Preventive Health Practices and Behavioural Risk Factors in Women Surviving Traumatic Brain Injury

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Running Head: Traumatic brain injury among women
Abstract

This retrospective cohort study examined behavioral risk factors, access to health screening and primary care services among women with a history of moderate to severe traumatic brain injury (TBI) many years following injury. We compared findings of women with TBI against a general female population. Women with a history of moderate to severe TBI (n=75) appeared to have relatively comparable use of primary care services with the general population.; also, use of alcohol was greater among women with TBI compared to general population estimates. Significantly more women reported poor mental health many years post injury and should be monitored long-term.

Keywords: traumatic brain injury, women’s health, health screening procedure, disability
Traumatic brain injury (TBI) is a leading cause of death and disability worldwide (DeSilva et al., 2009). In the United States (US), TBI leads to more than a million injuries and up to 500,000 hospitalizations annually (D'Ambrosio & Perucca, 2004; Langlois, Rutland-Brown, & Wald, 2006; Centers for Disease Control and Prevention [CDC], 2009; Rao & Lyketsos, 2000). The prevalence of TBI is estimated at 2% of the population (Thurman et al., 1999). Corrigan, Selassie, and Orman (2010) indicate that the global incidence of TBI is likely higher than an estimate of more than 9.5 million. It is more common than breast cancer (Canadian Cancer Society, 2008), spinal cord injury (Canadian Paraplegic Association, 2008), HIV/AIDS (Public Health Agency of Canada, 2007), and multiple sclerosis (Canadian Institute for Health Information, 2007) combined.

Although TBI occurs most often among males (Rao & Lyketsos, 2000; Kraus & McArthur, 1999; Hannay, Howieson, Loring, Fischer, & Lezak, 2004; Langlois, Rutland-Brown, & Thomas, 2005; Colantonio et al., 2010b), large numbers of women are still affected because of high incidence and high level of resultant disability. International estimates have shown that approximately one third of cases occur among women (Langlois et al., 2003; Coronado, Johnson, Faul, & Kegler, 2006; Colantonio et al., 2010b). Another study found that up to 24% of females from a New Zealand birth cohort, aged 0-25 years old, have had a TBI for which medical care was received (McKinlay et al., 2008). In the US, hospital discharge data indicate that the incidence rate of TBI among women is slightly more than half the rate of TBI among males (Langlois et al., 2003; Corrigan et al., 2010). In spite of this evidence, however, there is a paucity of research that focuses specifically on the health of women with TBI.
An increasing body of literature on persons with disabilities highlights health issues specifically relevant to women. Epidemiological studies have found that women with physical and/or cognitive disabilities are less likely to receive such health screening procedures as mammograms (Barr, Giannotti, van Hoof, Mongoven, & Curry, 2008; Mobley, Kuo, Clayton, & Evans, 2009; Altman & Bernstein, 2008) and Papanicolaou (Pap) smears (Barr et al., 2008; Nosek & Howland, 1997; Stein & Allen, 1999), with the likelihood decreasing as level of disability increases (Chan et al., 1999). In a recent national US study of non-institutionalized adults, Barr et al. (2008) found that the mammography rates among women aged 50 years and over were lowest among those with cognitive difficulties (52%) and movement disabilities (66%) compared to the non-disabled population (74%). Similarly, only 58% of cognitively disabled women and 69% of movement disabled women aged 18 years and older had a Pap smear test within the past 3 years, compared to 82.5% of the non-disabled population. Other researchers have reported similar findings for pelvic exams and cervical exams, but not for breast exams (Nosek & Howland, 1997). A significant proportion of persons with disabilities experienced difficulty accessing adequate and appropriate primary healthcare services necessary to maintain optimal health (Veltman, Stewart, Tardif, & Branigan, 2001; Branigan, Stewart, Tardif, & Veltman, 2001; Robert Wood Johnson Foundation, 1994). It is not clear, however, if these findings would apply, and to what degree, to women with TBI, an injury which puts them at risk for cognitive problems related to memory and self-management in addition to resulting physical disabilities. A recent study on this population showed that women 5 to 10 years post TBI are less likely to have Pap tests.
(Colantonio et al., 2010b); additional research is needed to understand how women with a TBI fare regarding access to other healthcare and screening services.

