WOMEN'S SEXUAL HEALTH

Resilience and Sexuality After Concussion in Women

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ABSTRACT

Background: Previous findings from our group show that in the acute (ie, 6−10 weeks) post-injury period, women with concussions have a 70% greater risk of sexual dysfunction than those with extremity injuries. There are currently limited treatment options for the clinical management of concussions. Resilience is a protective, modifiable psychological construct that has been shown to improve concussion-related sequelae. To date, however, no research has evaluated how resilience impacts sexuality outcomes after concussion in women.

Aim: Evaluate if resilience offers protection against negative sexuality outcomes in a cohort of reproductive, aged women with a concussion, seeking care in the Emergency Department of a Level-1 Trauma Center. We hypothesized that women with low resilience will be more likely to experience negative impacts on sexuality and that increasing levels of resilience will be associated with more positive sexuality outcomes.

Methods: Secondary data analyses.

Measures: Resilience was evaluated with the Resilience Scale (RS), and the Brain Injury Questionnaire for Sexuality (BIQS) was used for sexuality.

Results: Of the 299 participants recruited for the parent study, 80 with concussion had complete follow-up data and were included in these secondary analyses. Less than half (42.5%; n = 34) had low resilience (score≤130 on the RS), and the remaining 46 (57.5%) had high resilience (score>130 on the RS). In crude linear regression models, 1-unit increase in resilience was associated with a 4% increase in sexuality outcomes ($\beta = 0.04$, 95% CI:0.01, 0.05; $P = .008$). The effect estimate remained similar in post-concussion-symptom-adjusted models ($\beta = 0.03$, 95% CI:0.002, 0.06; $P = .03$). Mood-adjusted models showed a statistically significant interaction term ($P < .0001$). After stratifying by mood, findings showed that unit increases in resilience were associated with a 6% increase in sexuality outcomes for women in the high risk mood group (HADS score ≥11; PCS-adjusted $\beta = 0.06$, 95% CI:0.02, 0.11; $P = .009$).

Conclusion: Longitudinal studies are needed to evaluate how these improvements in resilience translate to patient recovery measures following concussion. **Anto-Ocrah M, Oktapodas Feiler M, Pukall C, et al. Resilience and Sexuality After Concussion in Women. Sex Med 2021;9:100297.**

Key Words: Resilience; Concussion; Female Sexual Function; Depression; Anxiety; Mood; Emergency Department

INTRODUCTION

Traumatic brain injury (TBI), a bump, blow, or jolt to the head or a penetrating head injury that disrupts the normal function of the brain[1,2] is one of the leading causes of death and disability globally.[3,4] According to the Centers for Disease Control and Prevention (CDC), an estimated 2.8 million TBI-related

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emergency department (ED) visits, hospitalizations, and deaths occur in the United States (US) annually.[2,5] Approximately 50,000 persons die from the injury, and more than 80,000 of the survivors experience an onset of long-term disability.[1,6] At least 75% (over 2.1 million) of all TBIs are mild traumatic brain injuries (mTBIs) or concussions[1,6,7]; a trauma-induced physiological disruption in brain function (such as loss of consciousness, amnesia, or confusion), resulting from a blunt impact force and or acceleration-deceleration event.[8] Although deemed "mild," the physiological damage induced by concussions has been associated with physical/somatic symptoms such as headache, nausea, fatigue, vestibular issues, cognitive defects, depression, anxiety, and other emotional difficulties, and sleep disturbances.[5,6] Between 30% and 80% of all patients with mTBI will experience at least one of these symptoms at some point.

Typical concussion symptoms resolve within weeks. However, studies have reported that a "miserable minority" of those who sustain mTBIs experience symptoms that linger into months, if not years.[9-13] Women, unfortunately, make up a large proportion of this "miserable minority,"[2,14] and their long-term outcomes tend to be worse than men's.[15-18] Women experience more post-concussion symptoms, worse cognitive deficiencies, higher levels of emotional/psychological disturbances, greater physiological burden, greater declines in the ability and functioning, and overall longer recovery time after injury.[5,9-13,15,18-25]

Negative sexual changes and dysfunctions are also known adverse outcomes after mTBI.[8,10,26-32] Previous findings from our group[8] show that in the acute (ie, 6−10 weeks) post-injury period, women with concussions have a 70% greater risk of sexual dysfunction (SD) than injured women with extremity injuries. Concussed women with SD also report more post-concussion symptoms (PCS), higher levels of anxiety, and greater depression.[8]

There are no evidence-based therapies for concussion management.[33] Past consensus-based recommendations emphasized physical and cognitive rest until complete symptom resolution.[34] This "rest is best" policy was supported by animal and human evidence of a vulnerable period early after a concussion during which the brain is susceptible to repeat injury and/or worsening symptoms with cognitive or physical stress.[35] Although emerging research challenges this notion,[33,36] there are still limited treatment options for the clinical management of concussions. In order to improve the recovery trajectory of the miserable minority of patients with mTBI-primarily women-it is important that researchers explore additional opportunities for intervention and treatment.

The concept of *resilience* as a major focus of treatment for TBI-related complications and rehabilitation has been gaining attention over the years.[11,37-40] Resilience refers to the process of overcoming any negative or adverse effects of particular risks and the ability to maintain mental and physical function following aversive stress or trauma.[37,38] It is a protective and modifiable psychological construct that reflects one's positive adaptations to adversity. Resilience was thought to be a personality trait that one was either born with or without.[37,40,41] It is now understood that resilience can be taught and learned, depending on life circumstances, and targeted interventions can improve one's overall resiliency.[40,42] The idea of incorporating resilience into treatment options is based on a positive psychology paradigm, which differs from the traditional deficit-based framework as it focuses on a strength-based model that seeks to identify qualities that help individuals thrive.[37,42]

Several studies have linked resilience with risk for concussion morbidity among civilian, military, and veteran populations.[11,38,43-45] No research, however, has evaluated the role of resilience in concussion-induced SDs. Resilience is modifiable.[11,46] Understanding its role in the neurosexuality of concussions offers opportunities for clinicians (rehabilitation scientists, psychologists, neurologists, to name a few), researchers, and implementation scientists to develop resilience-targeted interventions for mTBI patients who may experience changes in their sexuality (eg, sexual function, relationship quality) after their head injuries. Such interventions would be particularly beneficial for women with concussions, whose post-concussion sequelae tend to be worse than men's.[14-18]

The objective of this study was to fill this gap in the neurosexuality literature. Building off our earlier findings,[8] we sought to determine if resilience offers protection against negative sexuality outcomes in a cohort of women with mTBI seeking care in the Emergency Department (ED) of a Level-1 Trauma Center. We expanded our focus from SD specifically to sexuality in general by using a measure that assesses relationship quality and self-esteem, and mood related to sexuality, in addition to sexual functioning. Focusing exclusively on the subgroup of women with concussions, we hypothesized that those with low resilience will be more likely to experience negative sexuality outcomes than those with high resilience, and increasing levels of resilience will be associated with more positive sexuality outcomes. Identifying who *within* the concussed group is at great risk will allow researchers and clinicians to target them for appropriate treatment.

METHODS

This was a secondary data analysis of our previous research, which assessed the relationship between concussion and risk of SD in women of reproductive age[8] (Figure 1).

