

Major Article

College Health Surveillance Network: Epidemiology and Health Care Utilization of College Students at US 4-Year Universities

James C. Turner, MD; Adrienne Keller, PhD

Abstract. Objective: This description of the College Health Surveillance Network (CHSN) includes methodology, demography, epidemiology, and health care utilization. **Participants:** Twenty-three universities representing approximately 730,000 enrolled students contributed data from January 1, 2011, through May 31, 2014. **Methods:** Participating schools uploaded de-identified electronic health records from student health services monthly. **Results:** During this study, just over 800,000 individuals used the health centers, comprising 4.17 million patient encounters. Sixty percent of visits included primary care, 13% mental health, 9% vaccination, and 31% other miscellaneous services. The 5 most common specific diagnostic categories (with annual rates per 100 enrolled students) were preventive (16); respiratory (12); skin, hair, and nails; infectious non-sexually transmitted infection (5 each); and mental health (4). Utilization and epidemiologic trends are identified among subpopulations of students. **Conclusions:** CHSN data establish trends in utilization and epidemiologic patterns by college students and the importance of primary and behavioral health care services on campuses.

Keywords: clinical medicine, epidemiology, mental health, multisite, student health services

With over 21 million people enrolled in higher education in the United States,¹ college students constitute a sizable cohort of Americans. Proximity to academe and the research enterprise of universities has resulted in thousands of studies of students'

attitudes, behaviors, and health conditions. Specifically, self-reported survey data regarding their health are plentiful.²⁻⁶ However, actual clinical data from campus medical facilities are limited to single schools^{7,8} or to collaborative studies about single conditions from multiple schools.⁹⁻¹² Thus, there is a paucity of data regarding the epidemiology of health conditions among large populations of students who seek care in university college health services.

The American College Health Association (ACHA), representing 800 colleges and universities, is the leading professional organization for practitioners in college health.¹³ E. Victor Leino, PhD, Research Director of ACHA, estimates that approximately 1,500 health services exist on college campuses (personal communication, May 2014) providing medical and behavioral services to students. Despite the importance and expense of these student services, accurate data regarding health resource utilization by college students are not readily available.

The College Health Surveillance Network (CHSN), established in 2010, provides a unique database on the health status and health care utilization of college students. This paper describes the CHSN methodology and presents demographic, epidemiologic, and health care utilization trends using 41 months of data from participating universities.

METHODS

Participants

CHSN, founded in October 2010 with 3 years of start-up funding from the Centers for Disease Control and Prevention (CDC), currently comprises 23 universities recruited from among ACHA members via e-mail. Twenty-two of the participating universities are classified as Research Universities/Very High (RU/VH)¹⁴; 7 are private not-for-profit, 16 are public universities. CHSN includes schools in each

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TABLE 1. Demography^a of Enrolled Students

Characteristic		CHSN sample	Population ^b	Sample/Population (%)
Number of schools		23	108	21.30
Total enrollment		730,785	2,809,581	26.01
		%	%	Difference in %
Sex	Female	51.64	50.73	0.91
	Male	48.36	49.27	-0.91
Student level	Undergraduate	72.71	70.09	2.62
	Graduate	27.29	29.91	-2.62
Age	Under 18	0.73	1.01	-0.28
	18-19	24.68	23.79	0.89
	20-21	28.94	27.22	1.72
	22-24	19.46	19.53	-0.07
	25-29	13.60	14.99	-1.39
	30-34	5.43	6.22	-0.79
	35-39	2.41	2.79	-0.38
	40-49	2.33	2.68	-0.35
Race and ethnicity ^c	American Indian or Alaska Native	0.33	0.50	-0.17
	Asian	8.79	10.14	-1.35
	Black or African American	5.93	6.14	-0.21
	Hispanic	7.13	8.39	-1.26
	Native Hawaiian or other Pacific Islander	0.12	0.19	-0.07
	White	62.26	58.29	3.97
	2 or more races	2.03	2.22	-0.19

^aAll demographic data for College Health Surveillance Network (CHSN) and Research Universities/Very High are taken from US Department of Education Integrated Postsecondary Education Data System statistics.¹³

^b108 Carnegie classification Research Universities/Very High (RU/VH) nationally.¹²

^cSubsample of 15 schools with race/ethnicity data.

of the 4 national census bureau regions (Northeast = 6; South = 9; Midwest = 4; West = 4), representing approximately 730,000 enrolled students with over 900,000 unique visits to student health services each academic year.

