



Frequency, Method, Intensity, and Health Sequelae of Sexual Choking Among U.S. Undergraduate and Graduate Students

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Received: 7 September 2021 / Revised: 22 April 2022 / Accepted: 23 April 2022 / Published online: 28 July 2022
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Abstract

Although sexual choking is now prevalent, little is known about how people engage in choking in terms of frequency, intensity, method, or potential health sequelae. In a campus-representative survey of undergraduate and graduate students, we aimed to: (1) describe the prevalence of ever having choked/been choked as part of sex; (2) examine the characteristics of choking one's sexual partners (e.g., age at first experience, number of partners, frequency, intensity, method); (3) examine the characteristics of having been choked during sex; and (4) assess immediate responses of having been choked including the extent to which frequency and method (e.g., hand, ligature, limb) of having been choked predicts the range of responses endorsed by participants. A total of 4254 randomly sampled students (2668 undergraduate, 1576 graduate) completed a confidential online survey during Spring 2021. The mean age of first choking/being choked was about 19, with more undergraduates than graduate students reporting first choking/being choked in adolescence. Women and transgender/gender non-binary participants were significantly more likely to have been choked than men. Participants more often reported the use of hands compared to limbs or ligature. Common responses to being choked were pleasurable sensations/euphoria (81.7%), a head rush (43.8%), feeling like they could not breathe (43.0%), difficulty swallowing (38.9%), unable to speak (37.6%), and watery eyes (37.2%). About 15% had noticed neck bruising and 3% had lost consciousness from being choked. Greater frequency and intensity of being choked was associated with reports of more physical responses as was use of limb (arm, leg) or ligature.

Keywords Non-fatal strangulation · Manual strangulation · Choking during sex · BDSM · Sexual behavior

Introduction

Research from the United States, United Kingdom, and Germany demonstrates that sexual choking/strangulation has become prevalent among young adults, disproportionately

affects women, often begins in adolescence, and is frequently first learned about through pornography, social media, partners, and friends (Herbenick et al., 2020, 2021c, 2022b; Savanta Com Res, 2019; Sun et al., 2017; Wright et al., 2015). In a random sample survey of 4,989 U.S. college

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students, 58% of women had ever been choked during sex, and one quarter of women were first choked by age 17 (Herbenick et al., 2021c). In New Zealand, sexual choking has been identified as a growing trend among youth (Beres et al., 2020). The rise of partnered sexual choking is a substantial change for a sexual practice that—while well-documented across centuries (Tarr, 2016)—has long been considered uncommon, controversial, and high risk, including in kink and BDSM communities (e.g., Savage, 2017; Sheff, 2021; Wakefield, 2021).

The term *choking* refers to people using one or both hands, limbs (e.g., forearms), and/or ligatures (e.g., belt, tie) to press against or squeeze the neck (Herbenick et al., 2022b), making it a form of strangulation (Sauvageau & Boghossian, 2010). As people commonly call this behavior “choking” (Doucette, 2014; Gilmour, 2017; Joshi et al., 2012; Sauvageau, 2010; Savage, 2020), we use that term here except where the literature specifically refers to it as breath play or “strangulation,” the latter most often found in forensic, sexual assault, and intimate partner violence (IPV) literature. Indeed, choking/strangulation has increased as feature of sexual assault, particularly of women (Cannon et al., 2019; White et al., 2021). Further, unwanted and/or non-consensual choking sometimes occurs during otherwise consensual sexual experiences—e.g., when a person consents to sex but does not consent to be choked (Herbenick et al., 2019).

Choking Frequency and Method

Even though sexual choking is now prevalent, little is known about how people engage in choking in terms of frequency, intensity, and method (e.g., use of hands, ligature) apart from qualitative interviews and one prior campus-representative survey of randomly sampled undergraduate students (Herbenick et al., 2021c, 2022b, 2022c). Understanding how sexual choking is enacted is important as choking/strangulation method and frequency have been predictive of health sequelae, at least as part of IPV and sexual assault (Messing et al., 2018; Smith et al., 2001). In prior interview studies, participants indicated that their partner(s) usually used one hand to choke them and at various intensities. Few women described their partner(s) using a forearm, ligature, or both hands for choking, and the use of both hands was sometimes characterized as more aggressive or frightening compared to the use of one hand. In terms of frequency, the campus-representative college student survey found that 37% of women and 7% of men undergraduate students had been choked during sex more than five times (Herbenick et al., 2022c), but method and intensity were not assessed.

Physical Responses of Choking/Strangulation

Sexual choking involves pressing against or squeezing the blood vessels and/or airways in the neck, thus reducing the flow of oxygenated blood to and from the brain and potentially interfering with breathing. To understand the effects of acute cerebral anoxia and why wartime pilots were losing consciousness in flight, experimental research carried out in 1941 and 1942 (and unlikely to receive ethics approval today) involved applying an inflatable cervical cuff to the necks of more than one hundred male prisoners and to patients with schizophrenia, totaling about 500 neck compressions (Kabat & Anderson, 1943). As pressure around the neck increased, certain physical responses were predictably ordered among the research subjects. Within seconds of the application of pressure, subjects’ eyes became fixed, they experienced vision changes (e.g., blurred vision, seeing spots), vision loss, tearing up, and—after about 6 to 7 s—loss of consciousness (LOC) (Kabat & Anderson, 1943; Smith et al., 2011). Some subjects lost urinary control after about 15 s or lost bowel control after about 30 s of having their neck compressed/strangled (Kabat & Anderson, 1943). Upon regaining consciousness, subjects appeared dazed, confused, and often had a “foolish smile.” The latter may have reflected feelings of pleasure or euphoria that have since been associated with reoxygenation following choking/strangulation among youth playing The Choking Game (Linkletter, 2010).

The research, which involved subjects now widely recognized as vulnerable populations (e.g., Smith et al., 2011), has nevertheless been foundational to understanding some of the physical effects of cerebral hypoxia and anoxia in humans as well as how the physical responses correspond to duration of strangulation. However, given the limited time frame in which subjects were observed following the release of the pressure around their neck, the researchers may have been premature to conclude that there were no negative repercussions from the experiment. Since then, it has been found that strangulation can lead to long-term health sequelae, even in the absence of immediate observable outcomes. These include recurrent headaches, depression, anxiety, and injury; death is also a possible outcome (Bichard et al., 2021; Macnab et al., 2009; Suleman et al., 2021; Zilkens et al., 2016).

Recognizing the potential for health risks, neurologists have cautioned against neck compression that results in restricting blood flow to and from the brain (Berkman et al., 2020). Sexual choking is likely enacted in unique ways that distinguish it from choking/strangulation occurring in The Choking Game, IPV, and sexual assault. Consequently, empirical research on sexual choking is needed rather than assuming that all forms of strangulation are equivalent. As

an example, the goal of sexual choking is not usually to cause LOC, as it is in The Choking Game; however, about 2% of undergraduates who have ever been choked during sex have lost consciousness while being choked (Herbenick et al., 2021c), reflecting neural stress similar to hypoxia/ischemic injury and mild traumatic brain injury (mTBI). It is also well known that people who have been strangled may experience TBI symptoms even without LOC (Murray et al., 2016). The importance of examining strangulation-related alterations in consciousness (e.g., dizziness, loss of consciousness, visual changes) has recently been established (Valera et al., 2022). Sexual choking also differs from IPV and sexual assault in that sexual choking does not usually co-occur with violence, although it may occur in combination with so-called rough sex behaviors such as slapping or punching. Also, some people report being choked harder than felt safe or comfortable, or do not want to be choked and resist it (Herbenick et al., 2022b).

Among young U.S. adults, sexual choking is now a frequent, normative part of consensual sex, with 1 in 3 college women having been choked the most recent time they had sex (Herbenick et al., 2021a). Given its prevalence and frequency, sexual choking may be the most common form of choking/strangulation in the U.S., and it disproportionately impacts women. Yet, aside from case reports and media articles describing unintentional death from consensual sexual choking (e.g., Roma et al., 2013; Schori et al., 2022; Zemek, 2021), and one study demonstrating a cross-sectional relationship between a history of having been choked and poorer mental health (Herbenick et al., 2022a), little is known about potential health sequelae from being choked during sex. Building on prior research related to strangulation in other contexts, a goal of the present study was to characterize sexual choking, how it is enacted, and the physical responses people notice from having been choked. Understanding how people engage in choking and the physical responses they experience from being choked supports the work of those working in sexual medicine, education, research, and therapy.

