Prevalence and characteristics of acute headaches and dizziness in mild head injury

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Abstract

Little research has been undertaken into the prevalence and characteristics of the acute symptoms following mild head injury, especially within the first month. This study recruited 75 mild head injury patients identified by the Christchurch Hospital Emergency Department and followed them up at 1 week, 1 month and 3 months via questionnaire over the phone. Participants described their symptoms in their own words before being asked more specific questions by the researcher, who then determined which type of headache and dizziness were present, along with the prevalence of other symptoms.

The major causes of these mild head injuries were physical altercation (22, 29%) and sports injury (22, 29%), with the remainder due to household accidents (7, 9%), traffic accidents (6, 8%) and "other" (18, 24%). Forty-seven participants were male and 28 were female, and the response rate was 56.4%. The number of participants with headaches decreased with each follow up, 55 (73%) on presentation, 37 (49%) at one week, 22 (32%) at one month, and 11 (27%) at three months. The most common type of headache was consistently tension-type (one week, 35%, one month, 26%, three months, 36%), with the amount of other types varying at each follow up. The number of participants with dizziness was 14 (19%) on presentation, 18 (24%) at one week, 9 (13%) at one month and 3 (6%) at three months. The number of participants whose dizziness occurred with position change at one week was 12 (16%), at one month was 7 (10%), and at three months was 3 (6%).

The data provided in this study contributed to the literature surrounding mild head injury and the acute symptoms, especially headaches and dizziness, following it. The

fact that tension-type headaches are the most common type of acute post-traumatic headache is of great interest, as is the information that the majority of all headaches have resolved by the three month follow up. Novel information was also reported for dizziness. The prevalence of dizziness increased from presentation to the one week follow up and the resolution differed between dizziness occurring with position change and dizziness occurring without position change, with dizziness occurring with position change being the only type to persist past the 3 month follow up. An extension of this study with greater numbers is indicated.

Preface

The research for this project was carried out over the course of 11 months between January 2010 and December 2010, followed by the writing of this thesis. The project was supervised by Prof. Tim Anderson and Dr. Michael MacAskill at the Christchurch School of Medicine & Health Sciences, Christchurch campus of the University of Otago and Dr. Martin Than at the Emergency Department, Christchurch Public Hospital, Christchurch. This Honours project was completed at the Christchurch Hospital Emergency Department, where the participants were recruited, and at the Van der Veer Institute, where the phone interviews were conducted. The author conducted the project including; the recruitment of participants, the assembling of the questionnaire, the follow up phone interviews, the data analysis and subsequent formulation of the thesis. Preliminary results of this study were presented in poster form at the Australasian Winter Conference on Brain Research, which was held in Wanaka August/September 2010.

Acknowledgements

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Chapter 1 Introduction

In this thesis, common symptoms such as headache and dizziness, which are associated with mild head injury, will be examined. Despite mild head injury being a very common event, these symptoms have not been well characterised, especially in the acute phase following head injury. I hope to contribute to filling this gap in the literature.

1.1 Mild Head Injury

1.1.1 Definition

In the context of clinical practice and research the terms mild head injury, traumatic brain injury (TBI) and concussion are often used interchangeably, but their definitions are distinct. Concussion refers to impaired functional status as a result of head trauma, whereas mild head injury and traumatic brain injury mainly refer to how biomechanical trauma to the head or brain adversely impacts in a pathophysiological way. Head injury is a blanket term that refers to any injury that occurs to the head, including scalp lacerations, facial injury, dental injuries and bone fractures, whereas brain injury specifically refers to injuries to the brain itself. About 80% of head injury admissions are categorised as mild (Jennett, 1996; Kraus & Nourjah, 1989), resulting in admission rates estimated between 100 – 300 cases per year per 100 000 population, depending on country, region, age and gender. Some 41 different guidelines can be found for the grading of mild head injury, yet all lack empirical evidence to support them. Mild head injury is classified as head trauma that does not involve a loss of consciousness of greater than 30 minutes, a score on the Glasgow Coma Scale of 13 – 15 (moderate is 9 – 12 and severe is 8 or less); and signs and/or symptoms diagnostic of concussion (Headache Classification Subcommittee of the

International Headache Society, 2005), including headache, dizziness, amnesia, nausea, light sensitivity, and blurred vision (McCrea, Guskiewicz, Marshall, & et al., 2003).

1.1.2 Epidemiology

Mild head injuries make up a large number of hospital admissions and days of work lost. In Britain, an annual regional admission rate of between 210-404 per 100 000 for head injury has been reported (Jennett, 1996). In that study 80% of the injuries were categorised as mild and the admission rate was similar to the 91-403 per 100 000 reported in other countries including Australia, France, South Africa, Spain, Sweden and the USA (Andersson, Bjorkland, Enmanuelson, & Stalhammar, 2003; Kraus & McArthur, 1996; Nell & Brown, 1991; Tate, McDonald, & M., 1998; Tiret, et al., 1990; Vazquez-Barquero, et al., 1992). Another British study reported an annual incidence of 217 per 100 000 of mild head injuries in Britain (Richardson, 2000).

In the United States, one study has shown the rate of traumatic brain injury to be between 175-200 cases per 100 000 population, with most cases being mild or moderate in severity (Kraus & McArthur, 1996). On inspection of the 1991 US National Health Interview it was established that the yearly pre-admission/treatment rate of non-fatal mild to moderate brain injury was 618 per 100 000 persons (Sosin, Sniezek, & Thurman, 1996). Motor vehicle accidents (28%), sports (20%) and assault (9%) were found to be the most common causes of head injury, with other causes making up 43%. Seventy-five percent of all cases seek medical attention but only 25% are admitted into hospital. Males (15-24 years), people from lower income

households and people living alone have a higher incidence of medically-attended head injury (Sosin, et al., 1996).

Several regional surveys in European countries on the incidence of head injury are able to be compared: between 249 – 546 per 100 000 in Sweden (Andersson, et al., 2003; Johansson, Ronnkvist, & Fugl-Meyer, 1991), 314 per 100 000 for regions in Italy (Servadei, Verlicchi, Soldano, Zanotti, & Piffer, 2002), 281 per 100 000 in France (Tiret, et al., 1990), between 200-236 per 100 000 population for Norway (Edna & Cappelen, 1984; Ingebrigtsen, Mortensen, & Romner, 1998; Nestvold, Lundar, Blikra, & Lonnum, 1988) and 91 per 100 000 in Spain (Vazquez-Barquero, et al., 1992). These rates are similar to those shown in other, non-European, countries such as South Africa with 316 per 100 000 (Nell & Brown, 1991), Australia with between 100-392 per 100 000 (Lyle, Quine, Bauman, & Pierce, 1990; Tate, et al., 1998) and Taiwan with 180 per 100 000 (Lee, et al., 1992).

According to the 'Traumatic Brain Injury Rehabilitation Guidelines' issued by the Accident Compensation Corporation in New Zealand there is an overall rate of 180 cases of traumatic brain injury presenting to emergency departments per 100 000 population (ACC and the National Health Committee, 1998). Wrightson & Gronwall (1998) looked at the incidence of people with mild head injury presenting to the emergency departments at four Auckland hospitals over an eight week period. These results showed the annual incidence of mild head injury to be 252 per 100 000 persons below the age of 15, and 437 per 100 000 persons for ages 15 and over. Falls were the predominant injury cause for patients under 15, while in the age group 15 and over the head injury causes were mainly road accidents, sports injuries and

assaults. Around 5% of the non-admitted cases and 9.7% of the admitted cases were referred to a Concussion Clinic because of persistent symptoms. Heitger (2004) found that of the 30 participants with mild head injury he recruited from the Christchurch Hospital Emergency Department, 60% were caused by sports injuries, 23.3% by traffic accidents, 10% by falls, 3.3% by work accidents, and 3.3% by assault.

