of visits in each diagnostic category was calculated for SBHC users and for other users. Because SBHC users and other users could visit >1 type of health care site, their use was further described by calculating the frequency of visits in each diagnostic category for each type of health care site (SBHC, community clinic, and urgent/ED).

SBHC users were compared with other users for the following outcomes: visit rates, urgent/ED use, receipt of a HMV, receipt of a tetanus vaccine if needed, receipt of a hepatitis B vaccine if needed, and receipt of an influenza vaccine in those with asthma. Bivariate analyses were used to generate P values and unadjusted odd ratios for each of the outcome variables by each of the predictor variables. Multiple logistic regression controlling for gender, race, insurance status, and presence of chronic illness was used to generate adjusted odds ratios (aORs) comparing SBHC users with other users for each of the outcome variables. Because receipt of immunizations may be affected by the number of opportunities to vaccinate, number of visits as a continuous variable was also included in the regression models for receipt of tetanus, hepatitis B, and influenza vaccines. All of the covariates (gender, race, insurance status, chronic ill-

ness, and number of visits) were included in the regression models regardless of whether they were statistically significant because they were considered to be clinically significant.

The site of receipt of HMVs or immunizations was examined for SBHC users and other users. Because adolescents defined as SBHC users could have received HMVs or immunizations at community clinics as well as SBHCs, we were concerned that our results could be biased in favor of SBHCs for the quality-of-care markers if HMVs or immunizations actually occurring at the community sites were counted for the SBHC group. Therefore, we repeated the analysis counting only HMV or immunizations occurring at SBHCs for the SBHC users. SAS 9.1 for Windows (SAS Institute, Cary, NC) was used for all of the data analyses.

RESULTS

Population Description

Of the 3599 adolescents included in the cohort, 1615 (45%) did not make any visits to a DH SBHC, community clinic, or urgent/ED site during the study period. Another 269 adolescents (7%) only used an urgent/ED site. The remaining 1715 adolescents (48%) made ≥ 1 visit to a DH SBHC or community clinic during the study period. Adolescents who did not make any visits or only used an urgent/ED site were as likely to be enrolled in a school with an SBHC as adolescents who made ≥ 1 visit during the study period, with 87% of both groups enrolled in schools with SBHCs ($P = .98$). Twenty-two percent of adolescents in the cohort (790 of 3599) were defined as SBHC users, and 25% of adolescents in the cohort (925 of 3599) were defined as other users. Among the SBHC users, 456 (58%) visited SBHCs exclusively. Figure 1 illustrates the classification of the adolescents in the cohort.

Table 1 describes the age, gender, race, insurance status, and presence of chronic illness for the entire cohort by source of DH care during the study period.

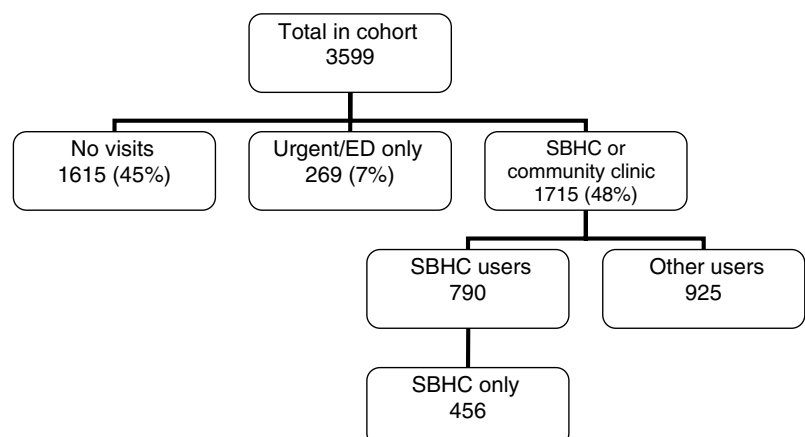


FIGURE 1

Classification of 3599 adolescents in a cohort on the basis of source of DH care during the study period of August 1, 2002, to July 31, 2003.

