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## US campus fraternities and sororities and the young adult injury burden

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### Abstract

**Objective**—To investigate whether the presence of fraternities and sororities was associated with a higher local injury rate among undergraduate-age youth.

**Methods**—In 2016 we compared the rate of 2010–2013 youth (18–24 years) emergency department (ED) visits for injuries in Hospital Service Areas (HSA) with and without fraternities and sororities. ED visits were identified in the State Emergency Department Database (n=1,560 hospitals, 1,080 HSAs, 16 states). US Census Bureau and National Center for Education Statistics sources identified HSA population and campus (n=659) characteristics. A proprietary database identified campuses with fraternities and sororities (n=287). ED visits explicitly linked to fraternities and sororities in the National Electronic Injury Surveillance System–All Injury Program were used to identify injury causes for sub-group analysis.

**Results**—HSAs serving campuses with fraternities and sororities had lower age 18–24 injury rates for all causes except firearm injuries (no difference).

**Conclusions**—Fraternities and sororities were not associated with a higher injury rate at the population level among undergraduate-age youth. A major limitation is not being able to observe campus health services utilization.

### Keywords

College fraternities and sororities; emergency service; hospital; wounds and injuries

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Journalistic accounts and medical case reports of college campus injuries—particularly related to alcohol poisoning, sexual assault, and hazing—have occasionally highlighted

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campus fraternities and sororities as risk factors for injuries.<sup>1–3</sup> Several studies have reported students' fraternity or sorority society membership or party attendance are associated with consumption of alcohol and illicit drugs.<sup>4–11</sup> Other studies have reported that society membership and fraternity party attendance are significantly associated with sexual assault, and that male fraternity members may be more likely than non-members to perpetrate sexual assault.<sup>12–14</sup> Jury awards and insurance pay-outs highlight instances in which campus fraternities and sororities were determined to be responsible for student injuries.<sup>15</sup>

The relationship between campus fraternities and sororities and injuries has typically been studied through voluntary student surveys, which are limited in a few ways with respect to this topic. First, voluntary surveys may suffer from participation bias. Second, most previous studies of this topic have not thoroughly addressed the potential endogeneity of fraternity and sorority participation to observed health outcomes (or, the question of whether students who participate in society activities would experience the same outcomes even in the absence of society participation).<sup>10</sup> Third, previous studies have typically defined fraternity and sorority influence through students' formal society membership; however, it is possible that fraternities and sororities influence health outcomes among youth who are not members. For example, society residences may be open to non-members for social events. To add to previous survey-based scholarship on fraternities and sororities and associated health outcomes, this study aimed to use geographic analysis methods to investigate whether the presence of fraternities and sororities on US college campuses was associated with a higher local injury rate among undergraduate-age youth.

## Methods

This study did not include human participants. In 2016, publicly available administrative data from multiple sources was aggregated into a commonly used geographic health care population unit of analysis, the Hospital Service Area (HSA). We compared the population rate of treat-and-release emergency department (ED) visits for injuries among youth age 18–24 years old (or, age 18–24 injury rate) in 2010–2013 in HSAs serving campuses with and without fraternities and sororities and HSAs without campuses (hereafter, HSA type). The primary outcome measures for this study were regression-adjusted age 18–24 injury rates by HSA type and injury cause (e.g., poisoning).<sup>16</sup>

### Population characteristics of Hospital Service Areas

Each HSA (n=3,436 nationwide) represents a collection of zip codes whose residents receive most of their hospitalizations from the hospitals in that area.<sup>17</sup> Zip codes are assigned to HSAs based on where the greatest proportion of Medicare residents are hospitalized, though HSAs are valid for younger populations.<sup>17</sup> Most HSAs contain only one hospital. Using HSA geographic boundary files from the Dartmouth Atlas,<sup>18</sup> the following population data from the US Census Bureau was extracted for each HSA and included in a regression model of HSAs' age 18–24 injury rate (model described below): annual population count age 18–24 years old by sex,<sup>19,20</sup> annual proportion of population by race/ethnicity (all ages; not available for 18–24 years old),<sup>21,22</sup> annual average individual income (all ages; standardized across study years to 2014 US dollars using the Consumer Price Index),<sup>23,24</sup> annual

proportion of population in poverty (all ages),<sup>25</sup> and proportion of population with urban residence at the most recent Census <sup>26</sup> (all ages and only available for 2010).