The 23 schools in CHSN constitute 26% of students enrolled in the 108 universities with Carnegie classification RU/VH.¹⁴ The demography (sex, race/ethnicity, age, undergraduate/graduate status) of students enrolled in CHSN schools closely matches the demography for the student population of those 108 universities (Table 1).

Data Sources

CHSN data are derived from de-identified electronic health records (EHRs) from the student health services. Participating schools upload files monthly for all patient encounters for students aged 15-50 seen the previous month. (The age range is restricted, per Institutional Review Board [IRB] request, due to the increased probability of identification of individual students outside of this age range by a combination of demographic variables, given that in participating schools only approximately 1% of enrolled students are outside of the 15-50 age range.) School enrollment by demographic group and funding status (public vs private) data are obtained from the US Department of Education's Integrated Postsecondary Education Data System (IPEDS) data set.¹⁵ IPEDS enrollment

profiles for these schools vary little over consecutive years, permitting use of 2011-2012 data as a baseline enrollment for the entire study period.

Data Content

Patient data consist of a confidential unique patient identifier, date of encounter, all International Classification of Diseases Ninth Revision (ICD-9) diagnostic codes¹⁶ and Current Procedural Terminology (CPT) procedural codes¹⁷ associated with the encounter, and available demographic information for the student. Each school developed its own confidential formula to create patient identification variables. All schools have age and sex available in their EHRs; 13 schools also have race/ethnicity data. Ten schools include records from counseling center clinical encounters. For most of the schools, CHSN data begin with January 1, 2011; 2 schools instituted EHR systems in mid-2011 and 1 school in mid-2012. The data presented here include 41 months: January 1, 2011, through May 31, 2014.

Data Quality

CHSN consists of secondary data, based on information derived from EHRs used for clinical and billing purposes. The director of each student health service agreed to develop institution-specific processes to ensure that clinical staff consistently used ICD-9 and CPT codes to categorize

diagnoses and levels of care. The very low enrollment and patient numbers for the racial/ethnic category “Hawaiian and Pacific Islander” precluded valid and reliable analysis; therefore, that category is not included in any analyses by racial/ethnic group.

Measures

Type of Visit

A patient visit was defined as any encounter with at least 1 valid CPT code. CPT codes were used to categorize 3 specific types of visits. Primary care visits are encounters with an office/outpatient or inpatient Evaluation and Management (E&M) code. Mental health visits are encounters with a behavioral/mental health service code. Vaccination visits are encounters with a vaccination code. Encounters with CPT codes that did not correspond to 1 of the 3 specific types are classified as “miscellaneous other” (eg, laboratory tests; dental, physical therapy, or optical visits; casting or laceration repair). Appendix A (available online) contains a complete list of CPT codes defining each type of visit.

Diagnostic Categories

CHSN providers used over 7,000 ICD-9 codes; one of the first challenges with these data was to aggregate these codes into categories that are clinically and epidemiologically relevant to college health. Such aggregation minimizes the impact of nuanced coding practices among individual clinicians. ICD-9 codes and existing schema for aggregation, such as Diagnosis-Related Groups (DRG), Ambulatory Diagnosis Groups (ADG), and Major Diagnostic Categories (MDC), were developed primarily to facilitate cost reimbursement,^{16,18–20} which is of less relevance in most college student health services. Additionally, many of the ICD-9 codes used in CHSN are not associated with a specific diagnosis or organ system but rather are symptom-based or associated with preventive or nonspecific visits.