Study Aims

In a campus-representative survey of undergraduate and graduate students, we aimed to: (1) describe the prevalence of ever having choked/been choked as part of sex; (2) examine the characteristics of choking one's sexual partners (e.g., age at first experience, number of partners, frequency, intensity, method); (3) examine the characteristics of having been choked during sex; and (4) assess immediate responses of having been choked including the extent to which frequency and method (e.g., hand, ligature, limb) of having been choked predicts the range of physical responses endorsed.

Method

Participants

Study protocols were reviewed and approved by the institutional review board at Indiana University. Data are from the 2021 Campus Sexual Health Survey, a confidential online campus-representative survey of undergraduate and graduate students at a large public university in the Midwestern U.S. Campus administrators randomly selected 9604 undergraduate students and 3845 graduate/professional students who were at least 18 years of age ($N = 13,449$) as the sampling frame. Administrators sent the list directly to the campus' survey research center, who administered the survey. In February and March 2021, students received an initial recruitment email and up to three follow-up emails that described the study, invited them to participate, and included a link to learn about the study, indicate consent, and complete the survey.

Participants could enter their email address in a drawing for one of 230 online gift card codes valued at \$20 ($n = 200$), \$50 ($n = 20$), or \$100 ($n = 10$). Of the 13,449 students, seven were ineligible or had their emails returned. The American Association for Public Opinion Research response rate 2 (AAPOR RR2), which includes complete and partial surveys, was 31.6% (3512 complete, 742 partially complete). Survey research center staff removed identifying information in students' open-end responses and created post-stratification weights based on gender/sex and race/ethnicity to correct for under- or over-coverage and to optimize the campus representativeness of the data set. A de-identified dataset was sent to the researchers.

Measures

The survey was developed by an interdisciplinary team with backgrounds in public health, sex research, sexual health education, IPV prevention and advocacy, health behavior, and epidemiology. Given the dearth of research on sexual choking, most choking-specific items were developed with feedback from undergraduate and graduate students.

Background Variables

Students were asked their year in school, race/ethnicity, social fraternity/sorority membership, sexual identity (heterosexual, gay or lesbian, bisexual, pansexual, asexual, something else), race/ethnicity, and relationship status. Even though many people consider pansexuality part of the bisexual umbrella, we included both pansexual and bisexual as options due to research demonstrating similarities and unique features of the

two identities (Galupo et al., 2017; Greaves et al., 2019). For gender identity, we adapted measurement approaches from prior research (Fraser et al., 2020) and provided participants with an open-ended item in which they could describe their gender in their own way. Also, we asked “When we analyze data by gender/sex, which category should we include you in?” (women, men, gender non-binary, transgender women or transfeminine, transgender men or transmasculine, prefer to describe).

Lifetime History of Choking and Being Choked

Using items modified from the National Survey of Sexual Health and Behavior (Herbenick et al., 2010) and the 2016 National Survey of Pornography Use, Relationships, and Sexual Socialization (Herbenick et al., 2020), we asked participants, “How recently have you...” and assessed nine solo and partnered sexual behaviors. The present study focuses on items about having “been choked during sex (e.g., a partner pressed or squeezed your neck with their hands, arm, or an object, etc.)” or “choked a partner during sex (e.g., you pressed or squeezed a partner’s neck with your hands, arm, or an object, etc.)” Response options were never, more than a year ago, past year, and past month; categories were dichotomized to never versus ever to indicate lifetime history of choking or being choked.

Age, Partners, and Pleasure in Relation to Choking/Being Choked

Those who indicated they had choked or been choked were asked follow-up questions, including how old they were the first time that they choked/were choked by a partner during sexual activities and the number of different people they had ever choked/been choked by. We also asked participants to indicate to what extent being choked was pleasurable for them (not at all, but I’ve let partner(s) do it because they seem to like it; not at all, and I don’t want people to do it to me; a little; somewhat; very much; other).

Consent

Participants who reported having ever been choked were asked, “Thinking about all the times people have choked you during sex, about what percent of the time was the choking consensual?” Response options ranged from 0 to 100.

Method and Frequency of Choking/Being Choked

We asked participants who had ever choked/been choked, “Using your best guess, about how many times...” they had choked (or been choked) using hands, an arm or leg, via ligation (described as “by wrapping something about their (your)

neck, like a belt, necktie, or scarf”), or “some other way” along with a textbox asking them to describe the method. Responses were open-ended and numerical.

Choking Intensity

Participants were asked “On a scale of 1–10 (1 = very light, 10 = very hard), about how light/hard have you usually choked partners?” (or, “Have people usually choked you during sexual activities?”).

Loss of Consciousness from Being Choked

Those who had ever choked a partner were asked, “Thinking about the times you’ve choked people during sex or sex play, about how many times has someone passed out (lost consciousness) from you choking them?” and were provided with an open-ended textbox.

Responses to Having Been Choked

Participants who had ever been choked were asked, “Thinking about the times you’ve been choked during sex, how has your body responded while you were being choked?” and shown a list of possible responses which they could indicate had occurred never, rarely, sometimes, or often. The list was based on the scientific and clinical literature related to non-fatal strangulation in other contexts as well as interviews with people who have been choked during sex (Herbenick et al., 2022b; Joshi et al., 2012; Sturgeon, 2015). The list included: difficulty swallowing; watery eyes/eyes teared up; could not speak; felt like I couldn’t breathe; felt a head rush; felt pleasurable sensations/euphoria; gasped for air; neck hurt/neck pain; felt scared; vision got blurry; lost vision/couldn’t see; felt dizzy or lightheaded, like I might pass out; lost consciousness/passed out; coughed; neck swelled up during or shortly after being choked; peed/urine leaked out without meaning to; and other physical responses, with a textbox to describe. In addition, we asked participants, “Thinking about your whole life, how many times have you noticed bruises on your neck from being choked during sexual activities?” to which they could select a numerical response.

Statistical Analysis

All analyses were conducted using Stata version 15 with the *svy* commands to account for weighted survey data. Weighted demographic characteristics and lifetime choking history were stratified by undergraduate/graduate student status as well as by gender (men/women/ transgender/non-binary/expansive [TGNB+]). The TGNB+ group included students who described themselves as transgender women, transgender men, non-binary, genderqueer, agender, and other gender

non-conforming identities. Chi-squared tests were conducted to determine if lifetime choking history (ever been choked/ever choked someone) differed between undergraduate and graduate students. Results are organized by undergraduate/graduate category to facilitate comparison of undergraduates' data with prior research and also because sexual choking appears to be an emerging behavior subject to an age cohort effect.

Analyses regarding choking characteristics were restricted to participants who reported ever choking someone or ever being choked. Weighted linear regression was used to test for differences among genders for continuous variables, and chi-squared tests were used for categorical variables; these analyses were conducted separately for undergraduate versus graduate students. For four responses, the reported age at first choking a partner or first being choked by a partner of less than three years was recoded as missing due to the likelihood that it was a typographical error or questionable in terms of its validity, as memories tend to be less reliable prior to age 3 (Eacott & Crawley, 1998). The total number of people that participants reported having choked, or been choked by, was categorized into three groups: 1–5 people, 6–10 people, and more than 10 people. The number of times the participant choked someone or was choked by someone by each method queried was categorized into four groups: 0 times, 1–5 times, 6–10 times, 11–25 times, or more than 25 times. Variables assessing LOC from having been choked during sex and bruises on the neck from having been choked during sex were dichotomized to any versus none.

Differences across genders regarding lifetime experiences of physical responses from being choked were assessed by chi-squared tests. The 16 separate physical responses were summed to create a score describing the range of responses experienced; additionally, a subset of responses that reflect alterations in consciousness (e.g., Valera et al., 2022) were organized within the list. The items “felt pleasurable sensations/euphoria” and “felt scared,” as more psychological responses, were not included in the summed score; results for each separate outcome are presented in the text.