1.2 Pathology of mild head injury

The immediate force upon impact during head trauma is of a high magnitude and is relatively short (5-200ms) in duration, translating into high accelerations of the head and brain. Two forces act upon the brain at impact: the first is translational (linear) force, which causes the head's centre of gravity to move along a straight line, and the second is rotational, resulting in the head moving around its centre of gravity (Ommaya, 1995; Sahuquillo, Poca, & Amoros, 2001). Rotational forces have the larger capacity to injure. Primary injury is caused by the impact of these initial mechanical forces, which affect neuronal and non-neuronal tissues equally, while secondary injury incorporates non-mechanical neuronal cell damage through adverse impact of hypoxemia and hypotension on cell oxygen supply/demand balances. Depending on the injury severity, both the primary and secondary injuries caused at time of head trauma contribute in differing degrees to brain damage and overall neural injury, with potential subsequent cerebral dysfunction.

1.2.1 Macroscopic pathology

Depending on the level of head trauma macroscopic pathology can include skull fractures, haematoma formation, intracerebral haemorrhage, disrupted tissue integrity, oedema, brain swelling and increased intracranial pressure (Richardson, 2000). Cumulative tissue damaged is caused by brain ischemia, hypoxemia and hypotension.

In addition, metabolic changes, such as increased neurotransmitter release and the immediate initiation of inflammatory processes, can often been seen within the brain following injury. Some sequelae are present immediately following trauma (e.g. skull fracture, structural tissue damage, disrupted blood brain barrier). Others, meanwhile, are initiated on impact, but do not show themselves until after a substantial time period. This can be seen in the formation of a haematoma which can develop in hours or days, depending on severity.

The likelihood of the presence of macroscopic pathology in a patient with head trauma increases with the severity of the head trauma. Even in mild head injury, skull and face (hairline) fractures (8-11%, (Dacey, Alves, Rimel, Winn, & Jane, 1986; Stein & Ross, 1992), significant haemorrhage and haematoma formation and critical hypoxemia can all occur (Haydel, et al., 2000; Hofman, Nelemans, Kemerink, & Wilmink, 2000; Jeret, et al., 1993; Madden, et al., 1995; Nagy, et al., 1999; Stein & Ross, 1992; Uchino, Okimura, Tanaka, Saeki, & Yamaura, 2001), but the incidence is very reduced and <1% will require neurosurgical intervention due to the presence of acute lesions (e.g. on a CT head scan).

1.2.2 Microscopic pathology

A cascade of events is triggered at initial impact that may continue for days and weeks following head injury (Williams, et al., 2001). At the time of injury the permeability of cell membranes for Na^+, K^+ and Ca^{2+} is altered, along with increased conductivity of voltage-dependent ion channels that are triggered by shock. This causes a depolarisation of the presynaptic neuron and neurotransmitters (e.g. glutamate) are released into the extracellular and interneuronal spaces. This then

affects nerve cells which were not mechanically damaged from the head trauma and causes an influx of Ca^{2+} and, consequently, ionic destabilisation of neurons and glia. Several intracellular second messengers and enzyme systems, which encompass lipases (degrading fatty acids), proteases (degrading peptides and proteins) and endonucleases (degrading nucleotides DNA and RNA), are activated, as are many uncontrolled metabolic cascades causing mitochondrial failure and production of reactive oxygen species (ROS). The resultant oxidative stress causes degradation of the cell membrane and cytoskeletal proteins. Presence of ROS triggers the formation of inflammatory mediators (e.g. tissue necrosis factor, interleukin-1 β), which, along with the activated intracellular second messenger pathways, induce an altered expression of DNA transcription factors and apoptotic proteins. This then leads to apoptosis, a major pathway (along with necrosis) for neuronal loss following head injury. The death of damaged neurons causes a retraction of synaptic terminals on undamaged neurons that were connected to the injured nerve cell and causes anterograde and retrograde transneuronal degeneration to these otherwise undamaged neurons (Jessell, 1991).

1.3 Headaches

Of all the symptoms following mild head injury, headaches are reported as being the most common, occurring in 30 – 90 % of patients (Blinman, et al., 2009; McAllister & Archiniegas, 2002; Rimel, Giordani, Barth, Boll, & Jane, 1981; Yang, et al., 2007). An acute post-traumatic headache is defined as beginning within seven days of trauma (or regaining of consciousness) and lasting up to three months (International Headache Society, 2005). After three months, the headaches are then classified as

chronic. The three month time period was assigned arbitrarily as the time by which we think many headaches have resolved.

Most studies of post-traumatic headache focus on the chronic post-traumatic headache. Some claim headaches are more common in mild head injury than in moderate to severe head injury (Couch & Bearss, 2001; Haas, 1996). In contrast others have found this not to be the case (De Benedittis & De Santis, 1983; Walker, et al., 2005).

Headaches that are not bought on by an external disorder are categorised as primary headaches. Secondary headaches are those which follow another disorder. If a temporal relationship is perceived between a new headache and a know cause of headache, the headache is classified according to the causative disorder. This is still the case when the headaches displays characteristics of primary headaches, such as migraine, tension-type, or cluster (International Headache Society, 2005). Post traumatic headaches are examples of secondary headaches as they are bought on by head trauma but display many characteristics of primary headaches (Lew, et al., 2006). The types of primary and secondary headaches can be seen below in Table 1.1.

Table 1.1 Adapted from International Headache Society (2005)

Types of primary headache (examples of)	**Types of secondary headache** (examples of)
Migraine headache	Headache attributed to head and/or neck trauma
Tension-type headache	Headache attributed to cranial or cervical vascular disorder
Cluster headache	Headache attributed to non-vascular intracranial disorder
Other trigeminal autonomic cephalalgias	Headache attributed to substance or its withdrawal
Stabbing headache	Headache attributed to infection
Cough headache	Headache attributed to disorder of homeostasis
Exertional Headache	Headache attributed disorder of cranium, neck, eyes, ears, nose, sinuses, teeth, mouth or other facial or cranial structures
Headache associated with sexual activity	Headache attributed to psychiatric disorder

1.3.1 Classification of post-traumatic headache

Post-traumatic headaches are classified by their characteristics into different types. The most common is tension-type headache, which make up 37% of chronic post-traumatic headaches (Radanov, Di Stefano, & Augustiny, 2001). The pain in tension-type headaches is typically bilateral, pressing or tightening in quality, of mild to moderate intensity, and is often described as a dull aching sensation. It tends to occur daily and persistently, and does not worsen with routine physical activity. It is usually not associated with nausea but sometimes photophobia or phonophobia may be present (Headache Classification Subcommittee of the International Headache Society, 2005). Tension-type headaches can inhibit activity but it's unusual for them to prohibit it. Emotionally tense or stressful situations can aggravate tension-type headaches (Packard, 1999). The International Headache Society (IHS) criteria for the diagnosis of tension-type headaches are given in Table 1.2.