Following the models of ADG¹⁹ and MDC,²⁰ and using an iterative review process, the coauthors (a physician with 25 years’ experience as a director of student health services and an epidemiologist) aggregated the most frequently occurring codes into 118 diagnostic groups, clustered around anatomic symptoms or signs, descriptive diagnoses, or specific etiology (eg, acute upper respiratory tract infection, anxiety, infectious mononucleosis); these diagnostic groups were further aggregated into 20 diagnostic categories (eg, respiratory, mental health, infectious non–sexually transmitted infection [STI], respectively). Approximately 1,200 ICD-9 codes, accounting for over 92% of codes used in CHSN, are included in the aggregation scheme; all codes occurring with a frequency of at least 2,000 are included; the mean frequency of the codes that are not included is 74. Although similar to the 25-category MDC²⁰ and the 34-category ADG,¹⁹ these 20 categories differ in 3 ways. First, similar diagnostic groups are consolidated into one

category (eg, the category “mental health” includes both mental health disorders and substance use disorders). Second, 2 categories reflect services not associated with a specific diagnosis: “preventive services” (eg, disease screening, contraceptive management, vaccinations) and “nonspecific services” (eg, abnormal findings in body substances, administrative, counseling or consultation, follow-up care, review of test results, exposure to blood or body fluids, and general symptoms). Third, common inpatient categories (eg, obstetrics and neonatology) are not included because they are not relevant to the vast majority of student health services. Appendix B (available online) contains a complete list of ICD-9 codes by diagnostic group and category and may provide a useful starting point for an evidence-based standardized system specific to college health.

Statistical Analyses

Data management and statistical analyses were accomplished with SPSS version 21 (IBM, Armonk, New York). Analyses of race/ethnicity are based on the 13 schools that upload race/ethnicity information. Following the convention used nationally,²¹ annualized rates with 99% confidence intervals (99% CIs), were calculated per 100 enrolled students, for the sample as a whole and for demographic groups. In the text, the word “significant” denotes differences that have nonoverlapping 99% CIs and are judged to be of particular interest clinically or epidemiologically.

The CHSN research project received approval from the University of Virginia’s IRB. Each participating institution also obtains IRB approval or completes a duly executed Data Use Agreement prior to enrollment in CHSN.

RESULTS

Analyses by Type of Visit

During the 41-month study period, 802,255 individual students used the health centers of these universities, compiling 4.17 million patient encounters. Sixty percent of visits (2.5 million) were classified as primary care, 13% (530,000) as mental health, 9% (360,000) as vaccination, and 31% (1.3 million) as miscellaneous other.

Table 2 presents the annual utilization rates, with 99% CIs, per 100 enrolled students. With the exception of mental health visits, rates were significantly higher at private schools for all visit types. Patient characteristics were also associated with significantly different utilization, with females and age categories “under 18” and “22–29” years having the highest rates for primary care and mental health visits. Overall utilization of services by the 3 principal minority groups among the enrolled students (African American, Asian, and Hispanic) was similar, with each group having higher rates than whites and Native Americans, particularly for primary care visits. African American students had higher utilization of mental health services compared with the other ethnic groups.

TABLE 2. Estimated Annual Utilization for Each Type of Visit, by School and Patient Characteristics