Participants

To be eligible to participate in the parent prospective cohort study, women had to be between the ages of 18-45 years and seeking care in the level-1 trauma center ED or its affiliated urgent care centers within 7 days of their injuries. Patients were required to meet the Centers for Disease Control and Prevention and/or American Congress of Rehabilitation Medicine (ACRM) clinical definitions of concussion or have an ED diagnosis of concussion.[8] Because we were unable to collect hormonal biomarkers to determine participants' menopause status, we took a

conservative approach and excluded women over the age of 45 due to the increased likelihood of menopause-associated hormonal irregularities after this age; a potential confounder for women's sexual health.[47] Additional exclusion criteria included current pregnancy, ≤3 months post-partum, having had a full hysterectomy that may impact hormonal regulation of sexual function, and admitted in-hospital or staying over 24 hours in the ED. All inclusion/exclusion criteria were self-reported and/or confirmed by chart review as appropriate.

Procedures

Enrollment and consent and was completed by trained and experienced Emergency Medicine Research Associates (EDRAs) in the ED.[8] All participants provided written consent. The study was approved by the University of Rochester's Institutional Review Board.

Baseline Assessment (January-July 2017)

The baseline survey administered by the EDRAs in the ED collected data on the injury attributes and mechanism (fall, motor vehicle crash, assault, etc.), patient demographics, relationship status, parity, menstrual and other reproductive histories, sexual orientation, religious affiliation, and mental health/medication history.

Follow-Up Outcome Assessment (March−September 2017)

At week 6 (up to week 10) after enrollment, participants were re-contacted by the PI (MAO) through a combination of telephone, email, or text messaging based on patient preference, and administered the follow-up survey. The survey evaluated participants' sexuality outcomes, post-concussion symptom burden, mood, and resilience. We chose to evaluate outcomes between 6−10 weeks after injury because, within this acute timeframe, concussion symptoms are expected to have resolved.[23,48,49] This timeframe also reflects the 1-month follow-up period used by Losoi, McCauley, and other research groups to evaluate the impact of resilience on concussion outcomes.[11,38,45,50]

Measures

Predictor Variable

Resilience. We used the Resilience Scale (RS)[51,52] to evaluate participants' post-mTBI resilience at 6−10 weeks. The 25 item survey is the original resilience measure and considered the "gold standard" for resilience assessments in various populations.[53] The RS measures the degree of individual resilience through 5 components: equanimity, perseverance, self-reliance, meaningfulness, and existential aloneness.[52] All items are scored on a 7-point scale from 1 = disagree to 7 = agree, with total scores of increasing resilience ranging from 25 to 175. The scale can be used continuously or dichotomized to cutoffs of ≤130 and > 130 to determine low and high resilience.[51,52,54] Cronbach's alpha coefficients range from 0.72−0.94, supporting the internal consistency reliability of the measure.[51,52] The resilience scale has been previously used to determine the resilience of mTBI populations in the literature.[11,38,40,55]

Primary Outcome

Sexuality outcome. The Brain Injury Questionnaire on Sexuality (BIQS)[26,56] is a validated 15-item instrument that evaluates sexuality after TBI through 3 subscales: sexual functioning, relationship quality, and self-esteem, and mood (ie, feelings of sexually-related depression and worry). The instrument requires respondents to compare aspects of their sexuality (eg, sex drive, sex appeal, communication with a sexual partner) with their pre-injury status on a 5-point Likert scale (1 = greatly decreased to 5 = greatly increased). Total sexuality scores range from 15−75, with lower scores indicative of decreases in sexuality outcomes. Scores below 45 are considered critical and indicative of injury-related changes in sexuality.[56-58] Cronbach's alpha coefficients range from 0.81−0.91.

Covariates

A priori we considered the following demographic and concussion-related variables as important covariates to adjust for, based on their associations with resilience and/or sexuality: age at the time of injury,[3,39,50] race,[59-61] ethnicity,[59-61] education,[59,60] religious affiliation,[41,60] relationship status,[56,60] sexual orientation,[56,60,62] parity,[59,60,63] history of previous concussions,[8] injury mechanism,[8] post-concussion symptom (PCS) burden,[8,11,19,21,40,43,55] and mood.[8,11,38,40,43,55,64,65] All these variables were self-reported by the study participants and confirmed with chart review as appropriate. For PCS and mood, we used the following validated questionnaires:

Post-concussion Symptoms (PCS). We used the Rivermead Post-concussion Symptoms Questionnaire (RPQ),[8,49,66] a 16-item self-report measure of the presence and severity of the most commonly reported post-concussive symptoms.[66] The scale compares any current symptoms to pre-injury symptom levels to account for potential symptom exacerbation subsequent to the head injury. Values for each of the 16 items are ranked on a 5-point scale (0 = not experienced at all, 4 = severe problem). Scores on the RPQ range from 0−64, with higher scores indicating greater PCS burden. This scale has been endorsed for mTBI populations by the National Institutes of Neurological Disorders and Stroke,[66] and was used previously to assess outcomes in mTBI populations.[49,66,67]

Mood. We used the Hospital Anxiety and Depression Scale (HADS) to evaluate post-injury mood. The HADS is a 14-item self-report measure designed to assess levels of emotional stress