Table 1.2 Tension-type Headache Diagnostic Criteria (International Headache Society, 2005)

A.	At least 10 episodes occurring on <1 day per month on average (<12 days per year) and fulfilling criteria B-D
B.	Headache lasting from 30 minutes to 7 days
C.	Headache has at least two of the following characteristics: 1. bilateral location 2. pressing/tightening (non-pulsating) quality 3. mild or moderate intensity 4. not aggravated by routine physical activity such as walking or climbing stairs
D.	Both of the following: 1. no nausea or vomiting (anorexia may occur) 2. no more than one of photophobia or phonophobia
E.	Not attributed to another disorder

The second most common type of post-traumatic headache is the post-traumatic migraine, comprising some 27% of chronic post traumatic headaches (Radanov, et al., 2001). Typically these are unilateral, have a pulsating quality, are of moderate or severe intensity and aggravated by routine physical activity. Migraines are associated with nausea and/or photophobia and phonophobia. The IHS diagnostic criteria for migraine-type headaches are given in Table 1.3. These characteristics are sometimes preceded by an aura of reversible focal neurological symptoms which gradually develop over 5 – 20 minutes and last for less than 60 minutes. To be classified as an aura the phenomenon must be one of the following: fully reversible visual symptoms including positive features, such as flickering lights, spots or lines, and/or negative features, i.e. loss of vision; fully reversible sensory symptoms including positive features, i.e. pins and needles, and/or negative features, i.e. numbness; or fully reversible dysphasic speech disturbance. It must also be associated with two of the following: homonymous visual symptoms and/or unilateral sensory symptoms; at least one aura symptom developing gradually over five minutes or longer and/or different aura symptoms occurring in succession over five minutes or longer; each

symptom lasting five minutes or longer and no more than sixty minutes (Headache Classification Subcommittee of the International Headache Society, 2005). People who experience post-traumatic migraines may have a genetic predisposition as in some studies it has been noted that a large majority had family members who also suffer from migraine (Packard, 1999). It has been shown that migraines are not significantly more frequent in patients who had suffered a traumatic loss of consciousness compared to those who did not (Radanov, et al., 2001).

Table 1.3 Migraine-type Headache Diagnostic Criteria (International Headache Society, 2005)

A.	At least 5 attacks fulfilling criteria B-D
B.	Headache attacks lasting 4-72 hours (untreated or unsuccessfully treated)
C.	Headache has at least two of the following characteristics: 1. unilateral location 2. pulsating quality 3. moderate or severe pain intensity 4. aggravation by or causing avoidance of routine physical activity (*e.g.*, walking or climbing stairs)
D.	During headache at least one of the following: 1. nausea and/or vomiting 2. photophobia and phonophobia
E.	Not attributed to another disorder

Following head trauma it is possible for mixed-type headaches to occur, this is a combination of migraine-type and tension-type headaches. This has an incidence of 18% in chronic post-traumatic headaches (Radanov, et al., 2001).

The final type of headache that can be seen following head trauma is a cluster-type headache. This headache involves attacks of severe or very severe, strictly unilateral pain which can be orbital, supraorbital, temporal, or any combination of these sites. This pain lasts 15 – 180 minutes if untreated and is associated with at least one of the following ipsilateral complaints; conjunctival injection, lacrimation, nasal congestion,

rhinorrhoea, forehead and facial sweating, miosis, ptosis and eyelid oedema. The IHS diagnostic criteria for cluster-type headaches can be seen in Table 1.4. In about 5% of non head injury cases, cluster headaches can be inherited in an autosomal dominant pattern. For unknown reasons however the prevalence is 3 – 4 times higher in men (Headache Classification Subcommittee of the International Headache Society, 2005). Following head injury the incidence can range from 6% to 10% of headaches with the onset of each headache being typically rapid but relatively brief in duration (Packard, 1999).

Table 1.4 Cluster-type Headache Diagnostic Criteria (International Headache Society, 2005)

A.	At least 5 attacks fulfilling criteria B-D
B.	Severe or very severe unilateral orbital, supraorbital and/or temporal pain lasting 15-180 minutes if untreated
C.	Headache is accompanied by at least one of the following: 1. ipsilateral conjunctival injection and/or lacrimation 2. ipsilateral nasal congestion and/or rhinorrhoea 3. ipsilateral eyelid oedema 4. ipsilateral forehead and facial sweating 5. ipsilateral miosis and/or ptosis 6. a sense of restlessness or agitation
D.	Attacks have a frequency from one every other day to 8 per day
E.	Not attributed to another disorder

As can be seen, there is a decided lack of evidence for the different headache types acutely after head injury, which has led to this study. We hope to begin to fill these gaps.

1.4 Dizziness

The prevalence of dizziness following mild head injury varies greatly between studies. One study (Yang, et al., 2007) comprehensively recorded the prevalence of dizziness at 1 week (74%), 2 weeks (45%), 4 weeks (18%) and 8 weeks (6%). This study found dizziness to be the most experienced symptom following mild brain

injury over this 2 month period. Other studies do not find this to be the case. Lundin et al. (2006) found dizziness present in 18% of participants at 3 months following mild head injury, making it less prevalent than headache (21%). De Kruijk et al. (2002) found dizziness to occur as commonly as headache, with a prevalence of 12% two weeks following head trauma and 3% six months later.

1.4.1 Classification of dizziness

Dizziness has numerous different definitions between participants and between studies, thus it is a difficult symptom to characterise and classify. It is mostly used as a blanket term that includes symptoms of disorientation, light-headedness and imbalance as well as vertigo (Maskell, Chiarelli, & Isles, 2006). One authority has divided dizziness into 4 broad categories. The first is related to the vestibular system and is the illusion of movement, called vertigo. The next is pre-syncopal light-headedness which is the sensation of an impending faint. It is assumed that this is due to cerebral hypoperfusion, e.g. a drop in blood pressure related to postural change. The third category is multisensory dizziness, occurring as a result of dysfunction of multiple sensory systems. It is more common in older populations and in populations with systemic disorders (e.g. diabetes). The last category is psycho-physiologic dizziness, comprising symptoms such as visual vertigo and space phobia (Davies, 1997).

One cause of specific post-traumatic dizziness is benign paroxysmal positional vertigo (BPPV). The etiology most accepted is that this is labyrinthine in origin, with free-floating debris in the semicircular canal (Hughes & Proctor, 1997). This free-floating debris is often the result of trauma to the head. The following are included in the signs and symptoms of this disorder; critical provocative head position, characteristic

nystagmus, brief latency, limited duration of attack, reversal of nystagmus on returning to erect position and fatigability of the nystagmus (Hughes & Proctor, 1997).

One study which did not explore the categories of dizziness found that the severity of dizziness correlated significantly with post-traumatic amnesia - the longer the duration of amnesia the more severe the dizziness (Drake, et al., 2006). Another study showed that dizziness was closely linked to psychological distress at 6 months after head injury. It also emerged in the same report that dizziness is an independent predictor of failure to return to work (Chamelian & Feinstein, 2004).

While the prevalence of dizziness could be said to be reasonably well documented in the literature, the actual characteristics of the dizziness are not so well reported. Our study is important because it delves further into these characteristics, hoping to illuminate more detail on the subject.

1.5 Aim

In this study I hoped to fill the gap that is in the literature by focussing on the acute symptoms following mild head injury. This was done by comprehensive follow up interviews to firstly, assess the prevalence and time course by ascertaining their prevalence at presentation, one week, one month, and three months post injury, and secondly and most importantly, to categorise the nature of acute headaches and dizziness.

