Sexual vs. Nonsexual Currently Most Upsetting Trauma: A Fresh Look at Attenuation of Sexual Response, Alcohol Intoxication, and Post-Traumatic Stress

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This study examined the dependence of sexual response (vaginal pulse amplitude [VPA] and subjective sexual arousal) on alcohol intoxication (.10% breath alcohol concentration [BrAC] versus no alcohol) and the nature of a woman's currently most upsetting traumatic event (C-MUTE), whether it was sexual (e.g., rape) or nonsexual (e.g., combat). Self-reported sexual outcomes were also compared by C-MUTE type. A total of 117 women completed background measures and either drank alcoholic or nonalcoholic beverages. They were shown erotic films and their VPA was assessed. A two (sexual versus nonsexual C-MUTE) by two (.10% BrAC versus no alcohol) analysis of variance (ANOVA) showed that, controlling for post-traumatic stress (PTS) symptoms, women with a sexual C-MUTE showed lower percent VPA change than women with a nonsexual C-MUTE. No significant effects were found for subjective sexual arousal. A multivariate analysis of variance (MANOVA) showed that women with a sexual C-MUTE reported more frequent anxiety and inhibition during partnered sex and more frequent lack of vaginal lubrication versus women with a nonsexual C-MUTE. There was no significant interaction between C-MUTE and alcohol intoxication. Whether a woman is currently upset by past sexual victimization may influence current sexual difficulties. Attenuated VPA may be attributable to the sexual nature of a C-MUTE as opposed to general trauma exposure.

As many as 60% of women experience sexual victimization (SV) during adulthood, childhood, or both, ranging from unwanted touching to forced rape (Abbey & Thomson Ross, 1996). Among women who experienced SV at any age, negative sequelae include depression (Acierno et al., 2002), anxiety (Ullman & Siegel, 1993), post-traumatic stress (PTS) (Messman-Moore, Brown, & Koelsch, 2005), and disruptions in their sexual experiences, including inhibited subjective sexual arousal (Leonard & Follette, 2002; Van Berlo & Ensink, 2000). However, findings on whether women with a history of SV show decreased physiological genital sexual arousal, measured by vaginal photoplethysmogapahy, compared to women without a SV history are mixed (Gilmore et al., 2010; Rellini & Meston, 2011; Schacht et al., 2007). The majority of studies find smaller increases in physiological genital sexual arousal among women with a history of SV compared to women without (Gilmore et al., 2010; Schacht et al., 2007), but a minority of others find no difference (Rellini & Meston, 2011).

Extant research in this area has compared only women with and without a history of SV, indirectly allowing the assumption that SV similarly impacted all participants. Thus, it is unclear

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whether a woman's currently most upsetting traumatic event (C-MUTE) being sexual in nature (e.g., rape) compared to nonsexual (e.g., combat) may be important for understanding attenuation of vaginal vasocongestion. If a woman's C-MUTE is sexual in nature, she may be reminded of this event during sexual activity and, through multiple potential mechanisms, this salience may negatively impact her sexual arousal functioning. This process may not occur if a woman's C-MUTE is nonsexual. It is also possible that the nature of a woman's C-MUTE may not influence sexual arousal functioning. Instead, variables associated with all types of C-MUTEs, such as PTS symptoms, could lead to inhibited functioning. Furthermore, compared to women without a history of SV, women with a history of SV engage in more frequent and pre-sex heavy drinking (drinking before or during sexual activity; Harrington & Leitenberg, 1994; Testa & Dermen, 1999); and alcohol intoxication is associated with attenuated vaginal vasocongestion (George et al., 2011; George et al., 2009; Gilmore et al., 2010). Thus, it is also important that research examines the influence of acute intoxication on vaginal vasocongestion dependent on whether a woman's C-MUTE is sexual compared to nonsexual.

Sexual Victimization and Sexual Arousal Difficulties

Sexual difficulties are commonly noted among survivors of SV. Women with a history of SV compared to those without report long-lasting sexual difficulties (e.g., difficulty reaching orgasm; Becker, Skinner, Abel, Axelrod, & Cichon, 2008; Weaver, 2009). Many women with a history of SV (about 70%) attribute their sexual difficulties to their experience of SV (Becker et al., 2008; Becker, Skinner, Abel, & Cichon, 1986). Difficulty achieving and sustaining sexual arousal, when an individual experiences the intensifying of physiological responses and subjective perceptions of excitation (Basson, 2001; Masters & Johnson, 1970), is common. Among women with a history of childhood sexual abuse, 49% to 85% report problems with sexual arousal (Leonard & Follette, 2002). Women with a history of childhood sexual abuse compared to women without are 1.73 times more likely to have difficulties with sexual arousal (Laumann, Paik, & Rosen, 1999). In addition, several studies have found that difficulties with sexual arousal can persist for years following adult sexual assault (for a review, see Van Berlo & Ensink, 2000). However, despite this research showing higher rates of sexual difficulties among survivors of SV, the mechanisms linking the two phenomena are still unclear.

Measurement of Sexual Arousal

Sexual arousal is a complex construct, consisting of, at a minimum, physiological, subjective, and attentional components (Janssen, Everaerd, Spiering, & Janssen, 2010). These components can be measured separately, and evidence of their inconsistent correlation (e.g., Chivers, Seto, Lalumière, Laan, & Grimbos, 2010; Clifton, Seehuus, & Rellini, 2015) suggests

they may be capturing different aspects of the phenomenal experience of sexual arousal. Subjective, self-reported sexual arousal is a woman's own experience of sexual arousal as reported to an experimenter. In a laboratory setting, subjective arousal can be captured either continuously (Rellini, McCall, Randall, & Meston, 2005) or through self-report survey measures (George et al., 2011; Rellini, Elinson, Janssen, & Meston, 2012). These two measures have been found to correlate with each other (Rellini et al., 2005) and to inconsistently correlate with measured physiological genital sexual arousal (e.g., see Chivers et al., 2010). Multiple explanations for this lack of concordance between subjective sexual arousal and physiological genital sexual arousal have been discussed. For example, women with more arousal-positive sexual schemas have greater coherence between genital and subjective measures (Clifton et al., 2015). One interpretation of this evidence is that there may be cognitive (whether conscious or automatic) moderators between the biological process of genital sexual arousal and the report of the subjective experience of sexual arousal. This is consistent with both theoretical and experimental work on the effect of attention on physiological genital and subjective sexual arousal (e.g., Barlow, 1986; Meston, 2006; Purdon & Watson, 2011). Detected changes in genital arousal, as opposed to genital arousal per se, may be more highly correlated with subjective sexual arousal (Laan, Everaerd, Velde, & Geer, 1995). Scientific literature suggests that subjective sexual arousal and genital sexual arousal in women are at least partially independent (Laan & Everaerd, 1995).