Characteristic	Enrollment ^a	Primary care visits			Mental health visits			All visits ^d		
		n ^b	Rate ^c	99% CI	n ^b	Rate ^c	99% CI	n ^b	Rate ^c	99% CI
Total sample	730,785	2,521,321	100	99.9, 100.2	529,525	21	20.9, 21.1	4,170,415	165.5	165.3, 165.7
Private schools	143,034	687,667	139.4	139.0, 139.9	104,542	21.2	21.0, 21.4	1,198,302	243.0	242.4, 243.5
Public schools	587,751	1,833,654	90.5	90.3, 90.6	424,983	21	20.9, 21.1	3,499,113	172.7	172.4, 172.9
Female	377,383	1,608,815	123.6	123.4, 123.9	340,883	26.2	26.1, 26.3	2,984,519	229.4	229.0, 229.7
Male	353,402	909,074	74.6	74.4, 74.8	188,470	15.5	15.4, 15.6	170,7734	140.2	139.9, 140.4
Under 18	5,371	46,434	251	247.7, 253.7	8,416	45	44.2, 46.7	87,276	471.2	467.1, 475.3
18–19	180,385	535,162	86	85.7, 85.3	89,055	14.3	14.2, 14.4	938,570	150.9	150.5, 151.3
20–21	211,455	704,119	96.6	96.3, 96.9	142,863	19.6	19.5, 19.7	1,262,059	173.1	172.7, 173.5
22–24	142,203	541,854	110.5	110.1, 110.9	126,095	25.7	25.5, 25.9	1,033,069	210.7	210.1, 211.2
25–29	99,386	461,103	135	134.0, 135.1	100,975	29.5	29.2, 29.7	897,841	262.0	261.3, 262.7
30–34	39,687	156,553	114	113.7, 115.1	41,233	30	29.7, 30.5	313,915	229.4	228.3, 230.4
35–39	17,606	44,681	74	72.7, 74.5	12,918	21	20.8, 21.8	95,165	156.8	155.4, 158.1
40–49	17,017	29,892	51	50.2, 51.7	7,668	13	12.7, 13.5	65,998	112.5	111.3, 113.6
African American	20,122	105,403	152	150.7, 153.1	27,207	39	38.6, 39.8	193,667	279.1	277.5, 280.7
Asian	27,605	133,368	140	139.1, 141.1	29,597	31	30.6, 31.6	265,314	278.8	277.5, 280.1
Hispanic	18,272	95,843	152	150.8, 153.4	18,695	30	29.1, 30.2	157,941	250.7	249.0, 252.3
Native American	1,258	4,483	103	99.4, 107.3	1,057	24	22.4, 26.3	8,377	193.1	187.7, 198.5
White	241,777	936,741	112.4	112.1, 112.7	257,168	30.8	30.7, 31.0	1,778,780	213.4	212.9, 213.8
Two or more races	7,501	6,450	25	24.1, 25.7	2,403	9	8.8, 9.8	12,745	49.3	48.2, 50.4
Graduate	199,453	705,671	102.6	102.3, 102.9	133,019	19.3	19.2, 19.5	1,380,036	200.7	200.2, 201.1
Undergraduate	531,332	1,294,346	70.6	70.5, 70.8	243,607	13.3	13.2, 13.4	2,342,690	127.9	127.6, 128.1

^aAll demographic data for College Health Surveillance Network and Research Universities/Very High is taken from US Department of Education Integrated Postsecondary Education Data System statistics.¹³ Ethnicity enrollment is for the 13 schools reporting ethnicity data; Hawaiian/Pacific Islander category is excluded because of low numbers.

^bFor 41 months.

^cAnnual rate per 100 enrolled students.

^dAll visits also includes vaccination visits: $n = 361,613$, rate = 14, 99% confidence interval [CI] [14.3, 14.4]; and miscellaneous visits: $n = 1,284,956$, rate = 51, 99% CI [50.9, 51.1].

Analyses by Diagnostic Category

Table 3 rank orders the number and percent of patients in each of the diagnostic categories for the entire study period. Prevention-related services (eg, contraceptive management; physical examinations for athletics, travel, and work; and screenings for STIs, lipid abnormalities, and hypertension) had the highest frequency. Respiratory conditions constitute the second most common diagnostic category. The third most frequent category is the nonspecific category (ICD-9 codes not associated with a specific diagnosis). Skin disorders, including contact dermatitis, acne, and skin infections, constitute most of the fourth most frequent category. The fifth category comprises non-sexually transmitted infections (eg, influenza, infectious mononucleosis, streptococcal pharyngitis, mumps, chicken pox, conjunctivitis, hepatitis B, herpes zoster, pertussis, and latent tuberculosis). Mental health disorders were the fifth most common specific category. Musculoskeletal disorders, injuries, and abdominal/gastrointestinal complaints had similar rates, whereas eye, ear and mouth disorders and female reproductive diagnoses rounded out the top 10 diagnostic categories seen in college health services. Sexually transmitted illnesses, of special interest because of their public health significance, were the 14th ranking category, with 50,292 diagnosed patients: 32% with human papillomavirus

(HPV), 4.3% with genital herpes, 1.1% with chlamydia, 0.9% with gonorrhea, 0.3% with human immunodeficiency virus (HIV), and 48.5% with other/unspecified STIs.

