Women's Health Outcomes After Traumatic Brain Injury

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Abstract

Background: Traumatic brain injury (TBI) is a major public health problem, yet little is known about how this injury may affect long-term outcomes unique to women. This research examined the health outcomes relevant to premenopausal women 5–12 years after injury.

Methods: This was a retrospective cohort study at eight participating acute care/rehabilitation facilities. Participants were consecutive eligible women with moderate to severe TBI. A follow-up interview assessed menstrual functioning, fertility, and pregnancy experiences before and after injury as well as cervical cancer screening. Demographic variables, self-rated general and mental health, and functional limitations were also collected. Injury-related information was abstracted from health records. Female control participants recruited were matched on age, education, and geographic location.

Results: Of the 104 women with TBI (W-TBI), 46% experienced amenorrhea with duration of up to 60 months. Cycles became irregular for 68% of W-TBI after the injury. These findings were significantly different from those of controls. Among W-TBI, menstrual disturbances were associated with injury severity. No differences were shown between W-TBI and controls with respect to fertility, although significantly fewer W-TBI had one or more live births, and they reported more difficulties in the postpartum period than controls. W-TBI were less likely to have regular Pap smears and reported lower mental health, self-rated health, and function.

Conclusions: These findings inform prognosis after TBI for women and provide evidence for long-term monitoring of health outcomes and increased support after childbirth. More research is needed in this area, particularly with respect to the neuroendocrine system.

Introduction

TRAUMATIC BRAIN INJURY (TBI) is a leading cause of death and disability globally and, thus, is of major public health importance.¹ TBI is more common than breast cancer, spinal cord injury, HIV/AIDS, and multiple sclerosis (MS) combined.^{2–5} There are approximately 18,000 hospitalizations associated with a TBI diagnosis annually in Canada.⁶ The Centers for Disease Control and Prevention (CDC) estimates that 2% of the U.S. population lives with the effects of a TBI, of which about one third are women.⁷ Although men are at least twice as likely to sustain TBI, there is a very large population of women with TBI (W-TBI). Despite the large population affected, the health-related consequences of TBI unique to women have not been adequately studied. In particular,

there is a paucity of information on the impact of TBI on the female reproductive system, and there is limited information on the use of health services relevant to W-TBI, such as cervical cancer screening, in Canada.

Little is known about the effect of TBI on women's reproductive health with respect to menstrual cycles, conception, and pregnancy long term, in contrast to injuries with much lower incidence, such as spinal cord injury.^{8,9} To date, only one study¹⁰ has investigated preinjury and postinjury menstrual and reproductive functioning in a small sample of 30 women who were 1 and 3 years postinjury and had completed inpatient rehabilitation. The authors found that many participants' menstrual functioning changed after injury, with a significant increase in skipped menses postinjury and a tendency toward more painful periods. However, because of the small number of women in

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their study, the authors were not able to make any meaningful comparisons between preinjury and postinjury fertility.

The current investigation extends these findings in a number of ways. First, the inclusion of a control group in this study provides reference data for evaluating health outcomes after TBI. Second, participants were at least 5 years postinjury, which enables the assessment of longer-term health outcomes after TBI. Third, the sample size was larger and drawn from multiple centers across a wider geographical area. Lastly, we also addressed preventive health services specific to women as well as other measures of health and function. The information gained from this study is important, as it provides useful information specific to prognoses. In addition, it provides information on the neuroendocrine system that may lead to better treatment interventions or addressing barriers to care.

The main objective of this study was to investigate the long-term impact of moderate to severe TBI on women's health outcomes specific to premenopausal women, such as menstrual functioning, fertility, pregnancy experiences, and cervical cancer screening. General health, mental health, and physical function were also assessed.

Materials and Methods

Participants

This multicenter study was approved by the Research Ethics Board at all eight participating acute and rehabilitation centers across Ontario. Consecutive health records of female patients, aged 18–40 years at the time of TBI from January 1996 through December 2002, were reviewed for eligibility. Inclusion criteria for moderate to severe injury included having a Glasgow Coma Scale (GCS) score of <13 at the scene of injury or at hospital.¹¹ If GCS scores were unavailable or if a person had a GCS ≥ 13 , eligibility was determined by evidence of loss of consciousness >30 minutes, posttraumatic amnesia of >1 day, or abnormal CT scans.^{12–14} Other eligibility criteria included living in the community, being able to communicate in English, and competence to sign a consent form.