Physiological genital sexual arousal is commonly operationalized for measurement purposes as vaginal vasocongestion (Prause & Janssen, 2006; Sintchak & Geer, 1975; Woodard & Diamond, 2009). This can be measured experimentally as the change in blood flow to the capillary bed in the vaginal vault (measured as vaginal pulse amplitude, or VPA), most often assessed via continuous measurement from a vaginal photoplethysmograph between a control or resting state and during provoked response. These studies (for a review, see Clifton et al., 2015) commonly present a nonerotic video and one or more erotic videos and report the percent change in vaginal vasocongestion between the two states. That change is interpreted as increased physiological genital sexual arousal. Although research finds equivalent levels of self-reported subjective sexual arousal between women with and without a history of SV (Gilmore et al., 2010; Rellini & Meston, 2011), findings on differences in vaginal vasocongestion are somewhat mixed, with most studies finding attenuation of VPA in women with a history of SV (Gilmore et al., 2010; Rellini et al., 2012; Rellini, Hamilton, Delville, & Meston, 2009; Rellini & Meston, 2006; Schacht et al., 2007) and others showing no differences (Bird, Seehuus, Clifton, & Rellini, 2013; Rellini & Meston, 2011). Sexual arousal has been shown to have a curvilinear relationship with sympathetic nervous system activity (Lorenz, Harte, Hamilton, & Meston, 2012). Furthermore, PTS symptoms, which are also associated with increased sympathetic nervous system activity (Morris & Rao, 2013), have been previously associated with difficulty achieving sexual arousal and other

sexual problems (Letourneau, Resnick, Kilpatrick, Saunders, & Best, 1996). Therefore, to better clarify VPA changes, research may need to control for the influence of PTS symptoms, because they, too, may contribute to VPA.

Currently Most Upsetting Traumatic Event: Sexual versus Nonsexual

Research has classified women as having a history of SV (childhood sexual abuse, adult sexual assault, or both) or not having a history of SV. Some women may currently be most upset by their SV; other women may be currently most upset about a nonsexual traumatic event, which may differentially impact sexual difficulties and ease of sexual arousal. The learning model of sexual problems (Barlow, 1986; Becker et al., 1986) suggests that, through experiencing SV, women are conditioned to respond to assault-related reminders, such as sexual stimuli or contact, with negative emotions such as fear, shame, or guilt. Sexual activity or viewing sexual stimuli (e.g., films), for example, can elicit negative emotions to the extent that sexual cues are reminders of SV experiences (Sutherland, Fantasia, & Adkinson, 2014). A rich body of literature has documented the deleterious effects of negative emotionality and distraction from sexual cues on sexual arousal responding (Kuffel & Heiman, 2006; Nelson & Purdon, 2011; Rellini et al., 2012; Silverstein, Brown, Roth, & Britton, 2011). Thus, an important but as yet unexamined factor to consider is whether a woman's C-MUTE is sexual in nature or nonsexual. That is, regardless of SV history, if a woman is currently most distressed about nonsexual traumatic experiences such as a natural disaster or combat, that trauma may be less salient during sexual activity and thus have less of an effect on sexual functioning. Alternatively, if the trauma a woman is currently most aware of is sexual in nature, that trauma may have more of an effect on sexual functioning because it is more connected to her experiences during sexual activity. There are a number of possible mechanisms that may connect the C-MUTE and subjective and physiological responses, including processes related to emotional activation (Laan & Everaerd, 1995; Peterson & Janssen, 2007), sexual self-schema activation (Rellini & Meston, 2011), and differences in attention to erotic versus nonerotic cues (Meston, 2006; Silverstein et al., 2011).

Furthermore, it is unknown whether the attenuated VPA often seen in women with a SV history is due to traumatic experiences broadly or to sexual trauma specifically. Women who report a history of rape compared to women who experienced other crimes (e.g., robbery or aggravated assault but not rape) have reported more sexual problems, such as fear of sex and inability to become or stay sexually excited or aroused (Letourneau et al., 1996). However, other work found that PTS symptoms, regardless of type of trauma, are associated with sexual functioning difficulties (Yehuda, Lehrner, & Rosenbaum, 2015) and mediate the relationship between SV

and sexual health outcomes (see Weaver, 2009 for a review). The relationship between nonsexual trauma and genital arousal is also unclear. Preliminary evidence suggests that PTS symptoms (not necessarily related to sexual trauma) may mediate the relationship between lifetime childhood sexual abuse and percent VPA change (Rellini et al., 2009). However, another study found that PTS symptoms did not mediate the relationship between childhood maltreatment (scored to include multiple types of abuse) and percent VPA change (Zollman, Rellini, & Desrocher, 2013). A better understanding of these relationships will aid assessment and intervention work. Although multiple types of studies will be needed to characterize the relationship between trauma and VPA, comparing the VPA of women whose C-MUTE is sexual to women whose C-MUTE is nonsexual would be a useful next step.