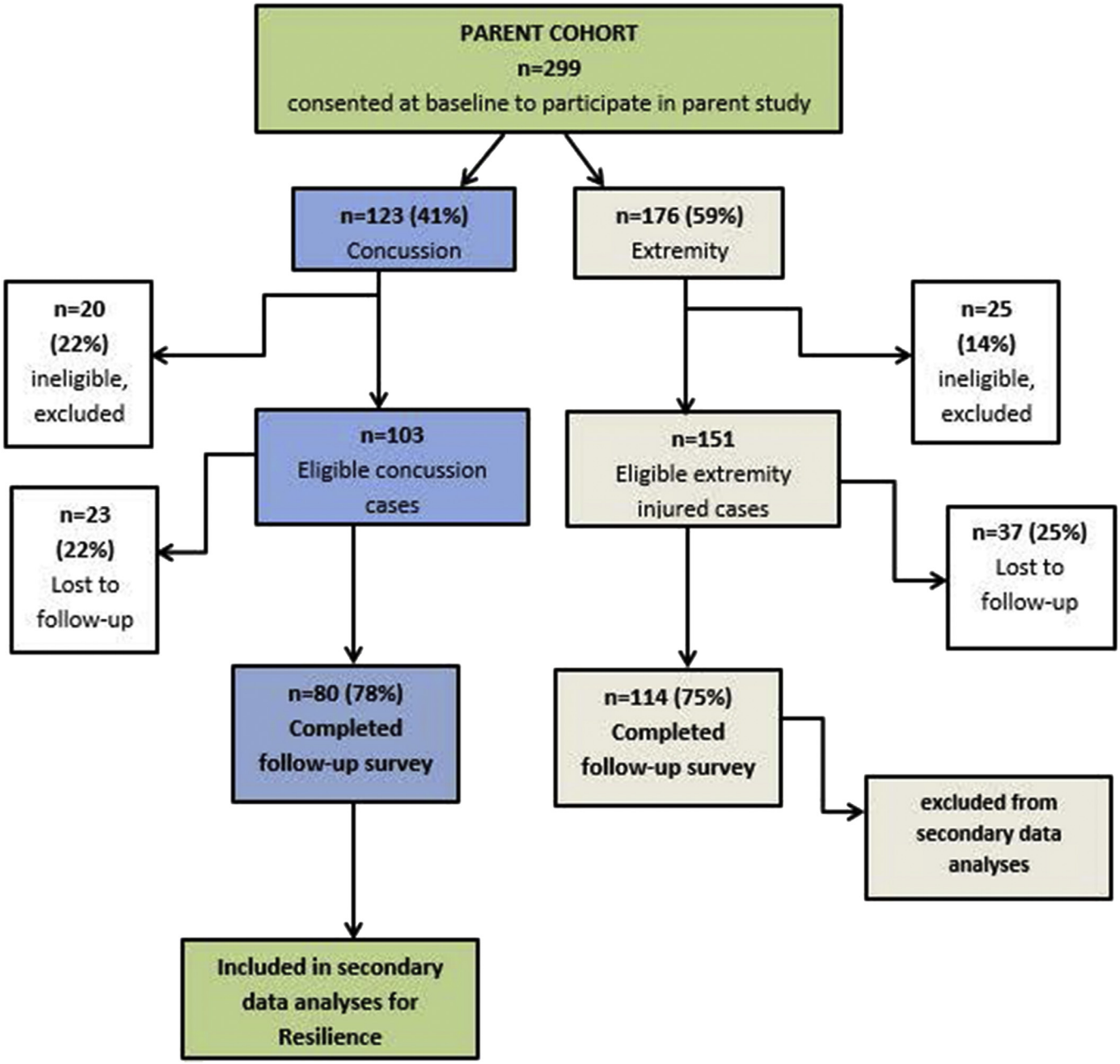

Figure 1. Flowchart of participants included in study and secondary data analyses of resilience.

and somatization. It has been used in a range of clinical and research settings, including studies with mTBI populations.[8,57,58,68] The tool includes 14 items, 7 related to anxiety (HADS-A) and 7 to depression (HADS-D). The 14 items are combined to provide a Total-HADS score, which can be further categorized into HADS-A and HADS-D for clinical and therapeutic purposes. Each item on the scale is scored between 0 (No, not at all) and 3 (Yes, definitely), for a total scale ranging from 0 to 21. Higher scores are indicative of more depressive and/or anxiety symptoms. The HADS has advantages over other instruments because of its clearly defined cutoffs for clinical caseness (normal = 0−7, borderline = 8−10, clinical caseness $\geq$11).[69] Studies have shown that the instrument has great versatility and is translational in nature,[69,70] allowing researchers to identify and refer study participants who fit the clinical cutoffs for treatment.

Statistical Analyses

Univariate analyses and descriptive statistics were performed to examine the frequencies and distributions of the data stratified by resilience, sexuality, and other important covariates, including PCS and mood. Bivariate differences were evaluated with chi-square (χ^2) tests and Fisher's exact tests as appropriate. Crude

Table 1. Demographic and resilience attributes of study population (n = 80)

	Low resilience (Scores ≤ 130) (n = 34)	High resilience (Scores > 130) (n = 46)	
Age, continuous			
Mean (±SD)	28.4 (±8.0)	27.5 (±7.3)	$P = .61$
Range	18–45	18–45	
Age Groups, categorized			
18–34	26 (76.5%)	34 (73.9%)	
35–44	7 (20.6%)	11 (23.9%)	$P = .90$
45	1 (2.9%)	1 (2.2%)	
Race			
White	23 (67.7%)	24 (52.2%)	
Black	7 (20.6%)	16 (34.8%)	$P = .35$
Other	4 (11.8%)	6 (13.0%)	
Ethnicity			
Hispanic	3 (8.8%)	9 (19.6%)	$P = .18$
Non-Hispanic	31 (91.2%)	37 (80.4%)	
Education, continuous			
Mean (±SD)	14.6 (±2.3)	14.5 (±2.4)	$P = .85$
Range	10–20	11–22	
Education, categorical			
High School/GED	19 (55.6%)	24 (52.2%)	
Associates, Bachelors or Higher	13 (38.2%)	18 (39.1%)	$P = .94$
Other	2 (5.9%)	4 (8.7%)	
Religious Affiliation			
Christian/Muslim/Jewish	13 (38.2%)	24 (52.2%)	$P = .0017$
Non-Religious	20 (58.8%)	11 (23.9%)	
Other	1 (2.9%)	11 (23.9%)	
Relational Attributes			
Relationship Status			
Single, not in a relationship	11 (32.4%)	16 (34.8%)	
Relationship, not married	13 (38.2%)	21 (45.7%)	
Married	8 (23.5%)	8 (17.4%)	$P = .74$
Divorced/Other	2 (5.9%)	1 (2.2%)	
Relational Attributes, continued			
Parity, continuous			
Mean (±SD)	1.1 (±1.5)	1.0 (±1.6)	$P = .96$
Range	0–6	0–6	
Parity, categorized			
0	19 (55.9%)	27 (58.7%)	
1 to 2	9 (26.5%)	13 (28.3%)	$P = .84$
3 or more	6 (17.7%)	6 (13.0%)	
Concussion comorbidities and mechanism			
Concussion History			
Yes	8 (23.5%)	9 (19.6%)	$P = .67$
No	26 (76.5%)	37 (80.4%)	
Post-Concussion Symptom Scores (Rivermead Post-Concussion Symptom Scale[90,91])			
Mean (±SD)	26.3 (±16.5)	18.0 (±14.0)	$P = .017$
Range	0.0–61.0	0.0–48.0	
Post-Injury Mood Scores (Hospital Anxiety and Depression Scale[9,70])			
Mean (±SD)	19.2 (±10.0)	10.4 (±8.9)	$P < .0001$
Range	1.0–38.0	0.0–37.0	

Table 2. Select predictors of sexuality outcomes among study participants (n = 80)

