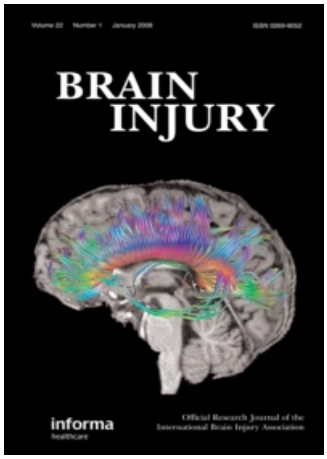

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Brain injury in a forensic psychiatry population

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Brain injury in a forensic psychiatry population

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Abstract

Objectives: The prevalence and profile of adults with a history of traumatic brain injury (TBI) has not been studied in large North American forensic mental health populations. This study investigated how adults with a documented history of TBI differed with the non-TBI forensic population with respect to demographics, psychiatric diagnoses and history of offences.
Method: A retrospective chart review of all consecutive admissions to a forensic psychiatry programme in Toronto, Canada was conducted. Information on history of TBI, psychiatric diagnoses, living environments and types of criminal offences were obtained from medical records.
Results: History of TBI was ascertained in 23% of 394 eligible patient records. Compared to those without a documented history of TBI, persons with this history were less likely to be diagnosed with schizophrenia but more likely to have alcohol/substance abuse disorder. There were also differences observed with respect to offence profiles.
Conclusions: This study provides evidence to support routine screening for a history of TBI in forensic psychiatry.

Keywords: *Traumatic brain injury, forensic psychiatry*

Introduction

Traumatic brain injury (TBI) frequently results in formidable cognitive, behavioural and social changes, which can have significant long-term consequences in the lives of survivors [1, 2]. These factors might also increase the TBI survivor's vulnerability to becoming involved in criminal activities [3–10] and sub-standard living environments.

Indeed, a history of TBI has been associated with criminality and offending and it is prevalent among prison inmates [4–18]. In a sample of US death row inmates, for example, 100% of those studied were found to have a history of TBI [14]. To date, however, there are no large North American studies of TBI in a forensic mental health population that examine how persons with a TBI in these settings differ from patients without a history of TBI in terms of sociodemographic indicators, co-morbid conditions and types of offences. This study addressed these issues, as TBI survivors may have special needs or behaviours that predispose them to certain maladaptive acts. In addition, issues with memory and cognition need to be considered in communication and follow-up.

Martell [9] documented a prevalence of severe head injury of 22% in a random sample of 50 maximum-security forensic psychiatric patients in the US. From the UK, Hawley and Maden [10] found that significantly more patients with a history of traumatic head injury were assessed to be at risk to others, which was a factor in delaying or hampering discharge. A similar study has yet to be done in a

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large North American forensic mental health population that extends comparisons to include issues related to living environments.

This study, therefore, aims to assess the prevalence of TBI and sociodemographic, criminal and mental health profiles among a large minimum-to-medium security forensic mental health population. This was part of a much larger project that examined the nature and extent of inappropriate living environments for persons after TBI.

Methods

Study design

The study involved retrospective chart reviews of patients admitted to the Law and Mental Health (LMH) Programme at the Centre for Addiction and Mental Health (CAMH) in Toronto, Canada between 1 January 2004 and 31 December 2004. The LMH Programme at CAMH is one of eight forensic psychiatry programmes in Ontario, Canada. It is responsible for ~25% of the province's forensic patients who are evaluated for Fitness to Stand Trial or Criminal Responsibility or who are under the supervision of the Ontario Review Board (as unfit or not criminally responsible). The programme consists of one assessment unit, two medium, three minimum secure inpatient units and one outpatient unit. The province of Ontario offers all residents public health insurance for 'medically necessary' care and, as such, the population is less likely to be affected by differential access to healthcare due to insurance status. The study received approval from the Research Ethics Boards of both CAMH and the Toronto Rehabilitation Institute.