Chapter 2 Methods

2.1 Recruitment and Consent

Participants were recruited from the Christchurch Hospital Emergency Department by utilising the attendance register to identify those with head injuries, and then using their medical notes to aid in recording details of their initial presentation. The home address and phone numbers of potential participants were also obtained from their medical notes and they were then sent an information sheet with a cover letter, inviting participation in the study. At one week following the presentation to the Emergency Department (and the mild head injury) they were contacted via telephone to answer any questions raised by the information sheet, and to gain informed consent from them to contact them at follow-up periods. As consent was gathered verbally, I completed a form confirming that consent had been given to participate in the study, to allow access to medical notes, and for information gathered in this study to be used in further studies given ethical approval by a Health and Disability Ethics Committee. The first follow-up interview was conducted immediately after consent was obtained (i.e. one week after the injury). Study participants were also contacted via telephone at one month and three months following their presentation to the Emergency Department, as follow-ups two and three respectively. About half an hour was designated for the first phone call, and about fifteen minutes for the subsequent two. The study was granted ethical approval by the Upper South A Ethics Committee of the New Zealand Ministry of Health.

2.2 Questionnaire

A study-specific detailed questionnaire constructed by the author (Appendix 1), was administered at each interview. Questions were formulated so as to assess the nature and prevalence of headache, dizziness and other symptoms within the sample, and their change over the follow-up period. It was used in conjunction with the participant's medical notes, which aided in discovering head injury details and presenting symptoms. The questionnaire was primarily a structured interview but participants were also given the opportunity to describe their symptoms using their own spontaneously-generated language. Participants were also asked about their previous and family history of any regular headaches and dizziness prior to the head injury in the one week (follow-up one) phone call. Because of this additional data collection in the first follow-up it generally took longer than the subsequent two.

2.3 Inclusion and Exclusion Criteria

To be included, participants had to be at least 16 years of age and have had a mild head trauma (defined as a loss of consciousness of no more than 30 minutes, a Glasgow Coma Scale score of 13-15 and post traumatic amnesia of <48 hours). The exclusion criteria were: the patients being unable to speak English, profound deafness (because of the phone interviews), the presence of any other major central nervous system disorders, severe facial injury, and previous moderate or severe head injury.

2.4 Headache classification criteria

For a headache to be classified as a specific type of headache it had to fit our fixed criteria. These criteria were slightly adjusted from those described by the International

Headache Society (refer to Table 1.2, 1.3, 1.4) with the difference being the exclusion of criteria A, due to the unfeasibility given the time period between follow-up interviews, and criteria E, given that the headaches are a consequence of a head injury. Headaches that fulfill the IHS diagnostic criteria (excluding criteria A and E) for each given type were suffixed with "type". If they fulfilled most but not all criteria they were suffixed with "like" (e.g. "migraine-type" vs. "migraine-like"). Headaches that were characterised by a mix of tension headache symptoms and migraine headache symptoms were labelled "tension-migraine type". If the headache did not conform to any specific categorisation, or if the participant didn't give sufficient information then it was classified as Headache Not Otherwise Specified (NOS).

2.5 Participants

Throughout a period of approximately 6 months, from the 6th June until the 8th December, I attempted to contact 216 people presenting acutely to the Christchurch Hospital Emergency Department with mild head injuries to request their consent to participate in this study. Of these people, 17 were unable to participate due to meeting one or more of the exclusion criteria, 13 left no phone number at the Christchurch Hospital Emergency Department, 17 left the wrong number, 56 people were unable to be contacted and 58 declined to participate, leaving 75 people who gave consent. The response rate was therefore 56.4%.

Of the 75 participants who were interviewed at the first follow up period of one week, 68 were interviewed at the second follow up period of one month, due to 7 participants dropping out (2 due to changing contact information, 4 due to being unable to reach despite no known change in contact information, and 1 due to death

unrelated to the head injury). At the time of completion of this thesis, 49 participants had been interviewed at the third follow up period of three months, with 4 dropping out (1 due to changing contact information and 3 due to being unavailable to do the questionnaire), and 15 not yet reaching their final follow up time.

Of the 75 participants, 47 (62.7%) were male with a mean age of 30.5 (SD ± 14.4, range 16 – 70) and 28 (37.3%) were female with a mean age of 35.0 (SD ± 14.9, range 16 – 59). This shows, males were overrepresented ($p = 0.02$, binomial test) relative to the general population. See Fig. 3.1 for graphical representation of age distribution. Participants' ethnicities were New Zealand European (58), Maori (6), British (4), Samoan (2), Australian (1), American (1) and Tongan (1), Indian (1) and Danish (1).

2.6 Analysis of data

This was a descriptive exploratory study, aimed at describing the characteristics and time course, in some detail, of the two major vegetative symptoms occurring acutely after mild head injury, in a relatively small sample of patients. The sample size was governed by the limited time available (6 months) in a BMedSci (Hons) project, and the presentation and recruitment rate of potential participants at the Christchurch Hospital Emergency Department. Thus the data has not been subjected to statistical analysis, but rather to descriptive analysis.

Chapter 3 Results

3.1 Participant age range

Simple mean and standard deviation are not the best description of this non-symmetrical data set which is skewed towards the younger (16 - 27 year olds), as seen in Fig. 3.1. This could be either due to higher injury rate or higher participation rate.

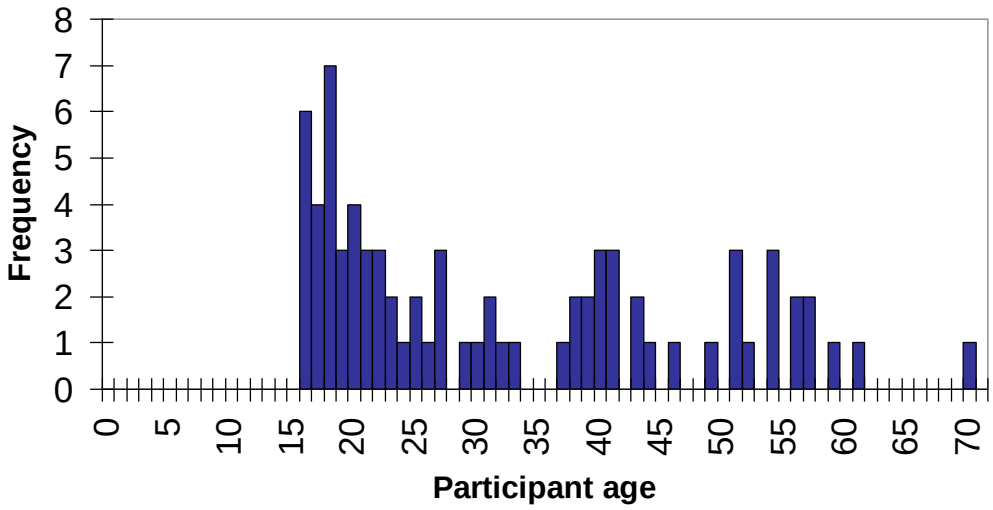


Fig 3.1 Age distribution of participants
The abrupt start at 16 was due participants under 16 years old being excluded.