### **Emergency department injury visits by Health Service Area**

HSAs included in this analysis (hereafter, analysis HSAs) were located in states that reported annual data in the 2010–13 (most recent data at the time of the analysis) Healthcare Cost and Utilization Project State Emergency Department Database (HCUP-SEDD) and allowed linking with the American Hospital Association (AHA) Survey for hospitals' geographic identification. HCUP-SEDD reports all hospital ED visits that do not result in hospitalization (i.e., treat-and-release; hereafter, ED visits), including patients transported to a different hospital for admission.<sup>27</sup> Analysis states (n=16) are reported in Table 1 notes. The analysis included 2–4 years of data for each state. HSAs with hospitals not reported in HCUP-SEDD, including non-community hospitals, were not included. The analysis included nearly one-third (or, 1,080/3,436) of HSAs nationwide (Table 1), and 1,560 hospitals.

ED visits for injuries were identified using an HCUP-SEDD indicator.<sup>28</sup> External cause of injury codes (or, E-codes) reported in HCUP-SEDD records were used to classify injuries by cause (e.g., poisoning) using standard criteria.<sup>16</sup> Not all HCUP-SEDD injury records include E-codes, which are reported in addition to diagnostic codes on patients' ED visit records at clinicians' discretion. The annual age 18–24 injury rate by cause per HSA was calculated as the HSA's number of ED injury visits by cause by year for patients age 18–24 divided by the HSA's age 18–24 population by year.

### **Campuses with and without fraternities and sororities by Health Service Area**

National Center for Education Statistics Integrated Post-secondary Education Data System (IPEDS) identified the location and characteristics of US undergraduate campuses during the analysis years 2010–13.<sup>29</sup> Institutions with campuses in the 50 US states that granted bachelor's degrees and offered on-campus housing for the entire study period (n=1,706; hereafter, colleges) were identified. The presence of fraternities and sororities on a given campus is not described in IPEDS or other publicly available data sources of which we are aware. Instead, proprietary data shared by Niche.com was used to identify campuses with fraternities and sororities (n=834/1,706, or 49%, of campuses nationwide, and n=287/659, or 44%, of campuses in the analysis HSAs) (Table 1). Niche.com's data on fraternities and sororities was collected 2009–15. For this study we assumed the presence or absence of fraternities and sororities by campus did not change from 2010–2013.

### **Injury subgroup analysis**

A subgroup analysis of ED visits for injuries by cause among HCUP-SEDD records was informed by a separate small sample of ED injury visit records from the National Electronic Injury Surveillance System–All Injury Program (NEISS-AIP). NEISS-AIP is a nationally representative sample of hospital EDs (n=66), reporting approximately 500,000 nonfatal injury-related ED visits annually. NEISS-AIP ED visit records include patient age, sex, diagnosis, body region affected, consumer products involved, disposition at discharge,

location where injury occurred, and abstracted clinicians' notes (or, case narratives) describing the cause of injury.

From 2001–13 NEISS-AIP annual data, a text search of case narratives for ED injury visits by patients, age 18–24 years, identified records where the attending clinician had used the words “Greek,” “fraternity,” or “sorority” to describe what had caused the patient’s injury. Three authors (CP, SF, WMH) individually reviewed the selected NEISS-AIP records (n=166), and included by consensus those in which case narratives indeed indicated fraternity or sorority involvement—i.e., an injury occurred at a society residence, during society activities, or the patient was noted as a society member by the attending clinician. Four records were excluded that did not refer to fraternities or sororities (for example, an injury sustained at a neighborhood Greek national culture festival). This modest sample size was not sufficient to generate a weighted analysis of fraternity and sorority injuries, as is the typical approach with NEISS-AIP data by injury type. Instead, fraternity and sorority-related injuries by cause and intent from the selected NEISS-AIP records (n=162) were translated to E-codes to identify the same injury types by cause and intent in HCUP-SEDD, generating a subgroup of injury causes (“fraternity/sorority-related”) for separate investigation.<sup>16</sup>

## Analysis

ArcGIS 10.3 (Esri Inc., Redlands, California) was used to match annual data from AHA, US Census, and IPEDS to HSAs, based on Dartmouth Atlas HSA geographic boundaries. SAS<sup>®</sup> 9.3 (Cary, North Carolina) was used for data linking by HSA identifier. To examine differences among HSAs by type beyond the presence of fraternities and sororities, two-sided t-tests with HSA-clustered variance (due to multiple observations of the same HSA during the study period) compared: 1) population characteristics among analysis HSAs versus nationwide HSAs by HSA type, and 2) population characteristics among analysis HSAs with fraternities and sororities versus analysis HSAs with no fraternities or sororities.