Subjects

The charts of all individuals who were admitted to one of the six inpatient units or patients who were part of Outpatient Services between 1 January 2004 and 31 December 2004 were selected for review. This represented a sample of 415 patients. Of these, 21 patients were excluded from review for the following reasons: (1) access to the patient's chart was restricted due to legal reasons ($n = 3$); (2) patients were mistakenly thought to have received assessment or treatment in 2004 but had not (e.g. had been AWOL ($n = 8$)); (3) patients were part of an outpatient programme outside of CAMH and therefore their charts were inaccessible ($n = 8$); and (4) patients were scheduled for admission to the CAMH but were not seen in 2004 ($n = 2$). The remaining 394 patients represented the study sample and their charts were reviewed with a focus on the variables listed below.

Study variables

The sociodemographic variables examined included age, sex, marital status, ethnicity, country of birth, level of education, employment status and living situation at the time of admission to CAMH, including a history of homelessness. The type of criminal offences committed prior to their admission to CAMH was collected and grouped according to the categorization used by Seto et al. [19].

The presence and numbers of previous forensic psychiatric admissions, psychiatric diagnosis/es at the time of admission to CAMH and history of head/brain injury represented the clinical variables examined. If a history of head/brain injury was ascertained, further review was conducted to identify a number of relevant factors including:

- how the history of head/brain was determined (i.e. self-report, report by informant such as a relative, hospitalization records or any combination of the three),
- evidence of loss of consciousness (LOC) and its duration, and
- mechanism of injury (i.e. motor vehicle crashes, falls, blows to the head, etc.)

Data analysis

The data was analysed using the Statistical Package for Social Sciences (SPSS) Version 12.0 for Windows. Given that more than one data abstractor was used in this study, data abstraction reliability tests were conducted using kappa statistics for categorical variables and inter-class coefficients for continuous variables on 9% of the data. Excellent-to-perfect agreement was found on key variables such as history of TBI, diagnoses (e.g. schizophrenia, depression), demographic variables (age, gender) and types of offences such as theft, robbery ($\kappa \geq 0.80$).

Frequency distributions and measures of central tendency (i.e. means, standard deviation, range) were conducted to characterize the study sample. The TBI group was also described in terms of the average age at TBI, presence and duration of LOC and mechanisms of injury. Next, analyses including chi-square analyses (for categorical variables) and Student's *t*-test (for continuous variables) were conducted to compare the TBI and non-TBI groups on sociodemographics, clinical factors and type of offences committed prior to the index admission to CAMH.

Table I. Sociodemographic and clinical characteristics of the study sample (comparing TBI *vs.* non-TBI cases).

Study variable	Non-TBI ($n=305$), % (n)	TBI ($n=89$), % (n)	χ^2/t-value	df	p-value
Age (mean, SD)	39.2 (12.8)	35.4 (11.7)	2.54	387	0.01
Sex ($n=394$)					
Male	81.3 (248)	92.1 (82)	5.93	1	0.02
Country of birth ($n=390$)					
Born in Canada	43.9 (134)	52.8 (47)	2.24	1	0.15
Ethnicity ($n=383$)			3.53	3	0.32
White	48.5 (148)	56.2 (50)			
Asian	11.1 (34)	7.9 (7)			
Black	25.6 (78)	18.0 (16)			
Aboriginal/other	12.1 (37)	14.6 (13)			
Education ($n=371$)			4.18	2	0.13
High school incomplete	51.8 (158)	52.8 (47)			
High school completed	19.3 (59)	27.0 (24)			
Greater than high school	23.0 (70)	14.6 (13)			
Housing at admission ($n=367$)			2.79	2	0.26
Apartment/house	50.8 (155)	53.9 (48)			
Group home/facility	10.5 (32)	5.6 (5)			
Homeless/shelter/nfa	30.5 (93)	38.2 (34)			
Employment ($n=391$)			0.214	2	0.91
Employed	8.9 (27)	7.9 (7)			
Unemployed	82.6 (252)	84.3 (75)			
Retired/student/other	7.9 (24)	6.7 (6)			
History of homelessness ($n=355$)			0.002	1	0.53
Have been homeless	39.3 (120)	42.7 (38)			
Axis I					
Schizophrenia	66.6 (203)	42.7 (38)	17.8	1	0.001
Alcohol +/or substance abuse/dependence	37.0 (113)	55.1 (49)	8.8	1	0.003
Bipolar disorder	8.9 (27)	12.4 (11)	0.91	1	0.34
Schizoaffective	8.5 (26)	7.9 (7)	0.05	1	0.82
Delusional disorder	3.6 (11)	7.9 (7)	2.79	1	0.10
Axis II					
Antisocial personality disorder/psychopathy	15.4 (47)	29.2 (26)	8.43	1	0.004
Borderline, histrionic or narcissistic personality disorder	5.2 (16)	11.2 (10)	3.90	1	0.048
Mental retardation	7.9 (24)	9.0 (8)	0.09	1	0.75