TABLE 1 Enrolled Denver Public School Adolescents Using DH Outpatient Care, 2002–2003: Characteristics by Source of Care During Study Period

Characteristics	Source of DH Care During Study Period			
	None (N = 1615)	Urgent/ED Only (N = 269)	SBHC Users (N = 790) ^a	Other Users (N = 925) ^b
Age, mean (SD), y	15.5 (1.1)	15.7 (1.2)	15.6 (1.1) ^c	15.5 (1.2)
Female gender, %	46.3	43.5	61.4 ^d	66.4
Race, %				
Black	18.9	16.0	19.5 ^e	23.2
Latino	66.0	70.3	69.5	68.3
White	9.4	9.3	6.7	6.0
Other	5.8	5.8	4.3	2.5
Insurance, %				
SCHIP	4.5	4.0	3.2 ^f	8.0
Medicaid	35.1	50.0	33.7	65.1
Uninsured	60.4	46.0	63.1	26.9
Chronic illness				
Chronic illness present, %	8.2	11.2	15.8 ^g	15.7
Among those with chronic illness, % with asthma (n/N)	63 (83/132)	60 (18/30)	73 (91/125)	61 (89/145)

^a SBHC users are cohort members who used a DH SBHC at least once during the study period from August 1, 2002, to July 31, 2003.

^b Other users are cohort members who used a DH community clinic at least once during the study period but did not use an SBHC.

^c Data are compared with other user; the *P* value is .3.

^d Data are compared with other user; the *P* value is .03.

^e Data are compared with other user; the *P* value is .06.

^f Data are compared with other user; the *P* value is .0001.

^g Data are compared with other user; the *P* value is .9.

SBHC and other users did not differ by age ($P = .3$), race/ethnicity ($P = .06$), or presence of chronic illness ($P = .9$). Compared with other users, SBHC users were slightly less likely to be girls ($P = .03$) and more likely to be uninsured ($P = .0001$).

Visit Rates and Diagnoses

Among the 1715 SBHC users and other users, the median visit rate was 3 visits per adolescent per year with a range from 1 to 33 visits. More SBHC users had ≥ 3 visits compared with other users, as shown in Table 2. This difference was more pronounced when urgent/ED visits were excluded from the analysis. When visits to all of the sites were included, the odds of having ≥ 3 visits were 2 times higher for SBHC users compared with other users. When visits were limited to SBHCs or community clinics, the odds of having ≥ 3 visits were ~ 3 times higher for SBHC users compared with other users.

Table 3 shows the frequency of visits in each diagnostic category for SBHC users and other users for all locations combined and for each type of health care site. For

both SBHC users and other users, the highest frequency of visits was in the acute category. SBHC users had a higher frequency of visits in the preventive care, immunization, and screening category than the other users (23% vs 13%). Among SBHC users visiting SBHCs, 36% of visits were in the acute category, and 30% were in the preventive care, immunization, and screening category. Among SBHC users visiting community clinics, 33% of visits were in the acute category, and 30% were in the contraception category.

Urgent Care and ED Use

The odds of having used an urgent/ED site during the study period were 2 times lower for SBHC users compared with other users (aOR: 0.50; 95% confidence interval [CI]: 0.39–0.64). These results are shown in Table 4.

Quality-of-Care Markers

Table 4 shows the comparison of quality-of-care markers between SBHC users and other users. The odds of having had a HMV during the study year were ~ 2 times higher for SBHC users compared with other users. Fifteen percent of SBHC users and 19% of other users were not up to date for hepatitis B before the analysis period. The odds of receiving ≥ 1 vaccine were 4 times higher for SBHC users compared with other users. Among 48% of SBHC users and 46% of other users needing a tetanus vaccine, the odds of receiving it were ~ 2 times higher for the SBHC users compared with the other users. Finally, among adolescents with asthma (12% of SBHC users

TABLE 2 Comparison of Adolescent Health Care Use Based on Source of DH Care: 2002–2003

Use	Source of DH Care, %		aOR (95% CI) ^a
	SBHC Users (n = 790)	Other Users (n = 925)	
No. of visits to all sites ≥ 3 visits	54.6	46.9	2.1 (1.7–2.6)
No. of visits to primary care sites ≥ 3 visits	51.8	34.1	2.8 (2.2–3.5)

^a Data are adjusted for gender, insurance status, race/ethnicity, and chronic illness.

TABLE 3 Frequency of ICD-9-CM–Coded Adolescent Visits Grouped Into 6 Diagnostic Categories Presented by Source of DH Care: 2002–2003

Diagnostic Category	SBHC Users, %				Other Users, %		
	All Locations Combined (3299 Visits)	SBHC (2298 Visits)	Community Clinic (773 Visits)	Urgent/ED (228 Visits)	All Locations Combined (3198 Visits)	Community Clinic (2655 Visits)	Urgent/ED (543 Visits)
Acute ^a	37.3	36.1	32.6	64.5	40.5	34.6	69.2
Chronic ^b	6.8	8.2	3.8	3.1	2.9	2.5	4.8
Preventive care, immunization, screening ^c	23.1	29.7	9.9	0.9	12.7	15	1.1
Contraception ^d	11.3	5.9	29.8	2.6	14.8	17.6	1.3
Injury ^e	5.2	4.4	2.5	22.4	4.5	1.9	17.1
Other ^f	16.4	15.7	21.3	6.6	24.7	28.4	6.4

^a Acute includes all diagnostic codes not found in the other groups described below.

