# PATTERN OF ALCOHOL USE AMONG PATIENTS WITH TRAUMATIC BRAIN INJURY IN MALAYSIA'S URBAN HOSPITAL

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ABSTRACT

Pattern of alcohol use among patients with traumatic brain injury in Malaysia's urban hospital

Objective:

To date, there is limited literature on the alcohol use among the patients with Traumatic Brain Injury (TBI) in Malaysia. Hence, the primary objective of the study is to determine the pattern of alcohol use among patients with traumatic brain injury in an urban hospital in Malaysia. The secondary objective is to investigate the association of alcohol use in the traumatic brain injured subjects with socio-demographic characteristics, duration of head injury and severity of head injury, history of alcohol use/substance use, psychological wellbeing, and cognitive function.

Method:

This is a cross sectional study conducted in the UMMC Rehabilitation Clinic, Neurosurgical clinic and ward, HKL Neurosurgical clinic and ward, the observation ward, Emergency Department. Data collection occurred from November 2017 till January 2018. A convenient sampling method was used. The patients were selected based on the selection criteria. The socio-demographic and clinical information were gathered after obtaining the informed consent from the patients or their guardians. The participants were each given a booklet of questionnaires to be filled which include their demographic particulars, alcohol use pre-or post TBI particulars, head injury particulars, AUDIT form, GHQ-12 form and MOCA form. All the questions were mainly in the Malay language and the researcher assisted the patients if the subjects had difficulties to understand the questions.

Results:

Out of the 60 patients approached, only 47 patients were included in the study. The mean age of the participants was 36.8 years- (SD±14.8). In 83% of the patients were male (n=39) and females constituted 17% (n=8). The majority of the patients were Malays (63.8%) followed by Indian (23.4%) and Chinese (10.6%). In 51.1% of the participants were married and 48.9% were single or divorced. About two third of patients attained at least secondary education. Almost half of the patients (44.7%) were unemployed. Their average salary was RM 1429.79 (SD± 2340.28)

A quarter of the subjects had used alcohol prior to their injury. There were significant associations between post-TBI alcohol use, an AUDIT score of 8 or more (OR 30, 95%CI 3.06-294.56) and alcohol use history (OR 1.31, 95%CI 1.03-1.67). A significant relationship was also noted between pre-TBI alcohol use and safety measure taken (OR 9.6, 95% CI 1.27-72.53). However, no significant associations were found between pre-TBI alcohol use with Modified Rankin Scale (mRS), neurosurgical intervention and GCS severity. Similarly, there was no significant associations were found between post-TBI alcohol use with age group, gender, marital status, educational status, occupation status, head injury duration, family history of alcohol use, pre TBI nicotine use, GHQ-12 score and MoCA score.

Conclusion:

The association with alcohol use and occurrence TBI is a complicated yet significant situation. Alcohol use affect incidence and subsequent recuperation from a TBI episode. The findings from the study, support the associations found in numerous literature; that the patients' alcohol use pre-injury may contribute to their recovery and post-TBI usage. The findings of the study add evidence to the need to monitor alcohol level in all patients presenting with traumatic head injury.

*Keywords: Alcohol use, prevalence, TBI, head injury, Malaysia*

ABSTRAK

Kelaziman penggunaan alkohol di kalangan pesakit yang mengalami kecederaan kepala di hospital bandar di Malaysia

Objektif:

Sehingga hari ini, tidak banyak artikel berkenaan penggunaan alkohol di kalangan pesakit yang mengalami kecederaan kepala di Malaysia. Oleh yang demikian, objektif utama kajian adalah untuk mengkaji corak penggunaan alkohol di kalangan pesakit yang mengalami kecederaan kepala di hospital bandar di Malaysia. Objektif sekunder adalah untuk menyelidik hubungan antara penggunaan alkohol selepas kecederaan kepala dengan data peribadi pesakit, jangka masa kecederaan kepala, tahap kecederaan kepala, sejarah penggunaan alkohol atau barang terlarang, tahap kesejahteraan mental pesakit dan fungsi kognitif.

Kaedah:

Kajian ini merupakan kajian keratan rentas yang dijalankan di Klinik Rehabilitasi PPUM, Klinik dan Wad Neurosurgikal PPUM, Klinik dan Wad Neurosurgikal HKL, Wad pemerhatiaan kecemasan HKL dari November 2017 hingga Januari 2018. Kaedah pengambilan sample mengikut keselesaan penyelidik dibuat bergantung kepada kriteria pemilihan. Soalan berkenaan data peribadi and data klinikal dikumpulkan setelah keizinan daripada pesakit atau penjaga diperoleh. Pesakit akan diminta untuk mengisikan borang penyelidikan yang disediakan termasuk data peribadi, soalan berkenaan penggunaan alkohol sebelum dan selepas kecederaan kepala, soalan berkenaan kecederaan kepala, soalan AUDIT, soalan GHQ-12 dan soalan MOCA. Semua soalan

yang diberikan adalah dalam Bahasa Melayu dan penyelidik akan membantu pesakit sekiranya terdapat soalan yang sukar difahami.

Keputusan:

Dari 60 pesakit yang ditemuramah, hanya 47 pesakit sahaja yang diambil untuk kajian ini. Umur purata pesakit adalah 36.8 tahun (SD±14.8). 83% daripada pesakit adalah lelaki (n=39) dan 17% adalah perempuan (n=8). Majoriti pesakit adalah dari bangsa Melayu (63.8%), diikuti dengan bangsa India (23.4%) dan Cina (10.6%). 51.1% daripada pesakit telah berkahwin dan 48.9% adalah bujang atau bercerai. Lebih kurang dua pertiga daripada pesakit mendapat sekurang-kurangnya pendidikan tahap menengah. 44.7% daripada pesakit tidak bekerja. Pendapatan bulanan secara purata adalah RM 1429.79 (SD±2340.28)

Terdapat hubungan yang ketara diperoleh melalui kajian ini dari segi penggunaan alkohol selepas kecederaan kepala dan skor AUDIT lebih dari 8 (OR 30, 95% CI 3.06-294.56). Hubungan ketara juga diperoleh dengan penggunaan alkohol selepas kecederaan kepala dan sejarah penggunaan alkohol (OR 1.31, 95% CI 1.03-1.67). Selain itu, hubungan ketara juga diperoleh daripada penggunaan alkohol sebelum kemalangan dan penggunaan alatan keselamatan (tali pinggang keselamatan, topi keledar)(OR 9.6, 95% CI 1.27-72.53). Walaupun begitu, kajian ini tidak menemui sebarang hubungan ketara berkenaan penggunaan alkohol sebelum kecederaan kepala dan Modified Rankin Scale (mRS), intervensi neurosurgical dan tahap kecederaan kepala (GCS Score). Selain itu, tiada hubungan ketara yang diperoleh berkenaan penggunaan alkohol selepas kecederaan kepala dengan umur pesakit, jantina pesakit, taraf perkahwinan, taraf pembelajaran, taraf pekerjaan, jangka masa kecederaan kepala, sejarah keluarga berkenaan penggunaan alkohol, penggunaan tembakau sebelum kecederaan kepala, skor GHQ-12 dan skor MOCA.

Kesimpulan:

Penggunaan alkohol dan kecederaan kepala adalah masalah yang rumit dimana kedua-dua faktor ini akan memberi kesan antara satu sama lain biarpun sebelum kecederaan kepala atau selepas kecederaan kepala. Selain itu, masalah ini juga merumitkan penjagaan pesakit selepas itu. Daripada kajian ini, kami dapat menghubungkan beberapa factor yang menyumbang kepada penggunaan alkohol selepas kecederaan kepala iaitu sejarah penggunaan alkohol dan penggunaan alkohol pada tahap bahaya sebelum kecederaan kepala. Kedua-dua faktor ini boleh digunakan oleh doktor yang merawat sebagai indikasi untuk masalah penggunaan alkohol di waktu kelak.

*Kata kunci: Penggunaan alcohol, kelaziman, kecederaan kepala, Malaysia*

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ABBREVIATIONS

ATS – Amphetamine Type Stimulant

AUD – Alcohol Use Disorder

AUDIT – Alcohol Use Disorder Identification Test

BAC – Blood Alcohol Concentration

BAL – Blood Alcohol Level

CI – Confidence Interval

CT – Computed Tomography

DALY – Disability Adjusted Life Years

GCS – Glasgow Coma Scale

GHQ-12 – General Health Questionnaire – 12

HKL – Hospital Kuala Lumpur

MOCA – Montreal Cognitive Assessment

MTBI – Mild Traumatic Brain Injury

NMRR – National Medical Research Registry

OR – Odds Ratio

PPUM – Pusat Perubatan Universiti Malaya

SD – Standard Deviation

TBI – Traumatic Brain Injury

UMMC – University Malaya Medical Centre

WHO – World Health Organization

# CHAPTER 1: INTRODUCTION AND LITERATURE REVIEW

## 1) Introduction.

The frequent and chronic use of alcohol has emerged as an important health and social problem worldwide (Rehm et al., 2007; Rehm et al., 2009; World Health Organisation, 2014; American Psychiatric Association, 2013). In many countries, alcohol has emerged as the foremost risk factor for various non-communicable diseases (Parry et al., 2011; Shield et al., 2012; Shield et al., 2014).

Numerous studies have shown alcohol ingestion to be a leading cause of injury (Rehm et al., 2003; Rehm et al., 2009; Parry et al., 2011; World Health Organisation, 2014), including head injury. It is without questionable the brain is the most vulnerable human organ affected by the chronic and large amounts of alcohol consumption (Oscar-Berman, 2000; Oscar-Berman and Marinkovic, 2003; Planas-Ballvé et al., 2017).

Several studies suggest a high prevalence of substance use problems in people presenting to the hospital and treated for a TBI, particularly alcohol. There are countless studies indicating traumatic injury from accidents were more seen in alcohol-impaired drivers (Bernier and Hillary, 2016; Bird et al., 2009; Iverson, 2006). The studies indicate in patients with alcohol-positive traumatic injury have more serious presentation and are likely to stay longer (Iverson, 2005; Green et al., 2015).

### 1.1) Alcohol and burden on health

Alcohol is an addictive substance (World Health Organisation, 2014; American Psychiatric Association, 2013). Regular use of alcohol has emerged as a key health and social problem globally (Rehm et al., 2007; Rehm et al., 2009; American Psychiatric Association, 2013; World Health Organisation, 2014).

Excessive and unregulated alcohol usage is tantamount to the terms burden and

harmful use (Rehm et al., 2007). Globally, its use causes approximately 3.3 million deaths every year with 5.1% of global burden of diseases attributable to its use (World Health Organisation, 2014; Mokdad et al., 2004). In 2000, Mokdad et al. (2004) identified alcohol was the second highest cause of death in the United States after tobacco.

Thus, it is not surprising alcohol has emerged and identified as a leading risk factor for death and disability globally (Fenoglio et al., 1997; Parry et al., 2011; World Health Organisation, 2014). Alcohol-related deaths currently make up approximately 4% of all global mortality (World Health Organization, 2004). Rehm et al. (2009) stated even in middle-income and high-income countries alcohol related factors are a leading cause of death. Rehm et al. (2009) and the World Health Organisation (2014) related alcohol for 3.8% of death and 4.6% of disability adjusted life years (DALYs) lost in 2004. Additionally, alcohol consumption is recognized as a vital risk factor for chronic disease and injury (Rehm et al., 2009; Rehm et al., 2003; Parry et al., 2011; World Health Organisation, 2014).

The American Psychiatric Association (2013) characterized excessive or harmful alcohol consumption as the intake of 40-60g/day of alcohol in females and 60-100 g/day in males. Alcohol consumption constitutes intoxication, binge drinking, abuse and dependency (American Psychiatric Association, 2013). The impact of excessive alcohol consumption on the society is well-documented (McIntosh and Chick, 2004; Kim et al., 2006). Excessive alcohol consumption adds burden to the society including psychosocial problems such as increase in utilization of healthcare by admission, alcohol related disease and injuries (Kim et al., 2006; McIntosh and Chick, 2004; World Health Organisation, 2014; Planas-Ballvé et al., 2017). The burden associated with alcohol consumption stems from heavy and regular drinking (Rehm, 2011; Rehm et al., 2012).

The constant and significant amount of alcohol consumption affects multiple neurotransmitter systems in the brain (Oscar-Berman and Marinkovic, 2003), among

which is the brain dopamine functioning (Volkow et al., 2003). Several ways alcohol affects the brain are via the dopaminergic neurotransmission (Loheswaran et al., 2016), which is altered by the acute alcohol consumption and dependence. The individual's brain dopamine function is markedly decreased after chronic abuse and during the withdrawal state, and the decrease is related to the dysfunction of the prefrontal regions (Planas-Ballvé et al., 2017). The alteration in the dopaminergic neurotransmission is a vital mediator to the effect of alcohol on the neuroplasticity of the brain (Loheswaran et al., 2016). Neuroplasticity is the change in neural structure and function in response to experience or environmental stimuli (Blugeot et al., 2011; Kays et al., 2012).

Oscar-Berman (2000) and Oscar-Berman and Marinkovic (2003) state a person's susceptibility to alcoholism–related damage is related to the person's

- age,
- gender,
- drinking history,
- blood alcohol level,
- nutrition state, and
- the vulnerability of the specific brain regions.

Rehm et al. (1996) added that an individual's drinking patterns as well play an important role.

Scientists remarked the relationship between alcohol consumption and health and social outcomes is complex and multidimensional (Rehm et al., 1996; Yue et al., 2017). Babor and Grant (1992) and Rehm et al. (2006) proposed the acute and long-term health and social consequences linked to alcohol is via three intermediate mechanisms:

1. toxic and beneficial biochemical effects,
2. intoxication, and
3. dependence.

The brain is particularly susceptible to injury from the constant and sizeable amount of alcohol consumption (Oscar-Berman, 2000; Planas-Ballvé et al., 2017). White (2003), reported among the cognitive functions affected are difficulty walking, blurred vision, slurred speech, slowed reaction times, and impaired memory.

The most important disease conditions in alcohol use usage is the alcohol use disorders (AUDs), which include alcohol dependence and harmful use or alcohol abuse (American Psychiatric Association, 2013; World Health Organization, 1992). Though the AUDs are less fatal than the other chronic disease conditions related to alcohol usage, these conditions are linked to considerable disability (White, 2003; Samokhvalov et al., 2010; World Health Organization, 1992; Rehm, 2011; American Psychiatric Association, 2013). Especially among males, the alcohol-use disorders is among the most disabling disease recognized for its global burden of disease (World Health Organization, 2004; World Health Organisation, 2002).

The existence of the disability associated with alcohol usage constitute a large part of this burden related to the AUDs (Samokhvalov et al., 2010). The health complication of alcohol can be divided into direct or indirect consequences (Rehm et al., 2009). Direct cause involves the toxic component of alcohol itself which may cause impairment in the organs. Alcohol usage is associated with a multitude of toxic effects on the different organs (Rehm et al., 2006; Rehm et al., 2013). In addition, accidental or intentional injuries or deaths follow alcohol intoxication (Rehm et al., 2003; Connor et al., 2005; Raj et al., 2015).

The consequences of alcohol on the central nervous system result in the subjective feeling of intoxication, and these effects are felt and can be measured even at light to moderate consumption levels (Eckardt et al., 1998; Connor et al., 2005). Rehm et al. (2006) stated the acute effects of alcohol and cardiovascular outcomes could occur following the patterns of drinking. Accidental and intentional injuries as examples of

acute effects of alcohol while coronary heart disease is consequences of cardiovascular outcomes (Rehm et al., 2003; Connor et al., 2005; Raj et al., 2015).

The use of alcohol can as well cause indirect injury which may involve more of social repercussion of alcohol itself whereby leading to impairment of judgement from intoxication and causing motor vehicle accidents, fights, fall (Watt et al., 2004). There is an increasing number of data implying alcohol-related injuries, trauma and deaths (Watt et al., 2004; World Health Organization, 2007).

World Health Organization (2007) stated every year more than 5 million deaths occur from injuries generating close to one-tenth of the global burden of disease. The link between alcohol and almost all kinds of injuries has long been established (Rehm et al., 2013; Rehm et al., 2012). Some researchers divided the injuries into two categories:

1. unintentional injuries, including road traffic injuries, drowning, burns, poisoning and falls; and
2. intentional injuries, as a result of deliberate acts of violence against oneself or others.

Injury related to alcohol consumption is a worrying situation (Taylor et al., 2010; Taylor and Rehm, 2012). The correlation of alcohol and virtually all types of unintentional injuries has extensively been recognized. Research found a distinctive correlation between alcohol and almost all kinds of unintentional injuries (Taylor et al., 2010; Taylor and Rehm, 2012; Rehm et al., 2009). The most obvious situation are road traffic accidents. The Department of Transportation (2000) reported thirty-nine percent of all traffic-related deaths were alcohol related while Tien et al. (2006) related up to 50% of patients with trauma and hospitalized were intoxicated at the time of injury.

Alcohol-attributable injury can occur even from a single instance of acute alcohol consumption, leading to intoxication and drunkenness (Taylor et al., 2008; Taylor et al., 2010) and thus the accident. Rehm et al. (2008) discovered the lifetime risk of injury

leading to death is 1 in 100 and happens once the consumption levels of about three drinks daily per week for women, and three drinks five times a week for men. Rehm et al. (2008) added engaging in the acute alcohol consumption repeatedly results in a higher risk of injury. Further Zador et al. (2000) discovered being male, and younger drivers are at relative risk of fatal single-vehicle crash injury. The study concluded the elevated risk to both to drivers and to other road users. Taylor et al. (2010) suggested from the systematic review on alcohol and risk of injury there is no safe level of consumption. Taylor et al. (2010) stated even with two standard drinks, the odds of injury almost doubled for most types of injury.

Alcohol consumption affects a person's psychomotor abilities (Rehm, 2011; Taylor et al., 2010). The adverse effects of alcohol are experienced at the Blood Alcohol Concentration (BAC) level approximately at 0.04 to 0.05 percent, which the person achieves after consuming two to three drinks in an hour (Rehm et al., 2012; Rehm, 2011). Eckardt et al. (1998) proposed at these levels alcohol in the system disrupts a person's psychomotor functions with increase consequences of injury. Taylor and Rehm (2012) cautioned at all levels of BAC, the odds ratio (OR) of fatal motor vehicle injury was significant whereby the 5 combined studies yielded OR of 1.74 (95%CI 1.43-2.14) for fatal injury every 0.02% raised in BAC.

Van Dyke and Fillmore (2014) disclosed drivers with a history of driving under the influence (DUI) of alcohol report heightened impulsivity and display reckless driving. In laboratory studies, Ogden and Moskowitz (2004) and Liguori (2009) of simulated driving performance demonstrate the presence of alcohol impairs the person's ability to maintain a stable position in the lane, reduces braking time and lessens the person's ability to detect potential hazards on the roads.