3.2 Causes of mild head injury

On the questionnaire the 5 options for cause of head injury were sports injury, physical altercation, household accident, traffic accident and "other". "Other" included such factors as falls (5), walking into lampposts and fences and banging heads on vehicles. The potential difficulty with classification was with causes fitting into more than one category as they are not necessarily mutually exclusive, like sports injury and assault. With these I had to read the participants account of what happened and choose the one that fit best. An example was when a participant rode his bike into

his garage and hit his head on the wall. This could have been interpreted as either a sports injury or a household accident. The decision was made to report it as a household accident.

In males the two main causes of head injury were sports injury (16, 34%) and physical altercations (16, 34%), followed by "other" (9, 19.1%), then household accidents (3, 6.4%) and traffic accidents (3, 6.4%). These details are given in Fig. 3.2.

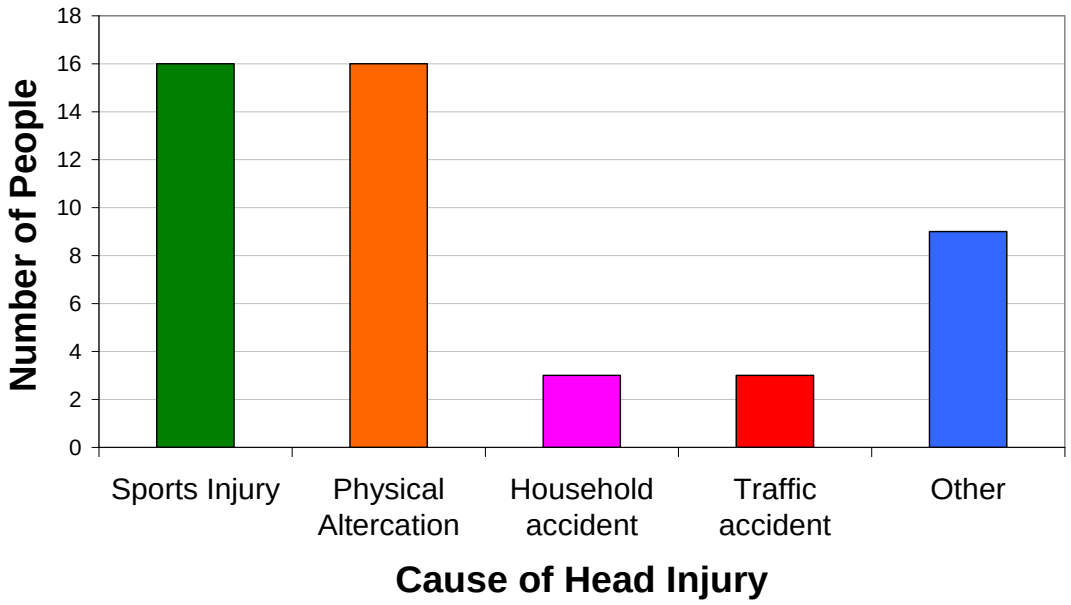


Fig. 3.2 Causes of mild head injuries in males

In females, injuries were more evenly distributed across the causes with "other" (e.g. falls) producing the highest number (9, 32.1%), followed by physical altercations (6, 21.4%), household accidents (4, 14.3%), sports injuries (6, 21.4%), and traffic accidents (3, 10.7%). These details are given in Fig. 3.3.

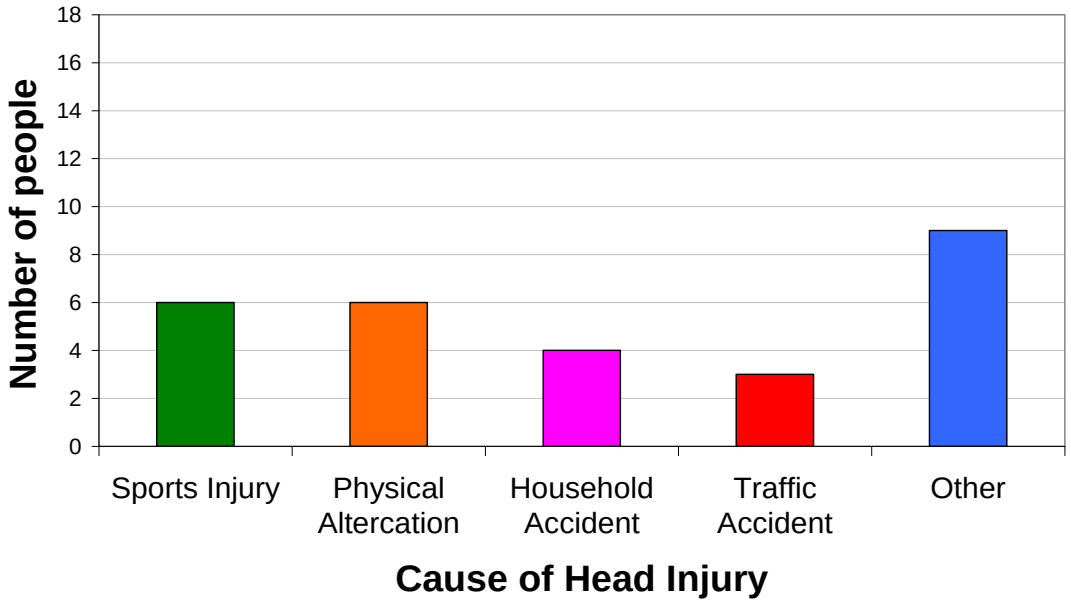


Fig. 3.3 Causes of mild head injuries in females

3.2 Symptoms present at presentation and follow up periods

On presentation to the Emergency Department and on subsequent follow ups, a variety of symptoms were reported. These included headache, dizziness, nausea, photophobia, phonophobia, memory loss, blurred vision and weakness. The prevalence of these symptoms can be seen in Fig. 3.4. The only symptom that frequently presented in isolation was headache, whereas the remainder usually presented in conjunction with other symptoms. A number (9) of participants also presented with no symptoms (they came into the Emergency Department simply because they had lost consciousness, were bleeding, or for another injury), while others reported no symptoms on subsequent follow ups.