Comparison of adjusted injury rates in HSAs with fraternities and sororities versus those without was conducted in three steps. First, ordinary least squares panel linear regression models (*xtreg* Stata<sup>®</sup> 13 College Station, Texas) using HSAs’ age 18–24 injury rates by cause as the dependent variable controlled for population characteristics (i.e., logged age 18–24 population size, proportion of males among age 18–24 population, proportion of the age 18–24 population that were students, logged average all-ages annual individual income, proportion of all-ages population below poverty level, and proportion of all-ages population by race/ethnicity), as well as fixed HSA and year effects. (The Census counts residential college students at their institutional location, therefore Census data were used for model covariates; undergraduate student characteristics are reported in Table 1 for reference.) Second, adjusted injury rates by cause and HSA type were calculated as the mean of those model-predicted values (*margins* Stata 13). Third, two-sided t-tests compared average age 18–24 regression-adjusted ED injury visit rates by cause among analysis HSAs with fraternities and sororities versus analysis HSAs without fraternities and sororities.

## Results

### Fraternity and sorority-related injury categories from the NEISS-AIP records

Among the small sample of NEISS-AIP records (n=162) in which clinicians documented fraternity or sorority involvement in patients' injuries, the highest frequency injuries by cause were unintentional falls, both intentional and unintentional struck by/against, unintentional poisonings, other specified unintentional injuries (Figure 1; see figure notes for selected injury type definitions). Injuries with the same cause and intent as fraternity/sorority-linked injuries in the NEISS-AIP records were separately analyzed among HSAs with and without fraternities and sororities, as described in the next section.

### Analysis Health Service Area characteristics compared to nationwide Health Service Area characteristics

There were few and modest significant differences in population characteristics among analysis HSAs compared to nationwide HSAs by type (Table 1, depicted in "Analysis states" columns with \* symbol). For example, the average age 18–24 year population size of analysis HSAs serving no campuses was slightly larger than comparable HSAs by type nationwide, and the average proportion of males in the age 18–24 population was slightly higher in analysis HSAs serving campuses without fraternities and sororities than in comparable HSAs nationwide. The average individual income in analysis HSAs without fraternities or sororities was higher and the proportion of the population in poverty was lower than comparable HSAs nationwide. The proportion of urban residence among analysis HSAs was substantially higher compared to nationwide HSAs by type. Analysis HSAs had modest differences in terms of population proportion by race-ethnicity compared to nationwide HSA averages by comparable HSA type.

### Population characteristics and injury rates in analysis Health Service Areas serving campuses with fraternities or sororities versus others

HSAs serving campuses with fraternities or sororities had substantially larger age 18–24 general populations and higher proportion of urban residence compared to HSAs without fraternities or sororities, as well as a modestly lower proportion of males age 18–24 years old, modestly higher individual average income and proportion of population in poverty, and larger non-white populations (Table 1, depicted in "All states" and "Analysis states" columns with # symbol). The population differences among undergraduates in HSAs with and without fraternities or sororities mirrored the general age 18–24 population differences.

A high proportion of HCUP-SEDD injury records had associated E-codes that identified injury cause and therefore made it possible to include those records in an analysis of injuries by type (Table 2). Adjusted for HSAs' population characteristics, the most common injury causes among analysis HSAs for the age 18–24 population were struck by/against, falls, and motor traffic vehicles (Table 2). All HSA types had relatively high rates of the type and cause of injuries linked to fraternities and sororities in the NEISS-AIP sample records (Table 2). However, HSAs serving campuses with fraternities or sororities had substantially lower age 18–24 injury rates overall compared to HSAs with no fraternities or sororities (111.4 (standard error [SE]: 0.5) versus 171.3 (0.5) per 1,000 population,  $p < .05$ ) (Table 2) and for

all injury causes, including the injury types identified as fraternity or sorority-related in the NEISS-AIP record sample (multiple comparisons, Table 2), except for firearm injuries, where there was no significant difference.