1.2) Traumatic brain injury (TBI)

Traumatic brain injury is an increasing concern with falls, motor vehicle crashes, struck by or against events, and assaults identified as leading causes (Langlois et al., 2006; Ahmed et al., 2017). Faul et al. (2010) reported in the 1.7 million TBIs occurring each year in the United States, 80.7% presented as emergency department visits. Subsequently 16.3% required hospitalizations, and 3.0% resulted in deaths.

Faul et al. (2010) added among the people who made hospital visits 4.8% of all injuries seen in emergency department visits were diagnosed with TBIs, with 15. % of all hospitalizations. Of all the injury- related deaths in the United States, TBI was a contributing factor 30.5% of the time.

Traumatic brain injury (TBI) is a non-degenerative, non-congenital insult to the brain (Iverson, 2005; Centers for Disease Control and Prevention, 2017). TBI refers to the brain dysfunction caused by external trauma (Ahmed et al., 2017). Traumatic brain injury (TBI) occurs when a blow or jolt to the head or a penetrating injury results in damage to the brain (Ahmed et al., 2017). The brain dysfunction is characterized by damage to the structure and certainly the function of the brain (Iverson, 2005; Centers for Disease Control and Prevention, 2017). The injuries cause the loss of consciousness (Langlois et al., 2006). While, the ongoing ischemia results in further brain injury and contributes to the overall mortality of TBI (Fabbri et al., 2002). Mild traumatic brain injuries are characterized by immediate physiological changes hypothesized as a multilayered neuro-metabolic force in which affected cells typically recover, although under certain circumstances a small number might degenerate and die (Schretlen and Shapiro, 2003; Iverson, 2005). Iverson (2005) describes during the first week after injury the brain undergoes a dynamic restorative process.

The TBIs can affect anyone at any age and may lead to severe complications and disabilities in the future (Langlois et al., 2006; Hyder et al., 2007; Faul et al., 2010). Even

in a developed country as the United States, the TBIs are a major health problem as the condition contribute to substantial number of deaths and cases of permanent disability (Hyder et al., 2007; Faul et al., 2010; Ahmed et al., 2017). In 7–20% of patients with a TBI presents to the emergency room with bleeding, bruising, or swelling on day-of-injury which can only be seen via computed tomography (Livingston et al., 1991; Iverson et al., 2000).

Researchers such as Langlois et al. (2006) described the situation as a "silent epidemic" as the problems experienced by the individuals with TBI, are often not visible. The TBIs may lead to severe complications and disabilities in the future. There are persistent cognitive sequelae in surviving individuals (Yue et al., 2017). Affected individuals are affected by impairment in their memory or cognition, which are often not noticeable by others (Langlois et al., 2006; Hyder et al., 2007).

Of concern is that, scientists are predicting TBI, will surpass many diseases and appear as the major cause of death and disability by the year 2020 others (Langlois et al., 2006; Hyder et al., 2007). Moreover, TBIs are under-diagnosed (Yue et al., 2017). While the TBIs can affect anyone at any age, Ahmed et al. (2017) found young males were more often hospitalized following injuries resulting in TBI.

Researchers such as Ahmed et al. (2017) and Faul et al. (2010) believed TBI is one of the significant public health burdens. Faul et al. (2010) showed that only about 25% of people achieve long-term functional independence following TBI. Ponsford et al. (2000) and (Carroll et al., 2004) showed only some cognitive symptoms resolve within a few months of the injury. Ponsford et al. (2000) investigating cognitive impairment in 84 adults with mild TBI found mainly the headaches, dizziness, fatigue, and visual disturbance improved a few months after the injury. Ponsford et al. (2000) noted significant levels of psychopathology remained in the majority.

1.3) The health burden related to TBIs

Traumatic brain injury is a leading cause of disability in young people, affecting their capacity for work, leisure and relationships (Bombardier et al., 2003; Rabinowitz and Levin, 2014). Vanderploeg et al. (2005) illustrious the cognitive functioning is affected despite in mild cases of TBI. Belanger et al. (2005) in a meta-analysis based on 39 studies comprising 1463 cases of mild TBI and 1191 control cases, illustrated the neuropsychological impairment improved by 3 months post-injury. However, the cognitive impairment remained, beyond three months. Belanger et al. (2005) noted the cognitive impairment may worsened over time. Marsh et al. (2016) observed the impairment occurs across various domains of mental functioning. The domains are attention, verbal and visual memory, visual-spatial construction and other executive functions. Patients with TBI most consistently have difficulties with information processing speed and verbal memory (Skandsen et al., 2010; Spitz et al., 2012).

These executive functions are critical for the persons to carry out complex behaviors in every novel situation involving beginning, goal setting, planning, organizing, judgment, and self-monitoring (Mateer and Sira, 2006; Marsh et al., 2016). Vanderploeg et al. (2005) supported the findings as their study found the subtle yet long-term impact of the multifaceted attention and working memory was impaired even in individuals with mild TBI. Spitz et al. (2012) followed-up 111 individuals with moderate-to-severe TBI assessed on average at 3, 6, and 13 months post-injury. The study noted poorer functional outcomes were in the older age-group, lower levels of education, and more significant days of posttraumatic amnesia. Vanderploeg et al. (2005) concluded these impairments can have adverse long-term neuropsychological outcomes and hampers recovery. The presence of cognitive impairment was associated with future disability (Skandsen et al., 2010; Spitz et al., 2012). Marsh et al. (2016) discovered following 71 individuals with

TBI the cognitive impairment was evident across all domains. Interestingly, Marsh et al. (2016) noted while the improvement of cognitive functioning could happen, the recovery of full functioning is unlikely.

### 1.4) Psychological impact of Traumatic Brain Injury

Thus, it is not surprising psychiatric symptomatology transpires with the affected mental functioning (Hoofien et al., 2001). The TBIs affect the individual's cognitive abilities, vocational status, family integration, social functioning, and independence in daily routines (Olver et al., 1996; Hoofien et al., 2001; Mateer and Sira, 2006). Memory and attentional impairments interfere with virtually every aspect of the person's daily life, including them, returning to work (Hoofien et al., 2001; Mateer and Sira, 2006). Memory impairment following TBI is almost universal and often persistent (Hoofien et al., 2001; Mateer and Sira, 2006).

Mittenberg et al. (1996) reported there are mood symptoms as part of the impairment. These symptoms include complaints of irritability, fatigue, headache, depression, anxiety, light sensitivity, and sound sensitivity. These symptoms may remit spontaneously in some patients, though Levin et al. (1987) suggested in many these symptoms continue for months after sustaining mild head trauma. Interestingly, Alves et al. (1986) revealed patients who experience two or more symptoms at three months after injury was probable to experience a similar number of symptoms after 6-12 months. Not surprisingly, Hoofien et al. (2001) examining 76 participants with severe TBI found the individuals with severe TBI, exhibit psychiatric symptomatology, and faced more family and social struggles post-injury. The individuals exhibited higher scores for hostility, depression and anxiety.

These neuro-behavioral problems of TBI affected the individuals and family functioning with devastating consequences (Hoofien et al., 2001). Having TBI impairs and changes the overall quality of life, interpersonal, occupational, and social functioning.

The situation results in psychological distress in their spouse and caregivers (Fann et al., 1995; Hoofien et al., 2001; Harris et al., 2001; Mateer and Sira, 2006).

Major depression is a common psychiatric complication among patients with TBI (Deb et al., 1999; Jorge et al., 2004; Roy et al., 2018). Koponen et al. (2002) evaluated sixty subjects for about 30 years after the traumatic brain injury. The study concluded in some individuals with TBIs, there is an apparent vulnerability to psychiatric illness as the traumatic brain injury caused protracted, lasting impairment. Similarly, Koponen et al. (2002) establish depressive episodes, delusional disorder, and personality disturbances were prevalent in these persons with the brain injury. Fann et al. (1995) followed up fifty patients with traumatic brain injury, a quarter of the patients had current major depression while another quarter had a first-onset major depressive episode after the injury that had resolved. In another quarter of the patients had a present generalized anxiety disorder, and in (8%) reported current substance abuse. Roy et al. (2018) followed-up 103 subjects with first-time TBI. The subjects were assessed within 12 months post-injury and evaluated for the development of new onset depression at 3, 6, and 12 months. Roy et al. (2018) revealed more than half of the subjects developed new onset depression and the risk of depression ensued with the decreased social functioning post-TBI.

The depressed and anxious subjects regarded their injuries and their cognitive functioning more debilitating (Jorge et al., 2004; Fann et al., 1995). Everyday problems, i.e., the disabilities arising from impaired mental functioning are the most handicapping for the depressed and anxious individuals, thus affecting their families. The presence of major depression after the TBI often raises the individuals' and their family's struggles. Similar to people without TBI, there is an increased risk of suicide (Roy et al., 2018).

Several patients with TBI take longer to return to their pre-injury functioning (Rabinowitz and Levin, 2014; Marsh et al., 2016). These patients' recovery can be incomplete and complicated by preexisting comorbid problems such as chronic pain,

depression, substance abuse, life stress, and unemployment, and protracted litigation (Rabinowitz and Levin, 2014; Marsh et al., 2016; Ponsford et al., 2000).

The literature review found evidence stating the leading causes of TBI are falls, motor vehicle crashes, struck by or against events, and assaults (Langlois et al., 2006; Ahmed et al., 2017; Hoofien et al., 2001). Additionally, the literature review showed an enormous volume of the link between alcohol and almost all kinds of unintentional injuries. Ponsford et al. (2007) investigating 121 hospital in-patients with TBI, documenting pre-injury alcohol and drug use, and with 133 demographically similar controls, discovered 31.4% of the TBI group and 29.3% of controls were drinking at hazardous levels. Interestingly, Ponsford et al. (2007) the alcohol and drug use declined in the first year post-injury, but subsequently recurred two years post-injury. Ponsford et al. (2007) added heavy alcohol use post-injury were among the young, male and heavy drinkers pre-injury.

Thus, the literature review revealed a high rate of psychiatric disorders among people with TBI. Many studies emphasize the importance of psychiatric follow-up after traumatic brain injury.

### 1.5) Relationship of alcohol use and traumatic brain injury (pre or post injury)

Some investigators characterized people with TBI as having: complicated vs. uncomplicated mild traumatic brain injury (MTBI) (Borgaro et al., 2003; Iverson, 2006). Complicated TBIs are those with pre-existing psychiatric problems or substance abuse problems. The patients with complicated MTBIs performed significantly poorer (Borgaro et al., 2003; Iverson, 2006). Borgaro et al. (2003) revealed individuals in the complicated group showed greater cognitive and affective disturbances.

In the early 90's Corrigan (1995) discovered and alerted the medical field regarding substance abuse among persons with TBI. Corrigan (1995)'s work established one third to one half of hospitalizations were related to alcohol intoxication. Corrigan (1995)'s work and the subsequent literature that followed alerted the community to substance abuse and specifically regarding alcohol usage and TBI.

Corrigan (1995) in the earlier work on substance use and traumatic brain injury, found half of the persons were intoxicated at the time of injury and hospitalized for the TBI. Corrigan (1995) subsequently disclosed, in 55–66%, of the subjects there was pre-TBI history of alcohol misuse. The study by Hibbard et al. (1998) similarly showed a significant percentage of individuals presented with substance use disorders prior to their TBI, which supported Corrigan (1995)'s findings. Many other studies support Corrigan (1995)'s findings (Kraus et al., 1989; Dikmen et al., 1995; Kreutzer et al., 1996a; Bombardier et al., 2002; Phelan et al., 2002; Connor et al., 2005).

What is the significance of alcohol use and traumatic brain injury? The relationship of alcohol and patients with traumatic brain injury can occurred either before the trauma or after the trauma (Bombardier et al., 2002; Ahmed et al., 2017). Brennan et al. (2015) disclosed in 30–72% civilians admitted to the hospitals with mild TBI were acutely intoxicated. Yue et al. (2017) cautioned the effects of acute intoxication with alcohol on the acute care and long-term outcomes following mild TBI is real. In many instances, it is life-threatening. Remarkably, Yue et al. (2017) showed a direct link between BAL[1] with increased loss of consciousness. Brennan et al. (2015) and Yue et al. (2017) theorized the increase in alcohol level depresses consciousness. The reduced in level of alertness, leads to increased risk of injury resulting from a combination state of decreased inhibition, decreased awareness, and delay in seeking fitting attention following the injury.

Researchers found intoxicated individuals had a more severe injury (Kraus et al., 1989; Gurney et al., 1992; Zink et al., 1993; Zink et al., 1998). Gurney et al. (1992) found individuals with alcohol were more likely to require intubation, develop pneumonia, and had respiratory distress. Zink and Feustel (1995) found in ethanol-treated animals following brain injury, hypoxia, and prolonged apnoea ensues.

Zink et al. (1998) discovered the presence of alcohol significantly shortened survival time, as the presence of the alcohol suppresses ventilation and hyper-capnia respiratory drive following the TBI (Zink and Feustel, 1995).

von Heymann et al. (2002) noticed an increase in posttraumatic infectious complications, Guidot and Hart (2005) showed an increased risk of acute respiratory distress syndrome. Following any trauma, alcohol causes changes in the body's physiological response leading to increased complications and mortality (von Heymann et al., 2002). Acute alcohol intoxication impairs the hemodynamic counter-regulatory response to hemorrhagic shock (Molina, 2005; Bird et al., 2009). Phelan et al. (2002) showed an accentuation of tissue injury in alcohol-intoxicated rats. Bird et al. (2009) further showed evidence supporting Phelan et al. (2002)'s. Bird et al. (2009) discovered alcohol intoxication accentuates the rise in alanine transaminine (Organization and Unit) and base deficit during trauma or hemorrhage. The discovery highlighted the presence of tissue injury resulting from the marked hypotension seen in alcohol-intoxicated animals. Bird et al. (2009) additionally showed pro-inflammatory cytokine response to hemorrhage following alcohol-intoxication. In animal studies, Zink and Feustel (1995) and Katada et al. (2009) found in animal studies, elevated intracranial pressure, acidemia, hypoxia, and decreased respiratory drive occurs in the presence of alcohol, with consequences of increased mortality (Katada et al., 2009).

Salim et al. (2009a) in the largest database review in 38 019 patients with TBI, patients with isolated moderate to severe TBI and with a positive serum ethanol level died

less frequently than their ethanol-negative counterparts. The notion is supported by Bernier and Hillary (2016) review of the trend of alcohol- related TBI over the past two decades. Bernier and Hillary (2016) study disclosed the patients admitted to the emergency department for TBI and who tested positive for alcohol had higher rates of survival. Bernier and Hillary (2016) hypothesized could alcohol have subtle protective effects? Bernier and Hillary (2016) further hypothesized alcohol is a known risk factor for TBI, however, the number of overall injuries would be reduced in the absence of intoxication.

Nevertheless, patients tested positive with alcohol faced increase complications. Several other studies reported the similar observations of increase complications seen in patients tested positive for alcohol (Jurkovich et al., 1993; Li et al., 1997).

Jurkovich et al. (1993) investigated 427 patients admitted to a tertiary referral hospital during a 23-month period. Similar to Salim et al. (2009a)'s findings, Jurkovich et al. (1993) disclosed acute intoxication also did not increase the risk of complications and mortality. However, Jurkovich et al. (1993) concluded chronic and not acute, alcohol abuse adversely affects outcome from trauma. Fabian and Proctor (2002) studying the clinically relevance of levels of acute ethanol and its influence on the cerebral perfusion pressure concluded ethanol after TBI may not affect mortality provided there is cardiopulmonary support. The conclusion is understandable as the deleterious effect of alcohol is greater in TBI with cerebral hemorrhage (Jurkovich et al., 1993; Salim et al., 2009a).

The literature search showed a diversified and curious consequence. Many studies support the hypothesis regarding serum ethanol level and TBI outcome (Luna et al., 1984; Salim et al., 2009a; Opreanu et al., 2010; Brennan et al., 2015). Several determine the impact of alcohol with increased mortality and the likelihood of respiratory complications

(Luna et al., 1984; Kraus et al., 1989; Katada et al., 2009; Yue et al., 2017). Interestingly, Mohseni et al. (2016) discovered among patients admitted between January 2007 and December 2011, and admitted to an academic trauma centre, the patients with positive blood alcohol level (BAL) were significantly younger with less co-morbidities. Additionally, the cohorts exhibited no significant difference in the severity of the intra-cranial injury with patients with no blood alcohol.

Many reports show the relationship between alcohol and nearly all types of unintentional injuries correlate with the blood alcohol concentration (BAC) (Tien et al., 2006; Taylor et al., 2010; Phillips and Brewer, 2011; Rehm, 2011). It shows an exponential dose response relationship (Taylor et al., 2010). The acute effects of alcohol consumption on injury risk are mediated by how regularly the individual drinks.

Studies have shown that alcohol consumption will lead to road traffic accidents mainly because it impaired the judgement and attitude of the driver which resulted in risk taking maneuvers and the driving because unsafe (Martin et al., 2013; Zhao et al., 2014). It is shown in a study that alcohol consumption causes injury in a dose-response manner and the risk increases non-linearly with increase alcohol consumption (Taylor et al., 2010). In another study done, noted that dependent alcohol drinking and binge drinking were more common among patients with head trauma compared to other types of trauma (Savola et al., 2005).

### 1.6) Road traffic accident and head injury

Road traffic accidents are part of unintentional injuries (Rehm et al., 2012; Rehm et al., 2013).

These traffic accidents are one of the leading causes of death and disability worldwide (World Health Organisation, 2002; Lopez and Murray, 1998; Krug et al., 2000; Gore et

al., 2011). Its impact is increasingly noted in many developing countries (Nantulya and Reich, 2002; Ameratunga et al., 2006). Road traffic injuries comprise approximately 3% of all global deaths (World Health Organisation, 2002), are the main cause of death in people under 30 (Mayou et al., 1993).

Several reports discovered more than half of patients with mild TBI are survivors of motor vehicle accidents (Tien et al., 2006; Salim et al., 2009a; Ruffolo et al., 1999). Unintentional injuries from road-traffic accidents are the second leading cause of disability-adjusted life years worldwide (World Health Organization, 2007; Gore et al., 2011; Hughes et al., 2015). Thus, the evidence supports road traffic accidents as an important cause of morbidity. The World Health Organization (2007) reported disability rate as a consequence of road traffic accidents range about 6% of total disability-adjusted life years in high- income countries to 16% in both southeast Asia and the eastern Mediterranean. The World Health Organization (2013) reported in half of the world's road traffic deaths occur among motorcyclists (23%), pedestrians (22%), and cyclists (5%). As a matter of fact, Gore et al. (2011) considered road-traffic accidents ranked second among daily-adjusted life years and the fifth leading cause for violence.

Road traffic injuries trigger enormous economic consequences to victims, their families and to society (Odero et al., 1997; Gupta et al., 2015), particularly among adolescents and young adults (Odero et al., 1997; Peden et al., 2004). Added to the worry is that in some developing countries there is a dramatic increase in the number of traffic fatalities (Odero et al., 1997; Nantulya and Reich, 2002; Ameratunga et al., 2006; Peden et al., 2004). Ameratunga et al. (2006) believed the increasing burden of road-traffic injuries further adds to the strain on the countries' medical and mental health services. Kumar et al. (2008) believed the increase in population and the number of motor vehicles on the road, were factors affecting fatalities in vehicular accidents.