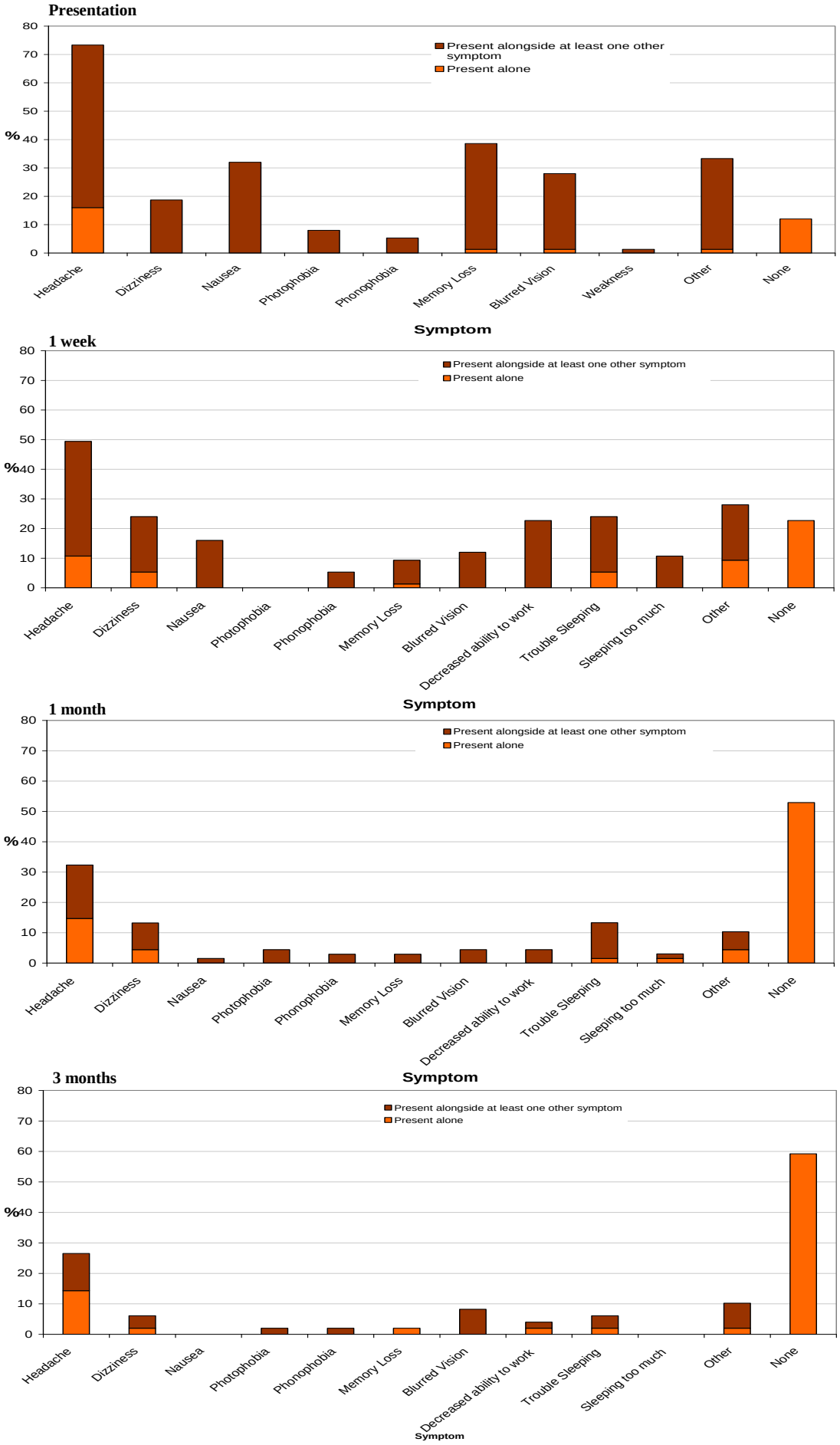


Fig 3.4 Prevalence of symptoms present at Presentation, 1 week, 1 month, and 3 months
The percentage of the total number of participants on presentation and at each follow up who reported the prevalence of these symptoms.

3.3 Headache

The number of participants with headaches at each follow up decreased over time. On presentation the number of participants was 55 (73.3%), at one week, 37 (49.3%), at one month, 22 (32.4%), and at three months, 13 (26.5%). Percentages are depicted in Fig. 3.5.

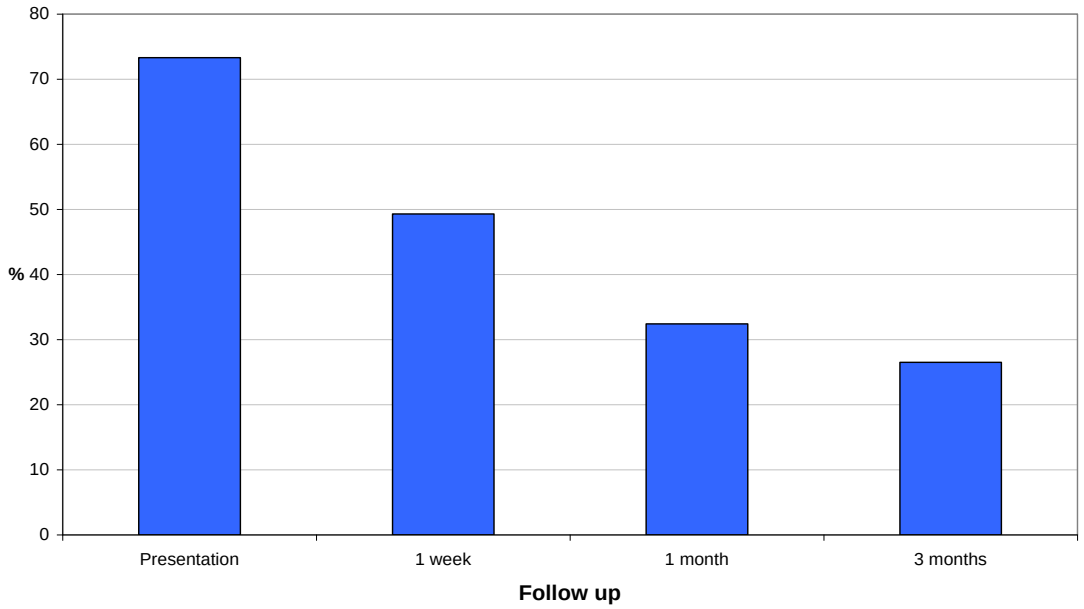


Fig. 3.5 Percentage of the total number of participants with headaches at Presentation, 1 week, 1 month and 3 months

Nineteen (25.3%) of the 75 participants reported that they had a previous history of regular headaches before their mild head injury, while 24 (32%) reported having a family history of regular headaches. Fig 3.6 shows the overlap between those with a previous history, those with a family history and those with headaches present at follow up one. One participant reported having a previous history but due to being adopted was unable to provide a family history. This participant was therefore excluded for the purpose of this analysis when producing Fig 3.6.

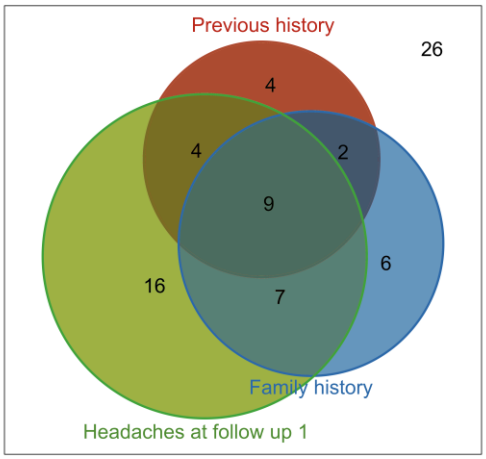


Fig 3.6 The overlap between the number of participants with previous history of regular headaches, a family history of headaches and/or who reported headaches present at follow up 1 (1 week). The number found outside of the Venn diagram (26) is the number of people who did not have a previous history of regular headaches, did not have a family history of headaches and did not report headaches a follow up 1 (1 week).

Of the 40 headaches present at one week, 16 (40%) had reported a particular trigger, which caused the onset of their headache, while 24 (60%) didn't. Six (15%) were triggered by exertion, 3 (7.5%) by tiredness, 2 (5%) by noise, 2 (5%) by bright lights, 1 (2.5%) by stress, 1 (2.5%) by looking at high objects, and 1 (2.5%) by touching a head wound site. All headaches only had one trigger. Fig. 3.7 shows the proportion of each trigger at each follow up.

Of the 23 headaches present at one month, 10 (43.5%) had a particular trigger while 13 (56.5%) didn't. Four (17.4%) were triggered by tiredness, 3 (13%) by stress, 3 (13%) by bright lights, 1 (4.3%) by exertion, 1 (4.3%) by heat, and 1 (4.3%) by remaining in the same position for a long time. Some of headaches had multiple triggers.