## Comment

HSAs serving campuses with fraternities or sororities did not have higher rates of ED injury visits among the 18–24 population compared to HSAs without fraternities or sororities. It is important to note that this analysis investigated the existence of a population-level impact from fraternities and sororities and did not directly address injury trends that might exist within campuses; for example, the injury rate at society housing versus other housing on the same campus. Moreover, the finding of lower injury rates at HSAs serving campuses with fraternities and sororities undoubtedly reflects broader population differences among HSAs as categorized here (Table 1). For example, HSAs without fraternities and sororities had significantly smaller and less urban populations, both of which potentially influence injury incidence (Table 1).

Our findings are generally consistent with previous research suggesting college students and young adult graduates may be healthier than non-student peers.<sup>30</sup> A National Crime Victimization Survey study indicated the rate of rape and sexual assault from 1995–2013 was 1.2 times higher for nonstudents than for students (7.6 versus 6.1 per 1,000) among females age 18–24.<sup>31</sup> Although college students drink more and more frequently than non-college peers, observed differences may be due to endogenous factors, rather than college attendance, and researchers have noted student status itself can be difficult to measure.<sup>32</sup> Despite reporting less alcohol consumption, non-college students reportedly experience more drinking-related problems, such as fighting or passing out.<sup>33</sup>

## Limitations

This study was limited to US states that reported ED data through HCUP-SEDD. This analysis included only treat-and-release ED visits (i.e., not ED visits with subsequent inpatient admission to the same hospital). Only an estimated 12% of rape victims receive ED medical treatment, so this study has not addressed whether sexual assault is associated with fraternity and sorority activities.<sup>34</sup> This study's comparison of injury rates by cause relied on E-codes, which are not universally included in hospital discharge datasets, including HCUP-SEDD. This study was not able to account for the influence of other campus activities on the young adult injury rate per HSA; for example, campus sports have been linked to alcohol and drug consumption and injuries, as well as sexual assault.<sup>35</sup> The analytical operationalization of fraternities and sororities as the presence or absence of those organizations on each campus was deemed the best available option for an investigation of this topic that did not rely on voluntary student survey data and used publicly available data. However, given additional opportunities for data, superior options to identify fraternity and sorority influence per campus could include: the proportion of students per campus that were society members, the proportion of total students that attended society events, or a measure of the number or prominence of society events per campus over the study period.

A major limitation of this study's analysis approach is that it was not possible to separately examine the influence of characteristics that were constant, or fixed, within individual HSAs over the study period—owing to the nature of available data, this includes identifiable fixed characteristics, such as the presence of fraternities and sororities, the number of campuses served by each HSA, the relative population size of undergraduate students served by each HSA, and urban proportion of population, as well as fixed characteristics for which we did not have data.

Another major limitation is that this study could not account for campus student health services, which obscure the age 18–24 injury rate observed in community hospitals. A new database of student health services utilization at 23 participating universities reported 12% of student patients attending health services over a 41-month study period were treated for injuries, and those patients were treated over an average of 1.72 visits.<sup>36</sup> Injury visits accounted for approximately 4% (or, 164,457/4,170,415) of total student health center visits over the study period, which, if applied to that study's total annual visit rate (or, 165.5 per 100 enrolled students) suggests injury visits accounted for approximately 0.7 annual visits per 1,000 university students (authors' calculation). Campus health services therefore might account for a very small proportion of injury medical care among the 18–24 population, given that the annual rate of injury visits in hospital EDs serving residential campuses was >100 visits per 1,000 population age 18–24 in this analysis (Table 2). However, campus health services data might provide better opportunities to examine the influence of fraternities and sororities on health outcomes than either voluntary student surveys or the geographic modeling approach we have employed for this study.

## Conclusions

This study did not find a population-level association between the presence of fraternities and sororities and the ED-treated injury rate among undergraduate age youth. For college administrators, this study's results suggest that changes to local policy and practice targeted solely at fraternities and sororities may not reduce injury incidence among campus undergraduate populations. However, a future comprehensive examination of aggregated campus health services data that adequately identifies patient participation in fraternity or sorority activities could provide much firmer evidence regarding a potential link between injuries and fraternities and sororities than this analysis of ED visits in community hospitals was able to provide. Future analysis of this topic should also investigate options for better measurement of injuries that are not reliably identified through health services data, such as injuries related to sexual violence. Overall, this study did not find evidence of a systematic link between the presence of fraternities and sororities and the population youth injury rate, but this does not mean that fraternities or sororities at some campuses could be a causal influence in some student injuries.