^b Chronic is defined using the National Association of Children's Hospitals and Related Institutions Classification of Congenital and Chronic Health Conditions.²¹

^c Preventive care, immunization, and screening includes diagnostic codes V01–V06, V10–V19, V20.2, V21, V70.0, V70.3, V70.5, V70.9, V71, V72.0–V72.3, and V72.5–V72.9.

^d Contraception includes diagnostic code V25.

^e Injury includes diagnostic codes 800 to 999.

^f Other includes diagnostic V codes other than for preventive care, immunization, screening, or contraception and E codes for mental illness (290–319).

TABLE 4 Comparison of Adolescent Urgent/ED Use and Quality-of-Care Markers Based on Source of DH Care: 2002–2003

Variables	Source of DH Care		aOR (95% CI)
	SBHC Users (n = 790)	Other Users (n = 925)	
Urgent/ED use, %	17.0	33.8	0.50 (0.39–0.64) ^a
Receipt of HMV, %	47.5	33.2	1.9 (1.5–2.3) ^a
Among those who needed ≥1 HepB, n	119	174	
Receipt of ≥1 HepB, %	46.2	20.1	4.4 (2.4–8.0) ^b
Among those who needed Td vaccine, n	376	424	
Receipt of Td, %	33.2	21.5	1.9 (1.3–2.7) ^b
Among those with asthma, n	91	89	
Receipt of influenza vaccine, %	45.1	18.0	2.8 (1.2–6.5) ^c

HepB indicates hepatitis B; Td, tetanus booster.

^a Data are adjusted for gender, race/ethnicity, insurance status, and chronic illness.

^b Data are adjusted for gender, race/ethnicity, insurance status, chronic illness, and annual number of visits (urgent/ED visits excluded).

^c Data are adjusted for gender, race/ethnicity, insurance status, and annual number of visits (urgent/ED visits excluded).

and 10% of other users), the odds of receiving an influenza vaccine were ~3 times higher for the SBHC users compared with the other users.

Because SBHC users could use both SBHCs and community clinics, some of the SBHC users' HMVs and immunizations occurred at community clinics rather than at an SBHC. Among SBHC users, 12.5% of HMVs, 18.2% of hepatitis B immunizations, 24.2% of tetanus immunizations, and 19.5% of influenza immunizations occurred at a community clinic. To examine whether our results were biased in favor of SBHCs by including preventive care that occurred at community clinics for the SBHC-users group, we repeated our analysis excluding SBHC users' HMVs and immunizations that occurred at community clinics. In this repeat analysis, the aOR for HMVs was 1.43 (95% CI: 1.16–1.78), the aOR for hepatitis B was 3.18 (95% CI: 1.75–5.77), the aOR for

tetanus was 1.16 (95% CI: 0.81–1.68) and the aOR for influenza was 2.05 (95% CI: 0.87–4.80). Therefore, the differences between SBHC users and other users remained for HMVs and hepatitis B even when SBHC users' visits to community clinics for preventive care were excluded.

DISCUSSION

We found that SBHCs play an important role in improving access to high-quality health care for low-income and minority adolescents in Denver. SBHC users were more likely to have had an HMV and to have received recommended vaccines compared with adolescents who only used the other clinics in the DH system. Compared with other users, SBHC users made more primary care visits and were less likely to use urgent/ED sites, although they were more likely to be uninsured.

Our results regarding access to care are similar to the results of previous studies, including 2 studies conducted in Denver in the early 1990s among adolescents in a managed care system and among publicly insured and uninsured adolescents.^{11–14} In both previous Denver studies, adolescents who used SBHCs made more primary care visits and fewer urgent/ED visits compared with adolescents who did not use SBHCs.^{11,12} Our finding that SBHC users, the majority of whom were uninsured, had higher visit rates than other users suggests that SBHCs increase access to care particularly for the uninsured. The SBHC users' higher proportion of visits with a preventive care diagnosis compared with other users suggests that these additional visits were for needed preventive care. Possible explanations for the higher visit rates among SBHC users are that adolescents do not have to pay to use SBHCs, adolescents do not require transportation because the SBHCs are located on school grounds, and adolescents are able to visit the SBHCs during school hours.