Reports demonstrated many individuals involved in the road-traffic accidents tend to be younger (Ruffolo et al., 1999; Keyser-Marcus et al., 2002). Thus, if the symptoms of the TBI, persist returning to living and working is a challenge (Kreutzer et al., 1996a; Ruffolo et al., 1999; Keyser-Marcus et al., 2002). For many victims, not resuming work is a huge concern for themselves, socially and economically (Mayou et al., 1993; Ruffolo et al., 1999; Keyser-Marcus et al., 2002). The presence of psychiatric morbidity aggravates the individuals' post-accident challenges (Mayou et al., 1993). Interestingly, Levin et al. (1987) investigating neuro-behavioral functioning in 57 patients post-minor head-injury revealed nearly all the patients' cognitive or somatic complaints, and emotional malaise, resolve at the three months assessment. Levin et al. (1987) suggested that one uncomplicated minor head injury results in no permanent disability and neuro-behavioral impairment in a majority of patients and who are free of preexisting neuropsychiatric disorder and substance use.

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Studies shown that alcohol consumption is another factor causing road traffic accidents (Tien et al., 2006; Salim et al., 2009a; Zhao et al., 2014; Yue et al., 2017). Using alcohol while driving under its influence (DUI) is a serious traffic offence (Foster and Dissanaike, 2014; Jones, 1991; Foster et al., 1988). Drunk drivers place themselves and many innocent people at risk (Foster et al., 1988).

The review found mixed results regarding the presence of alcohol and its association with brain injury and the person's morbidity and mortality.

The presence of alcohol depresses an individual's consciousness (Yue et al., 2017; Brennan et al., 2015). Accidents occur mainly because its presence impairs the judgement and attitude of the drivers which resulted in risk taking maneuver's and the driving because unsafe (Martin et al., 2013; Zhao et al., 2014). Drivers driving under the influence of alcohol exhibit reckless driving behaviors seen by the increased rates of vehicle

crashes, moving violations, and traffic tickets (Van Dyke and Fillmore, 2014). The poor behavioral self-regulation could also increase sensitivity to the disruptive effects of alcohol on driving performance (Irwin et al., 2017; Mundt and Perrine, 1993).

A number of longitudinal studies have highlighted ongoing cognitive, behavioural and emotional sequelae of post-accident brain injury (Hoofien et al., 2001; Olver et al., 1996). Luna et al. (1984) investigating motor vehicle accidents among motor cyclists found in a quarter of the 134 subjects surveyed, were intoxicated. Luna et al. (1984) established the intoxicated group had a fourfold increased mortality rate, similar to opinions of (Oscar-Berman and Marinkovic, 2003) and Salim et al. (2009b). Savola et al. (2005) studied a group of 345 patients presenting to the hospitals for trauma and to investigate the relationship of different patterns of alcohol intake to various types of trauma. The study revealed dependent alcohol drinking and binge drinking were found to be significantly more common among patients with head trauma than in those with other types of trauma.

Even in Malaysia, researchers noted traumatic head injury is a leading cause of trauma seen in several general and tertiary hospitals (Sethi et al., 2002; Jeng et al., 2008; Ministry of Health Malaysia, 2011; Jamaluddin et al., 2009). Sethi et al. (2002) reported the head injuries were severe and requiring admissions to a tertiary care hospital. Moreover, the research noted the severity of the injury increased the consequences of the person's disability. Major trauma constitutes only 1.2% of the total trauma admissions, yet the extend of its mortality and morbidity causes a key burden to the society (Sethi et al., 2002; Jeng et al., 2008; Ministry of Health Malaysia, 2011; Jamaluddin et al., 2009). Moreover, motor vehicle accidents play a foremost role in the death of our young and productive population (Jamaluddin et al., 2009). The younger age group (15-34years old) consist of 56.6% of the major trauma cases (Ministry of Health Malaysia, 2011; Jamaluddin et al., 2009).

Such is the importance of trauma in Malaysia, the first Malaysian National Trauma Database was launched in May 2006 Sabariah et al. (2008). The study examined five tertiary referral centers and collected data on major traumas. The report aimed to look at the management of severe trauma and improve trauma care. Road traffic injury contributes significantly to major morbidity and mortality in a developing country as Malaysia (Sabariah et al., 2008). Sabariah et al. (2008) found road traffic accident made up close to 73.6% of injuries with 65% involving motorcyclist and pillion rider. The report did not state alcohol-related injury. However, Sabariah et al. (2008) concluded the findings suggested Malaysia has higher death rates from road traffic accident.

## 1.7) Prevalence of Alcohol use in Malaysia

The actual prevalence and alcohol-related disorders in the Malaysian community is unknown.

Malaysia is a multicultural and ethnicity country. In the early days, abstinence of alcohol is a norm in Malaysia during the sultanate ruling and only the indigenous population of Sarawak and Sabah practice drinking of rice wine. However, during the colonial era, European merchants had introduced alcohol to the workers brought in for mining and plantation which started the boom of alcohol industry in Malaysia. Alcohol use is not banned in Malaysia however is prohibited for the Muslim population in Malaysia (Jernigan and Indran, 1997).

There are few studies on patterns of alcohol usage in Malaysia. Based on the recent National Health and Morbidity Survey in 2015, it is reported that 14.5% of population had consumed alcohol before whereas 8.4% of adults of 18-years and above currently consumed alcoholic beverages (Institute for Public Health, 2015). From the

statistics, it is shown that the risk factor of alcohol consumptions is those from urban areas, males, other Bumiputras, age group of 25-29-years-old, singles, those with tertiary educations and those from higher income group (Institute for Public Health, 2015).

Another study done previously to determine the pattern of alcoholism in inpatient patients General Hospital showed that the prevalence of alcohol abusers/dependents was 10.6% of total patients admitted during the duration of study. However, the prevalence of patients who drank alcohol were 52% (Saroja and Kyaw, 1993)

1.8) Prevalence of alcohol use and mortality from motor vehicle accidents (MVA)

The Royal Malaysian Police (2007) reported in the 2006, the number of road accidents in was 341,232 of which 6,287 were road fatalities. The numbers were considered high for a population of 26,640,000, giving an index of 23.5 road fatalities per 100,000 inhabitants (Royal Malaysian Police, 2007; Abdelfatah, 2016).

Most of the research done in Malaysia and regarding road traffic accidents were among motor-cyclists (Rahman et al., 2015; Ramli et al., 2014; Kulanthayan et al., 2007). Motorcycle fatalities constitute the majority of road traffic deaths in Malaysia (Rahman et al., 2015; Ramli et al., 2014). Moreover, there are a significant number of deaths for both the motor-bike rider and their pillion rider (Rahman et al., 2015; Ramli et al., 2014).

There are no actual studies done in Malaysia to determine the prevalence of alcohol use among patients with traumatic brain injury. However, there are several studies conducted for fatality cases in motor vehicle accidents whereby the blood alcohol concentration was done that showed alcohol intoxication among the patients. From the fatal cases, most common cause of death was due to head injury (Ramli et al., 2014). Mohamed et al. (2012) examining fatal accidents in the Klang Valley found 11% of the fatality tested positive for drugs, which close to a quarter of the drivers were positive for alcohol. Mohamed et al. (2012) found in 2.3% of fatally injured drivers had both alcohol

and drugs in their bodies.

Odero et al. (1997) reviewed the epidemiology of motor vehicle accidents in developing countries and their association with alcohol. Despite the varying definitions, measurement methods and data completeness, the study found the significant association between alcohol and trauma. Odero et al. (1997) men were predominantly at risk than women of injury in crashes. Odero et al. (1997) disclosed males where often drivers in motor-vehicles and even cyclists. Moreover, a high proportion of males involved as pedestrians, and passengers suggesting the co-existence of other social and behavioral factors contributing to their vulnerability.

In a study done whereby a compilation was made for alcohol related traffic injuries and fatality in developing countries, it is noted that the prevalence of had a wide range from 8.5% up to 60% depending on how the alcohol test was being conducted whether by blood alcohol level, breath analyzer or from interview (Odero et al., 1997). One of the studies mentioned in the compilation was from our neighbouring country Singapore, and this study noted the prevalence of alcohol use prior to road traffic accident was around 10% (Wong et al., 1990)

A study showed that pre-injury alcohol use were highly predictive of post-injury alcohol use and problems (Bombardier, Temkin, Machamer, & Dikmen, 2003). It was found out that alcohol or drug use will declined during the 1st year post-injury however the quantity and frequency will increase over time and possibly returned to pre-injury level (Kreutzer, Witol, & Marwitz, 1996). The risk factor for post injury heavy alcohol consumption are those who are young, male, and had history of heavy drinking pre-injury (Ponsford, Whelan-Goodinson, & Bahar-Fuchs, 2007)

## 2) CHAPTER 2: RATIONALE AND OBJECTIVES OF THE STUDY

2.1) The rationale of this study

1. There is **limited information** available in Malaysia regarding the prevalence of alcohol use among traumatic brain injury patients.

2. To evaluate the extent of the problem so that necessary measures could be planned in the future. Early detection of problematic alcohol use can enable earlier intervention to improve outcome.

3. To evaluate the burden of alcohol or any substance related problem among patients with traumatic brain injury.

2.2) The objectives of this study include:

1. To determine the pattern of alcohol use among patients with traumatic brain injury in urban hospital of Malaysia.

2. To investigate the association of alcohol use in traumatic brain injury with:

a) socio-demographic characteristic

b) duration of injury and severity of injury

c) past history of alcohol use/substance use

d) psychological wellbeing

e) cognitive function



## 3) CHAPTER 3: METHODOLOGY

### 3.1) Site and subjects

This is a cross sectional study and it was conducted in 2 hospitals in Kuala Lumpur namely University Malaya Medical Centre and Hospital Kuala Lumpur. Both hospitals are tertiary centre for referrals especially complicated cases of traumatic brain injury which are severe and require urgent interventions. Both centres are government sponsored facilities.

The subjects included in the study consists of mainly outpatient cases which came for follow up in the neurosurgical clinic, neurorehabilitation clinic, emergency department (observation ward), and some stable admitted patients in the neurosurgical ward. The diagnosis of traumatic brain injury will be based on clinical notes that was reviewed during the sample collection day by the researcher.

Patients recruited were mainly based on convenience sampling and depends on both availability of the researcher and attendance of patient in the follow up clinic on that particular day. All patients were included in studies unless patient deemed too ill such acute cases still restless, comatose or those chronic cases but is globally aphasic, or having severe comprehension deficits.

Informed consent was obtained from all subjects or their substitute consent givers after a detailed description of the study.

Sample size calculation

Sample size calculation was based on the KISH formula.

$$n = \frac{t^2 \times p(1-p)}{m^2}$$

Description:

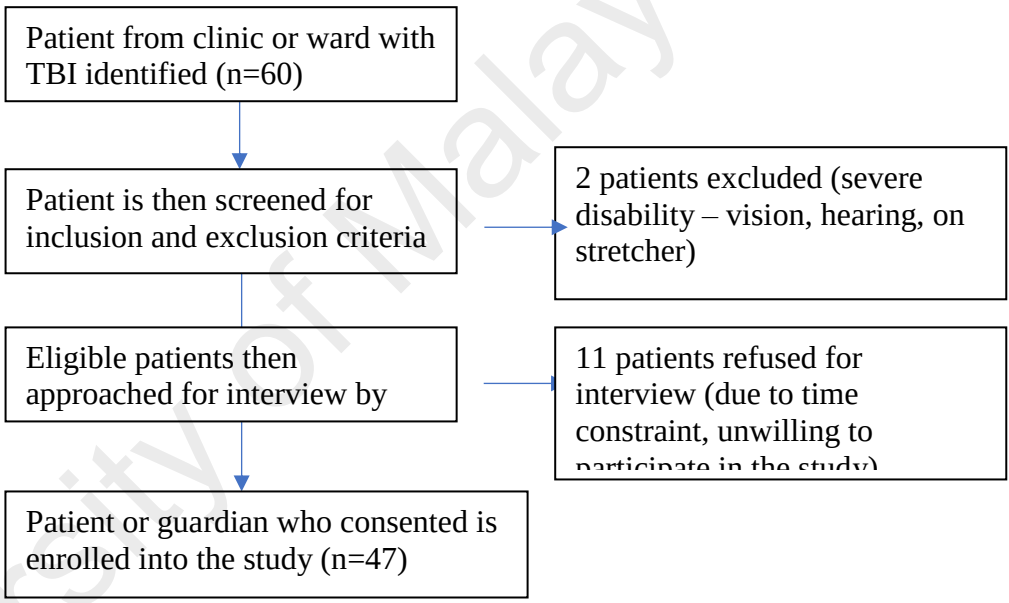
- n = required sample size
- t = confidence level at 95% (standard value of 1.96)
- p = estimated prevalence of substance use disorder in the area*

- m = margin of error at 5% (standard value of 0.05)

Based on a systematic review study of prevalence of substance use and Traumatic brain injury – it showed the prevalence range between 37-51% prior to the injury (Parry-Jones et al., 2006). Thus, prevalence of 37% is taken for this study.

$n = (1.96)^2 \times (0.37)\ (1-0.37) / (0.05)^2 =$ **358**

Flow Chart on recruitment process:




3.2) Measures

During the interview, data on demographics will be obtained using a standardized questionnaire. Further details regarding the alcohol consumption before and after the trauma as well as the further details of the trauma was taken as well using a standardized questionnaire. Both questionnaires had been given to experts of the field for opinions and validated by them. Questionnaire on alcohol use was reviewed by Associate Professor Dr. Amer Siddiq (Consultant Psychiatrist) and Dr. Abdul Razak (Consultant Psychiatrist).

Questionnairea on the traumatic brain injury part was reviewed by Associate Professor Dr. Sia Sheau Fung (Consultant Neurosurgeon) and Datuk Dr. Hj. Johari Siregar (Consultant Neurosurgeon).

a) Assessment of Alcohol use disorder

Assessment of alcohol use whether is hazardous or dependence using the AUDIT scale (Interviewer version) either in English or Malay language. The AUDIT-M has been validated among alcohol users in Malaysia and showed a significant correlation between AUDIT and AUDIT-M score (Spearman's $\rho = 0.979$, $p < 0.01$), Cronbach α coefficients for the total AUDIT-M was 0.823 thus is suitable for AUD assessment in Malaysia(Yee et al., 2015).

AUDIT is a free scale developed by World Health Organization (WHO) as a method of screening for excessive drinking and to assist in brief assessment. It consisted of 10 items with each response are scored between 0 to 4 and total maximum score of 40 points. A study done by Saunders et el (1993) showed that 92% of patients with a cutoff point of ≥8 had hazardous or harmful alcohol use while 94% of non-hazardous drinkers scored < 8 points(Saunders et al., 1993).

b) Assessment of General psychological wellbeing

Assessment of the subject's psychological wellbeing is done by using GHQ-12 (English and Malay version).

GHQ-12 is a 12-item questionnaire which is quick and easy to be conducted. It is also reliable and sensitive and ideal for research studies. It is however use mainly as screening tools rather than a diagnostic tools(Goldberg, 1972). The GHQ-12 (Malay) has been validated among medical students in Malaysia and it showed sensitivity of 81.3% and

specificity of 75.3% at cut-off point of 3 or 4 with a Cronbach α value of 0.85(Yusoff et al.).

c) Assessment of Brain injury severity

Assessment of the severity of the traumatic brain injury done by Glasgow Coma Scale (GCS).

It is a 15-point scale for estimating and categorizing the outcome of brain injury. It is also reliable in trauma patient intoxicated with alcohol. The GCS score information is obtained from the clinical notes of patient during the onset of the traumatic event.

d) Assessment of Cognitive function

Assessment of cognitive function was done using Montreal Cognitive Assessment (MOCA)- English and Bahasa Malaysia version

It is a 30-point scale for assessment of few components of the cognitive functions mainly visuospatial/executive, naming, memory, attention, language, abstraction, delayed recall and orientation. It is can be used for screening of cognitive impairment in TBI patients(Wong et al., 2012).

e) Assessment of physical disability

Assessment of physical disability was done using Modified Rankin Scale (mRS). This scale is commonly used for acute stroke patients and people with neurological deficits to measure the functional outcome(Kasner, 2006). There was a study which showed that the mRS at discharge has strong correlation with signal-intensity abnormality in MRI brain ($r=0.772$, $p<0.01$)(Schaefer et al., 2004). It is an observer rated with scoring to measure the physical limitation in the patients. It is rated as:

0- No symptoms

1- No significant disability. Able to carry out all usual activities despite some symptoms

2- Slight disability. Able to look after own affairs without assistance, but unable to carry out all previous activities.
3- Moderate disability. Requires some help but able to walk unassisted.
4- Moderately severe disability. Unable to attend to own body needs without assistance and unable to walk unassisted.
5- Severe disability. Requires constant nursing care and attention, bedridden, incontinent.
6- Dead

A cut off point of MRS 3 or more was taken as having significant physical disability and used in trials as poor outcome(Sulter et al., 1999).

3.3) Data Analysis

All the statistical analyses were performed using SPSS computer software. The socio-demographic data, alcohol questionnaires, head injury questionnaires, AUDIT score, GHQ-12 score and MOCA score were summarized using descriptive statistics. For the continuous data such as age group and salary will be presented in term of mean and standard deviation. For the categorical data, such as gender, race, occupation, and so on will be presented in either a pie chart or bar chart for better visualization. As for the association part, all the continuous data and those with multiple categories are grouped into yes and no categories. The data will be then inserted in 2x2 tables to analyze using cross tabulation with Chi-square technique. Variables and outcome of alcohol use post TBI or risk of pre TBI alcohol were used for the cross-tabulation analysis. Data will be presented in term of significant and odds ratio will be taken. Result were considered significant at $p<0.05$.

## 4. CHAPTER 4: RESULT

Throughout the study period November 2017 till January 2018, 60 patients were interviewed for the study and sample were taken mainly from UM Rehabilitation Clinic, UM Neurosurgical clinic and ward, HKL Neurosurgical Clinic and Ward, Emergency department (observation ward). Only 47 patients were included in the study, 2 patients unable to complete the questionnaire as having severe disability (vision, hearing, on stretcher), whereas 11 patients had refused for interview due to time constraint, unwillingness to participate in the study.