Acute Alcohol Intoxication, SV, and Sexual Arousal

Women who have a history of SV compared to women without a history of SV report more frequent and heavier general alcohol use (Bryan et al., 2016) and pre-sex drinking (drinking before or during sexual activity; Testa & Dermen, 1999). Furthermore, they have a higher likelihood of having engaged in pre-sex drinking the last time they had sex (Howard & Wang, 2005). Experimental laboratory studies have found a link between women's acute alcohol intoxication and attenuated VPA, particularly at breath alcohol concentrations (BrAC) $\geq .08\%$ (for a review, see George et al., 2009; George, Norris, Nguyen, Masters, & Davis, 2014). It is feasible that, under the effects of alcohol, the VPA and subjective sexual arousal responses of a woman who is currently most upset by a sexual trauma will differ compared to a woman whose C-MUTE is nonsexual. Mechanisms may be affective and/or cognitive. For example, alcohol myopia theory (Steele & Josephs, 1990) posits that impelling or salient cues are magnified during acute alcohol intoxication. The saliency of information in a woman's environment likely depends on her history, affecting her experience under the influence of alcohol.

Thus far, two studies have examined the interaction between SV and acute alcohol intoxication on VPA and subjective sexual arousal (Gilmore et al., 2010; Schacht et al., 2007). Although neither study found a significant SV by alcohol interaction for VPA, they did not examine women's C-MUTE, relying instead on comparing women with and without a history of SV in general. Gilmore et al. (2010) did not find a significant interaction between SV and acute alcohol intoxication on subjective sexual arousal. However, Schacht et al. (2007) found that intoxicated women with an SV history reported increased subjective sexual arousal in response to erotic film stimuli compared to their intoxicated nonvictimized counterparts. The authors posited that this may reflect an enhanced effect of intoxication on a belief that alcohol enhances sexual arousal. They suggest that acute alcohol intoxication may provide psychological distance from sexual situations for women with an SV history. This distance may increase their comfort and thus their experience of subjective

sexual arousal. Examining C-MUTE compared to lifetime history of SV may more accurately represent in-the-moment processes that occur during alcohol intoxication. Any interaction that exists between sexual trauma history and alcohol intoxication on VPA or subjective sexual arousal may not be (consistently) statistically significant if women with a SV history are assumed to be homogeneous in their current experience of an SV history. Thus, we argue for the importance of examining C-MUTE to investigate the relationship between sexual trauma and alcohol intoxication on VPA and subjective sexual arousal.

Current Research

The present study addressed two important gaps in the literature on SV and sexual health by comparing women with a sexual C-MUTE to women with a nonsexual C-MUTE. First, it examined percent VPA change (from neutral to erotic videos) and subjective sexual arousal between these groups, investigating whether the type of C-MUTE influences VPA. Relatedly, it examined differences in self-reported sexual difficulties comparing sexual and nonsexual C-MUTE groups. Second, it examined the role of acute alcohol intoxication in the relationship between C-MUTE and VPA and subjective sexual arousal. The present study differs from previous work by comparing women whose C-MUTE is sexual versus nonsexual as opposed to women with a lifetime SV history compared to no experience of SV. Findings could influence the theoretical explanations of traumatic sequelae and perhaps affect clinical decision making. We hypothesized that women whose C-MUTE is sexual in nature would experience lower VPA percent change and subjective sexual arousal increases compared to women whose C-MUTE was nonsexual. We also hypothesized that sexual C-MUTE women would self-report more sexual difficulties. In addition, we evaluated the interaction between C-MUTE and alcohol intoxication with regard to VPA and subjective sexual arousal. VPA and subjective sexual arousal are somewhat correlated. Thus, we predicted that women in the sexual C-MUTE group would show greater VPA percent change and subjective sexual arousal when intoxicated than when not intoxicated. We predicted this difference would not be found for women with nonsexual C-MUTEs.

METHOD

Participants

Women ages 21 to 35 ($M = 25.4$, $SD = 4.7$) were recruited from the community ($N = 117$) to participate in the current study, which was part of a larger study examining the influence of alcohol intoxication and sexual arousal on sexual risk taking. To meet criteria for the larger study, participants had to be interested in dating men and not be in a committed romantic relationship. They also had to drink at least an average of five drinks per week and have had five drinks in one drinking episode at least once in the past year.[1] The minimum threshold of alcohol use behavior was selected to avoid administering alcohol to abstainers and to avoid administering uncustomarily high amounts to light or occasional drinkers. In addition, in accordance with ethical standards of providing alcohol to research participants, participants were excluded if they reported current or past problem drinking[2] or if they were either taking medications or had a health condition that contraindicated alcohol consumption (National Advisory Council on Alcohol Abuse and Alcoholism, 2005). Only participants who had experienced at least one traumatic event chosen from the Post-Traumatic Diagnostic Scale (Foa, Cashman, Jaycox, & Perry, 1997) were included in the current study. The majority of participants were Caucasian (69.6%), had completed some education past high school (85.5%), and were employed (68.7%). Participants drank an average of 12.34 ($SD = 8.69$) drinks per week.

Procedure

Prospective participants completed a short telephone screening to assess eligibility. Upon meeting eligibility criteria, they were scheduled for a laboratory session. During the laboratory session, participants gave informed consent and their adherence to pre–alcohol administration instructions was checked.[3] Participants then completed computerized background questionnaires in a private room. All study procedures were approved by the university's institutional review board (IRB).

Participants were randomized to receive either nonalcoholic or alcoholic beverages. Participants in the no alcohol condition were not blind to the contents of their drinks. Participants were weighed to determine the amount of 190-proof grain alcohol needed to achieve a peak BrAC of .10% (dosage = 1.00 mL alcohol/kg body weight; 1:6 alcohol to fruit juice ratio). Assessment of BrAC took place every three minutes until participants reached the target criterion (BrAC ≥ .06) to ensure that sexual stimuli were presented during the ascending limb of the alcohol curve (Holdstock & de Wit, 1998; Martin, Earleywine, Musty, Perrine, & Swift, 1993). In the no alcohol condition, participants were given the same body weight–adjusted volume of fruit juice as they would have

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[1] In all, 112 callers were excluded from the study because they did not meet the alcohol use inclusion criteria.