Results

General characteristics of the study sample

Of the 394 subjects, 45.2% were admitted to the medium secure in-patient assessment unit, 13.3% to medium security units, 18.1% to minimum security units and 4.1% directly to Outpatient Service. Table I outlines the general characteristics of the study sample, which consisted of predominantly males (83.8%). The average age of the sample was 39.9 years old at the time of admission to CAMH. With respect to homelessness, 33.4% reported being homeless at the time of admission and over 40% reported a lifetime history of homelessness.

Schizophrenia (61.2%) was the most common psychiatric disorder found in the sample followed by alcohol/substance abuse disorder (41.5%). Approximately 58% of participants were diagnosed with more than one psychiatric condition. Among those with multiple psychiatric diagnoses, alcohol/substance abuse disorder was the most common secondary diagnosis (71.6%) followed by antisocial or psychopathic personality disorder (31.6%).

For the entire sample, the most common criminal offences, using the categories outlined by Seto et al. [19], were for assault (80.2%), escape (54.8%), theft (35.3%), mischief (32.0%), obstruction of justice (28.9%) and weapons-related charges (23.4%). See Table II for a list of the other criminal offences.

Characteristics of the TBI group

Overall, 22.6% of the study sample had a history of TBI documented in health records. This includes reports of head injuries with and without LOC and those for whom the experience and duration of LOC could not be ascertained from the charts. Most of these, 73%, were based on self reported data ($n=65$). Family members reported a brain injury in 27 of the cases (30%) and in 18 of the cases (20%) there was evidence of medical treatment or admission due to a brain injury.

Table II. Prevalence of criminal offences and charges (YES *vs.* NO) in the study sample (categorization based on Seto et al. [19]).

Criminal offences/charges	Non TBI ($n=303$), % (n)	TBI ($n=89$), % (n)	χ^2 value	df	p-value
Assault[a]	79.2 (240)	85.4 (76)	1.68	1	0.19
Escape[b]	51.2 (155)	68.5 (61)	8.40	1	0.004
Theft[c]	32.7 (99)	44.9 (40)	4.536	1	0.03
Mischief[d]	31.4 (95)	34.8 (31)	0.38	1	0.54
Obstruction of justice[e]	27.1 (82)	36.0 (32)	2.64	1	0.10
Weapons charges[f]	22.1 (67)	28.1 (25)	1.37	1	0.24
Drug charges[g]	13.9 (42)	16.9 (15)	0.50	1	0.48
Homicide[h]	13.9 (42)	15.7 (14)	0.21	1	0.65
Sexual assault[i]	12.9 (39)	15.7 (14)	0.48	1	0.49
Harassment	12.2 (37)	16.9 (15)	1.32	1	0.25
Robbery[j]	11.2 (34)	14.6 (13)	0.75	1	0.39
Dangerous/impaired driving[k]	8.9(27)	9.0 (8)	0.001	1	0.98
Fraud[l]	7.9 (24)	6.7 (6)	0.14	1	0.71

[a]including aggravated assault, choking, administering a noxious thing, assault causing bodily harm, assault with or without a weapon, uttering threats, threatening with a weapon and threatening damage.
[b]including absent without leave, failure to comply or to appear, return to court and unlawfully at large.
[c]including theft under $1000 (including possession of stolen property under $1000), theft under $1000 (including possession of stolen property over $1000), break and enter and commit and indictable offence (burglary) and break and enter with the intent to commit an offence.
[d]including mischief to public or private property over or under $1000.
[e]including obstructing a police officer (including resisting arrest) and assaulting a peace officer.
[f]including possession of prohibited or restricted weapon and carrying a concealed weapon.
[g]including possession of controlled substance and trafficking in narcotics.
[h]including homicide (murder, manslaughter, criminal negligence causing death) and attempted murder causing bodily harm with the intent to wound.
[i]including aggravated sexual assault, sexual assault causing bodily harm, sexual assault with/without a weapon, gross indecency (vaginal or anal penetration, forced to fellate offender, offender fellates or perform cunnilingus), attempted rape, indecent assault, sexual interference and invitation to sexual touching.
[j]including armed or unarmed robbery (bank, store), robbery with violence, armed robbery (not bank or store) and purse snatching.
[k]including dangerous driving or impaired driving (driving while intoxicated).
[l]including Fraud (extortion, embezzlement) and fraud (forged check, impersonation).