	Decreased sexuality outcomes (BIQS <45) (n = 46)	No decrease in sexuality outcomes (BIQS ≥45) (n = 34)	
Age, continuous			
Mean (±SD)	28.4 (±7.4)	27.3 (±7.9)	$P = .51$
Range	18–45	18–45	
Age Groups, categorized			
18-34	35 (76.1%)	25 (73.5%)	
35–44	10 (21.7%)	8 (23.5%)	$P = 1.00$
45	1 (2.2%)	1 (2.9%)	
Race			
White	20 (58.8%)	27 (58.7%)	
Black	13 (28.3%)	10 (29.4%)	$P = .98$
Other	6 (13.0%)	4 (11.8%)	
Ethnicity			
Hispanic	10 (21.7%)	2 (5.9%)	$P = .05$
Non-Hispanic	36 (78.3%)	32 (94.1%)	
Education, continuous			
Mean (±SD)	15.0 (± 2.4)	14.1 (±2.3)	$P = .10$
Range	10–22	11–18	
Education, categorical			
High School/GED	24 (43.5%)	19 (55.9%)	
Associates, Bachelors or Higher	20 (43.5%)	11 (32.4%)	$P = .35$
Other	2 (4.4%)	4 (11.8%)	
Religious Affiliation			
Christian/Muslim/Jewish	19 (41.3%)	18 (52.9%)	$P = .55$
Non-Religious	20 (43.5%)	11 (32.4%)	
Other	7 (15.2%)	5 (14.7%)	
Relational Attributes			
Relationship Status			
Single, not in a relationship	15 (32.6%)	12 (35.3%)	
Relationship, not married	16 (34.8%)	18 (52.9%)	
Married	12 (26.1%)	4 (11.8%)	$P = .14$
Divorced/Other	3 (6.5%)	0 (0%)	
Relational Attributes, continued			
Parity, continuous			
Mean (±SD)	1.0 (±1.3)	1.1 (±1.9)	$P = .75$
Range	0–5	0–8	
Parity, categorized			
0	24 (52.2%)	22 (64.7%)	
1 to 2	17 (37.0%)	5 (14.7%)	$P = .07$
3 or more	5 (10.9%)	7 (20.6%)	
Sexual Orientation			
Heterosexual	37 (80.4%)	31 (91.2%)	$P = .18$
Non Heterosexual	9 (19.6%)	3 (8.8%)	
Concussion comorbidities and mechanism			
Concussion History			
Yes	5 (16.1%)	9 (16.4%)	$P = .08$
No	26 (83.9%)	46 (83.6%)	
Post-Concussion Symptom Scores (Rivermead Post-Concussion Symptom Scale[90,91])			
Mean (±SD)	25.3 (±16.2)	16.4 (±13.4)	$*P = .01$
Range	0.0–61.0	0.0–52.0	

(continued)

Table 2. Continued

	Decreased sexuality outcomes (BIQS <45) (n = 46)	No decrease in sexuality outcomes (BIQS ≥45) (n = 34)	
Post-Injury Mood Scores (Hospital Anxiety and Depression Scale[9,70])			
Mean (±SD)	17.5 (±10.6)	9.6 (±7.9)	*$P = .0003$
Range	0.0–38.0	0.0–26.0	
History of Depression/Anxiety Medication Use			
Yes	15 (32.6%)	6 (17.7%)	$P = .13$
No	31 (67.4%)	28 (82.7%)	
Injury Mechanism			
Assault	6 (13.0%)	5 (14.7%)	
Fall	9 (19.6%)	11 (32.4%)	
Motor Vehicle/Motorcycle/Struck	22 (47.8%)	13 (38.%)	$P = .70$
Non-Fall Sports Injury	1 (2.2%)	1 (3.0%)	
Other	8 (17.4%)	4 (11.8%)	

*Met the cutoff for inclusion in multivariable models ($P < .05$)

and adjusted linear regression models were fit to determine the effect estimates for the average change in resilience scores with each unit increase in women's sexuality. We hypothesized that as resilience scores increased, there would be improvements in sexuality outcomes; thus, concussed women with low resilience will be more likely to experience negative sexuality outcomes than those with high resilience. We used $P < .05$ to determine statistical significance for all bivariate, crude, and adjusted analyses. All analyses were conducted using SAS version 9.4.

RESULTS

Of the 299 participants recruited for the parent study, there were 103 eligible concussion cases, of which 80 (78%) had complete follow-up data and were included in these analyses (Figure 1). As shown in Table 1, 42.5% (n = 34) had low resilience (met cutoff of ≤130 on the Resilience Scale), and the remaining 46 (57.5%) were classified as having high resilience (scored >130 on Resilience Scale). Women with low resilience tended to be slightly older, married, have only a high school/GED level education, and have a history of previous concussions, though these differences were not statistically significant (Table 1). However, there were statistically significant differences between the groups with regards to their post-concussion symptom scores and mood. Women with low resilience had higher PCS burden ($P = .017$) and worse mood scores ($P < .0001$) compared with those with high resilience. Additionally, there were high levels of religiosity amongst concussed women with high resilience, whereas those with low resilience tended to describe themselves as being non-religious ($P = .0017$). PCS and mood remained significant predictors of sexuality as well. As shown in Table 2, women with decreased sexuality outcomes also reported worse PCS morbidity ($P = .01$) and mood scores ($P = .0003$) than those without decreased sexuality outcomes. We included PCS and mood in linear regression models, given their associations with both resilience and sexuality.

Table 3 shows crude and adjusted effect estimates of the association between resilience and SD in the 80 women with a concussion. Crude linear regression models showed that every 1-unit increase in resilience was associated with a 4% increase in sexuality scores ($\beta = 0.04$, 95% CI: 0.01, 0.05; $P = .008$). The estimate was reduced slightly in PCS-adjusted models but remained statistically significant ($\beta = 0.03$, 95% CI: 0.002, 0.06; $P = .03$). Mood, however, changed the effect estimate by more than 10% from the crude estimate in all mood-adjusted models (Table 3), and the interaction term of mood and resilience showed statistical significance (mood*resilience interaction term = $P < .0001$), suggesting that mood was an effect modifier and that we needed to risk stratify the study sample by mood to identify potentially vulnerable subgroups of patients.

To achieve this, we grouped study participants into clinical and non-clinical mood groups based on their responses and scores on the HADS (Table 4). Participants who met the cutoff of ≥11 on the HADS were classified in the high-risk group of mood "clinical cases," and those who scored below 11 were grouped as "non-clinical cases."[69] As shown in Table 4, every 1-unit increase in resilience was associated with a 6% unit increase in sexuality scores for those in the high-risk group (PCS-adjusted $\beta = 0.06$, 95% CI:0.02, 0.11; $P = .009$), a 2% increase from the crude model. This model explains 19% of the variability in sexuality after concussion in this high-risk group of clinical mood cases (scatter plot in Figure 2).

DISCUSSION

Although the field of neurosexuality is beginning to gain momentum,[28,71-73] sexual changes after mTBI have been reported across the literature for decades.[10] As stated by the National Head Injury Foundation, "sexual dysfunction is more the

Table 3. Effect estimates of association between resilience and Sexual functioning (n = 80)

Mean change in sexuality Outcomes*					
	Crude	PCS-adjusted model‡	Mood-adjusted Model§	PCS and mood-adjusted model	Mood * resilience interaction model
Resilience Score†	$\beta = 0.04$ (95% CI: 0.01, 0.05) $P = .008$	$\beta = 0.03$ (95% CI: 0.002, 0.06) $P = .03$	$\beta = 0.006$ (95% CI: 0.03, 0.04) $P = .72$	$\beta = 0.009$ (95% CI:−0.03,0.04) $P = .60$	
Post-Concussive Symptoms (PCS)‡	-	−0.10 (95% CI:−0.15,-0.05) $P = .0001$	-	−0.03 (95% CI:−0.10, 0.05) $P = .51$	
Mood Scores§	-	-	−0.21 (95% CI:−0.29,−0.13) $P < .0001$	−0.17 (95% CI:−0.3,−0.05) $P = .005$	
Mood*Resilience					$P < .0001$

*Sexuality outcomes evaluated with Brain Injury Questionnaire for Sexuality (BIQS)[56]
†Resilience evaluated with the Resilience Scale (RS)[11]
‡Post-Concussive Symptoms (PCS) evaluated with Rivermead Post-Concussion Symptom Questionnaire (RPQ)[91]
§Mood Scores assessed with Hospital Anxiety and Depression Scale (HADS)[70]