Weighted linear regression was used to identify mean differences in the sum score of physical responses from being choked across genders. Further bivariate analyses using linear regression were conducted to examine the association between (1) the lifetime total number of times (frequency) of being choked, (2) the usual intensity of being choked, (3) ever been choked using ligature, and (4) ever been choked using an arm/leg, respectively, and the range of physical responses experienced from being choked. The lifetime total number of times of being choked was calculated by adding the number of times of being choked with hands, ligature, and an arm or leg. The number of times that participants were choked using a ligature or an arm/leg was also dichotomized (0 vs. 1+) separately to represent whether the participant had ever been

choked using ligature or an arm/leg. Variables that were statistically significantly associated with the range of responses experienced from being choked in bivariate analyses were included in the final adjusted model. A final adjusted linear regression model included the frequency and intensity of being choked, ever been choked using ligature, ever been choked using an arm/leg as well as other relevant covariates such as gender and sexual identity.

Results

A total of 4254 students completed the survey; 10 men were excluded due to mischievous responses. Of 4244 participants (weighted $N=4242$), 2,668 (62.9%) were undergraduate students, and 1576 (37.1%) were graduate students. Over 80% of the responses were complete responses ($n=3505$; 82.6%). All results hereinafter present the weighted data.

Participant Characteristics and Lifetime History of Engaging in Choking

As shown in Table 1, of 4242 total participants, 2104 (49.6%) were men, 2,041 (48.1%) were women, and 93 (2.2%) were TGNB+ participants. The mean age for the total sample was 22.2 years ($SD=5.1$; range 18–67), with mean age being 20.3 years ($SD=2.3$; range 18–53) for undergraduates and 28.5 years ($SD=6.4$; range 21–67) for graduate students. Most participants were white (76.9%) and not in a fraternity or sorority (82.0%). Though most identified as heterosexual (78.9%), sexual identities for TGNB+ participants were more diverse. Approximately three-fourths of the students were either single and not dating (38.7%) or in a romantic relationship (37.0%). Differences were observed across genders, with men being more likely to report having choked someone, women more likely to report having been choked, and TGNB+ students (especially TGNB+ undergraduate students) more likely to report having choked someone as well as having been choked. Additional differences in choking experiences were observed across race/ethnicity, fraternity/sorority affiliation, sexual identity, and romantic relationship status (see Table 1).

Significantly more undergraduate students, compared to graduate students, reported having choked a partner ($\chi^2(1)=28.42$; $p<.001$) or being choked by a partner ($\chi^2(1)=29.89$; $p<.001$); further analyses regarding choking characteristics were stratified by undergraduate/graduate student status. Among undergraduates, 37.1% had ever choked someone (26.7% women, 47.4% men) and 42.1% had ever been choked (57.6% women, 25.4% men); among graduate students 27.6% had ever choked someone (16.2% women, 37.7% men) and 32.1% had ever been choked (41.3% women, 23.5% men).

Table 1 Weighted participant demographics and lifetime choking history by undergraduate/graduate student status and gender

Characteristics	Total (<i>N</i> = 4242) % (<i>n</i>)	Ever been choked			Ever choked someone		
		No (<i>N</i> = 2333)	Yes (<i>N</i> = 1537)	<i>p</i> value	No (<i>N</i> = 2519)	Yes (<i>N</i> = 1346)	<i>p</i> value
		Row % (<i>n</i>)	Row % (<i>n</i>)		Row % (<i>n</i>)	Row % (<i>n</i>)	
Gender				< .001			< .001
Men	49.7 (2104)	75.1 (1414)	24.9 (469)		55.1 (1039)	44.9 (847)	
Women	48.2 (2041)	46.1 (872)	53.9 (1020)		75.7 (1427)	24.3 (459)	
Transgender and gender expansive	2.2 (93)	48.5 (44)	51.5 (47)		55.0 (50)	45.0 (41)	
Age, mean/SD (range)*	22.2/5.1 (18–67)	22.5/5.5 (18–67)	21.7/3.9 (18–54)		22.5/5.5 (18–67)	21.6/3.8 (18–54)	
Year in School				< .001			< .001
1 st year student	21.7 (920)	64.0 (535)	36.0 (301)		69.0 (578)	31.0 (259)	
2 nd year student	17.5 (742)	59.3 (406)	40.7 (279)		63.4 (432)	36.7 (250)	
3 rd year student	17.8 (756)	53.1 (359)	47.0 (318)		57.4 (388)	42.6 (288)	
4 th year senior	17.2 (730)	53.0 (350)	47.0 (310)		60.6 (399)	39.4 (259)	
5 th year senior	2.0 (86)	64.2 (52)	35.9 (29)		58.5 (48)	41.6 (34)	
Graduate or professional	23.7 (1006)	67.8 (629)	32.2 (299)		72.5 (674)	27.5 (256)	
Racial Heritage							
White	76.9 (3236)	56.2 (1665)	43.8 (1297)	< .001	61.8 (1830)	38.2 (1133)	< .001
Black or African American	6.5 (274)	51.6 (134)	48.5 (126)	.012	58.9 (153)	41.1 (107)	.072
American Indian or Alaska native	1.1 (47)	49.3 (23)	50.7 (24)	.138	62.4 (29)	37.6 (18)	.711
Asian Indian	8.0 (336)	82.1 (238)	17.9 (52)	< .001	78.6 (224)	21.4 (61)	< .001
Other South Asian	0.5 (20)	83.0 (17)	17.0 (3)	.066	72.9 (15)	27.1 (5)	.526
Chinese	5.0 (212)	81.8 (163)	18.2 (36)	< .001	87.0 (173)	13.1 (26)	< .001
Korean	1.7 (71)	71.5 (46)	28.5 (18)	.081	78.1 (50)	21.9 (14)	.043
Other East Asian	2.7 (115)	67.2 (74)	32.8 (36)	.160	71.3 (78)	28.7 (31)	.216
Native Hawaiian	0.1 (3)	100.0 (3)	0.0 (0)	.177	100.0 (3)	0.0 (0)	.224
Other Pacific Islander	0.1 (3)	83.5 (3)	16.5 (1)	.281	100.0 (3)	0.0 (0)	.184
Other	2.5 (104)	71.9 (65)	28.2 (25)	.031	66.7 (60)	33.3 (30)	.789
Fraternity or sorority				< .001			< .001
Yes	15.2 (645)	47.0 (266)	53.0 (300)		54.7 (308)	45.3 (255)	
No	82.0 (3474)	62.6 (2001)	37.4 (1194)		67.1 (2142)	32.9 (1052)	
Participating in “rush”	2.8 (118)	61.2 (66)	38.8 (42)		63.2 (68)	36.8 (40)	
Sexual identity				< .001			< .001
Heterosexual	78.9 (3338)	64.3 (1939)	35.7 (1076)		66.6 (2006)	33.4 (1007)	
Gay or lesbian	5.7 (242)	52.5 (120)	47.5 (108)		58.8 (134)	41.2 (94)	
Bisexual	10.4 (438)	38.6 (161)	61.4 (256)		60.1 (249)	39.9 (166)	
Pansexual	2.9 (121)	41.7 (50)	58.3 (70)		47.9 (58)	52.1 (63)	
Asexual	0.8 (33)	87.3 (26)	12.7 (4)		91.4 (27)	8.6 (3)	
Something else	1.4 (60)	61.4 (35)	38.6 (22)		74.9 (42)	25.2 (14)	
Romantic relationship				< .001			< .001
Single and not dating	38.7 (1640)	78.8 (1170)	21.2 (315)		80.6 (1195)	19.4 (288)	
Hooking up with several people	5.1 (216)	33.7 (63)	66.3 (124)		36.4 (68)	63.7 (119)	
Hooking up with someone	6.7 (284)	36.2 (93)	64.8 (163)		51.0 (130)	49.0 (125)	
Dating several people	0.9 (38)	28.5 (9)	71.5 (24)		44.2 (15)	55.9 (18)	
Dating someone	3.2 (135)	48.7 (61)	51.3 (64)		55.3 (70)	44.7 (56)	
In a romantic relationship	37.0 (1566)	48.3 (702)	51.7 (752)		53.9 (782)	46.1 (669)	
In more than one romantic relationship	0.4 (16)	28.6 (4)	71.4 (9)		47.6 (6)	52.5 (7)	
Engaged	2.2 (94)	60.0 (53)	40.0 (35)		67.1 (59)	32.9 (29)	

Table 1 (continued)

Characteristics	Total (<i>N</i> = 4242) % (<i>n</i>)	Ever been choked			Ever choked someone		
		No (<i>N</i> = 2333)	Yes (<i>N</i> = 1537)	<i>p</i> value	No (<i>N</i> = 2519)	Yes (<i>N</i> = 1346)	<i>p</i> value
		Row % (<i>n</i>)	Row % (<i>n</i>)		Row % (<i>n</i>)	Row % (<i>n</i>)	
Married	5.9 (249)	78.0 (178)	22.0 (50)		84.5 (194)	15.5 (36)	

*Age is missing for 935 (22.0%) students (547 undergraduate students, 388 graduate students)

Characteristics of Choking Partners During Sex

Age at First Choking a Partner During Sex

The mean age participants gave for having first choked a partner during sex was 19.3 years ($SD = 2.9$; see Table 2). Among undergraduates, women were significantly more likely to report an older age at first choking a partner as compared to men and TGNB+ students ($F(2, 2402) = 5.99$; $p = .003$). Among undergraduates who had ever choked a partner, 23.6% had first done so between ages 13 and 17 and an additional 32.2% had first choked a partner at age 18 (i.e., more than half had first choked a partner by age 18). Among graduate students who had ever choked a sexual partner, 3.8% had first choked a partner between ages 15 and 17 and an additional 8.9% had first done so at age 18. Taking the combined sample of undergraduate and graduate students into consideration, 19.7% of those who had ever choked a partner first did so by age 17 and an additional 27.6% first choked a partner at age 18.