The age at initial TBI ranged from 1–75 years old with an average age of 19.3 years (SD = 12.8). Thirty-nine cases suffered their TBI at age 18 or younger. Among those with TBI, details about LOC were included in 58 charts (65.2%). Of these, 76% ($n=44$) reported some LOC. Even though 44 patients had documentation of LOC following their initial TBI, more precise information was found on a sub-set. In 12 cases, LOC was reported as less than 30 minutes and, in two cases, LOC was reported between 1–3 hours. For eight individuals, LOC ranged from 1 day to 36 weeks. Therefore for 10 cases (11.2%) there was specific information supporting a moderate-to-severe TBI. Details regarding LOC were unclear for 31 cases (34.8%).

Figure 1 illustrates the distribution of the mechanism of injury among those for whom this information could be ascertained ($n=78$). Mechanism of injury could not be ascertained from the records for 12.3% ($n=11$) of the TBI cases. Falls and motor vehicle crashes accounted for the two largest percentages of injuries (i.e. 30.8% and 29.5%, respectively). With respect to psychiatric diagnoses, schizophrenia, alcohol/substance abuse disorder and antisocial/psychopathic personality disorder were the three most common psychiatric diagnoses among those with TBI.

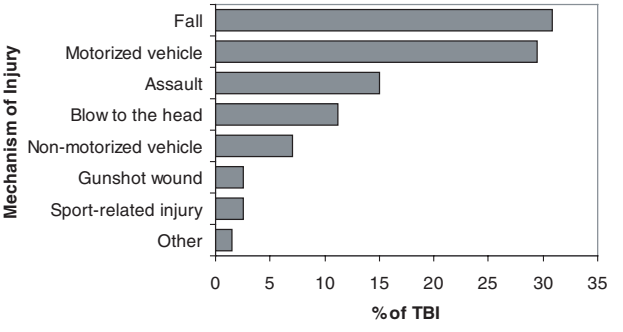

Figure 1. Mechanisms of TBI in a forensic psychiatry population.

Comparison of the TBI vs. non-TBI groups on common characteristics

The results in Table I show that the TBI cases were significantly younger at admission. As well, there were slightly more males in the TBI group compared to those with no reference to TBI in medical records. There were no statistically significant differences

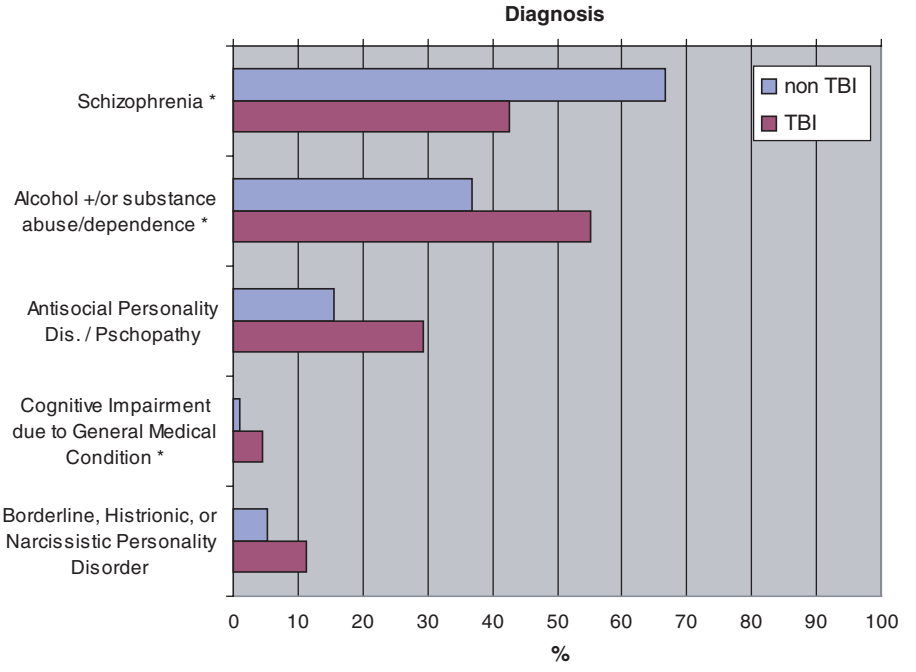

Figure 2. Percentage of people for the five most common diagnosis in TBI group ($n = 89$) and non-TBI group ($n = 303$), $^{\star}p \leq 0.01$ chi-square test.