Mental health disorders have the highest number of visits per patient (4.93). Only one other diagnostic category (developmental/congenital) has greater than 3 visits per patient, and over 50% of those patients have a dual diagnosis of a mental health condition. Table 4 provides a more detailed examination of the mental health diagnostic category, with summary statistics for the 10 mental health diagnostic groups constituting that category. Anxiety and depression occurred among 44% and 34%, respectively, of patients with a mental health diagnosis, followed by psychosocial stressors (19%), adjustment disorders (17%), drug abuse (13%), and attention-deficit/hyperactivity disorder (ADHD) (12%). Alcohol-related disorders occurred infrequently (4%). Students with eating disorders and personality disorders had the highest number of visits throughout the study period.

Estimated Rates of Common Diagnostic Categories and Overall Utilization of Health Services by School and Patient Characteristics

Annualized rates among enrolled populations of students were computed for 3 of the most common specific

TABLE 3. Patients and Visits by Diagnostic Category

Diagnostic category	Patients		Diagnosis specific visits		
	<i>n</i>	% ^a	<i>n</i>	Per patient	99% CI
Preventive	393,220	49.0	905,517	2.303	2.297, 2.309
Respiratory	294,240	36.7	525,682	1.787	1.78, 1.793
Nonspecific	232,018	28.9	474,923	2.047	2.039, 2.055
Dermatologic	124,436	15.5	209,814	1.69	1.68, 1.70
Infectious (non-STI)	114,894	14.3	164,520	1.43	1.42, 1.44
Mental health	103,844	12.9	511,929	4.93	4.91, 4.95
Musculoskeletal	95,808	11.9	197,687	2.06	2.05, 2.08
Injuries	95,446	11.9	164,457	1.72	1.71, 1.73
Abdomen, digestive, gastro	89,943	11.2	138,256	1.54	1.53, 1.55
Eye, ear, mouth	86,453	10.8	133,898	1.55	1.54, 1.56
Female reproductive	73,056	9.1	120,662	1.65	1.64, 1.66
Urinary	65,351	8.1	99,156	1.52	1.50, 1.53
Allergies	52,404	6.5	117,415	2.24	2.22, 2.26
STIs	50,292	6.3	84,214	1.67	1.66, 1.69
Circulatory, lymph	45,113	5.6	69,777	1.55	1.53, 1.56
Neurologic	25,147	3.1	41,055	1.63	1.61, 1.65
Metabolic, endocrine	17,825	2.2	41,574	2.33	2.30, 2.36
Sleep	11,983	1.5	25,021	2.09	2.05, 2.12
Rehabilitation	4,368	0.5	8,522	1.95	1.90, 2.01
Male reproductive	3,118	0.4	3,740	1.20	1.15, 1.25
Developmental, congenital	1,393	0.2	5,491	3.94	3.80, 4.08

Note. CI = confidence interval; STI = sexually transmitted infection.

^aThe sum of percents of individual diagnoses is greater than 100 because students can have multiple diagnoses over the course of the study period.

diagnostic categories (Table 5). Private schools had significantly higher rates than public schools, and females were higher than males in all 3 categories. Higher proportions of students under 18 were seen in all categories. Students 18–21 years old had higher rates of respiratory-related visits than the older age groups, whereas higher proportions in some older age groups were seen for mental health conditions (22–34 years old).

The annualized rate for the different diagnostic categories varied to a lesser degree by racial group. Hispanics had the highest rate of respiratory diagnoses; Asian students had the lowest rate of mental health diagnoses. From an analysis of aggregated data for the entire network, approximately 32% of enrolled students used the health service at least once during a 12-month period. Utilization varied significantly by school characteristics

TABLE 4. Patients and Visits by Mental Health Diagnosis

Mental health diagnosis	Patients		Visits		
	<i>n</i>	% ^a	<i>n</i>	Per patient	99% CI
All mental health diagnoses	103,844	100	511,929	4.93	4.91, 4.95
Anxiety	46,008	44.3	192,130	4.18	4.15, 4.20
Depression	34,788	33.5	169,741	4.88	4.85, 4.91
Psychosocial stressors	19,910	19.2	80,461	4.04	4.00, 4.08
Adjustment disorders	17,397	16.8	70,271	4.04	4.00, 4.08
Drug abuse	13,789	13.3	27,727	2.01	1.98, 2.04
ADHD	12,279	11.8	64,142	5.22	5.17, 5.28
Eating disorders	6,428	6.2	52,137	8.11	8.02, 8.20
Bipolar and psychotic disorders	5,958	5.7	30,734	5.16	5.08, 5.23
Alcohol disorders	4,548	4.4	16,656	3.66	3.59, 3.74
Personality disorders	1,397	1.3	9,097	6.51	6.34, 6.69

Note. CI = confidence interval; ADHD = attention-deficit/hyperactivity disorder.