Number of Partners Choked

Of those with a lifetime history of having choked partners during sex, the mean number of people choked was 2.8 for the total sample ($SD = 6.6$; median = 1; range = 1–120). Among undergraduates, a greater percentage of TGNB+ students (14.7%) compared to women (3.9%) and men (8.6%) reported having choked six or more people ($\chi^2(4) = 36.80$; $p = .009$).

Methods of Choking a Partner

Using hands was the most frequently enacted method, with a mean of 19.3 times ($SD = 65.9$) reported by participants during their lifetime. In general, women reported fewer instances of choking people as compared to people of other genders. Also, statistically significant gender differences were observed among undergraduates regarding choking with hands or an limb as well as graduate students reporting choking with hands or ligature. Write-in responses included

using a belt, collar, foot on neck, shoulder, sitting on throat, clothing, partner's bra, or shirt.

Intensity of Choking Partners

Among those who reported ever choking someone during sex, the usual intensity of choking was reported on a scale of 1 to 10 (1 = very light, 10 = very hard), with an average of 3.8 for the full sample ($SD = 1.7$). Men reported using the full range of intensities (1–10) whereas women reported intensities from 1 to 9 and TGNB+ participants reported intensities from 1 to 7. Women reported using a significantly lower intensity when they choked partner(s) compared to men and TGNB+ participants for both undergraduate ($F(2, 2398) = 16.70$; $p < .001$) and graduate ($F(2, 3030) = 7.14$; $p < .001$) students.

Partner Loss of Consciousness

Fewer than 1% of participants reported that their partner had ever lost consciousness due to their choking them. No statistically significant gender differences were observed for either undergraduate or graduate students.

Characteristics of Being Choked During Sex

Age at First Being Choked During Sex

The mean age that participants were first sexually choked was 19.2 years ($SD = 2.9$; Table 3). Undergraduate men were significantly more likely to report an older age at first being choked by a partner compared to women and TGNB+ undergraduates ($F(2, 2620) = 5.12$; $p = .006$). Among undergraduates who had ever been choked during sex, 25.0% had first been choked between ages 10 and 17; an additional 31.0% were first choked at age 18. Among graduate students who had ever been choked during sex, 6.2% had first been choked by a partner between ages 14 and 17; an additional 11.7% were first choked at age 18. Taking the combined sample of undergraduate and graduate students into consideration, 21.2% had first been choked by a partner by age 17 and an additional 27.0% at age 18.

Table 2 Characteristics of choking people during sex by gender, among those who have ever choked a partner using any method

Characteristics	Total % (n)	Undergraduate			Graduate		
		Men	Women	Trans* and gender expansive	Men	Women	Trans* and gender expansive
		% (n)	% (n)	% (n)	% (n)	% (n)	% (n)
Age first choked a partner, mean/SD (range)*	19.3/2.8 (15–38)	18.4/1.9 (13–35)	18.8/1.9 (15–36)	18.5/3.0 (14–29)	22.3/3.9 (16–38)	22.1/3.0 (16–31)	20.7/3.5 (15–28)
Number of people choked, mean/SD (range)	2.8/6.6 (1–120)	3.0/6.7 (1–110)	2.2/5.3 (1–100)	3.1/2.7 (1–10)	3.7/9.7 (1–120)	2.3/2.6 (1–19)	3.0/2.5 (1–10)
1–5 people*	92.6 (1185)	91.3 (568)	96.2 (361)	85.3 (28)	89.9 (158)	94.2 (63)	92.1 (8)
6–10 people	5.0 (64)	5.8 (36)	2.5 (9)	14.7 (5)	5.8 (10)	3.8 (3)	7.9 (1)
More than 10 people	2.5 (32)	2.8 (18)	1.4 (5)	0.0 (0)	4.3 (8)	2.0 (1)	0.0 (0)
No. of times choked people with hands, mean/SD (range)*§	19.3/65.9 (0–999)	25.7/76.1 (0–999)	7.1/10.7 (0–100)	40.6/167.6 (1–999)	23.2/72.2 (0–999)	7.9/10.7 (0–100)	13.1/14.9 (1–60)
0 times*	1.3 (17)	0.7 (5)	2.4 (9)	0.0 (0)	1.0 (2)	1.9 (1)	0.0 (0)
1–5 times	52.1 (678)	44.5 (283)	65.7 (249)	46.5 (15)	49.5 (88)	58.2 (39)	40.0 (3)
6–10 times	19.7 (256)	20.9 (133)	17.1 (65)	17.2 (6)	20.1 (36)	23.3 (16)	20.7 (2)
11–25 times	14.5 (188)	17.2 (110)	10.9 (41)	10.2 (3)	13.1 (23)	12.7 (9)	26.7 (2)
More than 25 times	12.5 (162)	16.7 (106)	4.1 (15)	26.1 (8)	16.2 (29)	3.9 (3)	12.7 (1)
No. of times choked people with ligature, mean/SD (range)§	0.7/4.6 (0–99)	0.9/6.2 (0–99)	0.3/2.0 (0–30)	0.4/1.7 (0–10)	0.9/3.1 (0–20)	0.2/0.7 (0–5)	/ 1.8 (0–5)
0 times	89.0 (1126)	88.6 (546)	92.8 (344)	91.4 (30)	81.9 (142)	91.8 (60)	62.9 (5)
1–5 times	8.8 (111)	8.9 (55)	6.1 (23)	5.7 (2)	13.3 (23)	8.2 (5)	37.1 (3)
6–10 times	1.2 (15)	1.2 (7)	0.2 (1)	2.9 (1)	3.1 (5)	0.0 (0)	0.0 (0)
11–25 times	0.5 (6)	0.2 (1)	0.6 (2)	0.0 (0)	1.7 (3)	0.0 (0)	0.0 (0)
More than 25 times	0.6 (7)	1.0 (6)	0.3 (1)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
No. of times choked people using an arm or leg, mean/SD (range)*	1.3/6.7 (0–100)	1.5/6.4 (0–100)	0.6/2.7 (0–40)	4.2/17.0 (0–100)	1.7/9.5 (0–100)	1.2/7.8 (0–100)	0.9/3.0 (0–12)
0 times*	83.2 (1046)	80.3 (492)	88.4 (326)	72.3 (23)	83.3 (142)	87.2 (57)	82.9 (7)
1–5 times	11.7 (147)	13.6 (83)	9.2 (34)	14.7 (5)	11.1 (19)	8.3 (5)	10.8 (1)
6–10 times	2.8 (35)	2.9 (18)	1.9 (7)	10.2 (3)	2.5 (4)	3.4 (2)	0.0 (0)
11–25 times	1.7 (22)	2.6 (16)	0.3 (1)	0.0 (0)	2.3 (4)	0.6 (0)	6.3 (1)
More than 25 times	0.6 (8)	0.7 (4)	0.3 (1)	2.9 (1)	0.8 (1)	0.6 (0)	0.0 (0)
Usual intensity of choking people, mean/SD (range)*§	3.8/1.7 (1–10)	4.1/1.7 (1–10)	3.4/1.6 (1–9)	3.8/1.5 (1–7)	3.9/1.7 (1–10)	3.3/1.6 (1–8)	4.4/1.5 (1–6)
Partner has lost consciousness due to choking	0.9 (11)	1.3 (8)	0.0 (0)	4.5 (1)	1.1 (2)	0.0 (0)	0.0 (0)