Behavioral health risks must also be considered in relation to primary healthcare because physicians can perform a key role in monitoring risk factors and educating patients. Further, consequences of injury that may result from risk-taking behavior contributes to health costs in many ways. There is a demonstrable lack of available information on behavioral risk factors among women many years post-TBI. It is important to address this gap in the literature, as the prevention of further disability through disease or re-injury is of critical importance in this vulnerable population. Although health risk behaviors such as substance abuse are known to decline after TBI (Ponsford, Whelan-Goodinson, & Bahar-Fuchs, 2007; Graham & Cardon, 2008), more information is needed about these behaviors among survivors of TBI many years after injury, particularly among female survivors. Some authors have shown that persons with disabilities are more likely to have ever smoked, to be current smokers, to smoke more cigarettes, and to have at least one drink per day (Brawarsky, Brooks, Wilber, Gertz, & Walker, 2002; McGuire, Strine, Okoro, Ahluwalia, & Ford, 2007; Nosek, Hughes, & Robinson-Whelen, 2008; Becker & Brown, 2008) compared to non-disabled peers.

Our aim was to investigate health factors related to primary healthcare, including screening unique to women and behavioral risk factors for women many years after a moderate to severe TBI, and compare these to the general female population in Pennsylvania (PA).
Method

Participants

Potential participants were identified from among 92 women originally interviewed in a retrospective cohort study on long term outcomes of TBI by Colantonio et al. (2004). This original study included participants from a rehabilitation treatment facility in PA who required in-patient rehabilitation, were at least 14 years of age at the time of injury and had an eligible ICD8 or ICD9 diagnostic code for head injury (800-801.9; 803-804.9; 850-854.9).

Eligibility for this study included two criteria: (1) not living in an institution where access to healthcare is more regulated, and (2) being able to communicate functionally in a phone interview. Of the women in the original study, 82 (89%) met the criteria, 64 (78%) agreed to participate, 8 (9%) refused, and 11 (13%) were deceased, unable to participate, or lost to follow-up. Twenty additional women were contacted who were identified for the original study but lived out of the catchment area for a face to face interview. However, since this study required only a phone interview, distance was not a factor, and they were potentially eligible for participation. Of this group, 2 (10%) refused, 6 (30%) were lost to follow-up, 1 (5%) did not meet eligibility criteria, and 11 (55%) agreed to participate. Overall, we collected data on 75 participants through a telephone interview.

Medical records were reviewed to determine TBI severity by examining loss of consciousness (LoC) and other clinical characteristics. Charts were reviewed of patients with LoC of less than 20 minutes to confirm moderate to severe injury. The mean injury severity score was 26.9 (SD 9.3). Of the 75 participants, we had data on
length of LoC for 61 (81.3%) women. Of these, 6 (9.8%) had a LoC of less than 20 minutes, 3 (4.9%) between 20 and 59 minutes, and the remainder 52 (85.3%) had a LoC of 1 hour or more. Women with loss of consciousness of less than 20 minutes possessed other clinical characteristics that indicated at least a moderate injury, such as positive CT scans, a neurosurgical intervention or prolonged post traumatic amnesia. A detailed description of the sample is found elsewhere (Steadman-Pare, Colantonio, Chase, & Vernich, 2001). There were no significant differences between participants who were selected for this study and those who were not selected with respect to pre-injury marital status (chi-square p=0.58), level of education (t-test p=0.05), age at injury (t-test p=0.91), length of loss of consciousness (Chi-square p=0.97), amnesia at injury (Chi-square p=0.33), and injury severity score (t-test p=0.36).