^aThe sum of percents of individual diagnoses is greater than 100 because students can have multiple diagnoses over the course of the study period.

TABLE 5. Prevalence of 3 Common Diagnostic Categories

Characteristic	Enrollment ^a	Respiratory			Infectious non-STI			Mental health		
		<i>n</i>	Rate ^b	99% CI	<i>n</i>	Rate ^b	99% CI	<i>n</i>	Rate ^b	99% CI
All schools	730,785	294,240	11.68	11.6, 11.7	114,894	4.56	4.5, 4.6	103,844	4.1	4.09, 4.2
Private schools	143,034	71,394	14.5	14.3, 14.6	34,465	7.0	6.9, 7.1	28,141	5.7	5.6, 5.8
Public schools	587,751	222,846	11.0	10.9, 11.1	80,429	3.97	3.9, 4	75,703	3.74	3.7, 3.8
Female	377,383	172,767	13.3	13.2, 13.4	64,275	4.94	4.9, 5	62,264	4.78	4.7, 4.8
Male	353,402	121,364	10.0	9.9, 10	50,572	4.15	4.1, 4.2	41,501	3.41	3.36, 3.45
Under 18	5,371	7,769	41.9	40.7, 43.2	2,942	15.9	15.1, 16.6	1,848	10.0	9.4, 10.6
18–19	180,385	80,131	12.9	12.8, 13	28,116	4.52	4.5, 4.6	19,966	3.2	3.15, 3.3
20–21	211,455	98,293	13.5	13.4, 13.6	38,085	5.22	5.2, 5.3	29,722	4.08	4.02, 4.14
22–24	142,203	55,030	11.2	11.1, 11.4	21,791	4.44	4.4, 4.5	22,477	4.6	4.5, 4.7
25–29	99,386	35,482	10.4	10.2, 10.5	16,263	4.7	4.6, 4.8	18,571	5.4	5.3, 5.5
30–34	39,687	11,800	8.6	8.4, 8.8	5,320	3.9	3.8, 4	7,418	5.4	5.3, 5.6
35–39	17,606	3,488	5.7	5.5, 6	1,466	2.4	2.3, 2.6	2,279	3.8	3.6, 4
40–49	17,017	2,149	3.7	3.5, 3.9	872	1.49	1.4, 1.6	1,495	2.5	2.4, 2.7
African American	20,122	10,393	15.0	14.6, 15.4	3,794	5.5	5.2, 5.7	4,413	6.4	6.1, 6.6
Asian	27,605	12,569	13.2	12.9, 13.5	6,115	6.4	6.2, 6.6	3,418	3.6	3.4, 3.7
Hispanic	18,272	11,459	18.2	17.8, 18.6	4,194	6.7	6.4, 6.9	5,245	8.3	8, 8.6
Native American	1,258	523	12.1	10.7, 13.4	186	4.3	3.5, 5.1	231	5.3	4.4, 6.2
White	241,777	114,119	13.7	13.6, 13.8	42,013	5.04	5, 5.1	39,134	4.7	4.6, 4.8
Graduate	199,453	59,034	8.6	8.5, 8.7	26,628	3.87	3.8, 3.9	23,406	3.4	3.3, 3.5
Undergraduate	531,332	169,969	9.28	9.2, 9.3	64,167	3.5	3.47, 3.54	55,093	3	2.97, 3.04

Note. CI = confidence interval.

^a2011–2012 enrollment statistics.¹³

^bAnnual rate per 100 enrolled students.