A total of 367 women were identified as potentially eligible from health records; however, only 238 could be contacted within limits of the current privacy legislation. We were not able to determine how many identified cases did not meet eligibility criteria (eg., deceased/institutionalized or out of catchment area) at follow-up or how they differed from nonparticipants. Of the eligible women contacted, 104 consented to take part in the study.

W-TBI completed a face-to-face interview, during which a detailed questionnaire about women's health issues before and after injury was administered. Demographic and injury-related data were abstracted from the participants' health records after consent was obtained. All interviews and data abstraction were conducted by trained research staff.

The control group for this study consisted of 104 women with no prior history of a TBI, recruited through random digit dialing. They were matched with W-TBI by age (± 5 years), education ($\pm$ one level), and geographic location (first two digits of postal code). The controls completed only the interview portion of the study. Because of geographic and funding constraints, a small portion of the control women were interviewed by telephone ($n = 14$). The controls were asked

about the same health issues within time periods corresponding to those used for the TBI participants. The time periods of 5–10 years ago and within the last 5 years were used as correlates of before and after injury, respectively.

Measures

Demographic information obtained included age at time of interview, living situation, marital status, number of children, education level, foreign-born status, employment history, and household income. Participants' postal codes were used to distinguish geographic location (i.e., urban vs. rural). Perceived supports on emotional, instrumental, and informational levels were also assessed in the questionnaire.

Perceived health and function. A 5-item self-rated health question from the Medical Outcomes Short Form-36 (MOS SF-36)¹⁵ was used to assess perceived health status at the time of the interview. Emotional well-being and fatigue items from the MOS SF-36 also were included. Functional status was measured in terms of limitations in basic activities of daily living (ADL) (e.g., bathing) and instrumental ADL (e.g., preparing meals) using subsets of the Older Americans Resources and Services (OARS) and the Multidimensional Functional Assessment Questionnaire.¹⁶ Self-reported measures of activity limitations and items from the MOS SF-36 have been found to be reliable and valid^{17,18} in TBI research.¹⁹

Injury-related variables. For W-TBI, information about age at time of injury, date of injury, length of unconsciousness, length of posttraumatic amnesia, GCS score, length of acute hospital stay, evidence of brain lesions on imaging report, mechanism of injury, and other injuries were abstracted from health records. An injury severity score (ISS) was subsequently generated, which is a standard measure to assess a person's overall injury level using scores from seven anatomical areas.²⁰

Reproductive health. Questions were designed to explore the impact of TBI on women's menstrual cycles, fertility, and experiences with pregnancy. W-TBI were asked about the regularity and duration of their menstrual periods before and after their injury, specifically, if their menses were absent (amenorrhea), if cycles were irregular, if there were any changes in intensity of periods, and to indicate any other menses-related changes.²¹ Our definition of irregular cycles included occurrence of amenorrhea. W-TBI were also asked if they ever became or tried to become pregnant either before or after their injury. For those who responded positively, further questions covered such issues as difficulty conceiving, complications during pregnancy, miscarriages, abortions, and postpartum difficulties.²² For instance, we asked: Did you have any postpregnancy difficulties in the pregnancies that occurred after your brain injury? Women who answered yes to this question were asked to identify problems from the following list: inability to concentrate, depression, loss of independence, increased fatigue, spasms, mobility problems, pain, extremity edema, and other. The same questions were asked of controls using similar corresponding time points.

Cervical cancer screening. Validated questions, drawn from the Canadian Community Health Survey,^{23,24} were

used to assess frequency of screening for cervical cancer. We conducted a reliability study on reproductive and cervical screening outcomes that yielded 77%–100% agreement on these items, with most with values >85%.²⁵

Statistical analysis

All data analyses were performed using Statistical Analysis System version 9.1 (SAS Institute, Cary, NC). Descriptive analyses, including frequency distributions and measures of cen-

tral tendencies, were generated to describe the sample of W-TBI as well as their case-matched controls. Conditional logistic regression was used to analyze the matched pairs. The *p* values were based on the Score test or the McNemar's test. These two tests are the same if the variables have two levels; however, only the score test is relevant for variables with more than two levels. When the variable has more than two levels, such as education, the odds ratio (OR) is for a change in one level of the ordinal score, assuming the scores are linear. The confidence intervals (CI) from the OR are calculated from the profile