**Table 1: Socio-demographic Data Table**

| Variables | | Percentage% (n) | Mean (Std. Dev.) |
|---|---|---|---|
| Age, years: mean | | | 36.8 (±14.8) |
| Sex | Male | 83.0% (39) | |
| | Female | 17.0% (8) | |
| Race | Malay | 63.8% (30) | |
| | Chinese | 10.6% (5) | |
| | Indian | 23.4% (11) | |
| | Others | 2.1% (1) | |
| Marital Status | Single | 46.8% (22) | |
| | Married | 51.1% (24) | |
| | Divorced | 2.1% (1) | |
| Education Status | Primary | 17.0% (8) | |
| | Secondary | 51.1% (24) | |
| | Tertiary | 31.9% (15) | |
| | No Education | 0% (0) | |
| Occupation Status | Government sector | 10.6% (5) | |
| | Private Sector | 31.9% (15) | |

| | | | |
|---|---|---|---|
| | Self employed | 6.4% (3) | |
| | Student | 6.4% (3) | |
| | Unemployed | 44.7% (21) | |
| Salary, RM/month: mean | | | 1429.79 (±2340.28) |
| Past Medical History | None | 72.3% (34) | |
| | Congenital | 4.3% (2) | |
| | Acquired | 23.4% (11) | |

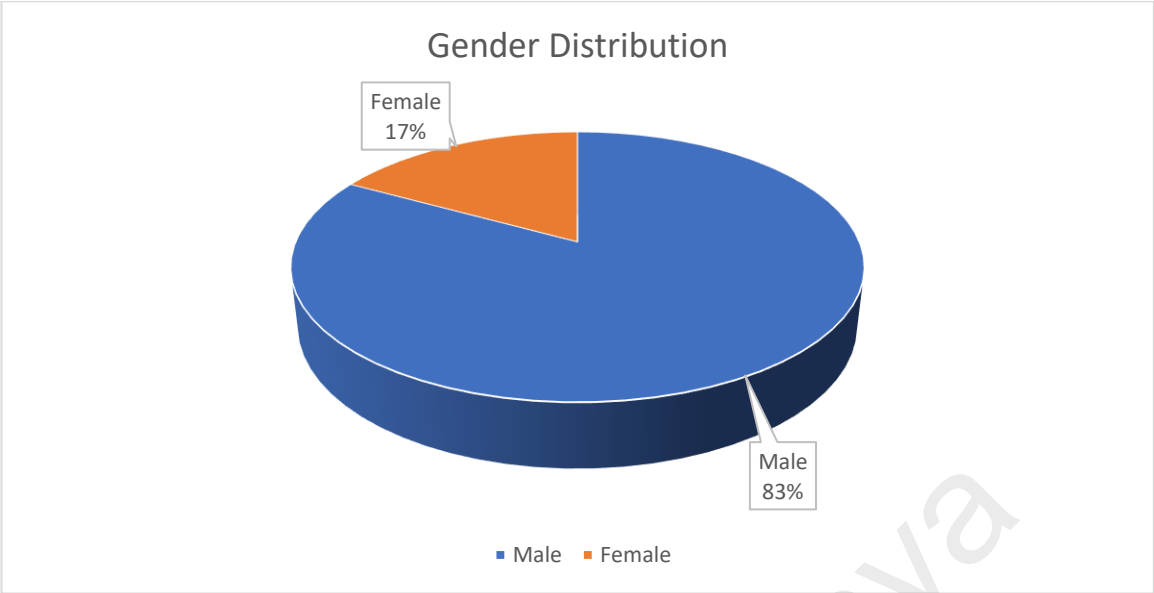
4.1 Questionnaires on Socio-demographic Data

**Table 2: Age group.**

| Age Group | Percentage % (n) |
|---|---|
| < 20 years old | 2.1% (1) |
| 20-29 years old | 42.1% (20) |
| 30-39 years old | 19.1% (9) |
| 40-49 years old | 17.0% (8) |
| 50-59 years old | 10.6% (5) |
| 60-69 years old | 4.2% (2) |
| 70-79 years old | 4.2% (2) |
| Total | 100% (47) |

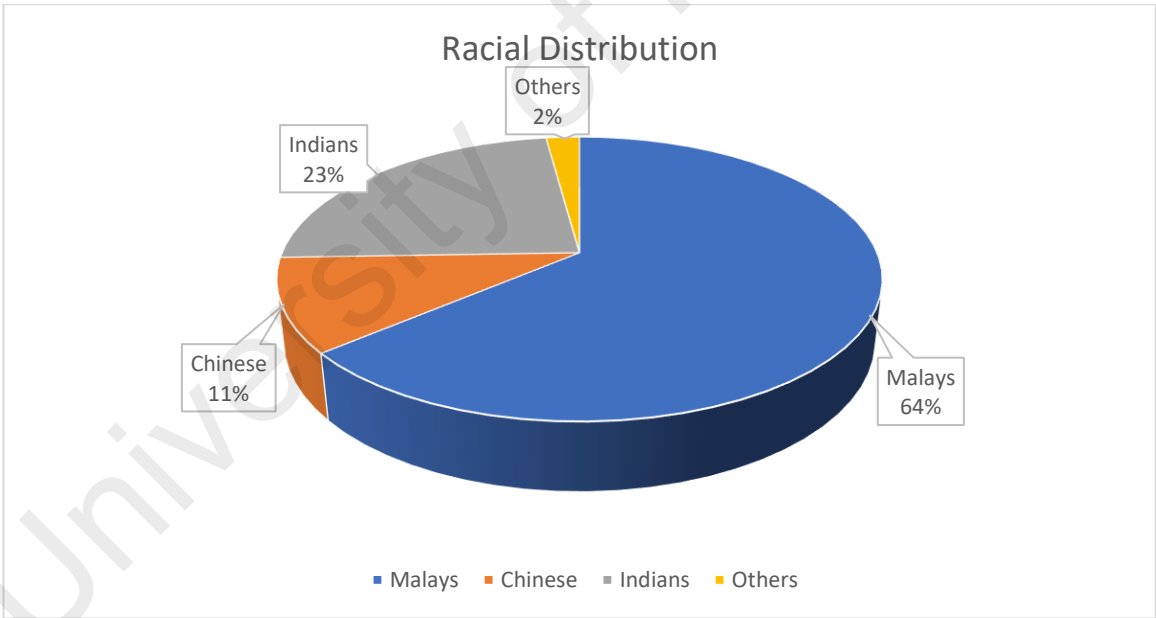
The final study sample was composed of 47 patients. The mean ± SD age of this group was 36.8 ± 14.8 years, median = 33 years old. The youngest patient was 16 years old whereas the oldest patient was 74 years old.

**Figure 1: Gender distribution**



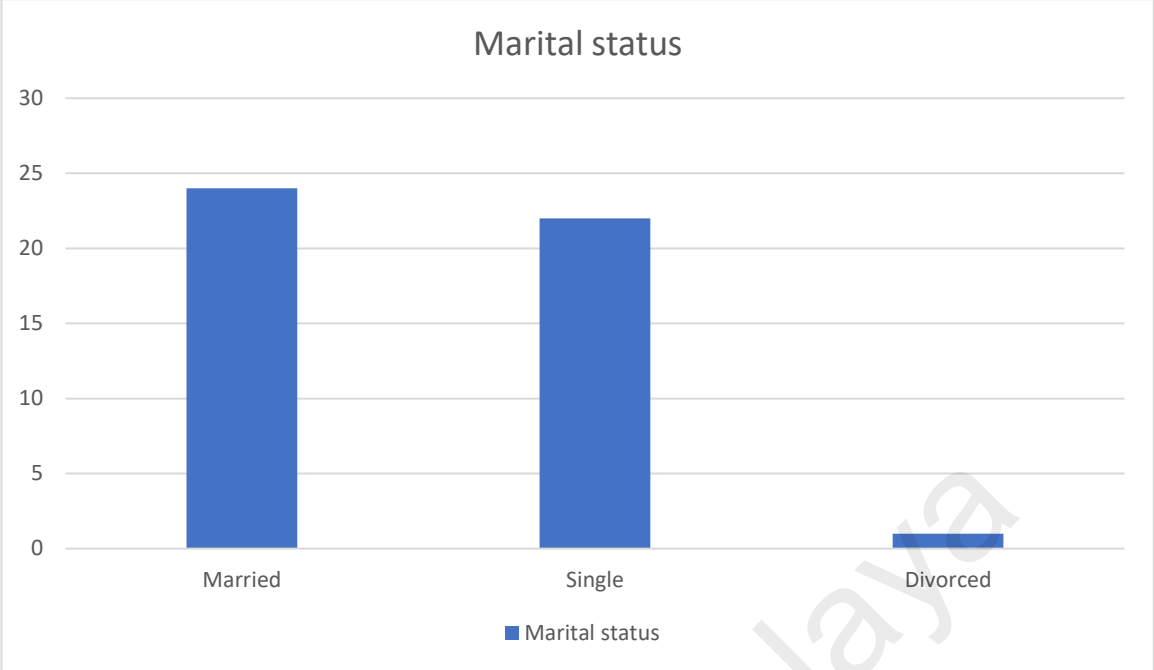

83% (39) of patients were male and 17% (8) were females.

**Figure 2: Racial Distribution**



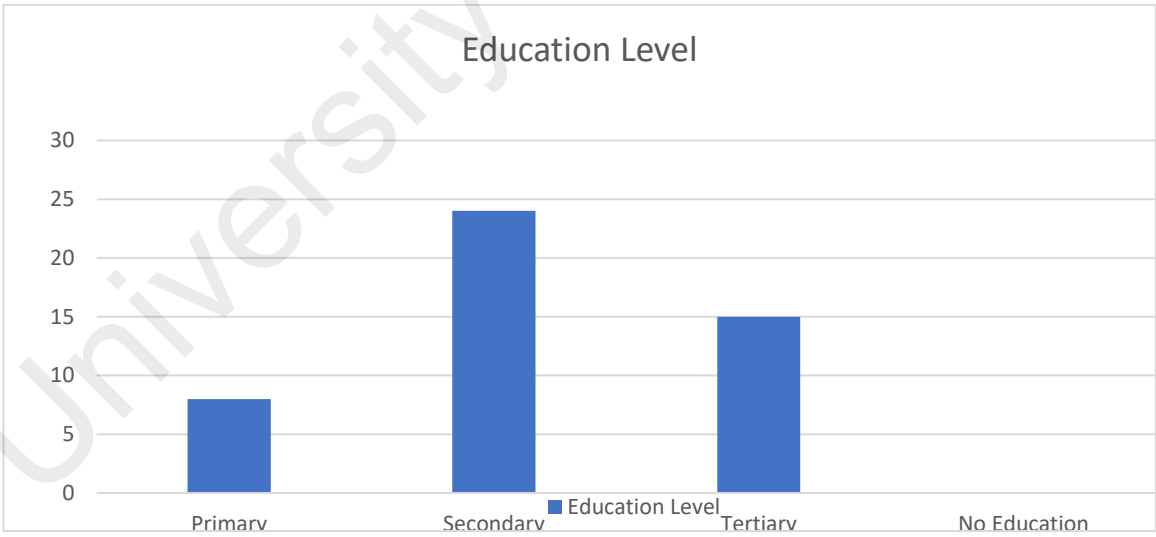

The racial distribution was as follows; Malays 63.8% (30), Chinese 10.6% (5), Indians 23.4% (11) and others 2.1% (1). There was an over representation of Indian patients as compared to the general population.

**Figure 3: Marital Status**



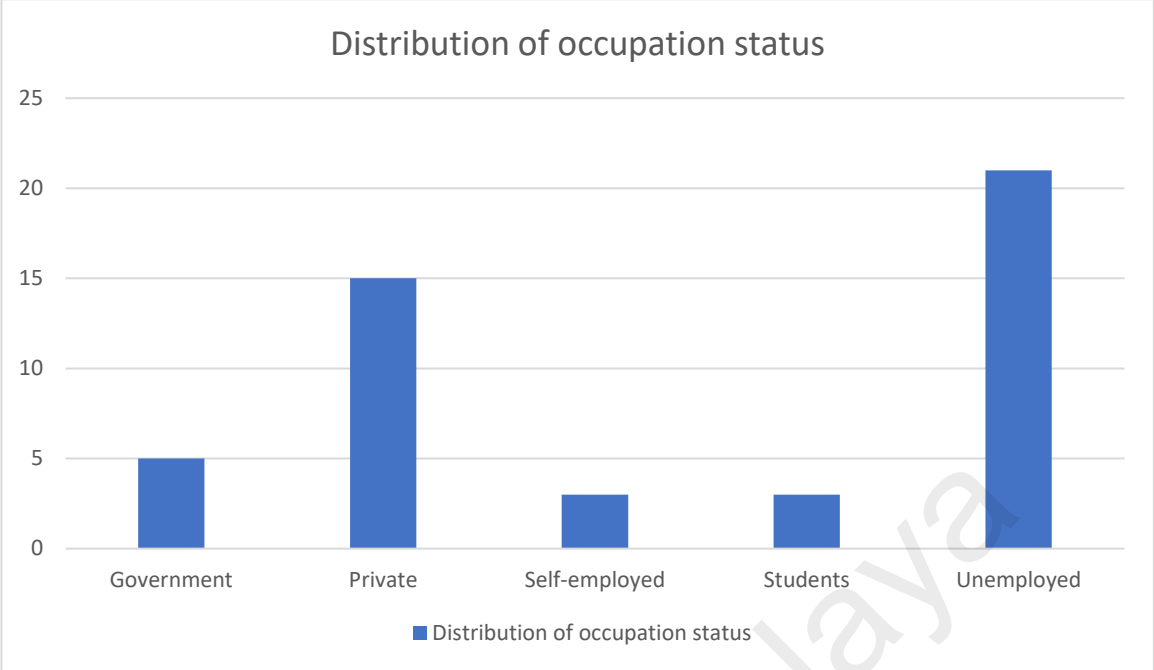

51.1% (24) of the sample were married, 46.8% (22) were single and 2.1% (1) were divorced.

**Figure 4: Education status**



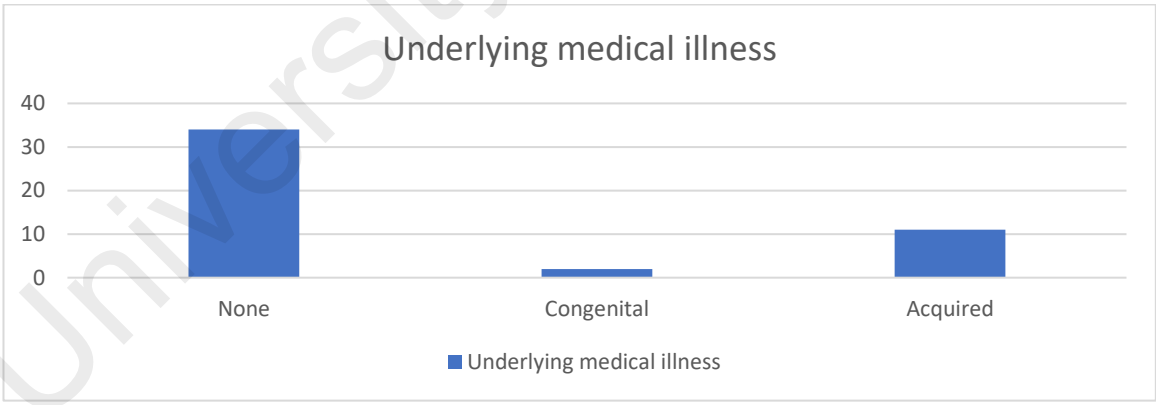

Regarding the education status, 17% (8) were until primary level, 51.1% (24) were until secondary level and 31.9% (15) were until tertiary level. There was no patient without any formal education.

**Figure 5: Occupation status**




Regarding the occupation, 10.6% (5) worked in the government sector, 31.9% (15) worked in the private sector, 6.4% (3) were self-employed, 6.4% (3) were students and 44.7% (21) were unemployed.

**Figure 6: Past Medical History**




.

72.3% (34) had no underlying medical illness, 4.3% (2) had congenital medical illness (asthma) and 23.4% (11) had acquired medical illness (such as diabetes mellitus, hypertension, dyslipidaemia)

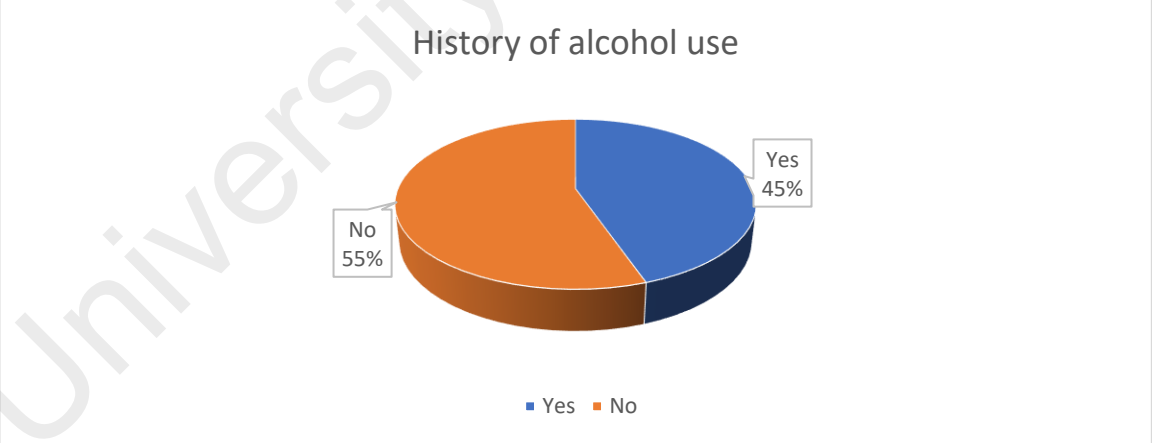
**Table 3: Salary**

| Salary group (per month) | Percentage % (n) |
|---|---|
| < RM 1000 | 44.7% (21) |
| RM 1000-1999 | 27.7% (13) |
| RM 2000-2999 | 12.8% (6) |
| RM 3000-3999 | 12.8% (6) |
| >RM 4000 | 2.1% (1) |
| Total | 100% (47) |

The mean salary for the patients were RM 1429 per month which include those who are not working currently. 20 patients had RM 0 salary whereas there was 1 patient who earns RM 15000 per month.

4.2 Questionnaire on Alcohol use and other substance use (Pre and post TBI)

**Figure 7: History of alcohol use (Pre TBI)**




44.7% (21) patients had tried on alcohol beverage before the TBI and 55.3% (26) patients never tried on alcohol before the TBI.