Our questionnaire was developed using existing US population based initiatives – the Behavioral Risk Factor Surveillance System (BRFSS) – as a foundation. We used relevant state data as a comparison group because funding constraints limited our ability to collect new data from a relevant control group. The BRFSS is a health survey system that collects data on a monthly basis across the US pertaining to health conditions and risk behaviors, using a questionnaire jointly designed by state coordinators and CDC staff (CDC, 2010). The questionnaire collects data on “health behaviors related to the leading preventable causes of death, including physical inactivity, injury, weight control, alcohol consumption, tobacco use, and HIV-AIDS” (Nelson, Holtzman, Waller, & Leutzinger, 1998, p.214); the BRFSS also collects data on preventive health practices such as mammograms. The
target population for the BRFSS is the non-institutionalized civilian population aged 18 years and older. Data is collected via telephone interview in each state, random digit dialing (RDD) is employed as the method of sampling, and it takes roughly up to 15 call attempts to reach randomly selected adults (Nelson et al., 1998). Each state varies on how many interviews they conduct; according to Nelson et al., approximately 125,000 interviews are carried out across the country annually, and occur continuously throughout the year. The BRFSS is considered moderately to highly reliable and valid on most measures (Nelson, Holtzman, Bolen, Stanwyck, & Mack, 2001). The comparative data we utilized was from the state of Pennsylvania from 1999; there were 3,559 respondents for this data set (CDC, 1999a).

We obtained informed consent at the time of the interview. The study received ethics approval from the HealthSouth Rehabilitation Hospital and the University of Toronto.

Variables measured

We used a set of survey questions about preventive health practices and risk factors in this study. As stated above, virtually all of the questions were drawn from the BRFSS Questionnaire (CDC, 1999b), allowing a comparison of the study sample with data collected for PA by the CDC or the Census. We utilized comparative data for 1999, the year the survey took place, or for an adjacent year if the data were not available for 1999. In a few cases, data were not available specifically for PA, and national CDC data were used for comparison.

We collected demographic information including age, education, marital status, employment status and information about the participants’ injuries. Also, to
characterize the sample, we asked questions about health indicators such as self-rated physical and mental health, the number of days with poor mental health over the last 30 days, and whether respondents had ever been told by a doctor, nurse or other health professional that they had high blood pressure or high cholesterol.

Height and weight were collected so body mass index could be generated in order to determine obesity, where obesity is defined as having a Body Mass Index (BMI) of 30.0 kg/m² or greater (CDC, 2000).

Concerning primary healthcare and screening procedures specific to women’s health, we asked respondents when they had their last Pap smear. For women aged 40 and over we also asked about the length of time since their last mammogram, and whether they had a breast self-examination in the last year.

Other information collected included whether respondents had their cholesterol checked (in the last 5 years), blood pressure checked, and/or routine visit to a doctor within the last year; reasons for not visiting a doctor; and access to, and type of, health insurance. Lastly, respondents were asked questions about behavioral risk factors, such as smoking, drinking and binge drinking (defined by BRFSS as five or more alcoholic drinks at one session at least once over the last month) as well as the use of seat belts.

**Statistical analysis**

We conducted an analysis of descriptive statistics using SAS Ver. 9.2 (SAS Institute). We also performed a chi-square analysis for comparisons involving categorical data analysis. A p-value of less than 0.05 was deemed statistically significant.
Results

Table 1 provides demographic information about study participants and the comparison group.

Demographic information:

The mean time since injury was 16.4 years (SD 4.4). The mean age at follow-up for the women interviewed was 46.4 years (SD 13.5) with a range of 26 to 76 years. Although there was a higher proportion of older women in the PA sample, this did not reach statistical significance. The mean years of pre-injury education was 12.8 (SD 2.4). Our data on years of education was not directly comparable to the PA data which asked about levels of education. Further, we only had information on education at time of injury rather than at time of interview so it was not totally relevant.

Thirty five (46.7%) of the participants were employed at time of follow-up. Of those who were unemployed, 29 (38.6%) participants indicated that TBI was the reason for their unemployment.