TABLE 1. DEMOGRAPHIC CHARACTERISTICS OF WOMEN WITH TRAUMATIC BRAIN INJURY AND CONTROL GROUPS

Variable	W-TBI (n = 104)		Controls (n = 104)		OR ^a	CI ^b	p value ^c
	n	%	n	%			
Level of education at follow-up							
University/college	73	70	80	77	0.63	(0.30-1.23)	0.18
High school	23	22	17	16			
Some high school/elementary	8	8	7	7			
Country of birth							
Canada	87	84	93	89	0.57	(0.22-1.33)	0.20
Foreign	17	16	11	11			
Marital status before injury							
No	67	64	36	35	0.16	(0.06-0.36)	<0.0001
Yes	37	36	68	65			
Marital status at follow-up							
No	55	53	21	20	0.24	(0.12-0.46)	<0.0001
Yes	49	47	83	80			
Marital status change							
Yes before and No after	9	8.7	7	6.7	0.87	(0.47-1.58)	0.78
No before and Yes after	21	20	22	21			
No change	74	71	75	72			
Social support available							
Emotional support	94	90	102	98	0.11	(0.006-0.59)	0.01
Instrumental support	99	95	99	95	1	(0.28-3.60)	1
Financial support	90	87	103	99	0.07	(0.004-0.36)	0.0008
Informational support	96	92	102	98	0.25	(0.04-1.00)	0.06
Employment status before injury							
Yes	88	85	90	87	0.83	(0.35-1.93)	0.67
No	16	15	14	13			
Employment status at follow-up							
Yes	62	60	89	86	0.29	(0.14-0.57)	0.001
No	42	40	15	14			
Employment status change							
Yes before and No after	38	37	12	12	0.47	(0.27-0.77)	0.003
No before and Yes after	12	11	11	10			
No change	54	52	81	78			
Household income ^d							
<19,999	17	18	0	0	0.71	(0.58-0.83)	<0.0001
20,000-29,999	5	5	9	10			
30,000-39,999	14	15	4	4			
40,000-49,999	8	9	7	8			
50,000-59,999	10	11	10	11			
60,000-69,999	9	10	7	8			
≥70,000	29	32	55	60			
	Mean	SD	Mean	SD			
Age at follow-up	35.2	7.6	35.4	8	0.97	(0.85-1.09)	0.58

^aOR is based on matched pair analysis/conditional logistic regression, with the control group as the reference group. When a variable has more than two levels (eg., education), the OR is for a change in one level of the ordinal score, assuming a linear relationship between levels.

^bCI is calculated from the profile likelihood for the conditional regression.

^c*p* value from the Score/McNemar statistics. The Score test and the McNemar test are the same if the variables are dichotomized.

^dThe unit of change for household income for the OR is one level of income, which is usually \$10,000. This also assumes that the relationship of the income levels is linear.

CI, confidence interval; OR, odds ratio; W-TBI, women with traumatic brain injury.

likelihood from the conditional logistic regression. For pregnancy outcomes, the matching was broken and only analyzed as a simple regression because there were only 13 relevant pairs for analyses. Logistic regression was used to assess correlations between severity of injury measures and key outcomes.

Results

Sociodemographic characteristics

Table 1 summarizes the demographic profile of the W-TBI and control groups. With respect to the W-TBI group, the mean age at time of injury was 27.5 years, standard deviation (SD) 7.5. The follow-up period ranged from 4.7 to 12.2 years postinjury (mean 7.8 years). At the time of interview, the mean age was 35.2 (SD 7.6) years, with a range of 24–50 years. Most W-TBI were well educated, with 70% having postsecondary education at the time of follow-up. The majority were white (69%), Canadian-born (84%), and urban-dwelling (76%).

As expected because of matching, W-TBI and controls did not differ significantly on age and education. A significantly higher percentage of W-TBI were not married before injury (64%) compared with controls 5–10 years before the interview (35%). More W-TBI (53%) were also unmarried after injury compared with controls (20%) in a similar time frame. Change in marital status was not significant, indicating that marital status remained stable after injury. W-TBI were less likely to be employed at the time of the interview compared with controls, despite similar employment rates before injury. Approximately 37% of W-TBI became unemployed after injury compared with significantly fewer controls (12%) within a similar time period. Household income was significantly lower among W-TBI, whereas no control women had incomes <\$19,000 and most had incomes of ≥\$70,000. Further comparison of income levels revealed that controls were three times more likely to have more income than W-TBI. In addition, significantly more W-TBI indicated they lacked financial and emotional support, which were among the areas of perceived support examined.