Table 4. Association between Resilience and Sexual Functioning, stratified by Mood Clinical Cut-offs (n = 80)

Mean change in sexuality outcome scores*			
		Met mood§ clinical cut-off (HADS ≥11) n = 46	Did not meet mood§ clinical cut-off (HADS <11) n = 34
	Crude model	PCS‡ adjusted model	PCS‡ adjusted model
Resilience Score†	$\beta = 0.04$ (95% CI: 0.01, 0.05) $P = .008$	$\beta = 0.06$ (95% CI:0.02,0.11) $P = .009$	$\beta = -0.05$ (95% CI:−0.08,−0.02) $P = .002$
Post-Concussion Symptom (PCS) Score‡	-	−0.14 (95% CI:−0.23, −0.06) $P = .0007$	0.02 (95% CI:−0.05,0.08) $P = .6$

*Sexuality outcomes evaluated with Brain Injury Questionnaire for Sexuality (BIQS)[56].
†Resilience evaluated with the Resilience Scale (RS)[11]
‡Post-Concussive Symptoms (PCS) evaluated with Rivermead Post-Concussion Symptom Questionnaire (RPQ)[91]
§Mood Scores assessed with Hospital Anxiety and Depression Scale (HADS)[70]

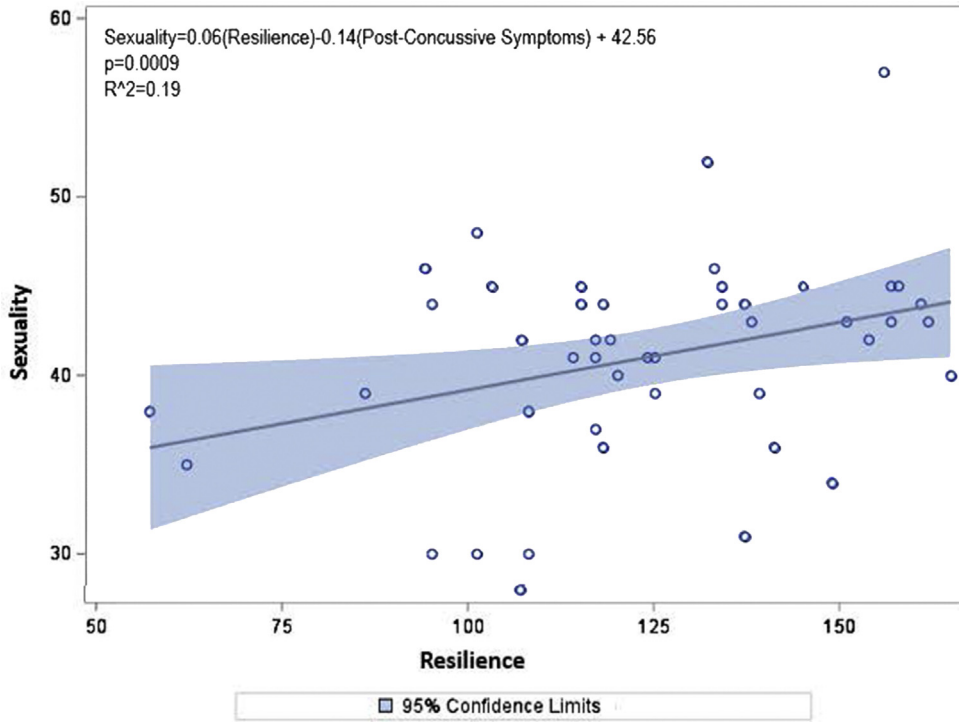

Figure 2. Scatter plot of Sexuality predicted by Resilience among Concussed Women who are Mood Clinical cases (HADS ≥11) n = 46.

rule than the exception in head injury…."[74] Concussion-induced sexual dysfunctions (SDs) have been associated with cognitive decline,[75,76] employment status,[77] relationships discord,[78-81] fertility,[30,76] and overall quality of life.[10,26,78,81] However, there is little to no research on treatment options for individuals who experience these sexual sequelae after their concussion injuries. Resilience is a modifiable psychological construct that has been shown to protect against adverse concussion sequelae,[11,38,40,42,45,55] but the association between resilience and SD, particularly in women with mTBI, has not been explored until now. We evaluated the association between resilience and sexuality in a cohort of women with mTBI seeking care in the ED of a level-1 trauma center. This group of head-injured patients represents the increasing majority of women who sustain their concussions via non-sports mechanisms,[2,5,82,83] and who also comprise a large proportion of the "miserable minority" of patients who experience prolonged concussion recovery.[2,12,14]

In this cross-sectional assessment, we observed small yet positive increases in sexuality outcomes among women with higher levels of resilience. These results suggest that women with low resilience are more likely to experience more negative concussion-induced sexuality outcomes than women with high resilience. Even more vulnerable are women who experience high levels of post-concussion anxiety and depression. The effect estimate was larger in this subgroup of mood-affected patients who could be targeted for resilience-focused interventions. This potentially positive impact of resilience on sexuality outcomes observed in our study in the acute (6 to 10 week) post-injury period aligns with the results of other concussion researchers; these researchers have shown that this period in the concussion recovery trajectory is critical for identifying and targeting the "miserable minority" who experience atypical concussion recovery. In a longitudinal study designed to evaluate short-term and long-term outcomes of injured individuals, Losoi and colleagues[11] compared return-to-work (RTW) outcomes in adults with mTBI (n = 74) and ankle injuries (n = 40) at 1, 6, and 12 months post-injury. The authors reported that concussed patients reported significantly more PCS than the extremity injured comparison group at 1 and 6 months post-injury (P = .001 and P = .029, respectively). Although 96% of mTBI patients reached RTW status at the 12-month assessment, the subgroup that did not have "modifiable psychological risk factors" (ie, depression, traumatic stress, and/or low resilience) at 1-month of follow-up. At the 6-month follow up, they had greater post-concussion symptoms, fatigue, insomnia, traumatic stress, and depression. McCauley and collaborators[38] also observed that preinjury resilience, evaluated within 24 hours after mTBI, significantly predicted postinjury anxiety and post-concussion symptoms at 1-week and 1-month post-injury (all $P < .007$) for patients with mTBI (n = 46) and an orthopedic comparison group (n = 29) recruited from the ED of level-1 trauma centers. Similarly, Merritt et al[45] observed a negative relationship between resilience and self-reported neurobehavioral symptoms within 12 months following mTBI in 142 US military service members. These studies emphasize that certain acute, short-term outcomes are predictive of long-term recovery and illustrate the importance of providing evidence-based treatment

and rehabilitation services early in the recovery period after a concussion.