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**Abbreviations**

<b>AHA</b>	American Hospital Association
<b>CDC</b>	US Centers for Disease Control and Prevention
<b>E-codes</b>	External cause of injury codes
<b>ED</b>	emergency department
<b>HCUP-SEDD</b>	Healthcare Cost and Utilization Project State Emergency Department Database
<b>HSA</b>	Hospital Service Area
<b>IPEDS</b>	National Center for Education Statistics Integrated Postsecondary Education Data System
<b>NEISS-AIP</b>	National Electronic Injury Surveillance System–All Injury Program
<b>SE</b>	standard error

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Cause	Manner/Intent				
	Self-inflicted	Assault <sup>a</sup>	Unintentional <sup>b</sup>	Undetermined <sup>b</sup>	Other
Cut/pierce	E956	E966	E920.0-.9	E986	E974, E995.2
Drowning/submersion	E954	E964			E995.4
Fall	E957.0-.9	E968.1	E880.0-E886.9, E888	E987.0-.9	
Fire/burn	E958.1,2,7	E961, E968.0,3, E979.3	E890.0-E899, E924.0-.9	E988.1,2,7	
Fire/flame	E958.1	E968.0, E979.3	E890.0-E899	E988.1	
Hot object/substance	E958.2,7	E961, E968.3	E924.0-.9	E988.2,7	
Firearm	E955.0-.4	E965.0-4, E979.4	E922.0-.3,8,9	E985.0-.4	E970
Machinery			E919 (.0-.9)		
Motor vehicle traffic	E958.5	E968.5	E810-E819 (.0-.9)	E988.5	
Occupant			E810-E819 (.0,1)		
Motorcyclist			E810-E819 (.2,3)		
Pedal cyclist			E810-E819 (.6)		
Pedestrian			E810-E819 (.7)		
Unspecified			E810-E819 (.9)		
Pedal cyclist, other			E800-E807(.3), E820-E825 (.6), E826.1,9, E827-E829(.1)		
Pedestrian, other			E800-807(.2), E820-E825(.7), E826-E829(0)		
Transport, other	E958.6		E800-E807 (.0,1,8,9), E820-E825 (.0-.5,8,9), E826.2-8, E827-E829 (.2-9), E831.0-.9, E833.0-E845.9	E988.6	
Natural/environmental	E958.3		E900.0-E909, E928.0-.2	E988.3	
Bites and stings			E905.0-.6,9, E906.0-.4,5,9		
Overexertion			E927.0-.4,8,9		
Poisoning <sup>c</sup>	E950.0-E952.9	E962.0-.9, E979.6,7	E850.0-E869.9	E980.0-E982.9	E972
Struck by/against <sup>d</sup>		E960.0; E968.2	E916-E917.9		E973, E975, E995 (.0,1)
Suffocation	E953.0-.9	E963	E911-E913.9	E983.0-.9	E995.3
Other specified and Classifiable	E955.5,6,7,9, E958.0,4	E960.1, E965.5-9, E967.0-9, E968.4,6,7, E979 (.0-2,5,8,9)	E846-E848, E914-E915, E918, E921.0-9, E922.4,5, E923.0-9, E925.0-E926.9, E928(.3-7), E929.0-5	E985.5,6,7, E988.0,4	E971, E978, E990-E994, E996, E997.0-2
Other specified, not elsewhere classifiable	E958.8, E959	E968.8, E969, E999.1	E928.8, E929.8	E988.8, E989	E977, E995 (.8,9), E997.8, E998, E999.0
Unspecified	E958.9	E968.9	E887, E928.9, E929.9	E988.9	E976, E997.9
All injury	E950-E959	E960-E969, E979, E999.1	E800-E869, E880-E929	E980-E989	E970-E978, E990-E999.0
Adverse effects					E870-E879, E930.0-E949.9
Medical care					E870-E879
Drugs					E930.0-E949.9
All external causes					E800-E999

Notes. Shading indicates this injury type appeared with explicit reference to fraternity or sorority involvement in NEISS-AIP case narratives. Reproduced from [http://www.cdc.gov/injury/wisqars/ecode\\_matrix.html](http://www.cdc.gov/injury/wisqars/ecode_matrix.html) (accessed 4 January 2016). Free ICD-9-CM code definitions available at: [icd9.chrisendres.com/index](http://icd9.chrisendres.com/index)

<sup>a</sup> Includes sexual assault.

<sup>b</sup> Unintentional and unknown not differentiated in NEISS-AIP.

<sup>c</sup> Includes drugs, medicinal substances, biologicals, other solid and liquid substances (e.g., alcoholic beverages), gases, and vapors.