TABLE 2. INJURY CHARACTERISTICS OF WOMEN WITH TRAUMATIC BRAIN INJURY

	Mean	SD
Age at time of injury	27.5	7.5
Acute LOS	25	21.8
Injury Severity Score	23.8	10.5
	n	%
GCS score		
3–8	71	68.3
9–12	26	25.0
13–15	5	4.8
Unknown	2	1.9
Mechanism of TBI		
Automobile	79	76.0
Pedestrian	10	9.6
Fall	8	7.7
Blow to the head/other	7	6.7

GCS, Glasgow Coma Score; LOS, length of stay; SD, standard deviation; TBI, traumatic brain injury; W-TBI, women with TBI.

Injury-related variables

Table 2 shows that 68% of the W-TBI in the study had severe brain injuries. The 5 women included with a GCS score of ≥13 and the 2 women with unknown GCS scores were found to have other evidence of moderate to severe brain injury. These women had posttraumatic amnesia for >1 day, had documented lesions (frontal lobe or temporal/parietal lobe involvement), with 1 W-TBI having a subdural hematoma. The primary mechanism of injury was motor vehicle related (76%).

Perceived health and function

Table 3 shows significantly lower ratings on overall perceived health, emotional well-being, energy/fatigue, and physical function among W-TBI.

Reproductive health

Menstrual periods. The mean duration of amenorrhea was 6.5 months, with a range of 1–60 months. There was 1 participant whose periods stopped at time of injury and had not returned by time of interview. Significantly fewer W-TBI (49%) reported changes in menstrual flow after injury compared with their control counterparts (64%, $p = 0.018$). Matched case-control conditional regression analyses showed that W-TBI were 21 times more likely than controls to report amenorrhea after injury; for those with regular cycles, W-TBI were 6 times more likely to experience irregular cycles. Among W-TBI, amenorrhea was associated with lower GCS scores (OR 0.83, CI 0.72–0.93, $p = 0.0025$), higher ISS, and longer length of acute hospital stay ($p < 0.001$) (Table 4). Irregular periods emerging after the injury were significantly associated with higher ISS only.

Fertility/pregnancy. Of W-TBI ($n = 29$), 28% indicated that they tried to conceive or became pregnant after their TBI vs. 35% of controls ($n = 36$) during a comparable time period ($p = 0.26$). Hence, the subgroups for these analyses are smaller in size (Table 3).

No significant group differences were found in terms of difficulty conceiving ($p = 0.40$) or difficulties during pregnancy after injury ($p = 0.14$) (Table 5). Of those who became pregnant, however, significantly fewer W-TBI had one or more live births compared with controls ($p = 0.0045$). W-TBI were also more likely to report postpregnancy difficulties in the pregnancies that occurred after the brain injury compared with controls in the equivalent time period. The 12 women reported the following: increased fatigue ($n = 8$), pain ($n = 6$), depression ($n = 5$), mobility problems ($n = 3$), inability to concentrate ($n = 4$), and lower extremity edema ($n = 1$). Three women who did not report depression reported “feeling the blues,” and 1 woman reported hip pain/headaches.

Cervical cancer screening

The majority of W-TBI and controls reported having their last Pap smear within the recommended time interval (Table 3). There was a trend showing that W-TBI were more likely than controls to have their last Pap smear >3 years ago ($p = 0.06$).

Discussion

To our knowledge, this study is the most comprehensive investigation to date of women's unique health issues after