Although anxiety and depression are factors that are substantially easier to change with psychological therapy than resilience, we advocate for a more comprehensive, novel, and dynamic psychological therapy of anxiety, depression, *and* resilience so patients can cope better with the stress of the brain injury, in addition to their mood. During the mTBI recovery and rehabilitation processes, resilience skills can be developed in individuals who, early on, demonstrate low or non-resilient profiles.[84] Although many TBI survivors find it difficult to remain positive in the face of the traumatic changes imposed by their injuries, interventions such as the Resilience and Adjustment Intervention (RAI), a seven-hour curriculum-based outpatient program,[84] have been shown to improve patient resilience, emotional well-being, and overall post-injury adjustment. By focusing on emotion regulation, relationship building, goal setting, and optimism, the skills-based intervention program has been shown to improve patient's resilience outcomes by an average of 7.29 points ($P < .001$) and decrease depression and anxiety scores by 7.06 ($P < .001$) and −5.28 ($P = .006$) scores, respectively. Our findings that higher resilience scores are associated with better sexual functioning outcomes in women with concussion align with that of other concussion researchers and advocates for incorporating the RAI and other resilience-building tools early in the rehabilitation process of head-injured patients. Through randomized control trials, future studies should evaluate the impact of these resilience interventions on women's post-mTBI sexual sequelae since there are currently little to no treatment options available for those who experience these morbidities.

Human sexuality is a complex and multidimensional construct that includes the interaction of various biological, intrapersonal and interpersonal, and socio-cultural factors.[59] Increasing awareness of the bio-psycho-social nature of sexuality has led to a better acknowledgment within the scientific community of the importance of assessing sexuality as a health outcome to promote the quality of life of individuals with neurodisabilities.[71] To our knowledge, this is the first study to evaluate the impact of resilience on women's sexuality after a concussion. By focusing on women ED patients, we targeted one of the fastest-growing mTBI populations in the United States who are under-represented in the concussion and neurosexuality literature, yet who experience worse sexual sequelae.[10,15,22,85] Despite the study's importance, there are some limitations. First is the small sample size. Although we found statistically significant findings that supported our hypothesis, larger studies are needed to substantiate our findings. Studies with larger sample sizes would accommodate more resilience groups (instead of high vs low, there could be 3 groups of low, medium, high, for example) and also accommodate more complex analyses that can pinpoint the most salient questions on the resilience scale/measure for the mTBI patient. A second limitation of the study is the lack of temporality in assessing the relationship between resilience and women's sexuality. Both resilience and sexuality were measured at the same time point (6−10 weeks after injury). This cross-sectional assessment makes it difficult to determine the directionality between resilience and sexuality. Like other research groups, our analyses held the assumption that resilience predicts mTBI-induced sexuality outcomes. However, poor sexuality outcomes could have also predicted low resilience. The study's cross-sectional design creates challenges for determining the directionality of the association between resilience and sexuality. Resilience requires social support, optimism, religiousness and spirituality,[86] attributes that may also be sequestered after trauma. After mTBI, individuals' social support may increase as friends and family members garner their support for the injured person. Highly resilient participants in our study also reported high levels of religiosity (Table 1), but without pre-injury and/or relative assessments, it is difficult to determine the magnitude of patients' changes in resilience and what the benchmark is for determining "recovery."

Despite these limitations, our study fills an important gap in the concussion literature and offers potential treatment targets for women with concussion who also experience negative mTBI-induced sexuality outcomes. Knowing that treatment options that incorporate resilience may be available for these concussed patients could encourage more provider-initiated discussions about the sexual sequelae of concussions in the neurorehabilitation and outpatient settings.[87,88] These discussions are especially crucial for women, given societal expectations placed on them as wives, mothers, and daughters, which often result in a much more differentiated constellation of family dynamics when TBI is introduced.[89]

CONCLUSION

mTBI is a stressful event that can induce individual-level changes in sexuality outcomes, an important aspect of quality of life. Resilience training may improve sexuality outcomes after a concussion, and is worthy of further investigation. Resilience-based interventions may be most critical during the early, acute, post-mTBI recovery process, as studies have shown that intervening and modifying behaviors early in the recovery trajectory may have the greatest impact on patients' overall recovery outcomes.

Women with post-injury anxiety and depression may benefit the most from such resilience-geared interventions.

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REFERENCES

1. Centers for Disease Control and Prevention, Division of Unintentional Injury Prevention. Injury Prevention & Control: Traumatic Brain Injury. Available from: http://www.cdc.gov/traumaticbraininjury/basics.html; http://www.cdc.gov/traumaticbraininjury/outcomes.html, 2015 Accessed December 1, 2015
2. Taylor CA, Bell JM, Breiding MJ, Xu L. Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, and Deaths — United States, 2007 and 2013. **MMWR Surveill Summ 2017;66:1-16.**
3. Colantonio A, Mar W, Escobar M, et al. Women's health outcomes after traumatic brain injury. **J Womens Health (Larchmt) 2010;19:1109-1116.**
4. World Health Organization. Neurological disorders: public health challenges 2007 2/15/2016]; Available from: http://www.who.int/mental_health/neurology/neurological_disorders_report_web.pdf.
5. Centers for Disease Control and Prevention. Report to Congress on Traumatic Brain Injury in the United States: Epidemiology and Rehabilitation. Atlanta, GA: National Center for Injury Prevention and Control; Division of Unintentional Injury Prevention; 2015.
6. Centers for Disease Control and Prevention. Facts about Concussion and Brain Injury. U.S. Atlanta, GA: Department of Health and Human Services; 2020.
7. Faul M, Xu L, Wald MM, et al. *Traumatic brain injury in the United States: emergency department visits, hospitalizations and deaths 2002—2006*. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2010.
8. Anto-Ocrah M, Bazarian J, Lewis V, et al. Risk of female sexual dysfunction following concussion in women of reproductive age. **Brain Inj 2019;33:1449-1459.**
9. De Koning ME, Scheenen ME, Van Der Horn HJ, et al. From 'miserable minority' to the 'fortunate few': the other end of the mild traumatic brain injury spectrum. **Brain Inj 2018; 32:540-543.**
10. Anto-Ocrah M, Tiffany K, Hasman L. Mild traumatic brain injury/concussion and female sexuality, A Scoping review of the literature. **Inj Epidemiol 2020;7:7.**
11. Losoi H, Silverberg ND, Waljas M, et al. Recovery from mild traumatic brain injury in previously Healthy adults. **J Neurotrauma 2016;33:766-776.**
12. Iaccarino M. Mild traumatic brain injury: a Clarion Call for Care of the postconcussive Spectrum. **JAMA Netw Open 2018; 18:e180211.**
13. Meehan WP 3rd, O'Brien MJ, Geminiani E, et al. Initial symptom burden predicts duration of symptoms after concussion. **J Sci Med Sport 2016;19:722-725.**
14. Centers for Disease Control and Prevention. Traumatic brain injury & concussion: Rates of TBI-related emergency department visits by sex — United States, 2001—2010. 2016 January 22 2016; Available from: https://www.cdc.gov/traumaticbraininjury/data/rates_ed_bysex.html.
15. Colantonio A. Sex, gender, and traumatic brain injury: a Commentary. **Arch Phys Med Rehabil 2016;97(2 Suppl):S1-S4.**
16. Benedict PA, Baner NV, Harrold GK, et al. Gender and age predict outcomes of cognitive, balance and vision testing in a multidisciplinary concussion center. **J Neurol Sci 2015;353:111-115.**
17. Meares S, Shores EA, Taylor AJ, et al. The prospective course of postconcussion syndrome: the role of mild traumatic brain injury. **Neuropsychology 2011;25:454-465.**
18. Bazarian JJ, Blyth B, Mookerjee S, et al. Sex differences in outcome after mild traumatic brain injury. **J Neurotrauma 2010;27:527-539.**
19. Covassin T, Moran R, Elbin RJ. Sex differences in reported concussion injury Rates and time loss from participation: an Update of the National Collegiate Athletic association injury Surveillance program from 2004-2005 through 2008-2009. J Athl Train; 2016.
20. Niemeier JP, Perrin PB, Holcomb MG, et al. Gender differences in awareness and outcomes during acute traumatic brain injury recovery. **J Womens Health (Larchmt) 2014;23:573-580.**
21. Preiss-Farzanegan SJ, Chapman B, Wong TM, et al. The relationship between gender and postconcussion symptoms after sport-related mild traumatic brain injury. **PM R 2009; 1:245-253.**
22. Harris JE, Colantonio A, Bushnik T, et al. Advancing the health and quality-of-life of girls and women after traumatic brain injury: workshop summary and recommendations. **Brain Inj 2012;26:177-182.**
23. Broshek DK, De Marco AP, Freeman JR. A review of post-concussion syndrome and psychological factors associated with concussion. **Brain Inj 2015;29:228-237.**
24. Gupte R, Brooks W, Vukas R, et al. Sex differences in traumatic brain injury: what We Know and what We should Know. **J Neurotrauma 2019;36:3063-3091.**
25. Covassin T, Savage JL, Bretzin AC, et al. Sex differences in sport-related concussion long-term outcomes. **Int J Psychophysiol 2018;132(Pt A):9-13.**
26. Latella D, Maggio MG, De Luca R, et al. Changes in sexual functioning following traumatic brain injury: an overview on a neglected issue. **J Clin Neurosci 2018;58:1-6.**
27. Moreno JA, Arango Lasprilla JC, Gan C, et al. Sexuality after traumatic brain injury: a critical review. **NeuroRehabilitation 2013;32:69-85.**
28. Dyer K, das Nair R. Talking about sex after traumatic brain injury: perceptions and experiences of multidisciplinary rehabilitation professionals. **Disabil Rehabil 2014;36:1431-1438.**