[2] Potential participants were excluded if they reported having been (a) told by a professional that they had problems with alcohol, (b) ever seriously concerned about their own drinking, or (c) treated or advised to seek treatment for drinking. They were also excluded if they had ever experienced any of the following after drinking alcohol: (a) fainting or seizure, (b) highly unusual flushing of the skin, or (c) severe or unusual psychological reaction. Potential participants were also excluded if they reported average consumption greater than 40 drinks/week.

[3] Not to drive, not to eat or consume caloric drinks for three hours before the appointment, and not to drink alcohol or use recreational or over-the-counter drugs for 24 hours prior). Participants were also given a pregnancy test if they were in the alcohol condition.

received in the alcohol condition using a yoked control design (Giancola & Zeichner, 1997; Schacht et al., 2007).[3]

Participants then watched three short films: a neutral 2.5-minute bird documentary (BBC) followed by two three-minute erotic films (New Era Productions; VCA Productions). Erotic film content depicted a man and a woman participating in consensual kissing, oral sex, and vaginal intercourse. The first film ended with the couple engaging in penile–vaginal intercourse; the second film began with the woman performing oral sex on the man. Two films were shown to mitigate the risk that sexual responding would be film specific. During pilot testing, the films induced equivalent levels of self-reported sexual arousal (George, 2004). They were shown consecutively without an intertrial interval. During the neutral and erotic films, genital sexual arousal was measured using vaginal photoplethysmography (Sintchak & Geer, 1975). The plethysmograph is the size of a small transparent tampon, which the participant inserts into her vagina while in a private room. Before beverages were administered, the experimenter instructed the participant on how to insert the plethysmograph. Written instructions were also provided. After the beverages were consumed, the experimenter instructed the participant to insert the device. Participants were left alone to insert the device. Baseline readings were checked for quality before proceeding with data collection. Researchers communicated with participants via intercom. After obtaining a 1-minute baseline reading, the participant was shown the neutral film.

Measures

Currently most upsetting traumatic event. C-MUTE was measured using an item from the Post-Traumatic Stress Disorder Diagnostic Scale (PDS; Foa et al., 1997). Participants were prompted: "If you marked more than one traumatic event in Part 1, put a checkmark in the box below next to the event that bothers you the most. If you marked only one traumatic event in Part 1, mark the same one below." In Part 1, participants marked which potentially traumatic events they had experienced in their lifetime (*Yes/No*). They were given sexual and nonsexual options to choose from. Participants could also choose *Other*. There were three sexual C-MUTE options: *Sexual assault by someone you know; Sexual assault by a stranger*; and *Sexual contact under 16 with someone 5 or more years older*. There were eight nonsexual C-MUTE options: *Natural disaster; Combat; Accident/fire/explosion; Nonsexual assault by a stranger; Nonsexual assault by someone you know; Imprisonment; Torture*; and *Life-threatening illness*. All participants were asked to describe their C-MUTE, so we were able to see that all participants who marked *Other* described a nonsexual event and thus were included in the nonsexual C-MUTE group. Those who fell into the sexual C-MUTE group were dichotomously coded as 1, and those in the nonsexual C-MUTE group were coded as 0.

Sexual difficulties. Sexual difficulties were measured using a modified version of the Brief Index of Sexual Functioning (BISF; Taylor, Rosen, & Leiblum, 1994). The

items used in the current analysis were unedited with the exception of one question about sexual satisfaction. This question was edited to be used with women who were not in a committed sexual relationship: "Overall, during the past month, how satisfied have you been with your sex life?" Seven outcomes typically examined in the sexual difficulties literature (Mackey et al., 1991; Rosen et al., 2000; Weaver, 2009) were examined with single items. Participants reported the frequency of their sexual difficulties over the past month. Specifically, anxiety and inhibition during sex, difficulty with vaginal lubrication, painful penetration, difficulty reaching orgasm, and any sexual pleasure were rated from 1 = *Not at all* to 5 = *Always*, with intermediate options such as 3 = *Sometimes, about 50% of the time*. Sexual thoughts/fantasies were rated from 1 = *Not at all* to 7 = *More than once a day*. Sexual satisfaction was rated from 1 = *Very dissatisfied* to 5 = *Very satisfied*. However, for ease of interpretation, responses for sexual thoughts/fantasies and sexual satisfaction were reverse-coded such that higher scores indicated less frequent sexual thoughts/fantasies and less satisfaction.

Genital sexual arousal. Genital sexual arousal was measured using vaginal photoplethysmography (Sintchak & Geer, 1975; model MP 150, BioPac Systems, Inc., Santa Barbara, CA) by means of a Plexiglas vaginal probe (Behavioral Technology, Inc., Salt Lake City, UT). The probe, which contains an LED light source and a photocell, is inserted into the vagina. Changes in the amount of light backscattered from the vaginal wall as it became engorged with blood were measured and subsequently transformed into digital data for analysis. Using Acqknowledge software (version 3.7.2, BioPac Systems, Inc.), VPA was continuously sampled at a rate of 62.5 samples per second, and data were recorded in millivolts.

Data reduction and percent change calculation. An experienced investigator visually inspected waveform data, and movement artifacts were removed (Schacht et al., 2007). Acqknowledge software was used to reduce the data to 25 samples per second. Then, the height of each waveform was calculated, which produced a series of amplitude values; those values were recorded throughout the videos. Means were calculated every 30 seconds. The smallest mean amplitude value collected during the neutral film was used as the baseline value, and the largest mean amplitude collected during the erotic films was used as the peak value. The percent change score between these values was calculated for each participant.