**p* value < .05 for gender differences among undergraduate students§*p* value < .05 for gender differences among graduate students

Table 3 Characteristics of having been choked during sex by gender, among those who have ever been choked using any method

Characteristics	Total	Undergraduate			Graduate		
		Men	Women	Trans* and gender expansive	Men	Women	Trans* and gender expansive
	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)
Age first choked by a partner, mean/SD (range)*	19.2/2.9 (10–40)	18.9/2.0 (10–27)	18.4/1.7 (14–36)	18.4/3.0 (14–29)	22.3/4.1 (16–37)	21.9/4.1 (14–40)	20.9/3.7 (15–28)
Number of people choked you, mean/SD (range)	2.9/5.5 (1–100)	2.6/4.0 (1–20)	2.9/5.8 (1–100)	3.5/4.0 (1–20)	3.6/8.1 (1–75)	2.9/4.0 (1–30)	3.0/ 2.5 (1–10)
1–5 people	91.3 (1270)	91.7 (268)	91.5 (716)	90.3 (31)	88.7 (94)	91.2 (151)	89.4 (10)
6–10 people	5.7 (79)	3.6 (10)	6.4 (50)	2.7 (1)	6.5 (7)	6.1 (10)	1.6 (1)
More than 10 people	3.0 (42)	4.7 (14)	2.1 (17)	7.0 (2)	4.7 (5)	2.7 (5)	0.0 (0)
No. of times people choked you with hands, mean/SD (range)*§	15.4/30.4 (0–500)	6.7/13.2 (0–120)	17.7/26.7 (0–300)	14.4/16.2 (1–70)	8.2/21.6 (0–220)	25.9/58.4 (0–500)	14.9/24.9 (1–90)
0 times*§	1.6 (233)	4.3 (13)	0.6 (5)	0.0 (0)	2.6 (3)	1.4 (2)	0.0 (0)
1–5 times	49.4 (707)	69.6 (218)	41.4 (327)	44.2 (15)	67.1 (73)	39.7 (68)	47.5 (5)
6–10 times	17.4 (248)	15.6 (49)	17.4 (138)	16.3 (6)	15.0 (16)	21.3 (36)	28.3 (3)
11–25 times	16.7 (239)	6.7 (21)	21.5 (170)	17.8 (6)	8.4 (9)	18.7 (32)	10.0 (1)
More than 25 times	14.8 (212)	3.8 (12)	19.1 (151)	21.7 (7)	6.9 (8)	19.0 (32)	14.3 (2)
No. of times people choked you with ligature, mean/SD (range)	0.5/2.9 (0–50)	0.6/3.7 (0–50)	0.4/2.1 (0–40)	0.3/0.8 (0–4)	0.7/4.4 (0–45)	0.6/3.5 (0–50)	0.9/1.7 (0–5)
0 times	88.8 (1212)	87.9 (263)	89.3 (679)	83.3 (26)	89.9 (93)	89.6 (143)	72.8 (8)
1–5 times	9.6 (130)	10.2 (30)	9.3 (71)	16.7 (5)	7.7 (8)	8.0 (13)	27.2 (3)
6–10 times	0.9 (12)	1.5 (4)	0.7 (6)	0.0 (0)	1.5 (2)	0.6 (1)	0.0 (0)
11–25 times	0.5 (6)	0.0 (0)	0.5 (4)	0.0 (0)	0.0 (0)	1.6 (3)	0.0 (0)
More than 25 times	0.3 (4)	0.5 (1)	0.1 (1)	0.0 (0)	0.9 (1)	0.3 (0)	0.0 (0)
No. of times people choked you using an arm or leg, mean/SD (range)*	1.1/6.9 (0–200)	0.5/1.6 (0–10)	1.7/9 (0–200)	3.3/6.5 (0–30)	1.1/4.4 (0–30)	1.8/9.4 (0–100)	0.9/2.6 (0–12)
0 times*	84.5 (1143)	84.9 (249)	85.1 (643)	60.0 (19)	84.8 (87)	86.7 (137)	72.0 (8)
1–5 times	11.6 (157)	12.6 (37)	11.5 (87)	20.8 (7)	10.3 (11)	8.6 (14)	23.3 (3)
6–10 times	2.3 (31)	2.5 (7)	2.1 (16)	13.3 (4)	0.9 (1)	1.8 (3)	0.0 (0)
11–25 times	0.8 (11)	0.0 (0)	0.8 (6)	2.9 (1)	3.2 (3)	0.5 (1)	4.7 (1)
More than 25 times	0.8 (10)	0.0 (0)	0.6 (5)	2.9 (1)	0.9 (1)	2.4 (4)	0.0 (0)
Usual Intensity of People Choking You, Mean/SD (Range)*	4.1/1.9 (1–10)	3.7/1.7 (1–10)	4.3/1.9 (1–10)	4.5/2.2 (1–8)	4.1/1.8 (1–8)	4.0/1.9 (1–10)	4.8/1.9 (1–9)

Table 3 (continued)

Characteristics	Total	Undergraduate			Graduate		
		Men	Women	Trans* and gender expansive	Men	Women	Trans* and gender expansive
	% (<i>n</i>)	% (<i>n</i>)	% (<i>n</i>)	% (<i>n</i>)	% (<i>n</i>)	% (<i>n</i>)	% (<i>n</i>)
% of the time that choking was consensual, mean/SD (range)	92.1/23.1 (0–100)	92.2/23.8 (0–100)	93.5/20.6 (0–100)	85.1/30.4 (0–100)	92.1/22.8 (0–100)	87.7/29.0 (0–100)	82.7/36.9 (0–100)
Extent that being choked was pleasurable*§							
Not at all, but I've let partner(s) do it because they seem to like it	5.9 (85)	8.7 (27)	4.1 (33)	7.0 (2)	10.4 (11)	5.5 (10)	9.3 (1)
Not at all, and I don't want people to do it to me	3.1 (44)	5.2 (16)	1.2 (33)	2.7 (1)	5.9 (6)	5.6 (10)	16.5 (2)
A little	14.2 (205)	20.4 (64)	10.4 (83)	5.4 (2)	26.1 (29)	15.0 (26)	16.6 (2)
Somewhat	33.8 (486)	36.5 (114)	33.4 (267)	16.3 (6)	37.1 (41)	32.8 (57)	19.0 (2)
Very much	41.1 (592)	26.8 (84)	50.0 (400)	68.6 (23)	16.3 (18)	36.1 (62)	33.8 (4)
Other	2.0 (29)	2.3 (7)	1.0 (8)	0.0 (0)	4.3 (5)	4.9 (8)	4.9 (1)

**p* value < .05 for gender differences among undergraduate students

§*p* value < .05 for gender differences among graduate students

Number of People Who had Choked Them

Participants in the total sample reported having been choked by, on average, 2.9 (SD = 5.5) individuals. There were no statistically significant differences between genders for either undergraduate or graduate students.

Methods of Being Choked

Having been choked with a partner's hands was the most common method reported, with a mean of 15.4 times (SD = 30.4) reported by participants during their lifetime. Among undergraduates who had ever been choked, about one-fifth of women and TGNB+ students had been choked with someone's hands more than 25 times. Women reported higher numbers of instances of having been choked with a partner's hands compared to participants of other genders; this gender difference was statistically significant for both undergraduate ($F(2, 2619) = 35.28; p < .001$) and graduate ($F(2, 3140) = 11.10; p < .001$) students. Statistically significant differences were also observed among undergraduate students regarding being choked with an arm or leg ($F(2, 2570) = 4.53; p = 0.011$); TGNB+ students reported the

highest mean number of times choked using an arm or a leg (mean = 3.3; SD = 6.5). Having been choked with a ligature was uncommon and not significantly different by gender for either undergraduate or graduate students.

Intensity of Having Been Choked

The usual intensity of being choked reported on a scale of 1 to 10 was, on average, 4.1 for the total sample (SD = 1.9). Statistically significant gender differences with respect to choking intensity was observed among undergraduate students ($F(2, 2612) = 11.67; p < .001$); TGNB+ students and women reported being choked at a higher intensity than men. Women and men reported being choked across the full spectrum of possible intensities (1–10); TGNB+ students endorsed intensities of 1–9.