Despite the increased accessibility provided by SBHCs,

barriers to accessing health care remain for our adolescent population, because 52% of our study cohort did not have a visit or only visited an urgent/ED site in the DH system during the study year. The majority of these adolescents (87%) were enrolled in a school with an SBHC, indicating that the presence of an SBHC alone did not overcome these adolescents' barriers to access. Although our study design did not allow us to examine why adolescents who were in enrolled schools with SBHCs did not use them, a previous study by Pastore et al²² suggests that adolescents who did not use SBHCs had other health care available or thought that they did not need health care.

Although many SBHCs are likely to monitor their quality of care as recommended by the American Academy of Pediatrics,²³ few studies have been published in the medical literature comparing the quality of care in SBHCs to local or national standards. Gance-Cleveland et al²⁴ studied several quality indicators in SBHCs, including immunization rates and HMVs, and found that SBHCs did not meet their target goals for adolescent immunization status but did meet the goals for HMVs. Kaplan et al¹¹ and Juszczak et al¹² found that adolescents using SBHCs were more likely than adolescents using other sites of care to have had a HMV and screening for high-risk behaviors. Lancman et al²⁵ studied rates of hepatitis B vaccination completion in 2 SBHCs and a community-based adolescent health center. They found that 79% of adolescents had completed the series at the SBHC with aggressive immunization efforts, whereas only ~25% had completed the series at the community-based health center and the other SBHC without specific immunization interventions. Their study illustrates that the system of health care delivery in the SBHC is an important determinant of quality of care. Although we did not compare quality of care for SBHC users to national standards, we used other users to represent the local standard of care that would be received if care were not available in the SBHCs. By comparing SBHC users to other users, we sought to examine whether SBHCs augment the care provided by more traditional outpatient sites. Our finding that SBHC users were more likely than other users to receive HMVs and needed immunizations suggests that the addition of SBHCs improves the quality of care offered by the traditional safety-net health care delivery system. The quality of care provided by the Denver SBHCs is possible because they are part of the DH system, which has an emphasis on accessibility of information and integration of services. SBHCs that are not part of an integrated system of care may not have the resources, such as an immunization registry, to perform as well on quality-of-care measures.

Although overall immunization rates remained low in our study, with fewer than half of adolescents receiving indicated vaccines, we found that hepatitis B, tetanus, and influenza immunization rates were higher

among SBHC users compared with other users. The influenza immunization rate of 45% in subjects with asthma who used SBHCs represents an improvement compared with influenza immunization rates of 16% to 21% found in a multistate study of asthmatic children and 21% to 23% found in a national study of adults with asthma.^{26,27} Our data suggest that immunization coverage among adolescents can be improved by providing immunizations in a school setting. This is an important consideration in light of the Advisory Committee on Immunization Practices' recent recommendations for the pertussis booster, conjugated meningococcal vaccine, and human papilloma virus vaccine in adolescents.²⁸⁻³⁰ SBHCs could play an integral part in a comprehensive adolescent immunization program.

This study has several limitations. Administrative data are subject to errors; however, this should not significantly bias our results, because the probability of errors is probably equal for both groups. However, if SBHC staff were more careful about recording data than staff at other sites of care, bias might be introduced. Without data for visits occurring outside of the DH system, we may have underestimated or misclassified use, but the restricted study population of uninsured or state-insured adolescents is very likely to rely on the DH system. Insurance status was assessed at the last visit during the study period, and no method captured changes in insurance that may have occurred during the study period. Although mental health visits accounted for approximately one third of all visits to SBHCs in previous studies,^{11,12} this study did not include data about visits with mental health care providers. Finally, our findings may not be generalizable to other SBHCs, because quality of care could be influenced by factors specific to the DH health care delivery system.

These limitations are mitigated by several strengths. The retrospective cohort design and use of school enrollment data to form our cohort allow us to be fairly certain that our study population truly reflects adolescents who are "in the system" and allowed us to make some observations about those adolescents who did not use primary outpatient care during the study period. Our use of a large data set with detailed information about visits and linkage to immunizations enabled us to make accurate comparisons between groups and subgroups. Most importantly, our conclusions are strengthened because our results are consistent across multiple outcome measures.

CONCLUSIONS

On the basis of our findings from this study, we suggest that SBHCs are an effective way for health care systems to improve access to care and quality of care for underserved adolescents. In an era when health care funding is limited, these data may be used to advocate for increased resources for SBHCs.

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