between the groups in terms of country of birth, ethnicity, marital status, level of education and employment status and housing situation at the time of admission to CAMH. Both TBI and non-TBI groups experienced similar high levels of homelessness.

A lower proportion of individuals with a history of TBI were diagnosed with having schizophrenia (42.7%) compared to those without TBI (67.4%). However, a larger proportion of individuals with a history of TBI compared to those without TBI had a diagnosis of alcohol and/or substance abuse. Higher proportions of individuals diagnosed with antisocial personality disorder/psychopathy and slightly more with borderline, histrionic and/or narcissistic personality disorder were found for those with a reported TBI (Figure 2). Unfortunately, information on whether these disorders developed before or after the individual suffered their brain injury could not be systematically ascertained.

Table II outlines the comparison between individuals with and without TBI on the 13 most common criminal offences and charges in the study sample. There were higher proportions of escape among the TBI group compared to the non-TBI group, even after Bonferroni correction for multiple comparisons. There were only slight differences between TBIs and non-TBIs with respect to theft but no statistically significant differences between the two groups regarding the frequencies of the other offences outlined in Table II.

Discussion

The main findings of this study include the notable proportion of individuals admitted to the forensic psychiatry programme at CAMH with a history of TBI and their significant differential clinical and forensic profile. Also of note is the high proportion of individuals who were homeless at the time of admission to the CAMH programme overall.

The proportion of individuals with a documented history of TBI found in this study (23%) was similar to that found in some previous studies [9] but lower than that found in other studies [10]. The discrepancies in the prevalence of TBI in the forensic psychiatry population across studies is to a great extent related to the country of study, the source of the study sample, the sample size and the methods used to ascertain TBI status. For example, despite consistency in the prevalence of a history of TBI in the current study and Martell's [9] study from the USA, the latter utilized a random sample of 50 mentally disabled male patients at a maximum security state hospital and focused on individuals with severe brain injury. The current study, on the other hand, used a larger sample of patients from medium and minimum security units, as well as an outpatient unit, and had a wider reported range of severity of brain injury, as has been done in another study [10]. Hawley and Maden [10] drew their sample from multiple medium security facilities in the UK and included a sample of 113 patients with a preponderance of males and observed a prevalence

of TBI that was twice the size observed in this study. Similar to Martell [9] and Hawley and Maden [10], the current study depended on the indication of TBI in the charts to determine TBI status, which was primarily based on self-report, whereas De Souza's [8] study from Brazil, which reported a lower prevalence of TBI (5%), only included TBI cases that occurred prior to their offences that were diagnosed by a neurologist. These more rigid criteria possibly accounted for the lower prevalence of TBI observed by De Souza [8] and the inconsistency with the current findings where a more liberal definition was used. The authors recognize that a TBI history many not have always been systematically ascertained in the intake and therefore may have resulted in under-estimates. However, using cases with a more confirmed loss of unconsciousness, the prevalence would be closer to 11% and even smaller (5%) if cases were included with evidence of contact with the healthcare system. The current prevalence estimates may currently include persons for which the injury was sustained solely to the head without long-term impact to the brain. Self-report of a TBI and also loss of consciousness specifically is subject to recall bias and as such the results should be interpreted with caution. Despite these limitations to the data, a differential profile of persons with a history of TBI was obtained which was consistent with brain injury.