Thirty five (46.7%) of the participants were married, a lower rate than would be expected based on the PA census data (CDC, 1999a). When marital status was examined by age, prevalence of marriage declined between the ages of 25 and 64 for TBI survivors, while the number of women who were married remained stable in the general population data (CDC, 1999a). The women with histories of TBI were also more likely to have never married (CDC, 1999a). These differences, however, did not reach statistical significance.
Health indicators

Physical health

Fifty eight (77.3%) of the participants described their health as excellent, very good or good, which is considerably lower ($p=0.01$) than the general population (85.2%). Fifteen percent of the participants had high blood pressure, 25.6% had high cholesterol, and 15.7% were classified as obese. All of these percentages were lower than in the general population of women in PA, who reported rates of 24%, 28.6% and 19.8% respectively.

Mental health

Women with TBI reported a much higher prevalence of problems affecting their mental well-being including stress, depression, and emotional difficulties. Specifically, over three times as many women in the study sample (40%) reported having such problems for more than one week in the past thirty days compared to the reported rate of 13.9% for the general female PA population ($p<0.0001$).

Primary healthcare

Screening procedures and doctor’s visits

Among all participants, 77.3% had a Pap smear within the last three years. Sixty five percent of participants had a mammogram within the past two years; of participants 40 years of age and older, 87.5% had a mammogram within the last 2 years. Mammogram screening was significantly higher among study participants
than among the general population for women over 40. Fewer participants (69.3%) had clinical breast exams in the last year compared to the general population, but this did not reach statistical significance.

Seventy two percent of the study participants reported having their cholesterol checked within the last 5 years, similar to the general population. Conversely, the rates for blood pressure screening within the last year (84%) were significantly lower for women with a history of TBI. Routine visits to doctors were comparable: most women in the study (81%) had visited the doctor for a routine checkup in the last year, a figure similar to that reported for the comparison population (82%). Among the women who had sustained a TBI, 10 (13.3%) indicated that they needed to see a doctor during the previous year but had not been able to do so. Cost was cited as the most common reason (n = 7, 70%). Inaccessibility of the doctor’s office, unsupportive doctor, and feeling uncomfortable were each reported once as reasons for not being able to visit a doctor in the past year.

Healthcare coverage

A large majority of women in the sample (92%) reported that they had some form of healthcare coverage, similar to female residents of PA as a whole (91.8%). However, the source of coverage in the study sample was less likely to be the subject’s employer (24%) and more likely to be Medicare/Medicaid (22.7%) or someone else’s insurance plan (25.3%). In comparison, the source of insurance among the general population group was more likely to be employer-based (74.4%)
than Medicare/Medicaid (4.3%) (CDC, 1999a). Data on screening, healthcare services and health insurance are presented in Table 3.

[Insert Table 3]

**Behavioral risk factors**

We questioned participants about four behavioral factors considered to endanger physical and mental health: smoking, drinking, binge drinking, and inconsistent use of seat belts.

A higher percentage of women with a history of TBI (30.7%) smoked than general female residents of PA (22.1%); however, the difference was not statistically significant. Sixty percent of the study sample reported alcohol consumption in the last month, a significantly greater proportion than their PA counterparts (43.4%; p=0.01). Moreover, significantly more study participants (14.7%) reported recent binge drinking compared to the general female PA population (6.8%; p=0.02). Use of seat belts did not differ significantly between groups. Seventy nine percent of the female survivors reported that they always used seat belts compared with 85% of the control population in 1997 when that data element was questioned about. A further 2.7% reported “nearly always” using seat belts. The data on behavioral risk factors are summarized in Table 4.

[Insert Table 4]

**Discussion**

Our study showed that women with a history of a TBI reported similar, if not better, general health, blood pressure, cholesterol, and weight. However,
participants reported significantly lower mental health. Women survivors of TBI
did not appear to be disadvantaged compared to the general population with respect
to breast and cervical cancer screening. Blood pressure checks were also lower
than in the general female population. A high percentage of the women in our study
had health insurance and made regular visits to a doctor. An area of concern was
higher reported drinking among study participants over the previous month, which
may be a risk factor for future injury.