(private 39% vs public 30%), student sex (female 34% vs male 29%), age (from 21% among 40–49-year-olds to 92% for students under 18), ethnicity (African American 42%, Asian and Hispanic 48%, Native American 28%, white 33%), and school level (graduate 28% vs undergraduate 22%).

Preventive services had the highest prevalence rates of any category, with 15.6% of all enrolled students seen in this category each year. Trends for preventive services by demographic characteristics were as follows: private schools (24%) versus public schools (14%); female (19%) versus male (12%); African American (22%), Asian (28%), Hispanic (22%), versus white (16%); and graduate (18%) versus undergraduate (10%).

COMMENT

The CHSN is a unique resource and a representative sample of the 108 4-year Research Universities/Very High in the United States (Table 1). Data are now available that establish trends in college students' health care utilization and the epidemiology of common diagnostic categories. Over the 41 months of this study, just over 800,000 individuals among the enrolled students used the health centers of these universities, compiling 4.17 million patient encounters (Table 2.) Sixty percent of visits included primary care, 13% mental health, 9% vaccination, and 31% included other miscellaneous services. With rare exception, this order of service utilization sustained itself across almost all demographic groups of schools and patients,

highlighting the importance of primary and behavioral health care services on campuses.

The degree to which campus health services are utilized is probably dependent on a number of variables, including institutional commitment to health resources, service accessibility, cost, and reputation, as well as the relative availability of private health care in surrounding communities or from places of permanent residence (eg, family physicians). Nonetheless certain patterns emerged which are worth noting.

Private institutions had substantially higher rates of utilization than public institutions. In terms of student characteristics, the well-established trend of females using health services more than males was true in college students as in other populations^{7,21}; utilization also differed by age, school level, and ethnicity. Students under the age of 18 were seen at much higher rates for all categories. Developmentally this perhaps reflects their inexperience in self-management of health issues and the challenges of transitioning to independence in college.⁷ Higher utilization rates by the principal ethnic groups suggests that health services are accessible and receptive care options for these diverse populations of students.

The frequency of diagnostic categories (Table 3) substantially expands our understanding of the specific health conditions of students presenting at health services and the nature of the practice of college health.^{7,8,22} CHSN data documenting the preponderance of prevention-related services reflect the contemporary mission of college health,

which has evolved beyond campus clinics serving as first aid stations or urgent care centers²³ to include the promotion of health.

Congregate living, learning, and socializing promotes the spread of communicable illnesses, including respiratory pathogens such as mumps, meningococci, measles, and many other viruses and bacteria, sometimes complicated by sinusitis, tonsillitis, pharyngitis, bronchitis, and pneumonia.^{7,22,24} Care of these acute respiratory diseases therefore is a considerable burden on resources. Although our data are not able to differentiate urgent from more elective appointments, others have reported that acute respiratory conditions constitute a substantial proportion of same-day visits in college health.²²

Mental health conditions rank among the top 5 specific diagnostic categories seen in college health services. The observed frequencies of individual disorders (Table 4) are consistent with those reported by counseling center directors nationally²⁵; many of these conditions are risk factors for suicide, a leading cause of death among college students.²⁶ These data highlight the importance of these potentially serious psychological conditions, appropriately contextualize drug and alcohol abuse compared with other serious maladies and reinforce the critical nature of having appropriate behavioral health care accessible to students.

The annual rates of utilization of health services, as well as the proportion of groups of students with common conditions, provide valuable perspectives regarding resource use and epidemiologic trends among certain subpopulations. Each year, 16% of all enrolled students are seen at least once for prevention-related clinical services, increasing to 35% among the youngest students. Students enrolled at private schools receive diagnoses related to preventive services more often than students at public schools. Females, who have a greater need for contraceptive services, utilize preventive services much more than males. Females are seen in higher proportions for 3 of the common diagnostic categories compared with males.

Age was also an important epidemiologic factor, with younger students seen more commonly for respiratory and non-sexually transmitted infections. Younger students may be more vulnerable to exposure to these communicable diseases because they are more likely to live in residential housing, enroll in large introductory classes, and engage in crowded social gatherings.