Consent and Pleasure

Students who had been choked by a partner during sex reported that—on average—92.1% of the time choking was consensual. Choking was described as consensual in 100% of instances by 76.5% of women ($n = 864$), 85.6% of

men ($n=286$), and 63.6% ($n=28$) of TGNB+ participants. Also, 41.1% of all participants reported that being choked was very pleasurable, though significant differences were observed across genders among both undergraduate and graduate students. Among undergraduates, a higher percentage of TGNB+ students (68.6%) and women (50.0%) reported that choking was very pleasurable when compared to men (26.8%) ($\chi^2(10)=190.58$; $p<.001$). Fewer graduate students reported that being choked was pleasurable, though a similar trend was observed that more women (36.1%) and TGNB+ students (33.8%) reported that being choked was very pleasurable compared to men (16.3%) ($\chi^2(10)=204.66$; $p=.003$).

Lifetime Experience of Physical and Psychological Responses from Being Choked

Among the 16 physical responses assessed, participants reported a mean of 3.3 responses during their lifetime ($SD=3.4$), with TGNB+ students reporting the highest mean number of responses experienced (4.7; $SD=4.2$) (Table 4). The responses most often endorsed included head rush (43.8%), felt like they could not breathe (43.0%), difficulty

swallowing (38.9%), unable to speak (37.6%), and watery eyes (37.2%). In the total sample, 18.8% reported any alteration in consciousness (e.g., vision got blurry, dizzy/light-headed, LOC). Stratified by gender, 13.7% of men, 20.3% of women, and 33.4% of TGNB+ students reported a history of AIC ($p=.001$).

Statistically significant gender differences were observed for the following responses, with more women and TGNB+ students reporting the following as compared to men: difficulty swallowing, watery eyes/eyes teared up, could not speak, felt like I couldn't breathe, gasped for air, neck hurt/neck pain, bruises on neck, felt a head rush, vision got blurry, and felt dizzy or lightheaded like I might pass out. In addition to physical responses from being choked, 81.7% of participants reported that they felt pleasurable sensations/euphoria (73.3% men, 85.3% women, 82.7% TGNB+; $p<.001$), and 14.3% reported that they felt scared (8.5% men, 16.0% women, 30.4% TGNB+; $p<.001$). As shown in Table 4, women volunteered that they had experienced anxiety attack, bodily warmth, wheezing, crying, extreme fear, increased wetness, headache, easier orgasm petechiae and chest/neck redness. Men wrote in having experienced adrenaline, discomfort, feeling horny, and small scratches or

Table 4 Lifetime experiences of physical responses from being choked by gender

Responses	Total	Men	Women	Trans* and gender expansive	<i>p</i> value
	% (<i>n</i>)	% (<i>n</i>)	% (<i>n</i>)	% (<i>n</i>)	
Difficulty swallowing	38.9 (559)	25.8 (109)	44.0 (427)	51.7 (24)	<.001
Watery eyes/eyes teared up	37.2 (535)	27.1 (115)	41.0 (398)	78.2 (22)	<.001
Could not speak	37.6 (540)	27.0 (114)	41.9 (406)	44.2 (20)	<.001
Felt like I couldn't breathe	43.0 (617)	32.9 (139)	46.7 (452)	58.0 (26)	<.001
Gasped for air	33.4 (478)	19.3 (81)	38.5 (373)	52.8 (24)	<.001
Neck hurt/neck pain	18.5 (266)	14.0 (59)	19.8 (192)	32.4 (15)	.004
Coughed	25.7 (369)	21.8 (92)	27.0 (262)	33.9 (15)	.068
Neck swelled up during or shortly after being choked	3.6 (52)	3.6 (15)	3.5 (34)	7.9 (4)	.331
Bruises on neck	14.8 (211)	10.4 (43)	16.5 (160)	18.6 (8)	.015
Peed/urine leaked out, without meaning to	1.4 (20)	1.6 (7)	1.3 (12)	2.0 (1)	.831
Felt a head rush	43.8 (626)	38.1 (161)	45.6 (440)	56.9 (26)	.011
Other responses*	1.8 (20)	2.8 (9)	1.4 (10)	2.9 (1)	.256
<i>Alterations in consciousness (AIC)</i>					
Vision got blurry	11.9 (171)	6.8 (28)	13.6 (131)	24.9 (11)	<.001
Lost vision/couldn't see	4.0 (58)	2.7 (11)	4.4 (42)	9.1 (4)	.078
Felt dizzy or lightheaded, like I might pass out	15.2 (217)	11.6 (49)	16.1 (156)	26.9 (12)	.012
Lost consciousness/pass out	2.6 (38)	1.5 (6)	3.1 (30)	3.3 (1)	.216
Any AIC	18.8 (268)	13.7 (57)	20.3 (196)	33.4 (15)	.001
Total number of physical responses, mean (SD)	3.3 (3.4)	2.5 (2.7)	3.6 (3.6)	4.7 (4.2)	<.001

*Open-ended responses were as follows, for men: adrenaline, discomfort, horny, I didn't really like it, small scratches or skin discoloration; For women: anxiety attack/shutdown or withdraw, body felt warm, bruises, caused wheezing, cried, extreme fear, got wet or more wet, headache after, orgasm, orgasm easier, petechiae on face one time, redness around chest and neck, tried pulling his hand off my neck. For gender expansive participant: puked after

Note: The total N and the sum of the N's for each gender group may be off by one due to rounding from weighted N's

skin discoloration. A gender non-binary student wrote that they vomited after having been choked.

Choking Frequency, Intensity, and Method in Relation to Physical Responses Experienced

Bivariate analyses examining frequency and intensity of being choked in relation to the range of physical responses experienced found that a greater frequency of being choked and a higher intensity of being choked were each significantly associated with a higher number of responses (Table 5). Having ever been choked by a ligature or limb was also positively associated with the number of physical responses experienced. After adjusting for gender, sexual identity, intensity of having been choked, ever been choked with ligature, and ever been choked with a limb, being choked more than 10 times during their lifetime was positively associated with the number of physical responses experienced, though slightly attenuated compared to the bivariate analysis. After adjusting for gender, sexual identity, total number of times choked, ever choked with ligature, and ever choked with a limb, the association between the usual intensity of being choked and the range of physical responses was also attenuated though still statistically significant. Having ever been choked using ligature or a limb remained positively associated with the range of physical responses experiences in the adjusted model. In addition, women (compared to men) and participants with non-heterosexual sexual orientation identities except for pansexual (compared to heterosexual) reported experiencing a higher number of physical responses even after accounting for frequency and intensity of choking.

Discussion

Our study provides novel empirical data on (1) choking prevalence among both U.S. undergraduate and graduate students, (2) choking method, frequency, and intensity, (3)

physical responses to being choked, and (4) relationships between choking method, frequency, and intensity and physical responses. We found that choking is prevalent, with about 40% of participants having ever been choked during sex, and that it was significantly more prevalent among undergraduate students than graduate students. Additionally, more undergraduates, compared to graduate students, had first been choked as adolescents. These findings are consistent with prior research suggesting an age cohort effect (Herbenick et al., 2020).

The present study provides the first empirical data on sexual choking method among young U.S. adults, showing that most participants reported that choking occurred with hands; however, more than 10% had choked or been choked with a ligature or limb. As with literature on non-fatal strangulation in other contexts, we found that frequency, intensity, and ligature or limb use were significantly associated with reporting more physical responses (Busse et al., 2015). Our results call for a mechanistic investigation of whether, and to what extent, sexual choking influences neuronal cellular/molecular integrities and neurologic functions.