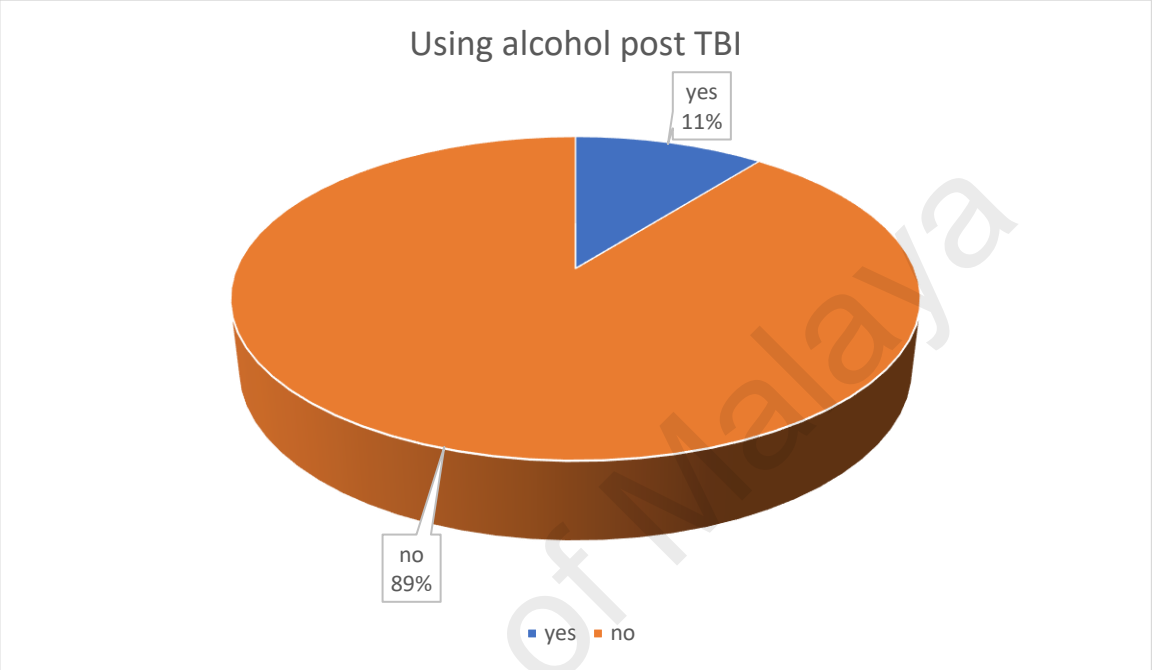
The mean age of first time use of alcohol beverage was 20.48 years old.

52.4% (11) out of 21 of the patients had first degree family members using alcohol as well. 95.2% (20) of the patients were males and 4.8% (1) patient was female.

51.1% (24) out of all the patients were using nicotine (smoking cigarette) pre TBI.

66.7% (14) out of 21 patients who tried on alcohol beverage before were using nicotine as well

**Figure 8: History of alcohol use (Post TBI)**




23.8% (5) out of 21 patients who had history of using alcohol pre TBI were still using alcohol post TBI.

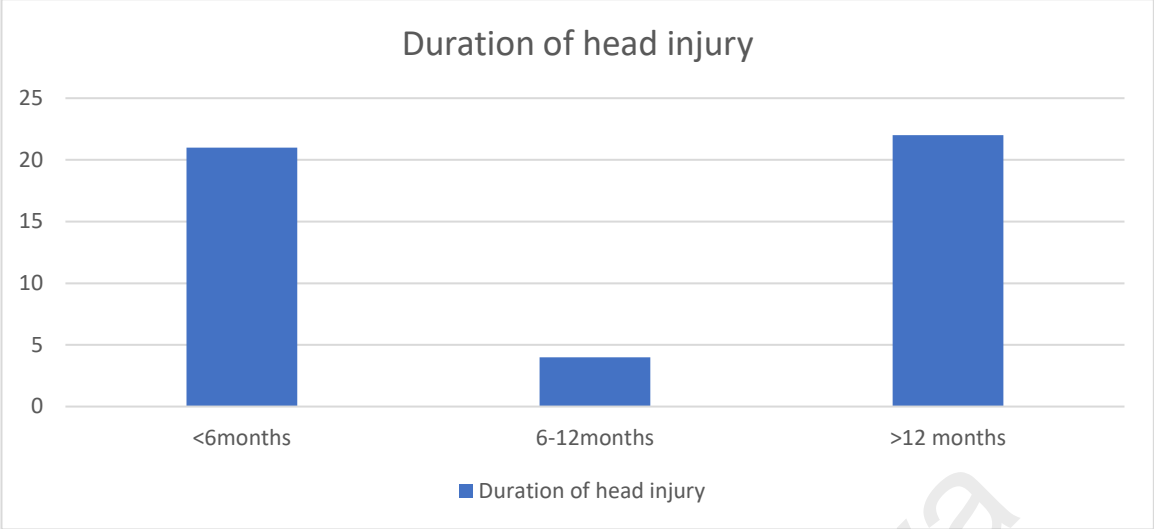
10.6% (5) out of all patients were using alcohol post TBI.

62.5% (15) out of 24 patients were still using nicotine post TBI.



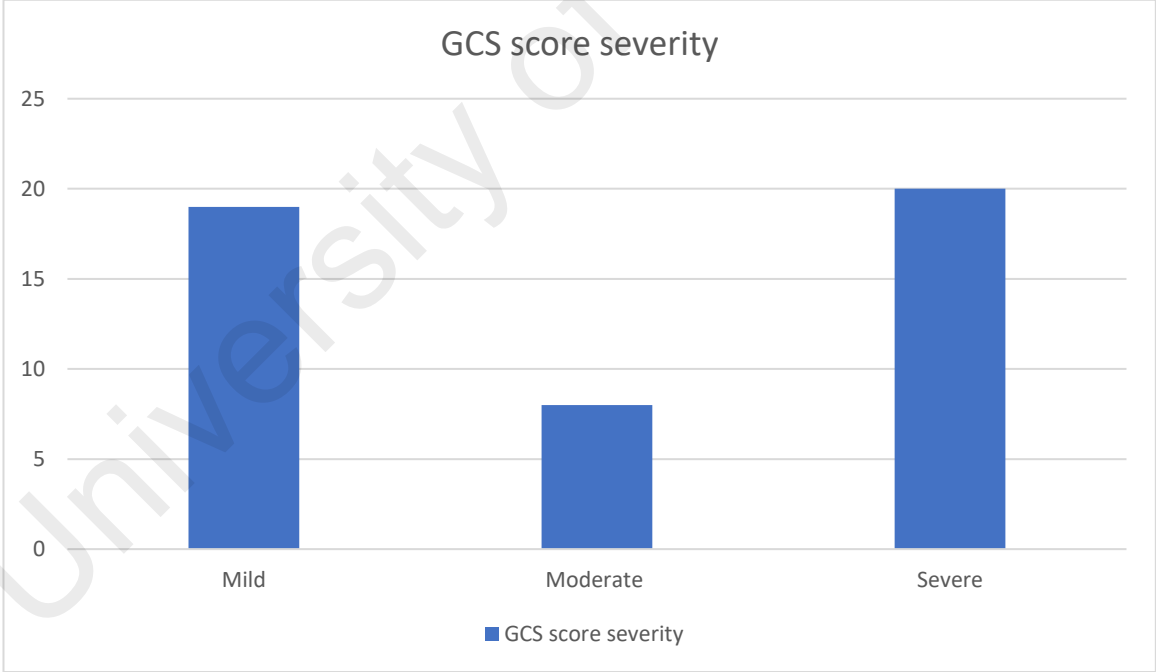
4.3 Questionnaires on TBI

**Figure 9: Duration of head injury**



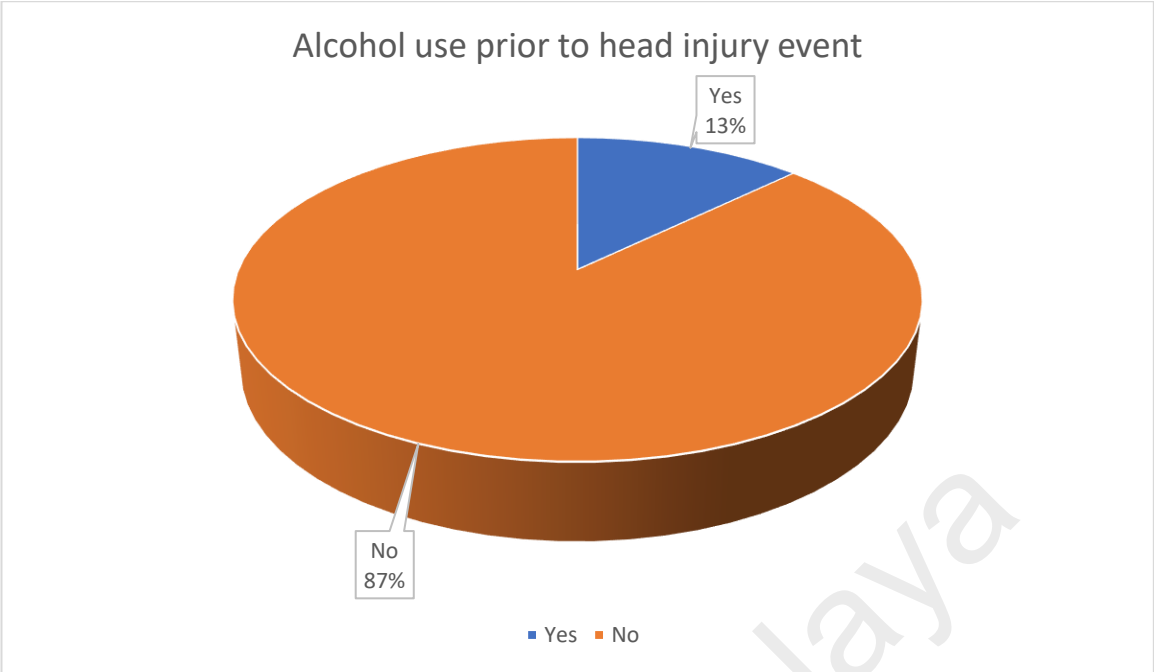

44.7% (21) had head injury less than 6 months ago, 8.5% (4) had head injury for 6-12 months ago and 46.8% (22) had head injury >12 months ago.

**Figure 10: GCS score severity**



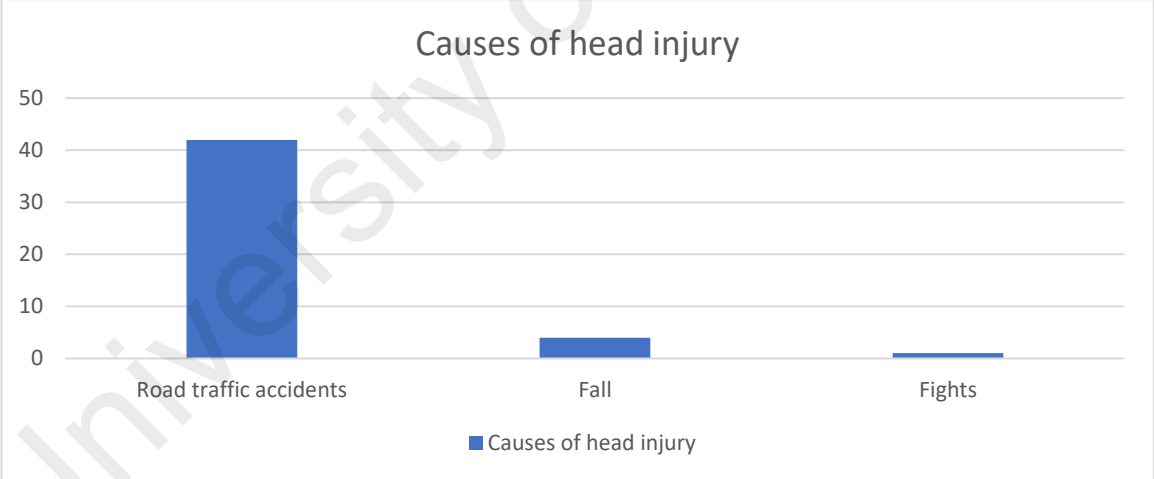

40.4% (19) had mild GCS score severity, 17.0% (8) had moderate GCS score severity and 42.6% (20) had severe GCS score severity. All of the GCS scoring was made during 1st arrival of patient and documentation in emergency department.

**Figure 11: Alcohol use prior to head injury event**



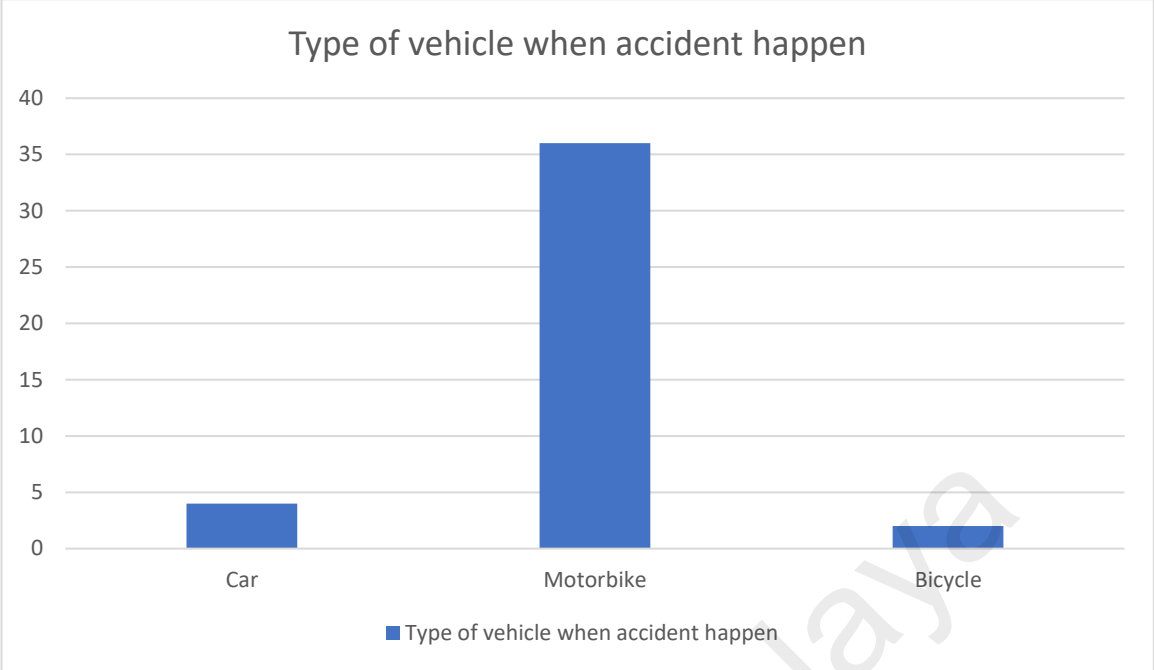

12.8% (6) had use alcohol prior to the head injury event.

**Figure 12: Causes of head injury**



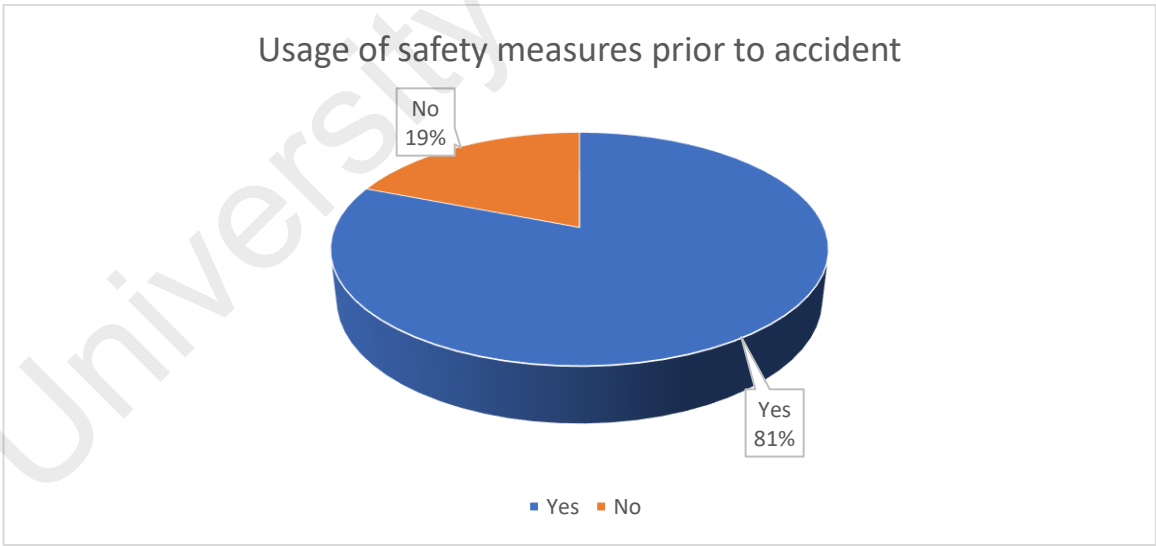

Out of the 47 patients, the causes of head injury for 89.4% (42) patients were due to road traffic accidents, 8.5% (4) due to fall and 2.1% (1) due to fights.

**Figure 13: Type of vehicle when accident happen**



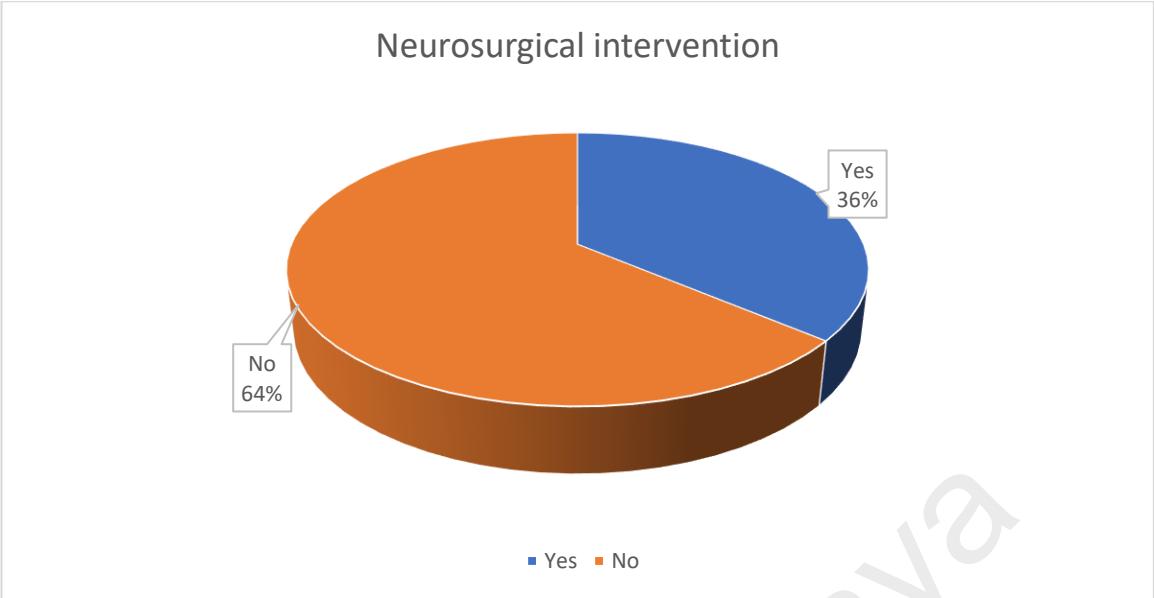

Among the 42 patients involved in road traffic accidents, 9.5% (4) while using a car, 85.7% (36) while riding a motorbike and 4.8% (2) while riding a bicycle.