<sup>d</sup> Includes fight or brawl, struck by blunt, thrown, or falling object, or other striking against with or without subsequent fall.

**Figure 1.** Non-fatal injury classification and coding with highlighting for injury categories linked to fraternities or sororities in selected National Electronic Injury Surveillance System–All Injury Program case narratives (n=162 emergency department visits for injuries, 2001–2013).

Hospital Service Area characteristics.

Table 1

Hospital Service Area characteristics (1)	All states						Analysis states (d)		
	No fraternities or sororities in the HSA			HSA serves campuses with fraternities or sororities in the HSA			No fraternities or sororities in the HSA		
	All HSA (2)	HSA serves no campuses (3)	HSA serves campuses with no fraternities or sororities (4)	All HSA (6)	HSA serves no campuses (7)	HSA serves campuses with no fraternities or sororities (8)	All HSA (6)	HSA serves no campuses (7)	HSA serves campuses with fraternities or sororities (9)
Number of HSA, n (% of total HSAs among those with no fraternities or sororities)									
2010	2,838	2,496 (87.9)	342 (12.1)	598	733 (84.4)	135 (15.6)	868	733 (84.4)	202
2011	2,838	2,495 (87.9)	343 (12.1)	598	673 (84.0)	128 (16.0)	801	673 (84.0)	181
2012	2,838	2,493 (87.8)	345 (12.2)	598	547 (84.7)	99 (15.3)	646	547 (84.7)	149
2013	2,838	2,494 (87.9)	344 (12.1)	598	535 (85.6)	90 (14.4)	625	535 (85.6)	140
All Years	11,352	9,978 (87.9)	1,374 (12.1)	2,392	2,488 (84.6)	452 (15.4)	2,940	2,488 (84.6)	672
Unique HSA (all years)	2,838	2,498 (88.0)	346 (12.2)	598	744 (84.7)	135 (15.4)	878	744 (84.7)	202
Population (b)									
Age 18–24, mean (SD)	6,614 (1,492)	3,681 (110)	10,195 (864)	77,618 (7,034)#	12,316 (5,353)	4,752 (222)*	83,653 (12,057)#	4,752 (222)*	83,653 (12,057)#
Age 18–24, % male mean (SD)	52.7 (0.1)	53.0 (0.1)	51.4 (0.2)	50.3 (0.2)#	52.9 (0.1)	53.2 (0.2)	50.1 (0.3)#	52.9 (0.1)	50.1 (0.3)#
Population past 12 months average income (2014 US dollars) (age 15+ years), mean (SD)	\$25,614 (172)	\$24,858 (142)	\$28,674 (521)	\$29,795 (647)#	\$27,573 (306)*	\$26,736 (287)*	\$31,516 (1,647)#	\$27,573 (306)*	\$31,516 (1,647)#
Population below poverty level (all ages), % mean (SD)	15.2 (0.1)	15.4 (0.1)	13.8 (0.3)	15.7 (0.3)	13.8 (0.3)*	13.8 (0.2)*	15.3 (0.5)#	13.8 (0.3)*	15.3 (0.5)#
Population urban residence (all ages), % mean (SD)	51.1 (0.7)	47.2 (0.6)	65.2 (1.5)	83.5 (1.0)#	59.0 (1.6)*	54.0 (1.3)*	88.0 (1.5)	59.0 (1.6)*	88.0 (1.5)
Population race/ethnicity (all ages), % mean (SD) per HSA									
○ Hispanic	10.1 (0.3)	9.7 (0.3)	9.8 (0.7)	13.2 (1.0)#	12.0 (0.9)*	10.8 (0.5)*	16.6 (1.8)	12.0 (0.9)*	16.6 (1.8)
○ Non-Hispanic White	76.6 (0.5)	77.3 (0.4)	77.0 (1.1)	64.3 (1.4)#	76.8 (1.1)	79.1 (0.8)*	61.3 (2.5)#	76.8 (1.1)	61.3 (2.5)#
○ Non-Hispanic Black	7.6 (0.3)	7.6 (0.3)	6.6 (0.5)	15.0 (0.9)#	5.9 (0.4)*	5.3 (0.4)*	13.6 (1.4)#	5.9 (0.4)*	13.6 (1.4)#
○ Non-Hispanic American Indian and Alaska Native	1.8 (0.2)	2.0 (0.2)	1.4 (0.4)	0.6 (0.1)#	1.0 (0.2)*	1.1 (0.2)*	0.4 (0.1)#	1.0 (0.2)*	0.4 (0.1)#
○ Non-Hispanic Asian, Native Hawaiian and other Pacific Islander	2.0 (0.1)	1.7 (0.1)	3.1 (0.3)	4.7 (0.4)#	2.7 (0.2)*	2.2 (0.2)*	5.9 (0.6)	2.7 (0.2)*	5.9 (0.6)
○ Non-Hispanic other race or two or more races	1.8 (0.0)	1.7 (0.0)	2.0 (0.1)	2.2 (0.1)#	1.6 (0.0)*	1.5 (0.0)*	2.1 (0.1)#	1.6 (0.0)*	2.1 (0.1)#
College campuses and undergraduates (c)									
Campuses, total number	872	0	872	834	369	0	287	369	287
Campuses per HSA, mean (SD) number	1.61 (0.07)	0 (0)	1.61 (0.07)	1.39 (0.04)#	1.74 (0.14)	0 (0)	1.42 (0.07)#	1.74 (0.14)	1.42 (0.07)#
Student population size, mean (SD)	2,597 (319)	0 (0)	2,597 (319)	6,639 (225)#	2,791 (791)	0 (0)	6,737 (446)#	2,791 (791)	6,737 (446)#