TABLE 3. COMPARISON OF WOMEN WITH TRAUMATIC BRAIN INJURY AND CONTROLS ON MAIN HEALTH OUTCOMES

Variable	W-TBI (n = 104)		Controls (n = 104)		OR	CI	p value
	n	%	n	%			
Menstrual cycles							
Became irregular ^a					6.41	(2.72-18.87)	<0.0001
Yes	45	68	18	27			
No	21	32	48	73			
Stopped for awhile					20.5	(6.31-125.78)	<0.0001
Yes	47	46	8	8			
No	55	54	94	92			
Fertility							
Tried/became pregnant before injury					0.31	(0.14-0.63)	0.0012
Yes	44	42	64	62			
No	60	58	40	38			
Tried/became pregnant after injury					0.70	(0.26-1.31)	0.26
Yes	29	28	36	35			
No	75	72	68	65			
Cervical cancer screening							
Last Pap smear <3 years ago	80	85	88	94	2.6	(0.98-8.10)	0.059
Last Pap smear ≥3 years ago	14	15	6	6			
Activity limitations							
Daily					b	b	b
No limitation	94	90	104	100			
One or more limitations	10	10	0	0			
Instrumental					12.25	(5.00-40.56)	<0.0001
No limitation	53	51	98	94			
One or more limitations	51	49	6	6			
Self-rated overall health					2.03	(1.49-2.88)	<0.0001
Excellent	19	18	33	32			
Very good	27	26	50	48			
Good	36	35	17	16			
Fair/poor	22	21	4	4			
Self-rated mental health ^c	Mean	SD	Mean	SD			
Emotional well-being	66	22	76	16	0.75	(0.63-0.89)	0.0004
Energy/fatigue	50	25	63	18	0.75	(0.65-0.87)	<0.0001

^aBased on having regular cycles before injury (*n* = 66).

^bThe estimate of the OR (including CI and *p* value) could not be calculated because none of the controls had daily activity limitations.

^cOR was estimated for change in 10 points on either emotional well-being or energy/fatigue scales.

CI, confidence interval; OR, odds ratio; W-TBI, women with traumatic brain injury.

TBI and the first to document these outcomes with such a long range of follow-up. We found that W-TBI were more likely to report menstrual changes after injury, including irregular cycles and amenorrhea, compared with women without TBI within a similar time frame. Among W-TBI who experienced amenorrhea, it was generally transient, with the average time postinjury until menses resumed being 6.5 months. No significant differences were found between W-TBI and controls with respect to fertility and pregnancy-related difficulties. However, significantly fewer W-TBI than controls reported having one or more live births after injury, and significantly more W-TBI than controls indicated postpartum difficulties after their most recent pregnancy. In addition, W-TBI reported lower levels of perceived health (including mental health), physical function, perceived support, and income and were less likely to be married before and after injury. W-TBI were also less likely to obtain Pap smears within the recommended time interval, but this difference only approached significance (*p* < 0.06).

Our findings regarding menstrual functioning are consistent with those of Ripley et al.,¹⁰ who reported a significant increase in skipped periods after injury among women with

mild to severe TBI. Injury severity was a significant predictor of amenorrhea among W-TBI in our study. With regard to cervical cancer screening, our results tend to support previous studies showing that women with cognitive and physical disabilities were less likely to have routine cervical cancer screening.²⁶⁻²⁸ With a larger sample, one could potentially see a larger effect.

There are many possible reasons for W-TBI having fewer children and experiencing more problems after childbirth. A previous small study of TBI survivors many years postinjury showed that parents with a history of a TBI experienced more symptoms of depression relative to a comparison group without TBI.²⁹ More depressive symptoms and fatigue, in fact, were reported in our study among W-TBI. In addition, W-TBI may not be able to return to previous roles, putting more strain on other family members, such as spouses. Long-term social isolation is also not uncommon after a TBI.^{30,31} The physical and cognitive demands of rearing a child may be such that W-TBI may not be in a position to cope with as many children or as well as they would have otherwise. They may not be able to return to work in the same capacity as before, thus, financial factors may contribute to a conscious

TABLE 4. SEVERITY OF INJURY AND OUTCOME MEASURES: LOGISTIC REGRESSION ANALYSES

Severity measure	OR	95% CI	p value
Periods stopped for a while			
GCS	0.83	0.72, 0.93	0.003
ISS	1.07	1.03, 1.12	0.001
Length of stay	1.04	1.01, 1.06	0.004
Periods became irregular when previously regular			
GCS	0.94	0.81, 1.08	0.347
ISS	1.08	1.03, 1.15	0.001
Length of stay	1.03	1.00, 1.06	0.066

CI, confidence interval; GCS, Glasgow Coma Scale; ISS, Injury Severity Score; OR, odds ratio.

decision not to have more children. Indeed, our study found that W-TBI had a significantly higher rate of unemployment and lower household incomes after the injury, which has been well documented in the literature.¹⁹

Study limitations included a lower than expected tracing and participation rate. We were not able to compare the characteristics of respondents with the characteristics of nonrespondents in order to assess the degree of generalizability, as we did not have consent from nonrespondents to access this information. Our TBI participants were probably more educated and of higher socioeconomic status (SES) than nonparticipants, which could potentially affect outcomes,

such as cervical cancer screening, more than biological outcomes, such as menstrual cycles. Our control participants, however, were matched on educational level and were also of higher SES, as one would expect of a volunteer population. We also did not collect more biological information, which could have helped to explain menstrual disruption. We acknowledge that W-TBI may be potentially more likely to have difficulty recalling events as a result of disturbances in long-term and short-term memory.