Also, despite the discrepancies in the prevalence rate for TBI, the current results and findings from other studies suggested that intake assessment should include questions about a history of TBI. The question would have to be tailored to the population. For instance, Slaughter et al. [12] utilized the following question in a prison setting: Have you ever had an injury to the head which knocked you out or at least left you dazed, confused or disoriented? The date or age at injury should be acknowledged and also the length of unconsciousness. Identifying hospitalization and length of hospitalization may also be helpful in determining severity. Clinicians should also note hospitalizations for head injury in clinical records any other resultant cognitive deficits. Persons who know the client well could also be questioned regarding a history of TBI. For persons with an ascertained history of TBI, a brief neuropsychological screening is recommended to provide information on cognitive abilities present.

This needs to be emphasized given the finding across studies of a lack of routine assessment for TBI in this population. Advocating for routine screening of TBI is important with accessible treatment and rehabilitation programmes for patient referrals. If clients are found to have a history of TBI, particularly in the moderate-to-severe range with accompanying deficits, staff should also be adequately trained with respect to the nature of the condition and appropriate behaviour management techniques [18]. Prisoners with a history of TBI, for instance, have been found to have more difficulty in following rules in prison [20]. Consultations with other trained experts in TBI and neuropsychological testing may be necessary to determine extent of existing deficits, particularly in more severe cases.

The results also demonstrated that most of the TBI cases were due to falls and motor vehicle crashes. This finding is consistent with previous literature that has reported these two mechanisms of injury to be the most common causes of TBI [1, 21]. TBI as a result of assault was much higher in this clinical and forensic sample than in the general Canadian population [21, 22].

The literature on TBI has consistently indicated that TBI is a problem that affects younger age groups and primarily males [1, 2] and these findings are replicated in this study. As well, the TBI group had higher proportions of individuals with diagnoses of alcohol and/or substance abuse and personality disorders. However, it is unclear whether these disorders developed before or after the individual suffered a brain injury due to the cross-sectional nature of the data. Alcohol use and alcohol/substance abuse are predisposing factors for TBI [23] and tend to persist after the TBI. In addition, post-injury alcohol abuse is strongly associated with a diagnosis of depression post-TBI and, as such, may be a way of self-medicating depressive symptoms [24]. At most, these results indicated that the assessment for these disorders and TBI, including information on LOC, post-traumatic amnesia, residual cognitive and behavioural sequelae, are important in the forensic psychiatry population. In fact, if a forensic psychiatry patient has a history of TBI, it is also important to further assess for substance use and personality disorders in light of possible links between these conditions, homelessness and offending.

There are in fact, many conditions and factors prevalent in forensic psychiatric populations that may also be implicated in neurocognitive difficulties. Specifically, conditions such as attention deficit and hyperactivity disorder and learning disorders should also be assessed [23–28] as well as the influence of sub-optimal intelligence scores and educational level. Consideration of these factors in future studies may help to quantify the specific impact of brain injury on neurocognition.

Most of the patients were unemployed and supported by public assistance programmes, more than 30% were homeless or of 'no fixed address' at time of admission to the hospital. Also, according to the records, over 40% had some history of homelessness over their lifetime. These figures on

homelessness are probably under-estimated given that only individuals with a clear history reported in their charts were recorded as being or having a lifetime history of homelessness. This is of concern since homelessness increases the individual's risk of subsequent TBI [29, 30] and the associated long-term consequences, which might include susceptibility for re-offending. Although the cross-sectional nature of the data does not allow one to determine whether TBI status specifically led to homelessness, except perhaps for those who were injured when they were children, and whether these combined vulnerabilities led to criminal behaviours, the associations between these factors underline the need for long-term follow-up studies on individuals with TBI and those with TBI who are in the forensic system.

Conclusion

In summary, the study suggests that it is important to screen for a history of TBI and possible long-term sequelae in minimum-to-moderate security forensic psychiatric populations. This may have implications in terms of treatment, including the introduction of compensatory strategies to clients. Clients with potential memory problems may need additional reminders to make court appearances, for instance, and/or require more written instructions. This data is limited by the problems associated with retrospective record collection. The collection of relevant data prospectively would provide a more accurate history. Prospective studies can also provide information on the intricate relationships between TBI, homelessness, mental health conditions and criminal activities for one to better understand and treat these vulnerable groups and move forward in prevention efforts. This disaggregation could not be adequately accomplished using this cross-sectional study design. As such, future large research studies using prospective designs which include neurological screening to ascertain cognitive ability are needed. This occurring in childhood and youth in particular need to be carefully followed for sequelae that might occur in later years.

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