**Figure 14: Usage of safety measures prior to accident**



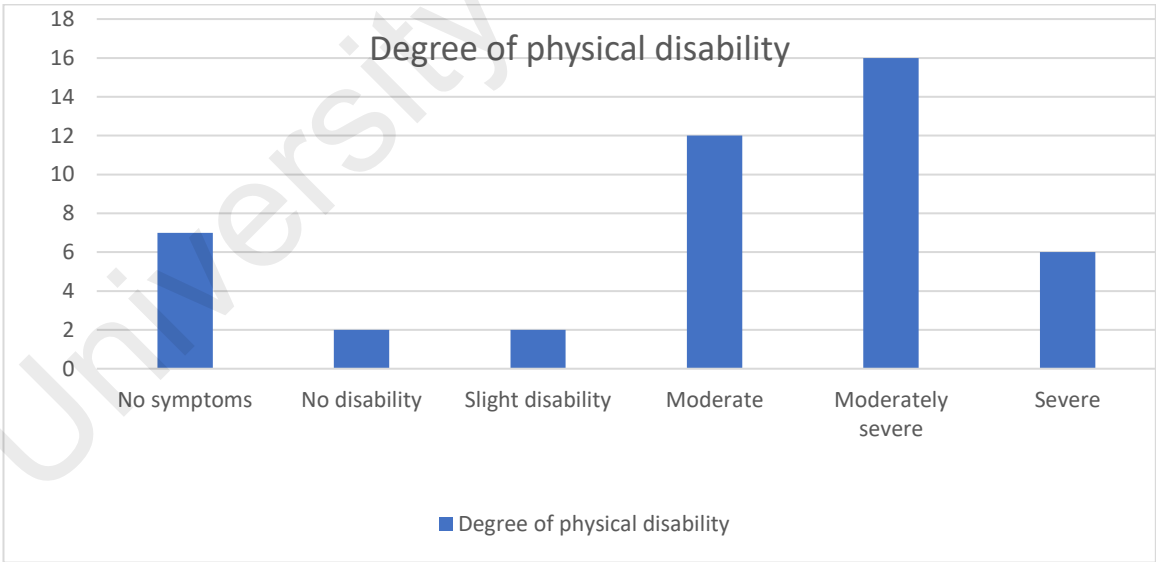

Out of the 42 patients involved in road traffic accident, 81% (34) patients were using safety equipment while driving/riding such as helmet or safety belt and 19% (8) were not using it.

**Figure 15: Neurosurgical intervention**



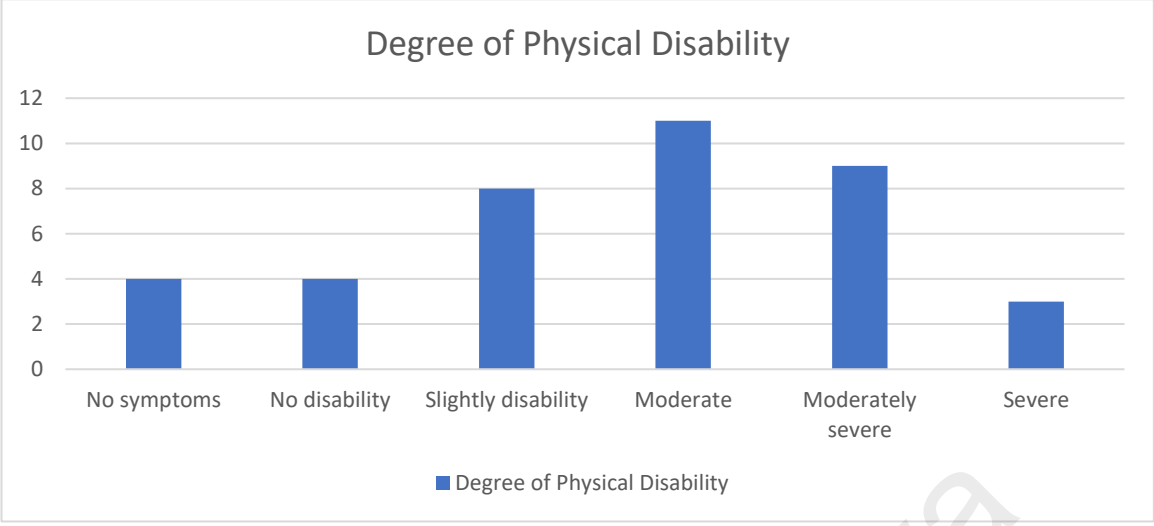

36.2% (17) of patients required neurosurgery procedure (operation) for their head injury and 63.8% (30) were treated conservatively.

**Figure 16: Modified Rankin Scale (MRS) – Degree of Physical Disability upon discharge**



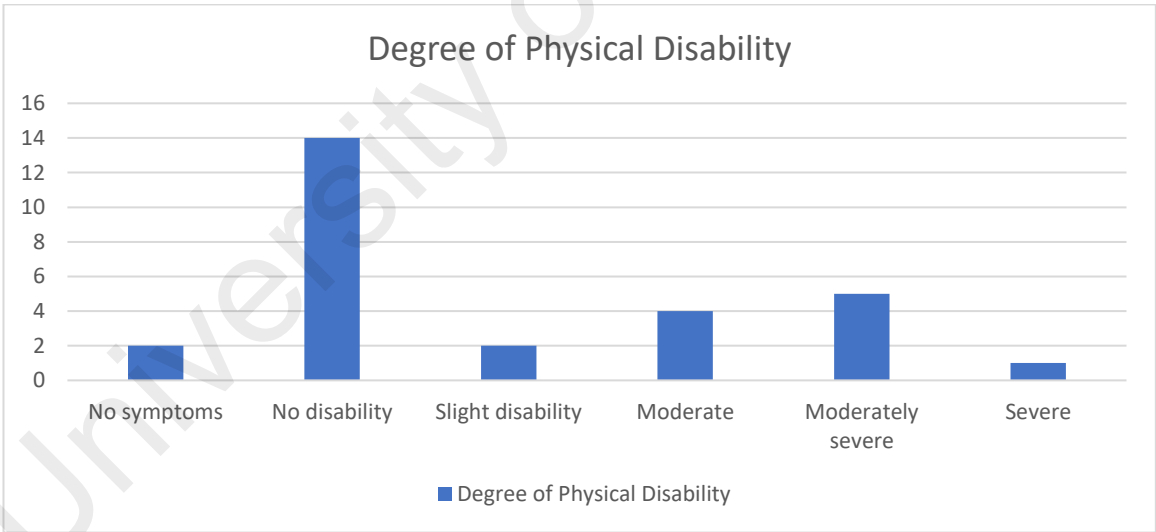

For MRS on discharge, 45 patients included as 2 patients were not admitted for their head injuries. 26.7% (12) had a score of 3 (moderate disability) and 35.6% (16) had a score of 4 (moderately severe disability)

**Figure 17: MRS after 1 month**



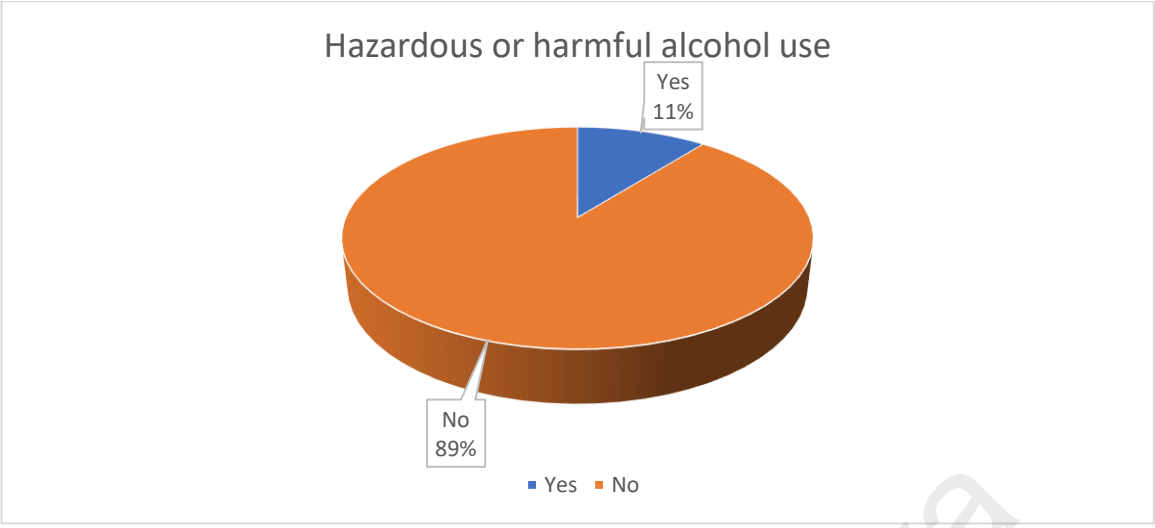

For MRS after 1 month, 39 patients included as some of the patients just had recent head injury and still in ward during assessment. 28.2% (11) had a score of 3 (moderate disability) and 23.1% (9) had a score of 4 (moderately severe disability)

**Figure 18: MRS after 6 months**



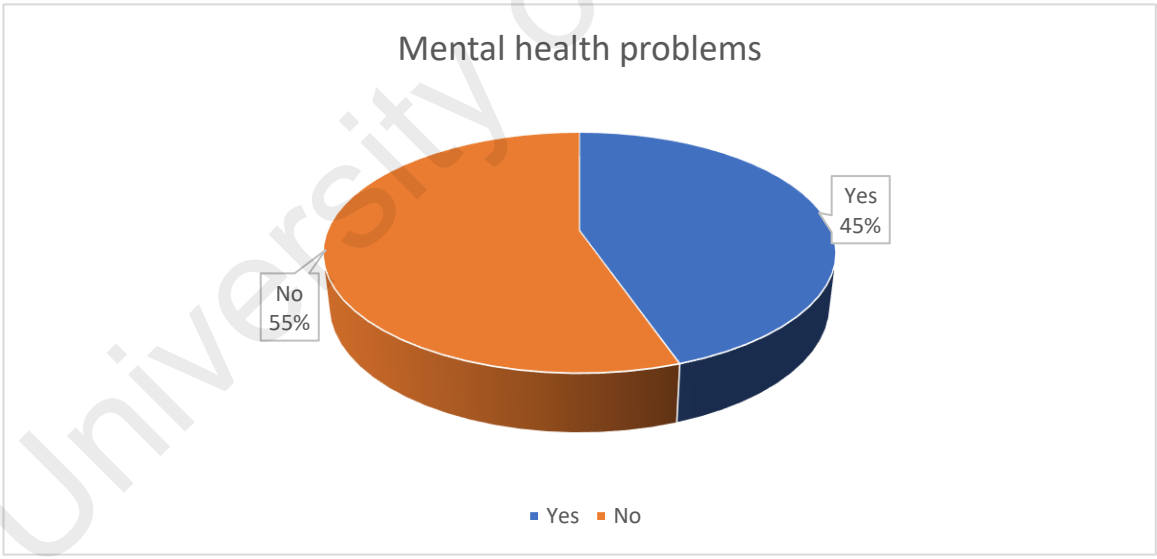

For MRS after 6 months, 28 patients included as some of the patients just had recent head injury and not yet 6 months duration. 50% (14) had a score of 1 (no disability) and 17.9% (5) had a score of 4 (moderately severe disability)

**Figure 19: Total AUDIT (Alcohol use disorder identification test) score (cut off point ≥8)**




10.6% (5) of patients scored ≥ 8 points for AUDIT which indicate hazardous or harmful alcohol use.

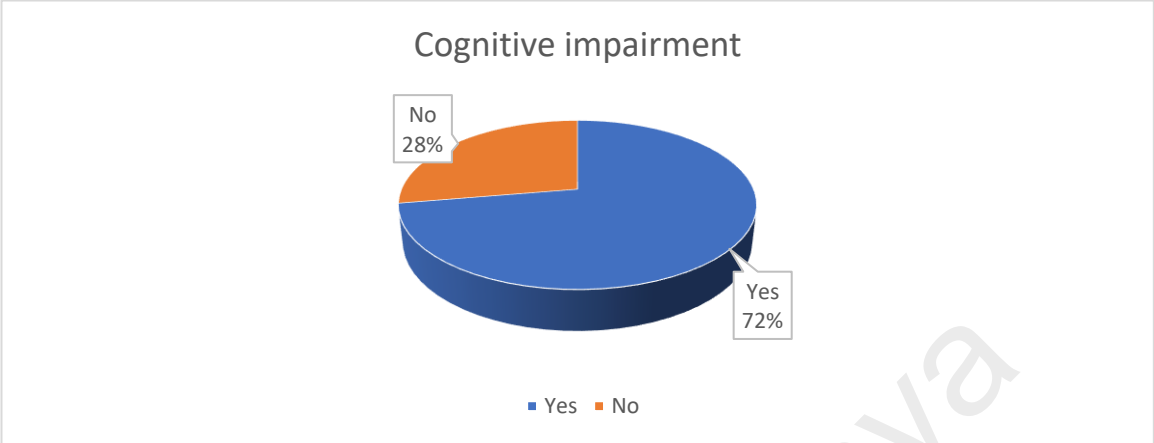
**Figure 20: Total GHQ-12 (General health questionnaire) score (cut off point ≥ 3, scoring using 0-0-1-1 method)**




The mean score for GHQ-12 is 2.49. Cut off point of ≥3 is based on the mean score and previous NHMS 2015 cut off point used.

44.7% (21) of the patients scored ≥ 3 indicating presence of mental health problems during the 1-month period during assessment.

**Figure 21: Total MOCA (Montreal Cognitive Assessment) score (cut off for normal ≥26/30, add 1 point if ≤12 years education)**




The mean MOCA score were 21.6.

72.3% (34) of the patients scored <26 score for MOCA indicating presence of cognitive impairment.

**Figure 22: Language score in MOCA**

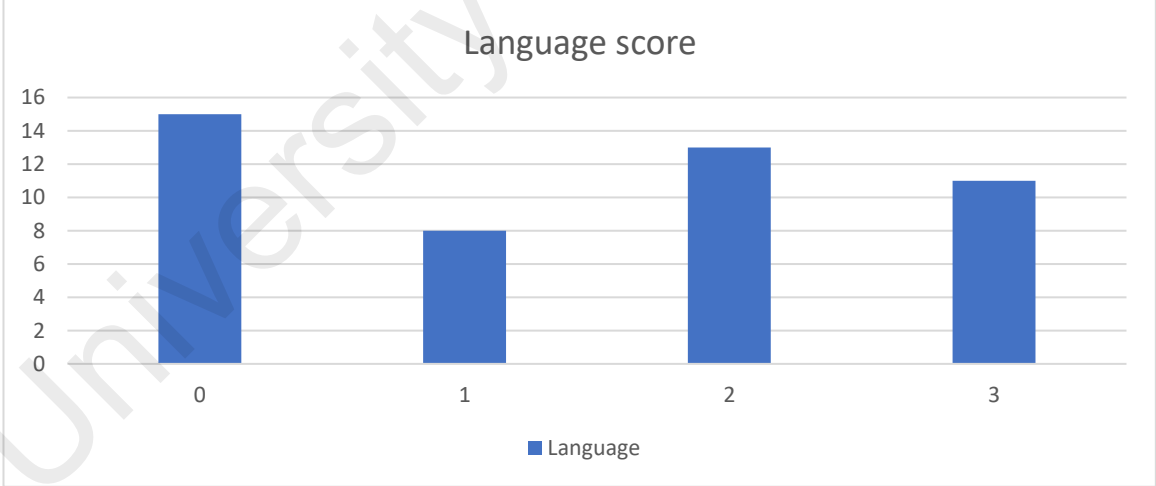
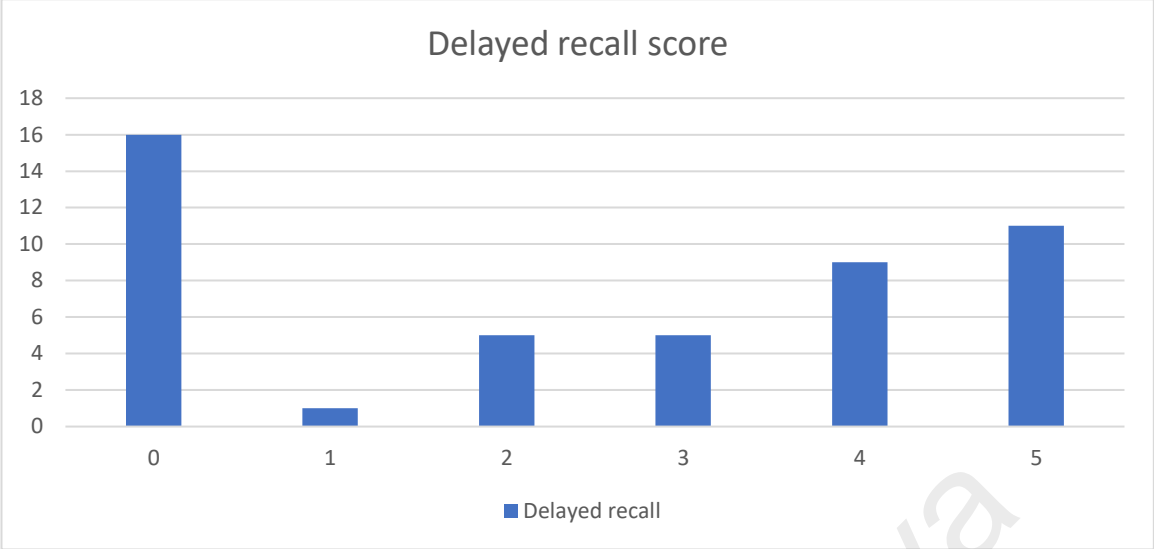



**Figure 23: Delayed recall score in MOCA**




In term of components of MOCA assessment, 2 main components which patients had difficulties were language and delayed recall. For language, 31.9% (15) scored 0 in the section and for delayed recall 34.0% (16) scored 0 in the section.