TBI is one of the etiologies of hypopituitarism, which has been found to affect 25%–59% of patients several months and even years after head trauma.^{32–35} Pituitary abnormalities are not entirely unexpected after TBI, given the pituitary's vulnerable location in the brain and its tenuous blood supply.³⁶ Low levels of sex hormones associated with hypopituitarism can also cause amenorrhea and other menstrual disorders^{37,38} and can have wide-ranging negative effects on quality of life, mental health, and overall recovery.³⁹ Unfortunately, screening for hypopituitarism after TBI is not commonly done, and, thus, hypopituitarism is relatively underdiagnosed in the TBI population.^{32,35} Menstrual difficulties post-TBI may be a sign of neuroendocrine irregularities, which may affect other health issues, such as cognition and mood. These relationships, however, need to be studied further. For instance, a prospective study could be conducted where participants would be asked to record menstrual functioning/reproductive health through the use of diaries and at the same time have hormonal assays performed.

TABLE 5. COMPARISON OF WOMEN WITH TRAUMATIC BRAIN INJURY AND CONTROLS ON FERTILITY AND PREGNANCY

Variable	W-TBI		Controls		OR	CI	p value
	n	%	n	%			
Difficulty conceiving before injury	(n = 44)		(n = 64)		0.36	(0.10-1.09)	0.07
Yes	4	9	14	22			
No	40	91	50	78			
Difficulty conceiving after injury	(n = 29)		(n = 36)		1.58	(0.54-4.71)	0.40
Yes	10	34	9	25			
No	19	66	27	75			
Pregnancy before injury							
Difficulties during pregnancy	(n = 42)		(n = 62)		1.09	(0.47-2.46)	0.85
Yes	15	36	21	34			
No	27	64	41	66			
Postpartum difficulties	(n = 42)		(n = 62)		0.46	(0.17-1.13)	0.09
Yes	8	19	21	34			
No	34	81	41	66			
Live births (one or more)	(n = 42)		(n = 62)		0.66	(0.12-3.73)	0.62
Yes	39	93	59	95			
No	3	7	3	5			
Pregnancy after injury							
Difficulties during pregnancy	(n = 26)		(n = 35)		2.18	(0.77-6.36)	0.14
Yes	13	50	11	31			
No	13	50	24	69			
Postpartum difficulties	(n = 24)		(n = 34)		3.25	(1.07-10.40)	0.04
Yes	12	50	8	24			
No	12	50	26	76			
Live births (one or more)	(n = 26)		(n = 35)		0.15	(0.03-0.57)	0.0045
Yes	16	62	32	91			
No	10	38	3	9			

These variables were not analyzed as matched pairs but as simple logistic regressions. These analyses were only applicable to those who were pregnant. Using matched pairs within this subsample would have resulted in a very small sample.

CI, confidence interval; OR, odds ratio; W-TBI, women with traumatic brain injury.

Our study provides important novel information about the impact of TBI specifically on women's health issues and has important implications for health professionals working with W-TBI. Given the high frequency of posttraumatic amenorrhea, screening for menstrual irregularities should be routinely conducted for women after TBI, with gynecological referrals as required. Our study findings indicate that the ability to carry a child to term is not affected by TBI, which provides prognostic information that is often requested after injury. We also found that W-TBI have fewer children and are at increased risk of postpartum difficulties. The results support prior research¹⁹ that shows that women may require ongoing long-term support after TBI because of significantly lower perceived mental health, energy levels, physical function, social support, and income. Health professionals working with these women need to address the medical and social needs that we have shown can frequently affect female survivors of TBI. Possible programs include screenings for menstrual disturbances in both the acute and postacute stage, early intervention programs, and prevention programs for pregnancy after TBI that involve assessment of both personal and environmental resources needed. Finally, there is a role for healthcare providers as advocates for greater supports specific to W-TBI.

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Disclosure Statement

The authors have no conflicts of interest to report.

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