Although ethnicity was strongly associated with increased utilization of services, it proved to be less important in terms of prevalence of common diagnoses. Students identified as African American, Asian, and Hispanic were seen in higher proportions for preventive diagnostic categories than whites and Native Americans. Hispanics were observed to have somewhat higher rates of respiratory conditions, whereas Asians were observed to have the lowest proportion with mental health conditions, likely due to recognized cultural barriers to seeking care for psychological issues.^{27,28} Frequencies among all other common categories were very similar.

Limitations

These data provide the most comprehensive portrayal to date of the utilization of health care services and the epidemiology of common clinical conditions among college students at 4-year institutions in America. However, there are limitations to the present study. Since schools' participation in this network was predicated on having EHR and the internal resources necessary to support the project, participating institutions do not constitute a random sample. Nonetheless the demographics of the 23 network schools are a very close match to the 108 4-year Carnegie Research Universities/Very High.¹⁴ These findings are therefore directly generalizable only to this category of institutions. Thirteen of 23 schools (375,000 enrolled students) include ethnicity in their EHR data. Therefore, our analysis among ethnic groups is limited to a subpopulation of approximately half the enrolled students in CHSN. However, the rates of utilization for primary care are close to those observed for racial groups in the general population,²¹ suggesting that CHSN data are representative of these students as well. Also, since EHR files do not include information about same-day appointments, we cannot assess the degree of urgency of a given condition. Acuity and chronicity can only be estimated based on the specific diagnosis (eg, acute respiratory infection or diabetes mellitus).

Although annualized data conform to common usage and therefore support comparison with other data sets, a college population varies greatly in size throughout the course of a year, because of academic, summer, and holiday breaks. Annualized data mask these variations, which not only affect use of student health services but also increase the potential use of other health care resources during those times. Furthermore, enrollment data from the Department of Education are updated for all 23 network schools biennially. Characteristics of enrolled students in general remain very stable over consecutive years, but any substantial variation in enrollment for a given school could introduce inaccuracies to the estimated annual prevalence of common diagnostic categories. Finally, patient and visit typologies rely on ICD-9 and CPT codes entered by providers. It is impossible to know precisely how providers code each visit. The aggregation of diagnostic codes into groups and categories helps to minimize variations in coding practices. The similarity in the order of frequency of the most common conditions among private and public schools suggests consistent coding by clinicians.

Conclusions

CHSN provides population-based estimates of both service utilization and prevalence of common conditions—data never before available to higher education. Facilities appear to be accessible to all students; groups traditionally underrepresented in US health care systems are utilizing campus resources at robust rates. Although still used for urgent and episodic care, campus health services are used for a wide

range of preventive and behavioral health care as well. The epidemiologic data available from CHSN provide a better understanding of the clinical needs of subpopulations of students and may help colleges plan appropriate services.

Finally, the data suggest areas for further investigation such as the differences in utilization rates between private and public universities, finer granularity and understanding of utilization differences by sex (eg, male utilization is much lower, suggesting a need for outreach services specific to male college students), age, and race/ethnicity as well as within diagnostic categories such as mental health, substance abuse, travel health, and STIs. As college health services face new levels of accountability and reorganization, CHSN offers the capability of more rigorous assessments of the health care needs and service utilization of American college students.

ACKNOWLEDGMENTS

The authors wish to thank the leadership of the participating schools for their commitment of time and resources to the College Health Surveillance Project and to their vision for furthering a better understanding of the epidemiology and health care needs of America's college students.

FUNDING

Initial development of CHSN was provided by the Centers for Disease Control and Prevention for the first 2 years of the project. The Department of Student Health and the National Social Norms Institute of the University of Virginia have provided subsequent ongoing support.

CONFLICT OF INTEREST DISCLOSURE

The authors have no conflicts of interest to report. The authors confirm that the research presented in this article met the ethical guidelines, including adherence to the legal requirements, of the United States and received approval from the Institutional Review Board of the University of Virginia.

SUPPLEMENTAL MATERIAL

Supplemental data for this article can be accessed on the publisher's Web site at <http://dx.doi.org/10.1080/07448481.2015.1055567>.

NOTE

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Received: 4 September 2014

Revised: 14 April 2015

Accepted: 12 May 2015