**Table 4: Association of variables and post TBI alcohol use**

| | | Post TBI alcohol use | | $X^2$ | Odds Ratio |
|---|---|---|---|---|---|
| | | Yes | No | | |
| Age 20-29 years old | Yes | 3 (15.0%) | 17 (85.0%) | 0.697** | 0.45 (95% CI 0.07 – 3.01) |
| | No | 2 (7.4%) | 25 (92.6%) | | |
| | | | | | |
| Race | Malay | 2 (6.7%) | 28 (93.3%) | 1.376** | 0.33 (95% CI 0.05-2.23) |
| | Non-Malay | 3 (17.6%) | 14 (82.4%) | | |
| | | | | | |
| Gender | Male | 4 (10.3%) | 35 (89.7%) | 0.035** | 0.80 (95% CI 0.08-8.28) |
| | Female | 1 (12.5% | 7 (87.5%) | | |

| | | | | | |
|---|---|---|---|---|---|
| Marital status | Married | 1 (4.2%) | 23 (95.8%) | 2.161** | 0.21 (95% CI 0.21-2.01) |
| | Single | 4 (17.4%) | 19 (82.6%) | | |
| Education level | Tertiary | 3 (20.0%) | 12 (80.0%) | 2.031** | 3.75 (95% CI 0.56-25.33) |
| | Others | 2 (6.2%) | 30 (93.8%) | | |
| Occupation status | Working | 3 (13.0%) | 20 (87.0%) | 0.274** | 1.65 (95% CI 0.25-10.91) |
| | Not working | 2 (8.3%) | 22 (91.7%) | | |
| Any alcohol use history | Yes | 5 (23.8%) | 16 (76.2%) | 6.927# | 1.31 (95% CI 1.03-1.67) |
| | No | 0 (0.0%) | 26 (100.0%) | | |
| Family history of alcohol | Yes | 3 (25.0%) | 9 (75.0%) | 3.496** | 0.18 (95% CI 0.03-1.26) |
| | No | 2 (5.7%) | 33 (94.3%) | | |
| Nicotine use pre TBI | Yes | 3 (12.5%) | 21 (87.5%) | 0.179** | 0.67 (95% CI 0.10-4.41) |
| | No | 2 (8.7%) | 21 (91.3%) | | |

| | | | | | |
|---|---|---|---|---|---|
| Head Injury duration | Less than 1 year | 2 (8.0%) | 23 (92.0%) | 0.391** | 0.55 (95% CI 0.08-3.64) |
| | 1 year or more | 3 (13.6%) | 19 (86.4%) | | |
| | | | | | |
| Hazardous drinking (8 or more) | Yes | 3 (60.0%) | 2 (40.0%) | 14.341# | 0.03 (95% CI 0.00-0.33) |
| | No | 2 (4.8%) | 40 (95.2%) | | |
| | | | | | |
| Mental health problem (GHQ-12 3 or more) | Yes | 2 (9.5%) | 19 (90.5%) | 0.050** | 1.24 (95% CI 0.19-8.20) |
| | No | 3 (11.5%) | 23 (88.5) | | |
| | | | | | |
| Cognitive impairment (MOCA < 26) | Yes | 3 (8.8%) | 31 (91.2%) | 0.426** | 1.88 (95% CI 0.28-12.78) |
| | No | 2 (15.4%) | 11 (84.6%) | | |

*Pearson Chi Square **Fisher's Exact Test #p<0.05

1. Social Demographic characteristic and alcohol use in traumatic brain injury patient.

a) Age group (20-29years old-in view of highest prevalence age group for alcohol use) and Post TBI alcohol use

**Table 5: Age (20-29years old) and Post TBI alcohol use (Cross tabulation)**

| | | Post TBI alcohol use | | |
|---|---|---|---|---|
| | | No | Yes | Total |
| Age 20-29years old | No | 25 (92.6%) | 2 (7.4%) | 27 |
| | Yes | 17(85.0%) | 3 (15.0%) | 20 |
| Total | | 42 (89.4%) | 5 (10.6%) | 47 |

There was no significant difference in the age group (20-29years old) and post TBI alcohol use. It was found that 15% of patients aged 20-29years old still uses alcohol post TBI and 7.4% of patients not in this age group of 20-29years old still uses alcohol post TBI. The relative odds of patients aged 20-29years old still uses alcohol post TBI compared to other age group is 2.21.

p = 0.638

Odds ratio = 2.21 95%CI (0.33-14.64)

b) Race and Post TBI alcohol use

**Table 6: Race and Post TBI alcohol use (Cross tabulation)**

| | | Post TBI alcohol use | | |
|---|---|---|---|---|
| | | No | Yes | Total |
| Race | Malay | 28 (93.3%) | 2 (6.7%) | 30 |
| | Non-Malay | 14 (82.4%) | 3 (17.6%) | 17 |
| Total | | 42 (89.4%) | 5 (10.6%) | 47 (100%) |

There was no significant difference in race between Malay and non-Malay for usage of alcohol post TBI. It was found that 6.7% of Malay patients still uses alcohol post TBI and 17.6% of non-Malay patients still uses alcohol post TBI. The relative odds of Malay patients use of alcohol post TBI compared to non-Malay patients is 0.33.

p = 0.336

Odds ratio= 0.33 95%CI (0.05-2.23)

c) Gender and Post TBI alcohol use

**Table 7: Gender and Post TBI alcohol use (cross tabulation)**

| | | Post TBI alcohol use | | |
|---|---|---|---|---|
| | | No | Yes | Total |
| Gender | Male | 35 (89.7%) | 4 (10.3%) | 39 |
| | Female | 7 (87.5%) | 1 (12.5%) | 8 |
| Total | | 42 (89.4%) | 5 (10.6%) | 47 (100%) |

There was no significant difference in gender between patients for usage of alcohol post TBI. 10.3% of male patient still uses alcohol post TBI and 12.5% of female uses alcohol post TBI. The relative odd of male patients still uses alcohol post TBI compared to female is 0.8.

p = 1.00

Odds ratio = 0.80 95%CI (0.08-8.28)

d) Marital status and Post TBI alcohol use

**Table 8: Marital status and Post TBI alcohol use (cross tabulation)**

| | | Post TBI alcohol use | | |
|---|---|---|---|---|
| | | No | Yes | Total |
| Marital status | Married | 23 (95.8%) | 1 (4.2%) | 24 |

| | | | | |
|---|---|---|---|---|
| | Others | 19 (82.6%) | 4 (17.4%) | 23 |
| Total | | 42 (89.4%) | 5 (10.6%) | 47 (100%) |

There was no significant difference in marital status between patients for usage of alcohol post TBI. 4.2% of married patients still uses alcohol post TBI and 17.4% of others (single, divorced) uses alcohol post TBI. The relative odds of married patients still use alcohol post TBI compared to others status is 0.21.

p = 0.188

Odds ratio = 0.21 95% CI (0.02-2.01)

e) Education level and Post TBI alcohol use

**Table 9: Education level and Post TBI alcohol use (cross tabulation)**

| | | Post TBI alcohol use | | |
|---|---|---|---|---|
| | | No | Yes | Total |
| Education level | Tertiary | 12 (80.0%) | 3 (20.0%) | 15 |
| | Others | 30 (93.8%) | 2 (6.2%) | 32 |
| Total | | 42 (89.4%) | 5 (10.6%) | 47 (100%) |

There was no significant difference in education level between patients for usage of alcohol post TBI. 20% of patients with tertiary level of education still uses alcohol post TBI and 6.2% of others (primary, secondary level) uses alcohol post TBI. The relative odds of patients with tertiary level education still uses alcohol post TBI compared to others is 3.75.

p = 0.309

Odds ratio = 3.75 95% CI (0.56-25.33)

f) Occupation status and Post TBI alcohol use

**Table 10: Occupation status and Post TBI alcohol use (Cross tabulation)**

| | | Post TBI alcohol use | | |
|---|---|---|---|---|
| | | No | Yes | Total |
| Occupation status | Working | 20 (87.0%) | 3 (13.0%) | 23 |
| | Not Working | 22 (91.7%) | 2 (8.3%) | 24 |
| Total | | 42 (89.4%) | 5 (10.6%) | 47 |

There was no significant difference in occupation status between patient for usage of alcohol post TBI. 13.0% of patients who are working still uses alcohol post TBI and 8.3% of patients who are not working still uses alcohol post TBI. The relative odds of patient who are working and still uses alcohol post TBI compared to those not working is 1.65.

p = 0.666

Odds ratio =1.65 95% CI (0.25-10.91)

2. Alcohol questionnaire and post TBI alcohol use

g) History of alcohol use pre TBI and Post TBI alcohol use

**Table 11: History of alcohol use pre TBI and Post TBI alcohol use (cross tabulation)**

| | | Post TBI alcohol use | | |
|---|---|---|---|---|
| | | No | Yes | Total |
| History of alcohol use Pre TBI | No | 26 (100.0%) | 0 (0.0%) | 26 |
| | Yes | 16 (76.2%) | 5 (23.8%) | 21 |
| Total | | 42 (89.4%) | 5 (10.6%) | 47 |

Patients who had history of alcohol use pre TBI was significantly more likely to use alcohol post TBI compared to those who did not had history of alcohol use pre TBI. 23.8%

of patients with history of alcohol use pre TBI will still use alcohol post TBI whereas 0% of patients who did not had history of alcohol use pre TBI uses alcohol post TBI.

p = 0.013 (p<0.05)

Odds ratio = 1.31 (95%CI 1.03-1.67)

h) Family history of alcohol use and Post TBI alcohol use

**Table 12: Family history of alcohol use and Post TBI alcohol use (Cross tabulation)**

| | | Post TBI alcohol use | | |
|---|---|---|---|---|
| | | No | Yes | Total |
| Family history of alcohol use | No | 33 (94.3%) | 2 (5.7%) | 35 |
| | Yes | 9 (75.0%) | 3 (25.0%) | 12 |
| Total | | 42 (89.4%) | 5 (10.6%) | 47 |

There was no significant difference in family history of alcohol use between patients who uses alcohol post TBI. 5.7% of patient who uses alcohol post TBI has no family history of alcohol use and 25.0% has family history of alcohol use. The relative odds of patient without family history of alcohol use and uses alcohol post TBI compared to those who had family history of alcohol use is 0.18.

p = 0.097

Odds ratio = 0.18 95%CI (0.03-1.26)

i) Nicotine use pre TBI and Post TBI alcohol use

**Table 13: Nicotine use pre TBI and Post TBI alcohol use (Cross tabulation)**

| | | Post TBI alcohol use | | |
|---|---|---|---|---|
| | | No | Yes | Total |
| | No | 21 (91.3%) | 2 (8.7%) | 23 |

| | | | | |
|---|---|---|---|---|
| Nicotine use pre TBI | Yes | 21 (87.5%) | 3 (12.5%) | 24 |
| Total | | 42 (89.4%) | 5 (10.6%) | 47 |

There was no significant difference in nicotine use pre TBI between patients who uses alcohol post TBI. 8.7% of patients who uses alcohol post TBI did not use nicotine pre TBI and 12.5% of patients who uses alcohol post TBI also used nicotine pre TBI. The relative odds of patients who did not use nicotine pre TBI and alcohol post TBI compared to those who use nicotine pre TBI is 0.67.

p = 1.00

Odd ratio = 0.67 95%CI (0.1-4.41)

3. Head injury questionnaire and Post TBI alcohol use

j) Head injury duration and Post TBI alcohol use

**Table 14: Head injury duration and Post TBI alcohol use (Cross tabulation)**

| | | Post TBI alcohol use | | |
|---|---|---|---|---|
| | | No | Yes | Total |
| Head injury duration | Less than 1 year | 23 (92.0%) | 2 (8.0%) | 25 |
| | 1 year or more | 19 (86.4%) | 3 (13.6%) | 22 |
| Total | | 42 (89.4%) | 5 (10.6%) | 47 |

There was no significant difference between head injury duration of patients and post TBI alcohol use. 8.0% of patients with less than one-year duration of head injury still uses alcohol post TBI and 13.6% of patients with one year or more duration of head injury still uses alcohol post TBI. The relative odd of patients with less than one-year duration of

head injury still uses alcohol post TBI compared to those patients whose duration of head injury is one year or more is 0.55

p = 0.654

Odds ratio = 0.55 95%CI (0.08-3.64)

4. AUDIT and post TBI alcohol use

k) AUDIT score (≥8)- harmful or hazardous drinking and Post TBI alcohol use

**Table 15: AUDIT score and post TBI alcohol use (Cross tabulation)**

| | | Post TBI alcohol use | | |
|---|---|---|---|---|
| | | No | Yes | Total |
| AUDIT score | Less than 8 | 40 (95.2%) | 2 (4.8%) | 42 |
| | 8 or more | 2 (40.0%) | 3 (60.0%) | 5 |
| Total | | 42 (89.4%) | 5 (10.6%) | 47 |

Patients with AUDIT score of 8 or more (hazardous drinking) were significantly more likely to use alcohol Post TBI. 60.0% of patients with AUDIT score of 8 or more still uses alcohol post TBI and 4.8% of patients with AUDIT score of less than 8 still uses alcohol post TBI. The relative odds of patients with AUDIT score of 8 and using alcohol post TBI compared to patients with AUDIT score of less than 8 and still uses alcohol Post TBI is 30.0.

p =0.006 ($p<0.05$)

Odds ratio = 30.0 95%CI (3.06-294.56)

5. GHQ-12 and post TBI alcohol use

l) GHQ-12 score (>2)- presence of mental health problems and Post TBI alcohol use

**Table 16: GHQ-12 score and post TBI alcohol use (cross tabulation)**

| | Post TBI alcohol use | |
|---|---|---|

| | | No | Yes | Total |
|---|---|---|---|---|
| GHQ-12 score | Less than 3 | 23 (88.5%) | 3 (11.5%) | 26 |
| | 3 or more | 19 (90.5%) | 2 (9.5%) | 21 |
| Total | | 42 (89.4%) | 5 (10.6%) | 47 |

There was no significant difference between GHQ-12 score and post TBI alcohol use. 11.5% of patients with GHQ-12 score of less than 3 still uses alcohol post TBI and 9.5% of patients with GHQ-12 score of 3 or more still uses alcohol post TBI. The relative odds of patients with GHQ-12 score of less than 3 and using alcohol post TBI compared to patients with GHQ-12 score of 3 or more is 1.24.

p = 1.00

Odds ratio = 1.24 95% CI (0.19-8.2)

6. MOCA and post TBI alcohol use

m) MOCA score (<26)- presence of cognitive impairment and Post TBI alcohol use

**Table 17: MOCA score and Post TBI alcohol use (cross tabulation)**

| | | Post TBI alcohol use | | |
|---|---|---|---|---|
| | | No | Yes | Total |
| MOCA score | Less than 26 | 11 (84.6%) | 2 (15.4%) | 13 |
| | 26 or more | 31 (91.2%) | 3 (8.8%) | 34 |
| Total | | 42 (89.4%) | 5 (10.6%) | 47 |

There was no significant difference between MOCA score and post TBI alcohol use. 15.4% of patients with MOCA score of less than 26 still uses alcohol post TBI and 8.8% of patients with MOCA score of 26 or more still uses alcohol post TBI. The relative odds

of patients with MOCA score less than 26 and using alcohol post TBI compared to patients with MOCA score 26 or more is 1.88.

p = 0.607

Odds ratio = 1.88 95% CI (0.28-12.77)

7. Pre TBI alcohol use and outcome

n) Pre TBI alcohol use (prior to accident) and GCS (severity)

**Table 18: Pre TBI alcohol use (prior to accident) and GCS Severity (cross tabulation)**

| | | GCS severity | | |
|---|---|---|---|---|
| | | Mild and Moderate | Severe (<9) | Total |
| Pre TBI alcohol use | No | 23 (56.1%) | 18 (43.9%) | 41 |
| | Yes | 4 (66.7%) | 2 (33.3%) | 6 |
| Total | | 27 (57.4%) | 20 (42.6%) | 47 |

There was no significant difference in GCS(severity) between patients who uses alcohol pre TBI. 43.9% of patients with severe GCS score did not use alcohol pre TBI and 33.3% of patient with severe GCS score uses alcohol pre TBI. The relative odds of patient who did not use alcohol pre TBI and having severe GCS score compared to those who uses alcohol pre TBI is 1.57.

p = 1.00

Odd ratio = 1.57 95%CI (0.26-9.53)

o) Pre TBI alcohol use and safety measures (seat belts, helmets)

**Table 19: Pre TBI alcohol use and safety measures (cross tabulation)**

| | Safety measure | |
|---|---|---|

| | | No | Yes | Total |
|---|---|---|---|---|
| Pre TBI alcohol use | No | 5 (13.5%) | 32 (86.5%) | 37 |
| | Yes | 3 (60.0%) | 2 (40.0%) | 5 |
| Total | | 8 (19.0%) | 34 (81.0%) | 42 |

Patients with pre TBI alcohol use were significantly more likely not using safety measures during road traffic accidents compared to those who was not using alcohol pre TBI. 60% of patients with pre TBI alcohol use did not use safety measures and 13.5% of patients with no pre TBI alcohol use did no use safety measures. The relative odds of patients with pre TBI alcohol use and not using safety measure compared to those without pre TBI alcohol use and not using safety measures is 9.6.

p = 0.04 (<0.05)

Odds ratio = 9.6 95%CI (1.27-72.53)

p) Pre TBI alcohol use (prior to accident) and neurosurgical intervention

**Table 20: Pre TBI alcohol use (prior to accident) and neurosurgical intervention (Cross tabulation)**

| | | Neurosurgical intervention | | |
|---|---|---|---|---|
| | | No | Yes | Total |
| Pre TBI alcohol use | No | 25 (61.0%) | 16 (39.0%) | 41 |
| | Yes | 5 (83.3%) | 1 (16.7%) | 6 |
| Total | | 30 (63.8%) | 17 (36.2%) | 47 |

There was no significant difference between patients with pre TBI alcohol use for neurosurgical intervention. 39.0% of patients who did not use alcohol pre TBI had neurosurgical intervention done and 16.7% of patients with pre TBI alcohol use had

neurosurgical intervention. The relative odd of patients with no pre TBI alcohol use and neurosurgical intervention compared to patient with alcohol use pre TBI is 3.2.

p = 0.396

Odd ratio =3.2 95%CI (0.34-29.96)

q) Pre TBI alcohol use (prior to accident) and Modified Rankin Scale (Physical disability)

**Table 21: Pre TBI alcohol use (prior to accident) and Modified Rankin Scale (physical disability)(Cross tabulation)**

| | | Modified Rankin Scale | | |
|---|---|---|---|---|
| | | Less than 3 | 3 or more | Total |
| Pre TBI alcohol use | No | 10 (24.4%) | 31 (75.6%) | 41 |
| | Yes | 3 (50.0%) | 3 (50.0%) | 6 |
| Total | | 13 (27.7%) | 34 (72.3%) | 47 |

There was no significant difference between patients with pre TBI alcohol use for physical disability using Modified Rankin Scale. 75.6% of patients who did not use alcohol pre TBI had score of 3 or more and 50% of patients who had pre TBI alcohol use scored 3 or more for the disability scale. The relative odd of patients with no pre TBI alcohol use and score 3 or more in disability scale compared to patient with alcohol use pre TBI is 3.1.

p = 0.326

Odds ratio = 3.1 95%CI (0.54-17.87)

# 5. CHAPTER 5: DISCUSSION

The present study attempted to investigate patterns of alcohol use among 60 patients with TBI. The patients were hospital based-individuals, either as out-patients attending the Rehabilitation Clinic, or Neurosurgical clinic or in the Neurosurgical ward or Emergency department. In 60 patients, approximately a quarter of the subjects (N=11, 23%) were from the Indian race, and predominantly males (N=39, 83%) and younger age group (<40 years).

The research found among the subjects presenting with TBI, 12.8% used alcohol before their injury. In subjects who had pre-TBI alcohol use were more likely not to use safety measures while driving. Additionally, in the subjects who had a history of alcohol use before TBI and in those with an AUDIT (hazardous, harmful drinking) scored of ≥8 were more likely to re-use alcohol post TBI.

The literature review found alcohol use as a common factor among persons with brain injury, and its role to both the cause of injury and post-injury adjustment (Kreutzer et al., 1996a). The study showed the prevalence of alcohol use before the TBI is 12.8%. The prevalence of the pre-TBI alcohol use is lower compared to other studies done previously. The review found several papers stating 30% to 50% of all patients persisting with trauma were intoxicated at the time of injury (Tien et al., 2006; Salim et al., 2009a). Oscar-Berman (2000) strongly believed alcohol is a major risk factor for injury and mortality.