We found that more undergraduate students rated being choked as “very pleasurable” compared to graduate students, which may reflect the rapid pace with which choking has moved into the mainstream among young people. Yet, for a sexual practice that is consequential to health and potentially lethal, we were struck that a minority of participants (albeit, a sizable minority) described being choked as “very pleasurable.” If it is not very pleasurable and yet carries significant risks, it is curious how choking has grown so quickly in prevalence. In other research, young adults have described sexual compliance related to choking (e.g., allowing themselves to be choked to please a partner even though they did not enjoy it); also, some men have described choking their partners to please them, even though they feel uncomfortable doing so (Herbenick et al., 2022b, 2022c). Subsequent research might explore choking in relationship to media influences, sexual

Table 5 Associations between choking frequency, intensity, and method and the range of physical responses experienced from being choked during their lifetime

	Unadjusted models			Adjusted models*		
	β	SE	<i>p</i> value	β	SE	<i>p</i> value
Total number of times of being choked						
1–5 times	0.00	–	–	0.00	–	–
6–10 times	0.42	0.22	.064	0.33	0.22	.125
11–25 times	1.79	0.24	<.001	1.52	0.24	<.001
>25 times	3.07	0.27	<.001	2.74	0.27	<.001
Usual intensity of being choked	0.95	0.04	<.001	0.89	0.04	<.001
Ever choked using ligature	2.56	0.36	<.001	2.30	0.35	<.001
Ever choked using an arm/leg	2.62	0.30	<.001	2.44	0.29	<.001

*Adjusted for gender (men/women/gender expansive) and sexual identity (heterosexual/gay or lesbian/bisexual/pansexual/asexual/something else)

communication, feminist identification, and perceptions of partners' desires.

In terms of the physical responses assessed, they were reported by significantly more women and TGNB+ participants, as compared to men. About 1% of participants had involuntarily lost urine while being choked and 4% reported having experienced neck swelling from having been choked. Neck edema (swelling) can occur quickly but has also been reported to occur up to 36 h following strangulation and can be life-threatening due to potential blockage of the airways (Stanley & Hanson, 1983). Among the responses queried, none were more likely to be reported by men, likely because they reported being choked at lower frequencies, lower intensities, and perhaps (at least for some men with female partners) more often by partners with less physical strength—although little pressure is needed to occlude the jugular veins or carotid arteries (Harle, 2012). Additionally, more women and TGNB+ students reported having experienced non-consensual choking. The responses that were endorsed suggest that people's experiences with choking would mostly be classified as mild or moderate strangulation based on symptomology, though those involving LOC and urine loss might be classified as severe (Plattner et al., 2005). Individuals who have experienced neck edema, LOC, or loss of bladder or bowel control from having been strangled are generally considered to have experienced life-threatening strangulation; it's been suggested that such individuals should be observed inpatient for 12–24 h (Armstrong & Strack, 2016). Subsequent research should query to what extent people who engage in choking are knowledgeable about its risks as well as how they identify situations that warrant seeking healthcare.

Findings on prevalence, frequency, and physical responses underscore a need for longitudinal research on choking, as well as a need to develop educational programs, interventions, and clinical approaches related to choking, including some tailored to adolescents and young adults. We must grapple with what it means for large proportions of young women to be choked/strangled so often—whether in terms of health risks, relationship dynamics, or their own sense of power and agency. (This is likely true, too, for young TGNB+ people, though our sample size is small and thus the estimates are less stable; subsequent research is encouraged.)

Individuals who have been strangled from IPV, experienced sexual assault, who have marginalized social locations, and those who engage in kink practices may be less likely to seek healthcare due to stigma and discrimination (e.g., Patch et al., 2021; Rossman et al., 2017; Waldura et al., 2016). Although we did not ask participants if they had sought care related to their symptoms, we would expect that most had not—whether due to perceived stigma or discrimination or due to a lack of awareness that choking can be consequential to health. Subsequent research might explore healthcare use

among people who have been choked during sex, including whether those who have experienced LOC or AIC have been screened for TBI. Given the prevalence of choking and other forms of rough sex (e.g., Herbenick et al., 2021b; Keene, 2019; Vogels & O'Sullivan, 2019), and that some proportion of experiences will have been frightening or part of an assault, findings underscore a need for trauma-informed, kink-aware clinical care (Lantto & Lundberg, 2021; Speciale & Khambatta, 2022).

Although there may be individual differences in noticeable bruising (e.g., due to age, skin color/skin tone, medication use), neck bruising suggests substantial force (Byard & Langlois, 2015). Participants described moderate intensities, on average, but their estimates of intensity were subjective. Strangulation injuries can be present even without noticeable bruising or other visible signs (Bichard et al., 2021; St. Ivany et al., 2021). About 3% of participants reported LOC from having been choked, consistent with an earlier undergraduate study (Herbenick et al., 2021c). LOC can occur from occlusion of the jugular veins, carotid arteries, or airways (McClane et al., 2001) and suggests ischemia possibly contributing to mTBI, which is a well-documented outcome of non-fatal strangulation (Bichard et al., 2021). LOC occurs as oxygen saturation decreases, with the heart slowing at levels of low saturation, and then asystole (Gilhooley et al., 2019). If a person does not realize—perhaps due to inexperience, substance use, the room being dark, or the sexual position in use—that their partner has lost consciousness, and if they continue to choke their partner, then a full cardiac arrest may be imminent.

Most choking experiences (> 90%) were described as consensual, yet 16% of women and nearly one-third of TGNB+ participants reported having felt scared while being choked, consistent with research demonstrating, and popular literature describing, that choking may be frightening when done harder than expected, with two hands, without first discussing, or in ways that are painful (Herbenick et al., 2019, 2022c; Polley, 2022; Selvaratnam, 2021). This may reflect that some experiences of consensual choking reflect sexual compliance and may have been unexpected or unpleasant but still accepted by the person who was choked (e.g., Herbenick et al., 2022b, 2022c). Findings echo research with IPV strangulation victims who describe feeling frightened and wondering if they might be killed (e.g., Joshi et al., 2012; Vella et al., 2017) and research showing non-fatal strangulation associated with coercive control (Bendlin & Sheridan, 2019). Young adults' greater frequency of having been choked has been associated with poorer current mental health status (Herbenick et al., 2022a) and a recent study found that women who had been choked/strangled prior to age 18 were at greater risk for clinical dissociation in adulthood (Kate et al., 2021), though the contexts of the choking/strangulation were not assessed. That said, it is also possible that some

individuals accept, or even enjoy, feeling afraid while being choked; subsequent research should investigate this.

That more than one-third of participants had been unable to speak while being choked has implications for sexual consent education, suggesting that safe gestures (and not just safe words) may be an important component of sexual communication and harm reduction. Unlike practices encouraged in BDSM communities, where there are strategies for harm reduction and consent, mainstream approaches to choking seem to involve few to no safety or harm reduction strategies (Herbenick et al., 2022b, 2022c), not even taking into account that people may not be able to speak or may lose consciousness when being choked. Because we asked participants about their lifetime experiences of physical responses, it was not clear which were from consensual choking and which were from non-consensual choking, or various degrees of wanted/unwanted choking. Given how frequently sexual choking occurs, we did not inquire about consent for each choking experience as it would have been unlikely to yield valid data (due to recall problems) and would have increased participant burden, risking survey drop-out. Daily diary research would support a better understand of event-level choking experiences, consent, and the relational context. We also did not assess participants' IPV histories; subsequent research might examine the extent to which people have been choked/strangled in multiple contexts and then examine potential cumulative effects.

With choking now prevalent among youth, it will be important for parents, educators, and clinicians to consider how to educate young people about choking during sex, its potential for lethality and health consequences, as well as legal consequences for those who cause injury or death by choking their partner(s). Given the challenges of providing medically accurate information to young people about even basic sexual health information, we acknowledge that most high schools will not address choking or rough sex—nor would most teachers likely have sufficient expertise in this understudied area to teach about choking in a way that is accurate and does not further stigmatize already marginalized communities. However, as choking is commonly depicted in pornography (Bridges et al., 2010; Fritz et al., 2020; Vera-Gray et al., 2021), there may be opportunities to educate about choking as part of pornography literacy programs (Dawson et al., 2020; Rothman et al., 2020). There may also be opportunities for the kinds of collective approaches and intergenerational alliances urged by Bey-Chang (2012) to support young women's sexual development.

Strengths and Limitations

Among our study's strengths is that our questionnaire was developed by an interdisciplinary team, students were randomly sampled, data collection occurred online which

may enhance reporting of sensitive behaviors (Burkill et al., 2016), and our response rate was high for campus surveys (American College Health Association, 2020), thus enhancing the generalizability of findings. Also, we included graduate students, extending prior research on choking focused on undergraduates and allowing us to examine the data in ways that may reflect age cohort differences and/or those related to differing social circles and relationships.