Of the 14 headaches present at three months, 8 (57.1%) had a particular trigger while 6 (42.9%) didn't. Four (28.5%) were reported to be triggered by stress, 3 (21.4%) by

dehydration, 2 (14.3%) by tiredness, 1 (7.1%) by bright lights, and 1 (7.2%) by bad moods. Some of these headaches had multiple triggers.

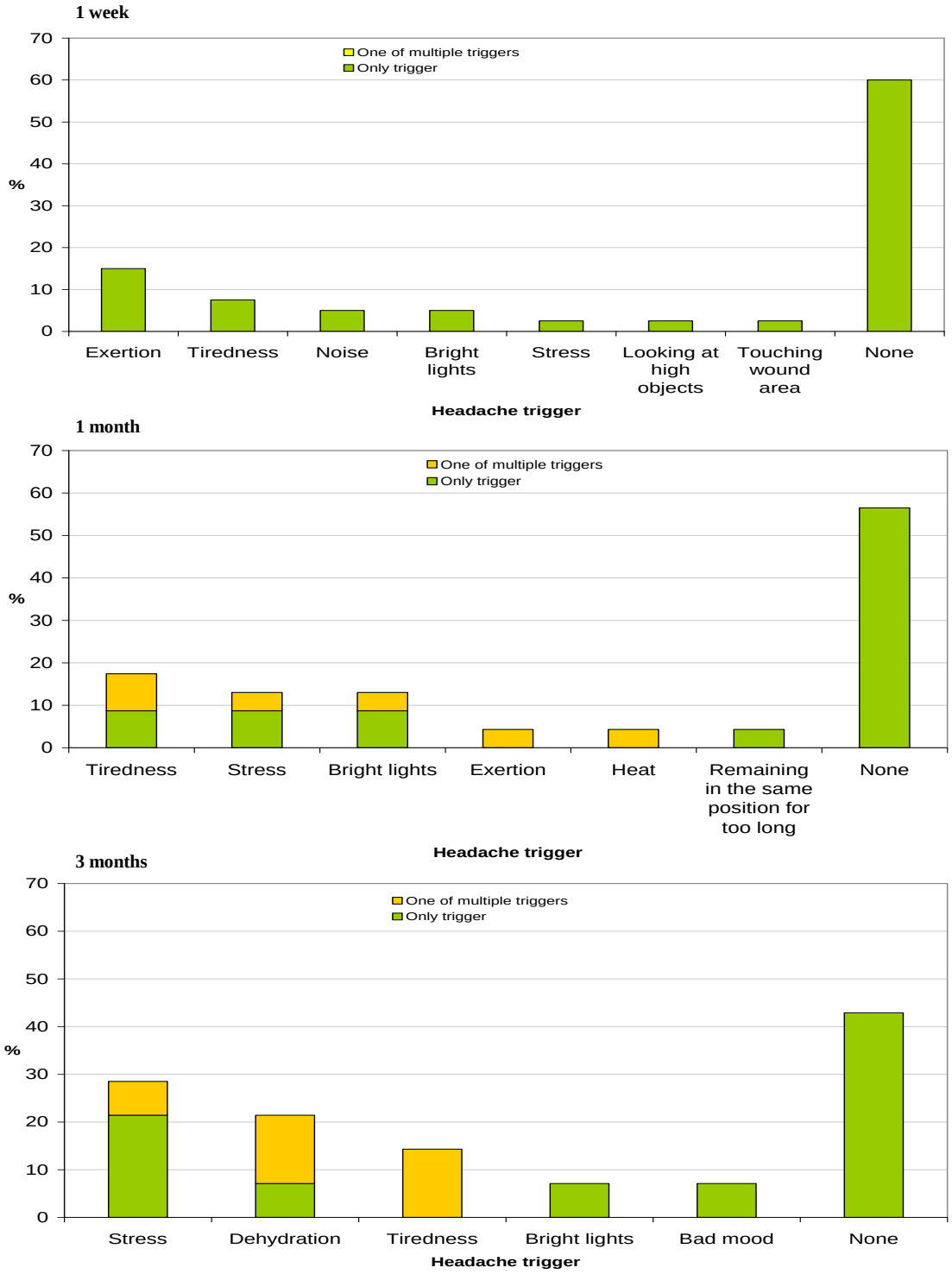


Fig 3.7 Headache triggers reported at 1 week, 1 month, and 3 months
Note that these are self-reported categories, which varied from one assessment to the next. Throughout, most participants reported no particular cause for headache onset

The types of headaches present at one week were tension-type (16, 35%), tension-like (4, 10%), tension-migraine (10, 25%), migraine-type (2, 5%), migraine-like (8, 20%), cluster-like (1, 2.5%) and headache NOS (1, 2.5%). These headaches could either present in isolation in a participant, or in conjunction with another type of headache. Those that presented along with another headache were tension-like (1, 2.5%), migraine-type (2, 5%), and migraine-like (1, 2.5%).

The types of headaches present at one month were tension-type (6, 26%), tension-like (4, 17.3%), tension-migraine (6, 26%), migraine-type (3, 13%), migraine-like (3, 13%), and cluster-like (1, 4.3%). Those that presented in conjunction with other headaches were tension-type (1, 4.3%), migraine-type (2, 8.7%), and migraine-like (1, 4.3%).

The types of headaches present at three months were tension-type (4, 35.7%), tension-like (1, 14.2%), tension-migraine (3, 28.6%), migraine-like (2, 14.2%), and cluster-like (1, 7.1%). Those that presented in conjunction with other headaches were tension-like (1, 14.2%), and migraine-like (1, 14.2%). The proportions of each of these headaches at each of the follow ups are show on Fig. 3.8.

Vignettes

Some representative descriptions for each type of headache are given below.

Tension-type headache: A 38 year old female hit her head when she fell whilst ice skating and experienced no loss of consciousness. In the first week she had a constant bilateral headache that lasted for days and felt like a tight band constricting the top of

her head. On the pain scale (1-10), it was a 3-4. Nausea, vomiting and photophobia were not present but there was an inability to eat and phonophobia. This headache resolved between the 1 week and 1 month follow up periods.

Tension-like headache: A 43 year old female was hit in the head by a soccer ball, fell over, hit her head on the ground and experienced a 10 second loss of consciousness. In the first week she had a constant headache that alternated which side of her head it was on, and lasted several days. It felt like pressure was building up in her forehead. On the pain scale (1-10), it was a 3-6. While there was no nausea or vomiting there was both photophobia and phonophobia. This headache resolved between the 1 week and 1 month follow up periods.

Migraine-type headache: An 18 year old female fell backwards onto concrete, hitting her head and experienced a 10 second loss of consciousness. In the first week she had a bilateral headache that lasted days. It had a throbbing/pulsating quality and was an 8 on the pain scale (1-10). Associated symptoms were nausea, photophobia and phonophobia. This headache persisted past the 3 month follow up.