Corrigan (1995) earliest work revealed, in 55–66% of the subjects surveyed, there was a pre-TBI history of alcohol. Hibbard et al. (1998) using the DSM-IV, to assess axis I psychiatric disorders in 100 community-residing persons with TBI, found 40% of the sample met DSM-IV criteria for substance abuse or dependence before the injury. The other studies reported rates of alcohol use:

1. Bombardier et al. (2003) 50% 203 consecutive inpatients with recent TBI,
2. Dikmen et al. (1995) reported pre-injury alcohol abuse in 42% of the subjects.

In a systemic review paper, Parry-Jones et al. (2006) discovered an estimate of 37–51% of the subjects were intoxicated at the time of injury and in 36–51%, had pre-TBI history of using alcohol. Ponsford et al. (2007) in a study among 121 hospital in-patients with TBI, close to 32% of the TBI group and 29% of the controls were drinking at a hazardous level. Savola et al. (2005) studied a group of 345 patients presenting to the hospitals for trauma discovered on admission, 51% of the patients had alcohol in their blood. The study also revealed binge drinking was the predominant in 78% of the subject. Thus, occurrence of head injury increased sharply with increasing BAC, the commonest causes for such injuries from accidents, falls and assaults.

Salim et al. (2009a) in a review of 38 019 patients and using the National Trauma Data Bank of patients injured between 2000 and 2005, discovered 38% tested positive for alcohol. Salim et al. (2009a) concluded serum ethanol is independently associated with decreased mortality in the patients with moderate to severe head injuries.

In a study done for alcohol-related traffic injuries and fatalities in developing countries. The prevalence of the pre-TBI alcohol use using interview method range 9-16% (Odero et al., 1997). Dikmen et al. (1995) investigated and followed-up patients with TBI. Dikmen et al. (1995) discovered 42% of the subjects were intoxicated while in the ED. Their alcohol use and associated problems decreased following the TBI. However, alcohol usage raised again by one year after injury. Dikmen et al. (1995) concluded:

1. patients with more severe head injuries were likely to decrease their drinking more than did those with less severe head injuries.
2. blood alcohol levels in the ED were a good indicator of the magnitude of their preinjury alcohol problems.

Meanwhile, the prevalence of alcohol use post-TBI is 10.6 %. The prevalence of alcohol use post-TBI is lower than pre-injury alcohol use and correspond with other

studies. In a prospective study done by Kreutzer et al. (1996a). The study followed-up 87 patients periodically after their head injury. Kreutzer et al. (1996a) discovered heavy drinkers were likely to return to drinking even at their second follow-up visits. Ironically, their alcohol use patterns were similar to pre-injury, for the heavy to moderate drinkers. Interestingly, several authors have suggested the presence of mood disorders pre and post-injury along with other complications of the trauma may contribute to the return in drinking (Dikmen et al., 1995; Jorge et al., 2004; Coetzer, 2004; Jorge et al., 2005; Ahmed et al., 2017).

The prevalence of alcohol use post-TBI is also higher compared to the Malaysian epidemiology data on prevalence of current drinker among 18-years-old and above which is 8.4% (Institute for Public Health, 2015). However, as it is a cross-sectional-studies thus the study is unable to show an increasing pattern of alcohol usage with duration.

Association (significant findings)

1.History of alcohol use pre-TBI, AUDIT score and post TBI alcohol use

Hibbard et al. (1998) suggested drinking problems may not continue after TBI. However, another has suggested otherwise. This study found in patients who had a history of alcohol use before the TBI and whom scored ≥8 in the AUDIT (hazardous, harmful drinking) were significantly more likely to use alcohol post-TBI. This is similar to other studies done which showed that history of alcohol abuse is a risk factor to return to alcohol usage post-TBI (Kreutzer et al., 1996a; Kreutzer et al., 1996b; Bombardier et al., 2003; Corrigan and Karelina, 2015; Weil et al., 2016). Besides, only 25% of people achieve long-term functional independence following TBI (Faul et al., 2010; Ahmed et al., 2017).

The present work showed the importance of getting a history of alcohol use pre- and post-TBI. As the literature and result of study showed the use of alcohol use can complicate the presentation and rehabilitation of patients.

Bernier and Hillary (2016) examining the trend of how alcohol- related TBI over the past two decades found the situation and association of alcohol- related TBI has not changed through the years. However, in the age sub-group, there seemed to be a decreasing trend of alcohol use and related injury in the 7-years and older cluster.

What is the significance of the knowledge? Many pieces of evidence suggested intoxicated drivers and involved in road traffic accidents had an additional history of driving under the influence or driving while impaired (Green et al., 2015; LaBrie et al., 2007; Rauch et al., 2010). (Green et al., 2015), Rauch et al. (2010) and LaBrie et al. (2007) are amount many authors who believe these individuals are more likely to be involved a subsequent alcohol-related accident or trauma. Kreutzer et al. (1990) recruited 87 brain injury persons from the outpatient clinic and followed them an average of 48 months post-injury. Kreutzer et al. (1990) discovered the number of moderate to heavy drinkers seemed to decline by two thirds from before to after TBI. Kreutzer et al. (1996b) in a cross-sectional study and following 322 young individuals post-TBI, a pattern of increasing alcohol consumption was noted. In the younger persons, a return to drinking was noted and with a higher level of consumption. Additionally, Kreutzer et al. (1996b) discovered lower consumption rates were found among subjects with higher levels of disability.

Thus, this present study and other literatures supports alcohol use pre-injury remains a major factor predicting alcohol usage post-injury.

2. Pre-TBI alcohol use and safety measures

The present study found in patients who had pre-TBI alcohol use were significantly more likely not to use safety measures such as seat-beat or helmet while driving (N=8, 19%). The finding is similar to another study done whereby it is found that patients with positive

blood alcohol concentration (BAC) were more likely not to use their safety belt compared to those with negative BAC (Stoduto et al., 1993; Fabbri et al., 2002; Friedman, 2014). Many studies indicate the adverse consequences of acute and chronic alcohol ingestion on psychological functions, safety behaviours, including safety measures while driving (Stoduto et al., 1993; Fabbri et al., 2002; Legrand et al., 2012; Friedman, 2014; Green et al., 2015; Blomberg et al., 2009). Blomberg et al. (2009) investigating 2,871 crashes along Long Beach and Fort Lauderdale, in the United States reported of the total crashes, 603 fled the scene of their crash. From the total individuals involved in the crash, the study managed to interview only 83% (the rest fled or refused) and 81.3% provided usable breath specimens.

The literature review has indicated alcohol affects the individuals' self-regulation, sensitivity and attitude thus consequences on their driving performance (Irwin et al., 2017; Mundt and Perrine, 1993; Zhao et al., 2014; Martin et al., 2013). Interesting, Zhao et al. (2014) studying the effects of alcohol on drivers and their driving performance disclosed it was easier to discriminate a driver with a higher BAC level from normal driving. The study identified the drivers' average speed, speed standard deviation, and lane position standard. The differences were significantly higher when the individuals were under the influence of alcohol. The risk of any accidents and fatal injury increases as the blood alcohol concentration levels surge (Taylor and Rehm, 2012; Taylor et al., 2010; Tien et al., 2006; Green et al., 2015). The evidence suggest drivers with blood alcohol level are likely to make poor driving decisions or engage in a physical altercation (Taylor et al., 2010). In fact, several authors such as Taylor et al. (2010) and Taylor and Rehm (2012) believed the consequences rapidly rises after a driver's BAC exceeds 50 mg/dL compared to unimpaired drivers.

Legrand et al. (2012) in a study comparing the prevalence of alcohol and illicit drugs in seriously injured drivers in Belgium (BE) and the Netherlands (NL), found

alcohol was the predominant substance use in both countries. The study concluded alcohol is still the most prevalent substance used among the injured drivers. The authors as well concluded the alcohol use trend among injured drivers has been consistent since the last 15 years.

These studies indicated alcohol and/or drugs are frequently detected in injured drivers, more frequently than in the general driving population. In this study, there was no formal investigation or test done to assess the presence and amount of alcohol usage prior to the accident. The reason for no blood alcohol level documented in this study is because it is not the current practice in Malaysia to conduct blood alcohol concentration for TBI patients at the emergency department.

Association (no significant findings)

The study examined other factors, however, the factors did not show any significant association with alcohol use and in the traumatic brain injured patients surveyed.

1. Socio-demographic data and post-TBI alcohol use

This study found that socio-demographic data such as age, race, gender, education level, employment, marital status, salary, past medical history was not associated with post TBI alcohol use.

Oscar-Berman (2000) revealed there were more males drinking, and females and males metabolize alcohol differently. Moreover, the female brain functioning is more vulnerable to alcohol than the males. In Bernier and Hillary (2016)'s review of alcohol-related TBI over the past two decades, found males out-numbered females in alcohol related-TBI. The review as well showed that men, alcohol usage and between the ages of 18–30 have the highest incidence of TBI overall (65%).

In a local finding on alcohol usage among Malaysian population, it was found subjects between the ages of 20-29-years-old contribute to the highest percentage of current alcohol drinkers, which is 21.3% (Institute for Public Health, 2015). Similarly, Rehm et al. (2013) revealed males and at the ages of 15 to 44-years were likely to use alcohol and increased mortality for high-risk alcohol users. However, from this study, age and gender did not seem significantly affecting the post-TBI alcohol use. In a study by Horner et al. (2005) he found that younger age group was a risk factor for heavy alcohol use after the TBI episode. The similar findings Ahmed et al. (2017) found young adults ages 15–24, and males were more at risk for TBI.

Abdel-Aty and Abdelwahab (2000) as well showed the younger age group of 25–34 age group experience the highest rate of alcohol or drug involvement in accidents. The rates decline with the increase in the age of the drivers (Abdel-Aty and Abdelwahab, 2000; Ahmed et al., 2017). Interestingly some investigators indicate gender and age plays a role in the effect of blood alcohol level and recovery from the TBI (Kaplan and Corrigan, 1992). Kaplan and Corrigan (1992) found females had lower blood alcohol levels than males but they experience longer length of post-traumatic amnesia and admission.

From this study, the majority of the patient with TBI were Malay which coincides with Malaysian demographic data. However, for it was found that patients of Indian race were much higher compared to Chinese patients. There was no association found between races and post-TBI alcohol use. Saroja and Kyaw (1993) did a survey on the prevalence of alcohol use among in-patients admitted to the General Hospital, Kuala Lumpur. All races including the Malay race were represented in 535 patients surveyed. The Malay race made up 20% i.e. the lowest race, while the Indians made up 36% of the group surveyed.

Studies done in Malaysia found drinkers from all race in Malaysia though individuals of Indian race were more likely to have dependence and abuse of alcohol (MI

and AS, 2014; Saroja and Kyaw, 1993). Meanwhile, for the Malay race, even though alcohol is considered illegal in religious views, it was noted that among binge drinker was the highest in the Malay race (MI and AS, 2014).

For gender, the present study also did not find any significant association between gender and post-TBI alcohol use. Kreutzer et al. (1996a) showed despite the number of moderate to heavy drinkers declined from before to after TBI, a history of pre-injury heavy drinking and males are at greatest risk for long-term alcohol abuse post-injury.

Similarly Horner et al. (2005) disclosed the male gender is considered one of the risk factor for post-TBI alcohol use. Horner et al. (2005) interviewed 1606 adults one-year post-injury. The study revealed risk factors of post-injury alcohol use include male gender, younger age, history of substance abuse prior to TBI, and being depression since the injury.

In the present study, there was also no significant association with the education level and post-TBI alcohol use. Even though, based on population study done in Malaysia, it was found that the highest number of current drinkers more than 18 years old were from tertiary education level. From this study, only 31% of the patients had tertiary education level and most of the patients were from secondary education level.

In the study, there was no significant in employment type and status with post TBI alcohol use. Most of the patients were unemployed which consisted of around 44% of the total patients. TBI is a major cause of long-term disability and this affects both the patients themselves, caregivers as well as the countries itself (Hyder et al., 2007). It was said to be the third largest contributor to the disability and global burden of disease after heart disease and depression according to WHO (Thornhill et al., 2000). According to a study, there was no accurate prediction of patient's ability to return to work as even mild TBI can cause lasting problem in sustained attention thus the need for more comprehensive rehabilitation programme tailored to each patient personally (Shames et al., 2007).

For marital status, this study found no significant in marital status and post TBI alcohol use. However, in another study done, noted that heavy drinkers are more likely to be single and infrequent/abstainer were mainly those who were married(Horner et al., 2005).

Thus, the study and review of the literature identified alcohol use as a common factor among persons with brain injury, relevant to both cause of injury and post-injury adjustment.

2. Other factors and post TBI alcohol use.

The other factors that possibly influence post TBI alcohol use such as family history of alcohol use, other substance usage, head injury duration, mental health of patients and cognitive problem were analyze as well however was found to be not significant in this study.

Family history of alcohol use was a well-known risk factor for a person to develop into problematic alcohol use in the future (Grant, 1998). However, in this study, there was no significant for family history of alcohol use and post TBI alcohol.

From this study, there was no significant between other substance usage (nicotine) and post TBI alcohol use. Post-TBI it was found that the usage of alcohol or other substance will increase overtime and the risk was mainly from past history of that particular substance use (Ponsford et al., 2007). Another possible reason is nicotine was the more preferred substance post TBI because it is more accepted among the culture in Malaysia generally.

Head injury duration was found to be one of the risk factor of increasing usage of post TBI alcohol in a few studies. It was found that patient will reduced intake of alcohol right after the head trauma but eventually the intake will increase overtime (Bombardier

et al., 2003; Ponsford et al., 2007). However, in this study, there was no significant found between head injury duration and post TBI alcohol use.

In a study done following head injury for mental health disorder, it was found that 65% of patients had some psychiatry diagnosis mainly depression followed by anxiety disorder and then substance use disorder (Whelan-Goodinson et al., 2009). Another study noted a lower percentage of patient with mental illness post TBI of 21.7% (Deb et al., 1999) However, in this study no formal diagnostic test was done for patient but a screening test for mental well-being was conducted and showed 45% of the patients had mental health problems. There were however no significant findings between the mental health problem and post TBI alcohol use.

Alcohol intake pre TBI was found to be a contributing cause for cognitive impairment in TBI patient and the blood alcohol concentration was predictive of poorer delayed verbal memory and poorer visuospatial functioning (S. Tate et al., 1999). The influence of blood alcohol level is most prominent to cause cognitive impairment within the one month of the injury but may persist in some areas beyond the one month duration (Bombardier and Thurber, 1998). In this study, there was no significant between cognitive impairment and post TBI alcohol use.

## LIMITATION, STRENGTH AND RECOMMENDATION

There were several limitations in this study. First and foremost is the small sample size collected from the study below the expected the numbers. The researcher initially started collecting the sample from a single site in UMMC which is Neurosurgical clinic and ward however when facing difficulties in getting the sample, more site was introduced half way into the research by getting permission to get samples from neuro-rehabilitation clinic UMMC and approval to collect in another urban hospital where the

researcher was posted which is Hospital Kuala Lumpur. Even though, more location for data collection was established, the approval took some time and restricted the duration of data collection in the new area. Also, to make things worse, all the clinics (neuro-rehabilitation UMMC, neurosurgical clinic UMMC, neurosurgical clinic HKL) for cases of head injury were placed on Monday and restricted the researcher on collecting the sample due to different location.

Apart from that, the researcher also faced difficulties to approach patients in a hectic clinic and occasionally some of the patients will be missed out as unable to wait for the interview sessions. Besides that, as the research topic involved alcohol which is considered slightly sensitive to our culture and especially for patients who suffered head injury, there were patients/ family members who were not keen to participate in the study.

The study uses convenient sampling method and depends on the availability of the researcher at that time thus may introduced selection bias. Convenient sampling is used to get as much samples as possible during the limited duration of data collection. The researcher tends to take more patients from certain location which were easier to get and thus the sample collected demographic may be skewed depending on the location of the sample taken. For this study, most of the sample taken were mainly from neuro-rehabilitation clinic in UMMC.

The questionnaires given to patient were mainly in Malay language as it is the national language of Malaysia thus more receptive for the patients. The average time taken to answer the questionnaires were around 20-30minutes. However, patients with TBI had some difficulties in concentration and attention, some also had some language barrier and not familiar with certain words in the questionnaire thus the researcher will clarify the questions again with the patients. Apart from that, as the main questions were about alcohol use, there may be some restriction in giving the true answer of certain

questions by the patients. Thus, the understanding of the questions and sensitivity of the questions may affect the outcome of the data in some way.

The other limitations of the research include difficulties in obtaining consent and consent validity especially in patients with traumatic brain injury in view of impairment in cognitive functions. For this study, no formal assessment tools were done prior to getting consent however in patients with gross difficulties to understand and comprehend, the consent was taken from guardians or family members of patients.

This study only uses GHQ-12 as screening for psychological problem affecting the patients with traumatic brain injury and it was unable to ascertain regarding certain psychiatric diagnosis or other social issues faced by the patients.

## STRENGTH

Although TBI and alcohol use relationship had been studied extensively throughout the world however, there were still very limited local data available in Malaysia. This study will help established a foundation and data regarding our local scenario of the situation. Hopefully from the study, certain significant findings were able to be use as a guidance for further research on this issue.

## RECOMMENDATION

There is much improvement needed for this study and could be recommended for future undertakings. The main issue that needed to overcome is to increase data collections and by increasing the sample size, the study is more robust and give a better finding which is statistically more representative of the population.

Regarding the difficulties to obtain consent and whether the consent will be valid as patients with traumatic brain injury are considered vulnerable group, thus for future

research it is suggested to use an assessment tools to assess ability of patients to give consent prior to the be included in the study.

In future studies, possibly the research could proceed with prospective study which then can establish the causality link between the factors and the outcome. Apart from that, possibly to use other screening or diagnostic tools to ascertain regarding other psychological or psychosocial problems which may affect patients with traumatic brain injury such as personality changes, depression and others.

## CONCLUSION

The present study supports the numerous literature on MVA related-TBI with a significant association of alcohol use. The results can add knowledge to alcohol use and traumatic injury. It is possible that interventions to increase public awareness about the danger of operating a vehicle while intoxicated. Additionally, stricter identification of people's driving state may contribute to the general safety of the population.

Alcohol use and TBI has been a complicated matter whereby both the factors can affect each other either pre-TBI or post-TBI and it does disrupt the subsequent management of the patients. From this study, we were able to see some associations that may contribute towards patients' alcohol use after TBI which were having history of alcohol use and harmful alcohol use before TBI. Both of these factors need to be monitored by treating physician and be used as a indicator of subsequent alcohol use in the future.

The study also gave an overview of the current situation of TBI patients in these 2 urban hospitals (UMMC and HKL). Besides the main outcome of the research regarding alcohol, it provides additional information regarding other substance use of patients post TBI such as nicotine, the mental health wellbeing of TBI patients and the cognitive impairment among the TBI patients.

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