29. Moreno J, McKerral M, Gan C. Unraveling the complexity of sexuality after traumatic brain injury. **Int J Psychol 2012; 47:684.**
30. Grashow R, Weisskopf MG, Miller KK, et al. Association of concussion symptoms with Testosterone levels and Erectile dysfunction in Former professional US-Style football players. **JAMA Neurol 2019;76:1428-1438.**
31. Kelly DF, Chaloner C, Evans D, et al. Prevalence of pituitary hormone dysfunction, metabolic syndrome, and impaired quality of life in retired professional football players: a prospective study. **J Neurotrauma 2014;31:1161-1171.**
32. Turner D, Schottle D, Krueger R, et al. Sexual behavior and its correlates after traumatic brain injury. **Curr Opin Psychiatry 2015;28:180-187.**
33. Leddy JJ, Haider MN, Ellis M, et al. Exercise is medicine for concussion. **Curr Sports Med Rep 2018;17:262-270.**
34. McCrory P, Meeuwisse W, Aubry M, et al. Consensus statement on concussion in sport–the 4th International Conference on concussion in sport held in Zurich, November 2012. **J Sci Med Sport 2013;16:178-189.**
35. Giza CC, Hovda DA. The new neurometabolic cascade of concussion. **Neurosurgery 2014;75(Suppl 4):S24-S33.**
36. Leddy JJ, Haider MN, Ellis MJ, et al. Early Subthreshold Aerobic Exercise for sport-related concussion: a randomized clinical TrialEarly Subthreshold Aerobic Exercise for sport-related concussion—a randomized clinical TrialEarly Subthreshold Aerobic Exercise for sport-related concussion—a randomized clinical trial. **JAMA Pediatr 2019;173:319-325.**
37. Wang JL, Zhang DJ, Zimmerman MA. Resilience THEORY and its IMPLICATIONS for Chinese ADOLESCENTS. **Psychol Rep 2015;117:354-375.**
38. McCauley SR, Wilde EA, Miller ER, et al. Preinjury resilience and mood as predictors of early outcome following mild traumatic brain injury. **J Neurotrauma 2013;30:642-652.**
39. Holland JN, Schmidt AT. Static and dynamic factors promoting resilience following traumatic brain injury: a brief review. Neural plasticity, 2015; 2015.
40. Losoi H, Silverberg ND, Waljas M, et al. Resilience is associated with outcome from mild traumatic brain injury. **J Neurotrauma 2015;32:942-949.**
41. Konnikova Maria. How people learn to become resilient 2016 1/1/2020 2/15/2016]; Available from: https://www.newyorker.com/science/maria-konnikova/the-secret-formula-for-resilience.
42. White B, Driver S, Warren A-M. Considering resilience in the rehabilitation of people WithTraumatic disabilities. **Rehabil Psychol 2008;53:9-17.**
43. Sullivan KA, Edmed SL, Allan AC, et al. The role of psychological resilience and mTBI as predictors of postconcussional syndrome symptomatology. **Rehabil Psychol 2015;60:147.**
44. Graham DP, Helmer DA, Harding MJ, et al. Serotonin transporter genotype and mild traumatic brain injury independently influence resilience and perception of limitations in veterans. **J Psychiatr Res 2013;47:835-842.**
45. Merritt VC, Lange RT, French LM. Resilience and symptom reporting following mild traumatic brain injury in military service members. **Brain Inj 2015;29:1325-1336.**
46. Connor KM, Davidson JR. Development of a new resilience scale: the Connor-Davidson resilience scale (CD-RISC). **Depress Anxiety 2003;18:76-82.**
47. Ripley DL, Harrison-Felix C, Sendroy-Terrill M, et al. The impact of female reproductive function on outcomes after traumatic brain injury. **Arch Phys Med Rehabil 2008;89:1090-1096.**
48. Kontos AP, McAllister-Deitrick J, Sufrinko AM. Predicting post-concussion symptom risk in the ED. **Pediatr Neurol Briefs 2016;30:19.**
49. Eisenberg M, Meehan W III, Mannix R. Duration and course of post-concussive symptoms. **Pediatr June 2014;133:999-1006.**
50. Tonks J, Yates P, Frampton I, et al. Resilience and the mediating effects of executive dysfunction after childhood brain injury: a comparison between children aged 9-15 years with brain injury and non-injured controls. **Brain Inj 2011;25:870-881.**
51. Wagnild G. A review of the resilience scale. **J Nurs Meas 2009;17:105-113.**
52. Wagnild GM, Young HM. Development and psychometric evaluation of the resilience scale. **J Nurs Meas 1993;1:165-178.**
53. The Resilience Center. The original resilience scale. 2020 6/28/2020]; Available from: https://www.resiliencecenter.com/products/resilience-scales-and-tools-for-research/the-original-resilience-scale/.
54. Windle G, Bennett KM, Noyes J. A methodological review of resilience measurement scales. **Health Qual Life Outcomes 2011;9:8.**
55. Sullivan KA, Kempe CB, Edmed SL, et al. Resilience and other possible outcomes after mild traumatic brain injury: a Systematic review. **Neuropsychol Rev 2016;26:173-185.**
56. Stolwyk RJ, Downing MG, Taffe J, et al. Assessment of sexuality following traumatic brain injury: validation of the Brain Injury Questionnaire of Sexuality. **J Head Trauma Rehabil 2013;28:164-170.**
57. Downing MG, Stolwyk R, Ponsford JL. Sexual changes in individuals with traumatic brain injury: a control comparison. **J Head Trauma Rehabil 2013;28:171-178.**
58. Ponsford JL, Downing MG, Stolwyk R. Factors associated with sexuality following traumatic brain injury. **J Head Trauma Rehabil 2013;28:195-201.**
59. Burnette M, Mcanulty R. Exploring human sexuality: making healthy decisions. 2nd edition. Boston, MA: Pearson Allyn and Bacon; 2004.
60. McAnulty RD, Michele Burnette M. Sex and sexuality: sexual function and dysfunction. Westport, CT [u.a.]: Greenwood Press; 2006.
61. Huddleston HG, Cedars MI, Sohn SH, et al. Racial and ethnic disparities in reproductive endocrinology and infertility. **Am J Obstet Gynecol 2010;202:413-419.**