Regarding limitations, our list of physical responses was not exhaustive. In consideration of survey length and participant burden, we did not ask participants about all possible responses—e.g., hoarseness, sore throat, or the presence of petechiae, as even professionals often require training to identify petechiae (Pritchard et al., 2018; Reckdenwald et al., 2019). However, one participant wrote in “petechiae,” which may reflect greater knowledge or having experienced choking as part of an assault, for which a forensic exam was conducted. We also depended on self-report; subsequent research should consider clinical evaluation of such responses and the development of valid tools of symptom assessment. Prior research has demonstrated that people often do not remember having lost consciousness from having been strangled (e.g., Kabat & Anderson, 1943; Mcquown et al., 2016) and thus our data on LOC may be an underestimate.

Also, we do not know how exactly people were choked. Choking that stops blood flow to the brain, primarily by compression of the carotid arteries, should be distinguished from choking that prevents breathing (though some choking techniques may do both). When blood flow to the brain stops, LOC is expected within seconds. People's partners would be unlikely to notice symptoms of LOC prior to its occurrence. Respiration may eventually become irregular and cease, although not immediately. Pressure on the carotid sinus may also slow heart rate through reflex mechanism resulting in LOC. In comparison, when breathing is stopped, hypoxia sufficient to cause LOC may take several minutes. Symptoms may be variable, but feelings of suffocation and hypoxia may occur; however, some individuals may be much less sensitive, and drugs and alcohol likely diminish these symptoms. If hypoxia continues, heart rate slows and asystole or complete cardiac arrest eventually occurs. Cardiac arrest, without rapid resuscitation, may result in brain damage and death. The time between LOC and cardiac arrest from hypoxia may be less than one minute. There is little scientific knowledge about how people engage in choking, whether they are attempting to press against blood vessels and/or airways, or their knowledge of neck anatomy. Findings from qualitative interviews indicate that people choke their partners, and have been choked, at the front, side, top, and bottom of the neck, and with limited awareness as to whether the blood vessels versus the airways are being compressed (Herbenick et al., 2022b, 2022c).

We also did not assess feelings that participants may connect to their choking such as power, arousal, sadness/happiness, femininity/masculinity, trust, intimacy, or resignation. Although, even when choking is considered pleasurable, that does not change its risk potential. Understanding these risks can inform fact-based sexuality education. Although sexual choking is not a new sexual practice, it has grown in prevalence. Systematic research on choking and its consequences is recent and has historically been limited by heteronormative perspectives in academia that have pathologized non-normative sex. As such, most sexuality educators may be ill-equipped to teach evidence-based information about sexual choking—that is, until the evidence base itself grows.

Our research was also limited in terms of our gender categorization. While TGNB+ students are not monolithic in terms of their gender or sexuality, neither are those identifying as women or men. We were underpowered for granular analyses by gender and—because we recruited students from a single campus—faced ethical issues in possible identification of participants had we presented data by each gender identity category. Thus, we chose to combine these groups into a TGNB+ category. Subsequent research might examine sexual choking within specific groups of people to better understand the role of gender or culture. We also did not assess participants' experience with auto-erotic asphyxiation (AEA); subsequent research might examine the extent to which students engaged in both partnered choking and AEA, given limited prior research in community samples (Baxendale et al., 2019). Finally, our participants were individuals; subsequent research might focus on dyads to examine the correspondence between participants' reports related to consent, intensity, and awareness of responses.

We need further research to understand how strangulation—long described as one of the most insidious forms of femicide (Monahan et al., 2020; Pereira et al., 2013)—has become a prevalent and frequent sexual practice enacted by young people who are just beginning to organize their sexual repertoires. Choking/strangulation is mostly enacted on the bodies of young women and sexual and gender minorities (SGM)—as well as *requested* by many women and SGM individuals (Herbenick et al., 2021c). Subsequent research should consider applying an intimate justice lens to the study of this emerging behavior (McClelland, 2010). What kinds of sexual practices, power dynamics, pleasure, and enjoyment do young women and SGM feel are available to them? What sexual and relational possibilities do people feel are open or closed to them if they do or don't engage in choking? What does sexual agency look like in the context of choking and other forms of rough sex? We are reminded of Bay-Cheng (2012, 2019), Gavey (2012), and Fine and McClelland (2006), among others, who have situated women's sexualities in broader social, relational, economic, and cultural realities. We encourage subsequent research, too, on the experiences

of people of all genders who are asked by their partner(s) to choke them—how do they feel about choking their partner(s), particularly if they have conceptualized themselves as someone who does not hurt people, or who does not harm women in particular? How do people distinguish sexual choking/strangulation from sexual violence?

Some people may have the impression that sexual choking is not risky, as deaths are rare. However, the COVID-19 pandemic has highlighted that even many healthcare providers are unaware that hypoxia may present differently from person to person and that some people may act normally and appear healthy even as their oxygen levels decline (Bickler et al., 2021). This is important as we cannot expect most people (especially adolescents and young adults) to be able to identify if their partner is becoming hypoxic, ischemic, or on the verge of losing consciousness. We are reminded of a recent case in which a 21 year-old man choked a 19 year-old woman during sex and, when she appeared to lose consciousness, he posted a photo of her nude body to Snapchat, writing “Just (expletive) this bitch. She passed out. I don't know what to do.” (Attrino, 2019). The young woman was later pronounced dead.

A recent review of fatal outcomes in BDSM found that strangulation accounted for most of the reported fatalities (Schori et al., 2022). Most people will have insufficient training to attend to someone should they lose consciousness, experience a seizure or cardiac arrest, or become unresponsive while being choked. Apart from occurrences in public sex locations, sexual choking likely occurs in private and not uncommonly by people who have just met and/or are using alcohol or other substances (Herbenick et al., 2021a). Some people may also point out that various forms of choking/strangulation routinely occur in sports such as mixed martial arts (MMA); indeed, there is an emerging and controversial literature examining potential neurocognitive effects of having been choked/strangled as part of MMA (e.g., Lim et al., 2019; Stacey et al., 2021; Stellpflug, 2019). Deaths in recreational freediving are well reported and may be associated with poor training and safety procedures (Stemberga et al., 2013). However, in freediving competitions, trained safety divers and medical personnel are immediately present, and a single death from pulmonary hemorrhage has occurred. Sexual choking lacks the kinds of supports that are used to minimize risks associated with hypoxia and ischemia in some sports—e.g., specific training and preparation for hypoxia, regular monitoring of oxygen levels in the blood, as well as the presence of highly trained coaches, medical doctors, and referees who are authorized to identify and immediately end unsafe behaviors and respond to medical emergencies.

Our findings suggest that sexual choking is consequential in ways similar to other forms are strangulation. In talking about choking with students or clients, sexuality educators and clinicians may find themselves wondering how

to balance sex positivity, affirmation of a person's sexual rights and bodily autonomy, prevention, health promotion, and/or harm reduction. In prioritizing bodily autonomy and sexual rights, one might argue that any type of consensual sex between people of legal consenting ages should be supported. Yet this perspective may be tempered by considering meaningful informed consent, which would best be supported by developing an evidence-base of risks/benefits of choking as well as widespread, accessible education. Such education would be aimed at helping people learn fact-based information about choking, so they could then have an opportunity to make a freely informed choice about whether they wish to engage in choking. Further, there are instances in which a sexual encounter may be consensual but choking or other behaviors within the encounter are non-consensual and making sense of these experiences can be emotionally fraught and complicated (e.g., Polley, 2022; Selvaratnam, 2021).

There are other principles and perspectives (e.g., related to feminism, enthusiastic consent, sexual liberation, trauma-informed education, queer feminist education, and first doing no harm) that sexuality professionals may find themselves considering as scientific and clinical knowledge evolve in relation to choking as a sexual practice. This work will benefit from interdisciplinary collaboration among those working in sexuality professions, intimate partner violence, health education, hypoxia/anoxia, women's and gender studies, medicine, psychology, criminal justice, and neuroscience, among other fields.

Author Contributions DH conceived of the study. DH, TCF, ST, DSV, MR, LGR, and PW wrote and/or edited aspects of the survey. TCF analyzed the data. DH and TCF wrote the manuscript. All authors reviewed, revised, and approved the manuscript.

Funding Internal support was provided by the Indiana University School of Public Health.

Availability of Data and Materials A limited data set can be accessed by contacting the authors' for data repository information.

Code Availability Not applicable.

Declarations

Conflict of interest All authors declare that they have no conflict of interest.

Ethical Approval The research involved human subjects, and the institutional review board at the authors' university reviewed and approved study protocols and measures (Protocol 1912431788). Participants reviewed an IRB-approved Study Information Sheet and indicated consent to participate prior to participating in an interview.

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