Subjective sexual arousal. Participants rated their subjective sexual arousal after the erotic videos about experiences felt "in the last 10 minutes." Items included sexual arousal (Kuffel & Heiman, 2006); sensation in genitals (Heiman & Rowland, 1983); sexual warmth in genitals, breasts, and body (Meston, Heiman, Trapnell, & Paulhus, 1998); and sexual absorption in the sensory components of the stimuli (Koukounas & McCabe, 2001). Responses from both times were averaged to create a single mean ($\alpha = .94$). Participants

responded using 7-point scales from 1 = *None at all* to 7 = *Extremely.*

PTS symptoms. PTS symptoms were measured using the PDS (Foa et al., 1997). Participants were instructed to refer to their C-MUTE when reporting PTS symptoms. Symptoms were assessed within the past week and were scored into reexperiencing (five items), arousal (six items), and avoidance subscales (six items). Scales ranged from 1 = *Not at all true or only one time* to 4 = *5 or more times a week/almost always.* Items were averaged for each subscale and the total score. Interitem reliability was excellent for all subscales, $\alpha = .91$; $\alpha = .87$; $\alpha = .86$, respectively, and for the total score, $\alpha = .90$.

Data Analytic Plan

This study explored the unique influence of the nature of participants' C-MUTE controlling for the influence of PTS symptoms. A 2 (sexual versus nonsexual C-MUTE) × 2 (.10% BrAC versus no alcohol) analysis of variance (ANOVA) was conducted examining percent VPA change. Finally, seven self-reported sexual difficulties were examined between C-MUTE groups using a multivariate analysis of variance (MANOVA). The ANOVA and MANOVA were also conducted, accounting for the influence of lifetime SV history given that the nonsexual C-MUTE group did not exclude women with a history of SV.

Results

Sample

Table 1 provides a summary of demographics for the entire sample and for both the experimental groups, .10% BrAC and no alcohol, and C-MUTE type (sexual and nonsexual). Based on chi-square analyses, no significant differences between the alcohol groups or C-MUTE groups were found on relationship status, education, or racial identification. No differences were found between the C-MUTE groups on income. A chi-square test identified a significant difference between the alcohol groups on income, $\chi^2 (6) = 12.73$, $p < .05$, with the alcohol group skewing toward a lower income; income was not found to be related to any of the other variables of interest. A t test comparing age was conducted; the two groups were not found to be significantly different. In all, 40 women (34%) identified

Table 1. *Demographics Comparing the No Alcohol and Alcohol Conditions and Comparing the Nonsexual and Sexual C-MUTE Groups*

Demographics	No Alcohol (N = 52)		Alcohol (N = 65)		Nonsexual C-MUTE (N = 77)		Sexual C-MUTE (N = 40)		All Participants (N = 117)	
	M	SD	M	SD	M	SD	M	SD	M	SD
Age (years)	25.07	3.87	25.65	5.29	25.27	5.08	25.62	3.93	25.39	4.70
	N	%	N	%	N	%	N	%	N	%
Relationship status										
Not in relationship	52	100.00	64	98.46	76	1.30	40	100.00	116	99.15
In relationship	0	0.00	1	1.54%	1	98.70	0	0.00	1	0.85
Education										
High school or less	7	13.64	8	12.31	10	12.99	7	17.50	15	12.82
Trade school or some college	28	53.85	31	47.69	36	46.75	23	57.50	59	50.43
College graduate or graduate degree	17	32.69	24	36.92	31	40.26	10	25.00	41	35.04
Annual household income*										
< $10,999	8	15.38	28	44.44	24	31.58	12	30.77	36	31.30
$11,000–$20,999	16	30.77	16	25.40	21	27.63	11	28.21	32	27.83
$21,000–$30,999	10	19.23	7	11.11	7	9.21	10	25.64	17	14.78
$31,000–$40,999	8	15.38	6	9.52	10	13.16	4	10.26	14	12.17
$41,000–$50,999	2	3.85	2	3.17	3	3.95	1	2.56	4	3.48
$51,000–$60,999	0	0.00	1	1.59	0	0.00	1	2.56	1	0.87
> $61,000	8	15.38	3	4.76	11	14.47	0	0.00	11	9.57
Racial identification										
Asian/South Asian	3	6.00	1	1.54	3	30.77	1	31.30	4	3.48
Native Hawaiian	0	0.00	1	1.54	1	28.21	0	27.83	1	0.87
African American/Black	2	4.00	8	12.31	7	25.64	3	14.78	10	8.70
Native American	0	0.00	2	3.08	1	10.26	1	12.17	2	1.74
Caucasian/White	38	76.00	42	64.62	53	2.56	27	3.48	80	69.57
Middle Eastern/North African	1	2.00	0	0.00	1	2.56	0	0.87	1	0.87
Multiracial/other	6	12.00	11	16.94	9	0.00	8	9.57	17	14.79
Hispanic or Latino/Latina[†]	5	10.00	4	6.15	4	5.56	5	6.94	9	7.83

Note. The two alcohol groups were significantly different by alcohol group, with the alcohol group having a higher income. The CMUTE groups were not different by alcohol group, and no other significant differences were observed.

[†]Participants were asked if they identified as Hispanic or Latino/Latina, in addition to being asked if they identified as any other ethnicity, so percentages add up to more than 100%.

a sexual C-MUTE and 77 (66%) identified a nonsexual C-MUTE. Thirty-seven women (48%) in the nonsexual C-MUTE group reported a history of adult or childhood SV, and 92% of the sexual C-MUTE group reported a history of nonsexual trauma.