62. Meana M. Elucidating women's (hetero)sexual desire: definitional challenges and content expansion. **J Sex Res 2010;47:104-122.**
63. MiddleSexMDBlog. Sexuality For Life. Info, advice and products for women over 40: Key Insights into Women's Sexuality 12/23/2013 [cited 1/28/2016. Available from: http://blog.middlesexmd.com/tag/rosemary-basson/.
64. Holland JN, Schmidt AT. Static and dynamic factors promoting resilience following traumatic brain injury: a brief review. **Neu Plast 2015;2015.**
65. Dolan S, Martindale S, Robinson J, et al. Neuropsychological sequelae of PTSD and TBI following war deployment among OEF/OIF veterans. **Neuropsychol Rev 2012;22:21-34.**
66. The National Institute of Neurological Disorders and Stroke (NINDS), National Institutes of Health (NIH). NINDS Common data Elements. Harmonizing Information. Streamlining research. 2/26/2016; Available from: http://www.sf-36.org/tools/ https://commondataelements.ninds.nih.gov/Doc/NOC/SF-36_NOC_Link.pdf http://www.sf-36.org/tools/pdf/SF-12v2_Standard_Sample.pdf https://www.optum.com/optum-outcomes/what-we-do/health-surveys.html. Accessed July 4, 2016.
67. Wunderle K, Hoeger KM, Wasserman E, et al. Menstrual phase as predictor of outcome after mild traumatic brain injury in women. **J Head Trauma Rehabil 2014;29:E1-E8.**
68. Curran CA, Ponsford JL, Crowe S. Coping strategies and emotional outcome following traumatic brain injury: a comparison with orthopedic patients. **J Head Trauma Rehabil 2000;15:1256-1274.**
69. Wiglusz MS, Landowski J, Michalak L, et al. Validation of the hospital anxiety and depression scale in patients with epilepsy. **Epilepsy Behav 2016;58:97-101.**
70. Osborn AJ, Mathias JL, Fairweather-Schmidt AK. Depression following adult, non-penetrating traumatic brain injury: a meta-analysis examining methodological variables and sample characteristics. **Neurosci Biobehav Rev 2014;47:1-15.**
71. Moreno A, Gan C, Zasler ND. Neurosexuality: a transdisciplinary approach to sexuality in neurorehabilitation. **NeuroRehabilitation 2017;41:255-259.**
72. Moreno A, Gan C, Zasler N, et al. Experiences, attitudes, and needs related to sexuality and service delivery in individuals with traumatic brain injury. **NeuroRehabilitation 2015;37:99-116.**
73. Verschuren JE, Enzlin P, Dijkstra PU, et al. Chronic disease and sexuality: a generic conceptual framework. **J Sex Res 2010;47:153-170.**
74. O'Carroll RE, Woodrow J, Maroun F. Psychosexual and psychosocial sequelae of closed head injury. **Brain Inj 1991;5:303-313.**
75. War FA, Jamuna R, Arivazhagan A. Cognitive and sexual functions in patients with traumatic brain injury. **Asian J Neurosurg 2014;9:29-32.**
76. Popovic V, Pekic S, Pavlovic D, et al. Hypopituitarism as a consequence of traumatic brain injury (TBI) and its possible relation with cognitive disabilities and mental distress. **J Endocrinol Invest 2004;27:1048-1054.**
77. Bellamkonda E, Zollman F. Relationship between employment status and sexual functioning after traumatic brain injury. **Brain Inj 2014;28:1063-1069.**
78. Goldin Y, Cantor JB, Tsaousides T, et al. Sexual functioning and the effect of fatigue in traumatic brain injury. **J Head Trauma Rehabil 2014;29:418-426.**
79. Kreutzer JS, Sima AP, Marwitz JH, et al. Marital instability after brain injury: an exploratory analysis. **NeuroRehabilitation 2016;38:271-279.**
80. Moreno JA, McKerral M. Differences according to sex in Sociosexuality and Infidelity after traumatic brain injury2015. Behav Neurol; 2015. p. 914134.
81. Goldin Y. Intimacy, sexuality and reproductive health after TBI. 1/5/2016; Available from: http://www.bianj.org/wp-content/uploads/2015/05/2015seminar_10goldin.pdf. Accessed May 1, 2016.
82. Cassidy JD, Boyle E, Carroll LJ. Population-based, inception cohort study of the incidence, course, and prognosis of mild traumatic brain injury after motor vehicle collisions. **Arch Phys Med Rehabil 2014;95(3 Suppl):S278-S285.**
83. Laker SR. Epidemiology of concussion and mild traumatic brain injury. **PM R 2011;3(10 Suppl 2):S354-S358.**
84. Kreutzer JS, Marwitz JH, Sima AP, et al. Efficacy of the resilience and adjustment intervention after traumatic brain injury: a randomized controlled trial. **Brain Inj 2018;32:963-971.**
85. Hibbard MR, Gordon WA, Flanagan S, et al. Sexual dysfunction after traumatic brain injury. **NeuroRehabilitation 2000;15:107-120.**
86. Dey NEY, Amponsah B, Wiafe-Akenteng CB. Spirituality and subjective well-being of Ghanaian parents of children with special needs: the mediating role of resilience. **J Health Psychol 2019;13; 1359105319873956.**
87. Gott M, Galena E, Hinchliff S, et al. "Opening a can of worms": GP and practice nurse barriers to talking about sexual health in primary care. **Fam Pract 2004;21:528-536.**
88. Parish SJ, Hahn SR, Goldstein SW, et al. The International society for the study of women's sexual health process of care for the Identification of sexual Concerns and Problems in women. **Mayo Clin Proc 2019;94:842-856.**
89. Bell KR, Pepping M. Women and traumatic brain injury. **Phys Med Rehabil Clin N Am 2001;12:169-182.**
90. Eyres S, Carey A, Gilworth G, et al. Construct validity and reliability of the Rivermead post-concussion symptoms questionnaire. **Clin Rehabil 2005;19:878-887.**
91. King NS, Crawford S, Wenden FJ, et al. The Rivermead Post Concussion Symptoms Questionnaire: a measure of symptoms commonly experienced after head injury and its reliability. **J Neurol 1995;242:587-592.**