Hospital Service Area characteristics (1)	All states				Analysis states (a)			
	No fraternities or sororities in the HSA		HSA serves campuses with no fraternities or sororities (4)		No fraternities or sororities in the HSA		HSA serves campuses with no fraternities or sororities (8)	
	All HSA (2)	HSA serves no campuses (3)	HSA serves campuses with no fraternities or sororities (4)	HSA serves campuses with fraternities or sororities (5)	All HSA (6)	HSA serves no campuses (7)	HSA serves campuses with fraternities or sororities (8)	HSA serves campuses with fraternities or sororities (9)
Student population male, % (SD)	46.9 (1.0)	0 (0)	46.9 (1.0)	45.1 (0.6)	52.3 (2.3)*	0 (0)	52.3 (2.3)*	46.5 (1.7)#
Student race / ethnicity, % (SD)								
○ Hispanic or Latino	7.4 (0.5)	0 (0)	7.4 (0.5)	7.9 (0.5)	7.5 (0.7)	0 (0)	7.5 (0.7)	9.1 (0.7)*
○ White	66.4 (1.1)	0 (0)	66.4 (1.1)	60.0 (1.0)#	68.7 (2.1)	0 (0)	68.7 (2.1)	59.5 (1.8)#
○ Black or African American	9.2 (0.6)	0 (0)	9.2 (0.6)	14.1 (0.8)#	7.7 (0.8)*	0 (0)	7.7 (0.8)*	11.3 (1.1)
○ American Indian or Alaska Native	2.3 (0.5)	0 (0)	2.3 (0.5)	0.8 (0.1)#	0.9 (0.4)*	0 (0)	0.9 (0.4)*	0.5 (0.0)*
○ Asian, Native Hawaiian or other Pacific Islander	2.9 (0.2)	0 (0)	2.9 (0.2)	4.3 (0.3)#	2.9 (0.3)	0 (0)	2.9 (0.3)	5.3 (0.4)
○ Two or more races	1.8 (0.1)	0 (0)	1.8 (0.1)	2.1 (0.1)	1.5 (0.1)*	0 (0)	1.5 (0.1)*	1.9 (0.1)#
○ Race/ethnicity unknown (c)	10.0 (0.5)	0 (0)	10.0 (0.5)	10.9 (0.4)	10.9 (0.8)	0 (0)	10.9 (0.8)	12.5 (0.8)*

Notes. ED emergency department, HCUP-SEDD Healthcare Cost and Utilization Project - State Emergency Department Database, HSA Hospital Service Area, SD standard deviation.

\* p < 0.05 for two-sided t-test (proc survey reg, variance clustered by HSA, SAS 9.3) comparing mean values between HSAs serving campuses with fraternities or sororities in analysis states versus all states (i.e., Column 6 versus Column 2, Column 7 versus Column 3, Column 8 versus Column 4, and Column 9 versus Column 5).

# p < 0.05 for two-sided t-test (proc survey reg, variance clustered by HSA, SAS 9.3) comparing mean values between HSAs serving campuses with fraternities or sororities versus HSAs with no fraternities or sororities, within all states (i.e., Column 5 versus Column 2) or analysis states (i.e., Column 9 versus Column 6).