Descriptive Data

Three participants seemed to have outlying VPA scores, so the analyses were run excluding them to determine if they had undue influence. The resulting analysis was similar in significance and direction, suggesting that the outliers did not have undue influence. For clarity and ease of interpretation, the reported analyses included all participants. Table 2 provides means and standard deviations for variables of interest,

organized by experimental group (.10% BrAC versus no alcohol) and C-MUTE type (sexual versus not sexual), in addition to number of participants in each experimental group. Variables reported include percent VPA change, subjective arousal post–erotic video, PTS reexperiencing, arousal, avoidance symptoms, and PTS total symptoms, as well as self-report past-month frequency of sexual thoughts, dreams, and fantasies; frequency of feeling anxious or inhibited during partnered sex; frequency of lack of lubrication during sexual activity; frequency of painful sex; frequency of having difficulty reaching orgasm; overall sexual satisfaction; and overall pleasure from sex. Percent VPA change was observed to vary between −13% and 735% with an average of 181.89% (SD = 133.03%). This mean is at the high end of previously published values for healthy premenopausal women. See Clifton et al. (2015) for a review of 12 such studies

Table 2. *Mean Scores and Standard Deviations for Measures of Interest by Group Membership and C-MUTE Type*

	No Alcohol				Alcohol			
	Not Sexual (N = 13)		Sexual (N = 39)		Not Sexual (N = 38)		Sexual (N = 27)	
	M	SD	M	SD	M	SD	M	SD
% VPA change	2.20$_a$	1.52	1.28$_b$	0.90	1.84$_{a,b}$	1.08	1.50$_b$	1.42
Subjective arousal	2.92$_a$	1.33	2.92$_a$	0.86	2.95$_a$	1.23	3.19$_a$	1.42
PTSD reexperiencing	1.23$_a$	0.36	1.34$_a$	0.82	1.33$_a$	0.52	1.26$_a$	0.46
PTSD arousal	1.41$_a$	0.72	1.66$_a$	0.83	1.36$_a$	0.64	1.71$_b$	0.73
PTSD avoidance	1.29$_a$	0.53	1.60$_a$	0.89	1.29$_a$	0.58	1.43$_a$	0.67
PTSD total	1.31$_a$	0.49	1.54$_a$	0.81	1.32$_a$	0.54	1.46$_a$	0.54
Past month sexual:								
Fantasies	5.36$_a$	1.48	5.23$_a$	1.79	4.95$_a$	1.47	5.52$_a$	1.45
Feel inhibited	1.73$_a$	0.91	2.33$_{a,b}$	1.32	1.77$_a$	0.76	2.26$_a$	1.25
Lubrication, lack of	1.79$_{a,c,d}$	0.90	2.33$_a$	1.00	1.52$_c$	0.63	1.96$_{b,d}$	0.75
Sex painful	1.39$_a$	0.63	1.13$_a$	0.35	1.21$_a$	0.63	1.30$_a$	0.70
Difficulty reaching orgasm	2.66$_a$	1.39	2.64$_a$	1.36	2.31$_a$	1.42	2.42$_a$	1.36
Satisfied	3.00$_a$	1.22	3.00$_a$	1.47	3.19$_a$	1.43	3.26$_a$	1.32
Pleasure	4.47$_a$	0.76	4.36$_a$	0.92	4.20$_a$	1.06	4.08$_a$	1.02

Note. Values in the same row not sharing the same subscript are significantly different at $p < .05$; % VPA change was measured by subtracting the minimum VPA during the neutral film from the maximum VPA during the erotic films and dividing by the minimum VPA during the neutral film.

Table 3. *Correlation Coefficients for Relations Between Measures of Interest*

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	% VPA change	—												
2	Subjective sexual arousal	.06	—											
3	PTSD reexperiencing	−0.14	.08	—										
4	PTSD arousal	−0.11	.15	.63**	—									
5	PTSD avoidance	−0.08	.15	.70**	.81**	—								
6	PTSD total	−0.11	.15	.82**	.91**	.95**	—							
	Past month sexual:													
7	Fantasies	−0.1	.15	−0.1	0.07	−0.05	−0.02	—						
8	Feel inhibited	−0.14	.03	.21*	0.17	0.17	0.2	−0.19	—					
9	Lubrication, lack of	−0.08	−.15	0.03	.26*	.21*	.21*	−0.07	.33**	—				
10	Sex painful	−0.2	−.06	.30**	.22*	0.2	.27*	0.03	0.21	.22*	—			
11	Difficulty reaching orgasm	0.14	−.08	.31**	.26**	.31**	.32**	−0.04	0.17	0.06	.24*	—		
12	Satisfied	0.07	−.05	−0.16	−.26**	−.22*	−.24*	0.00	−0.01	−0.12	−0.14	−.23*	—	
13	Pleasure	−0.02	.05	−.29**	−.24*	−.25*	−.29**	0.19	−.32**	−.29**	−.23*	−.22*	.21*	—

*p < .05; **p < .01; ***p < .001.

with mean percent VPA changes between 24% and 202%. Table 3 shows a correlation matrix among study variables.

Results of ANOVA Predicting Percent Change in VPA and Subjective Sexual Arousal

Two ANOVAs were conducted, modeling the relationship between C-MUTE type (sexual versus nonsexual) and alcohol group (.10% BrAC versus no alcohol) in predicting percent VPA change and subjective sexual arousal, while accounting for the influence of PTS total symptoms as a covariate. The same models were conducted accounting for the influence of lifetime SV history and results were unchanged. Thus, for ease of interpretation, only the first set of models is reported here. Results predicting percent VPA change are shown in Table 4, and results predicting subjective sexual arousal are shown in Table 5. There was a significant effect of C-MUTE type on percent VPA change, $F(4, 117) = 4.82$, $p < .05$, partial $\eta^2 = .04$, which suggests a small effect size. Women in the sexual C-MUTE group showed lower percent VPA change compared to the nonsexual C-MUTE group. The effects of PTS symptoms, alcohol group membership, and the interaction between C-MUTE type and alcohol group were not significant. No significant effects were found for the model predicting subjective sexual arousal.