These results are consistent with a recent study of Canadian women with TBI,
where no large significant differences were found in cervical cancer screening services
rates between women with TBI and women without a history of TBI (Colantonio et al.,
2010a). Our results differ somewhat from other studies that suggest a tendency toward
less use of, or less access to, health screening procedures among women with disabilities
(Barr et al., 2008; Mobley et al., 2009; Nosek & Howland, 1997; Chan et al., 1999). The
difference may occur in part because our participants all had disabilities resulting from
TBI, or multiple trauma including TBI, rather than disabilities in general, or specifically
physical disabilities. While many of our participants had physical limitations secondary
to their TBI, they may, as a group, have fewer activity limitations than the participants in
other studies of women with disabilities. Alternatively, as others have suggested, the
prolonged interaction of these participants with the healthcare system over the 8-24 years
since their TBI may have created greater awareness and greater opportunity to use
screening services (Nosek & Howland, 1997; Froehlich-Grobe, Figoni, Thompson, &
White, 2008).
The increased rate of alcohol use may reflect a form of self-medication or simply another lifestyle change. We were initially surprised to find that 24% of the women surveyed reported that they did not always use seat belts. Most traumatic brain injuries result from motor vehicle crashes and we expected that this group would become more attuned to injury prevention strategies. On the other hand, a disinclination to use restraints may have contributed to their injury in the first place. Similarly, higher alcohol use may have been a pre-morbid characteristic of this group, as other studies report (Kolakowsky-Hayner et al., 1999; Kreutzer et al., 1996). It may also be a result of injury.

Strengths and limitations

This is one of the largest long-term outcome studies of women living with a TBI ever published that addresses health issues and practices most relevant to this population. We present unique data using a validated questionnaire and compare the findings with population data from the same region. Our high response rate is very favourable given the length of time post injury, which has relevance for generalizability of results. The very long follow-up period makes the data particularly valuable since these women have had considerable experience living with the consequences of head injury.

The data reported here are all self-reported and are not based on actual observations. While we depended on self-reports of several health indicators, the reliability of such self-reported data, especially from survivors of TBI, has not been determined. Perceived health status and mental health issues, however, must be reported by the participant. We recognize that recall may be affected by memory. We also acknowledge that the comparison group for this study was not matched by age, education and socioeconomic status which also could affect results.
In order to keep the telephone interview to a manageable length for the participants, we decided to omit several important topics, such as high-risk sexual practices, measures of exercise and dietary intake. These topics should be considered for inclusion in future studies of this population.

Participants who survive many years post injury, are living in the community, and are able to participate in a phone interview most likely constitute a healthier, and large, subgroup of the post-TBI population. Likewise, as they were recruited through discharge records of a rehabilitation hospital, they may represent a group who received more medical services than other head injury survivors. They are unlikely to be a particularly privileged group in other respects as the rehabilitation facility from which they were recruited accepted a high proportion of patients with medical assistance, and a no fault automobile insurance system was in place in PA during most of the period when these traumatic brain injuries occurred.

It is important to appreciate that the relatively benign healthcare availability and screening data for these participants do not indicate that they are a healthy, risk-free cohort. Moderate to severe head injury seriously compromises health and is a major risk factor for poor functional outcomes (Colantonio et al., 2004; Corrigan, Smith-Knapp, & Granger, 1998; Hammond et al., 2001; Hoofien, Gilboa, Vakil, & Donovick 2001).

The effects of head injury in this cohort will be the subject of a separate paper.

Conclusion

Overall, our data demonstrate that there is scope to address preventive health strategies that could reduce the possibility of re-injury; particularly, high risk behaviors such as
drinking. Our findings also suggest that mental health is a substantial area of concern
many years post injury and should be monitored long-term. It is critical for mental health
supports to be made available to women survivors of TBI on a long-term basis.
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