(a) Analysis states: AZ, CA, FL, IA, KY, MA, MD, NC, NE, NJ, NV, NY, RI, UT, VT, WI. Not all states had data for all years.

(b) Unit of analysis is HSA-year.

(c) Includes non-US resident students, based on reference source data.

**Table 2**

Adjusted age 18–24 mean (standard error) rate of emergency department-treated injuries per 1,000 population by Hospital Service Area type in analysis states.

Injury type	No fraternities or sororities in the HSA			
	All HSA (n=2,490 <sup>a</sup> )	HSA serves no campuses (n=2,448 <sup>a</sup> )	HSA serves campuses with no fraternities or sororities (n=452 <sup>a</sup> )	HSA serves campuses with fraternities or sororities (n=672 <sup>a</sup> )
All injuries	171.3 (0.5)	175.9 (0.6)	146.1 (0.9)	111.4 (0.5)*
Injuries with external cause reported	160.7 (0.6)	164.9 (0.6)	137.5 (0.9)	104.7 (0.5)*
Injuries by external cause				
● Fraternity/sorority-related <sup>b</sup>	125.8 (0.5)	129 (0.5)	108.1 (0.7)	82 (0.4)*
● Cut/pierce	19 (0.1)	19.6 (0.1)	15.5 (0.1)	11.1 (0.1)*
● Drowning/submersion	0.1 (0.0)	0.1 (0.0)	0.0 (0.0)	0.0 (0.0)*
● Falls	26.6 (0.1)	27.1 (0.2)	23.3 (0.2)	17.3 (0.1)*
● Fire/flame	0.8 (0.0)	0.8 (0.0)	0.5 (0.0)	0.3 (0.0)*
● Hot object/substance	2.1 (0.0)	2.2 (0.0)	1.8 (0.0)	1.3 (0.0)*
● Firearms	0.4 (0.0)	0.4 (0.0)	0.4 (0.0)	0.4 (0.0)
● Machinery	1.2 (0.0)	1.3 (0.0)	0.8 (0.0)	0.5 (0.0)*
● Motor-traffic vehicles	22.5 (0.1)	22.9 (0.1)	20.1 (0.2)	15.8 (0.1)*
● Natural/environmental	1.4 (0.0)	1.5 (0.0)	0.9 (0.0)	0.6 (0.0)*
● Bites and Stings	6.8 (0.1)	7.1 (0.1)	5.3 (0.1)	3.6 (0.0)*
● Overexertion	16.3 (0.1)	16.8 (0.1)	13.9 (0.2)	10.7 (0.1)*
● Poisoning	3.7 (0.0)	3.9 (0.1)	2.9 (0.0)	2.5 (0.0)*
● Struck by/against	28.8 (0.1)	29.3 (0.2)	25.9 (0.2)	20.6 (0.1)*
● Suffocation	0.1 (0.0)	0.1 (0.0)	0.1 (0.0)	0.1 (0.0)*
● Other specified, classifiable	8.6 (0.1)	8.9 (0.1)	6.8 (0.1)	4.8 (0.0)*
● Other specified, NEC	5.1 (0.1)	5.0 (0.1)	5.5 (0.1)	3.8 (0.1)*
● Unspecified	11.2 (0.1)	11.5 (0.1)	9.6 (0.2)	8.5 (0.1)*
● Medical Care	0.1 (0.0)	0.1 (0.0)	0.1 (0.0)	0.1 (0.0)*
● Drugs	0.1 (0.0)	0.1 (0.0)	0.1 (0.0)	0.1 (0.0)*

Notes. HSA Health Service Area, NEC Not elsewhere classifiable.

\* p<0.05 for two-sided t-test of injury rates among HSAs serving campuses with fraternities or sororities (i.e., last column) versus all HSAs without fraternities or sororities (i.e., second column). Adjusted rate calculated as average model-predicted value of injury rate by cause by HSA type, controlling for variables described in the text. Fixed-effects regression panel model estimated with Stata 13 xtreg, model-predicted average values and SE estimated with Stata 13 margins.

<sup>a</sup>Unit of analysis is HSANUM-year (sample sizes reflect Table 1 “All years” data in “Analysis states,” columns 6–9).

<sup>b</sup>Includes injuries by cause and intent identified in National Electronic Injury Surveillance System–All Injury Program where case narratives noted involvement of fraternities or sororities (Figure 1).