Results of MANOVA Predicting Self-Report Measures

A MANOVA was conducted, modeling the relationship between C-MUTE type and seven self-report measures of sexual function and satisfaction (Table 6). The same model was conducted accounting for the influence of lifetime SV history; results were unchanged. Thus, only the first model is reported here. Overall, there was a significant effect of C-MUTE type and sexual function, $F(7, 80) = 2.81$,

Table 4. *Between-Subjects Analysis of Variance Results for Percent Change in Vaginal Pulse Amplitude*

Source	df	SS	MS	F	p	Partial η^2
C-MUTE type (C)	1	8.25	8.25	4.82	< .05	.04
Alcohol group (A)	1	.16	.16	.09	n.s.	.00
C × A	1	1.89	1.89	1.10	n.s.	.01
PTSD total	1	1.32	1.32	.77	n.s.	.01
Error	112	191.74	1.71			

Table 5. *Between-Subjects Analysis of Variance Results for Subjective Sexual Arousal*

Source	df	SS	MS	F	p	Partial η^2
C-MUTE type (C)	1	.08	.08	.05	n.s.	.00
Alcohol group (A)	1	.57	.57	.35	n.s.	.00
C × A	1	.44	.44	.27	n.s.	.00
PTSD total	1	3.74	3.74	2.32	n.s.	.02
Error	112	179.92	1.61			

Table 6. *Multivariate and Univariate Analyses of Variance F Ratios for C-MUTE Type Effects for Self-Reported Measures*

Analysis Type	C-MUTE Type (F)	Partial η^2
MANOVA, $F(7, 72)$	2.38*	0.19
ANOVA, $F(1, 78)$		
Fantasies	.00	0.00
Feel inhibited	3.97*	0.05
Lubrication, lack of	11.14**	0.13
Sex painful	.00	0.00
Difficulty reaching orgasm	.55	0.01
Satisfied	1.38	0.02
Pleasure	1.81	0.02

Note. Multivariate F ratios were generated from Pillai's trace, $V = 0.20$.
*$p < .05$; **$p < .01$; ***$p < .001$.

$p < .05$. There was a significant effect of C-MUTE type on frequency of feeling anxious or inhibited during partnered sex, $F(1, 78) = 3.97$, $p < .05$, partial $\eta^2 = .05$, with the sexual C-MUTE group having a significantly higher score, $M = 2.28$, $SD = 1.25$, than the nonsexual C-MUTE group, $M = 1.75$, $SD = 0.84$. There was also a significant effect of C-MUTE type on frequency of lack of lubrication during sexual activity, $F(1, 78) = 11.14$, $p < .01$, partial $\eta^2 = .13$, with the sexual C-MUTE group having a significantly higher score, $M = 2.06$, $SD = 0.83$, than the nonsexual C-MUTE group, $M = 1.65$, $SD = 0.78$. No other significant differences were observed.

Discussion

As hypothesized, percent VPA change was attenuated for women with a sexual C-MUTE compared to women with a nonsexual C-MUTE. Women with a sexual C-MUTE compared to a nonsexual one also reported more frequent sexual inhibition and lack of vaginal lubrication. While prior work has explored differences in percent VPA change and self-reported sexual difficulties between women with and without a history of SV, these findings extend and clarify that research by demonstrating that the type of C-MUTE (sexual versus nonsexual) predicts some aspects of sexual response and function. Until now, it has been unclear whether previous differences found in percent VPA change between women with and without a history of SV have been due to general trauma exposure or due to the sexual nature of the trauma. In addition, the current findings are the first to suggest that if a woman identifies her sexual trauma as the currently most upsetting traumatic event, she will show attenuated VPA percent change over and above PTS symptoms. This suggests it is not the distress or PTS symptoms themselves that impact VPA percent change but some other aspect of the C-MUTE, perhaps the sexual nature. The nonsexual C-MUTE group had a high number of women with SV histories and the sexual C-MUTE group had a high number of women with nonsexual trauma. In addition, the findings did not change when lifetime SV history was

included as a covariate, indicating results are significant above and beyond lifetime SV history. This further supports the importance of current distress as compared to lifetime history.

Further, the two self-reported items associated with the type of C-MUTE (sexual inhibition and lack of lubrication) are logically connected to the lower percent VPA change found in the sexual C-MUTE group. Past research has found support for the deleterious effect of attentional distraction on percent VPA change (George et al., 2011; Meston, 2006), consistent with Janssen's attentional model of desire (Janssen et al., 2010). To the extent that sexual inhibition may be associated with distraction from sexual cues (Janssen et al., 2010; Prause, Janssen, & Hetrick, 2008), such inhibition may be related to the lower percent VPA change in women with a sexual C-MUTE. It is of note, however, despite the theoretical support for this connection, sexual inhibition and percent VPA change were not found to be correlated in this sample. Thus, future research should attempt to replicate and understand the relationship between C-MUTE and VPA.

PTS symptoms were not associated with either sexual arousal outcome. Women who volunteer for sexual health studies that involve physically invasive measurement techniques tend to be more sexually liberal than those who do not (Plaud, Gaither, Hegstad, Rowan, & Devitt, 1999). Thus, participants might feel more comfortable with their sexuality compared to women who would not participate in such a study, even if they do experience some PTS symptoms. Thus, the association between PTS symptoms and sexual arousal outcomes may be stronger with individuals not recruited for a study that includes measurement of sexuality variables including VPA. This is an ongoing issue in sexuality research, and solutions are not well explored. We did not find a significant main effect of alcohol intoxication on percent VPA change. This is inconsistent with previous findings showing robust alcohol attenuation effects on percent VPA change in samples that included women with and without a history of SV (see reviews by George & Gilmore, 2013; George et al., 2014). However, all participants reported a history of trauma in the current study. Perhaps the relationship between alcohol intoxication and percent VPA change should be examined in multiple populations. In addition, no main effect of subjective sexual arousal was found. That we found a main effect for VPA on C-MUTE adds to the literature supporting that subjective and genital sexual arousal in women may function through at least partially independent processes (Chivers et al., 2010; Laan & Everaerd, 1995; Laan et al., 1995). Inconsistent with our hypotheses, we did not detect an interaction between alcohol intoxication and C-MUTE on percent VPA change or subjective sexual arousal. These findings are consistent with studies showing no interaction between acute alcohol intoxication and SV history on VPA change (Gilmore et al., 2010; Schacht et al., 2007) or subjective sexual arousal (Gilmore et al., 2010). Given this and past null results examining lifetime SV, it is possible that acute

alcohol intoxication is not differentially associated with percent VPA change depending on SV or C-MUTE history. The observed effect size, $\eta^2 = .011$, suggests that to have an 80% chance of identifying a real effect, a sample of at least 710 would be required, which is well beyond the scope of any published VPA studies to date. However, Schacht et al. (2007) did find an interaction between alcohol intoxication and SV history on subjective sexual arousal, so results are partly inconsistent with these previous findings. It is possible that acute alcohol intoxication influences subjective sexual arousal in women with a history of trauma, not necessarily specific to SV.

Limitations, Strengths, and Future Directions

The nonsexual C-MUTE group contained a high number of women with an SV history (48%), limiting conclusions about the clean comparison between SV history and other types of trauma. However, the objective in the current article was to examine the comparison between a sexual and a nonsexual C-MUTE. Tentative interpretations can be made in light of the high proportion of women with an SV history in the nonsexual C-MUTE group. Furthermore, controlling for lifetime SV history did not change the results. The sample primarily consisted of well-educated Caucasian women who engaged in moderate to heavy social drinking and reported drinking five drinks in one drinking episode at least once in the past year. This was also a non–problem drinking sample in that they endorsed no concerns regarding their alcohol use originating from themselves or from others, including professionals.[1] It is possible that results would not generalize to women who either drink less or drink more, but this research does add to the literature on female social drinkers. Future work should examine the relationship between C-MUTE and percent VPA change in more diverse groups, given the evidence that alcohol plays different roles in different cultural contexts (Amodeo & Jones, 1997; Mandelbaum, 1965; Mitchell, 2016).

Some limitations of measurement should also be considered. Self-reported sexual difficulties were measured using single items; future work should use measures with multiple items for increased validity. In addition, because VPA has no absolute zero, it has not been possible to establish norms. Being mindful of these limitations, however, researchers have created detailed guidelines for the use of vaginal photoplethysmography (Woodard & Diamond, 2009). These were implemented in the current study. For example, a within-person subject design was used to create a percent change score. The present findings are consistent with past research, in that an attenuation of percent VPA change was related to SV, and extend previous research, given that attenuation was found for women with a sexual C-MUTE but not for women with a nonsexual C-MUTE.

The sexual C-MUTE group included women with a history of both childhood sexual abuse and adult sexual assault. While this is an important first step in further explicating the nature of the relationship between SV and

adult sexual function, future work might examine women with a sexual C-MUTE associated with childhood sexual abuse compared to adult sexual assault to examine potential developmental differences in SV's influence on percent VPA change, in particular exploring the unique developmental and family factors associated with childhood sexual abuse (Seehuus, Clifton, & Rellini, 2015). To continue to understand the mechanisms that are associated with reduced VPA response, future research should also compare interpersonal trauma to noninterpersonal trauma. We did not collect information about total compound trauma history in the current research project. It is possible that if the sexual C-MUTE group had a more severe compound trauma history than the nonsexual C-MUTE group, then results could be confounded by these experiences, biasing the sexual C-MUTE group toward more negative sexual health outcomes. Future replication research should examine the role of compound trauma. Similarly, we did not ask if participants experienced multiple traumatic events as being equally currently distressing. It is likely that the presentation of C-MUTEs is complex for some individuals; future research should examine this possibility.

In addition, C-MUTEs and "traumatic events" were self-defined, in that participants decided which experiences constituted a traumatic event and were able to choose *Other* from a list of typically provided options (e.g., sexual assault by someone you know). It is also unknown how participants decided which event currently upset them the most. Future research could consider standardizing criteria for choosing a C-MUTE. It is possible that not all C-MUTEs would be considered by a clinician to be traumatic, although the difference in impact between "traumatic" as experienced by an individual and "traumatic" as assessed by a third party is not clear. It may be that believing something to be traumatic is enough to make it traumatic to the extent that mental health difficulties follow. However, that we found differences between C-MUTE groups in a community sample using self-defined traumatic events suggests the importance of continued examination of non-treatment-seeking women. It is also possible that some participants had a sexual C-MUTE but did not identify this on the measure. However, we posit that this makes our conclusion stronger given that the nonsexual C-MUTE group could include participants who actually were currently most bothered by a sexual C-MUTE. Any significant effects were thus found despite this possibility.

Clinical Implications

This study was cross-sectional in nature and drawn from a community sample. For those reasons, clinical implications are inherently speculative and are more suggestive of future lines of research than prescriptive of an approach. The current findings suggest that women with a sexual C-MUTE may show attenuated percent VPA change and difficulties with vaginal lubrication and sexual inhibition compared to women with a nonsexual C-MUTE. This information could be integrated into clinical assessments and treatment planning, but more research is

needed to understand for whom and under what conditions sexual problems do occur depending on the nature of the C-MUTE. The current findings highlight the importance of the sexual nature of a C-MUTE on sexual difficulties. Thus, future research should continue to explore the idea that clinical interventions for sexual difficulties related specifically to the sexual nature of a woman's C-MUTE may be more effective than treatments that do not focus on the sexual implications of trauma. In addition, most women in the nonsexual C-MUTE group also experienced a history of SV (79%). Thus, it is possible that a woman's current upset related to SV, as compared to having a lifetime history of SV (and a nonsexual C-MUTE), is more strongly associated with sexual difficulties. Future research should test this hypothesis more directly.

Conclusion

This study expanded and clarified the existing literature by providing evidence that the nature (sexual versus nonsexual) of the C-MUTE is associated with some current sexual difficulties, including inhibition, vaginal lubrication, and reduced physiological genital response as measured by percent VPA change. We suggest that future research investigate the clinical implications of these findings. In particular, future studies should explicitly address one question raised here: Should therapy address the client's most upsetting trauma? Therapists may deem certain traumatic experiences as the most upsetting based on their own judgment of severity and not that of the client's. Thus, best clinical practice may dictate careful assessment of the client's experience. Research might also explore more fully the effectiveness of sexually specific trauma treatments. In addition, the role and function of alcohol in the context of the sexual behavior and satisfaction of women with a history of SV should continue to be explored.

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