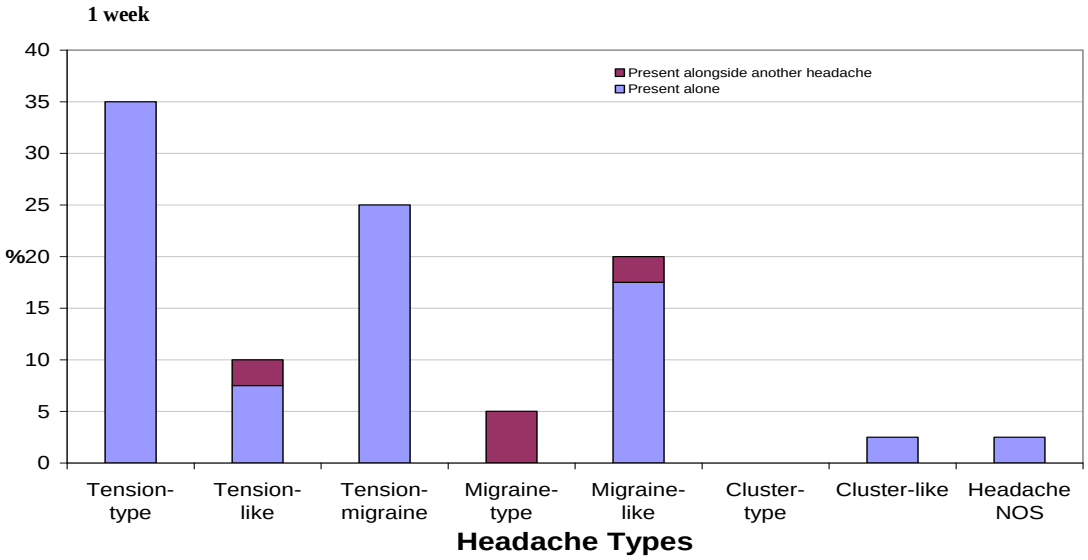
Migraine-like headache: A 19 year old male was tackled at rugby, hit his head and experienced a 5 -10 second loss in consciousness. In the first week he had a constant unilateral right-sided headache that lasted days and had a throbbing/pulsating quality. It worsened with exertion and was a 6-7 on the pain scale (1-10). There was no nausea, vomiting, photophobia or phonophobia. This headache resolved between the 1 month and 3 month follow up periods.

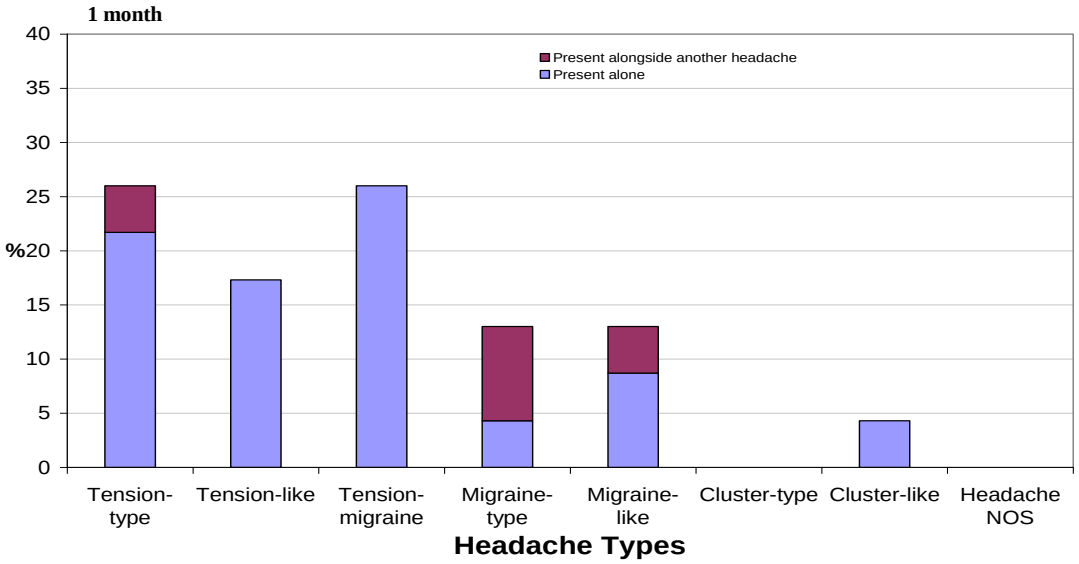
Tension-migraine headache: A 39 year old male was helping to cut down trees when one fell on his head and he experienced a 5 – 10 second loss of consciousness. In the first week he had a constant unilateral throbbing/pulsating headache above one eye that lasted days. It was a 4-5 on the pain scale (1-10). While there was no nausea or vomiting there was both phonophobia and photophobia. This headache resolved between the 1 week and 1 month follow up periods.

Cluster-type headache: There was no example of this type of headache present in any of the participants.

Cluster-like headache: A 57 year old male was working on a machine with a spring loaded arm that flipped back and struck him on the forehead. He experienced no loss of consciousness. In the first week he had daily brief (<30min) headaches which were localised to his left temple. It was aching in quality and was a 3-5 on the pain scale (1-10). There was so nausea, vomiting or phonophobia but photophobia was present. This headache persisted past the 3 month follow up.

Headache NOS: 25 year old male was tackled at rugby, knocked his head and experienced a 2 minute loss of consciousness. In the first week he had a single bilateral headache that lasted 2-6 hours and was of a pounding quality. As this participant did not give any more information on his headaches, the information given was insufficient to classify this headache by the IHS criteria. This headache resolved between the 1 week and 1 month follow up periods.





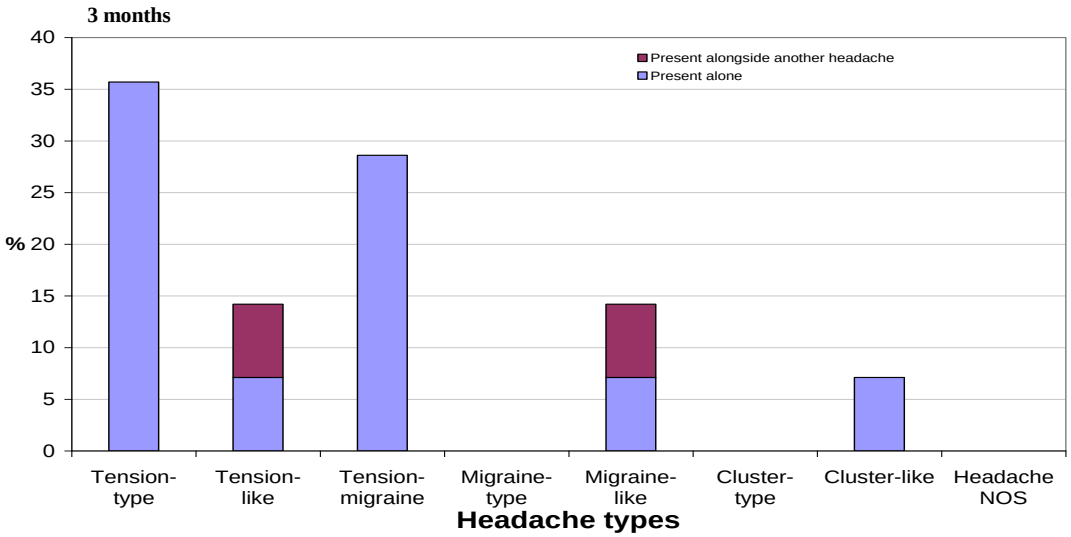


Fig. 3.8 Headache types at 1 week, 1 month, and 3 months
These are the percentage of the total number of headaches reported at each follow up. It is possible for a participant to experience more than one type of headache at each follow up.

3.4 Dizziness

At presentation the number of participants with dizziness was 14 (18.7%), at 1 week it was 18 (24%), at 1 month it was 9 (13.2%), and at 3 months it was 3 (6.1%). Percentages shown in Fig. 3.9.

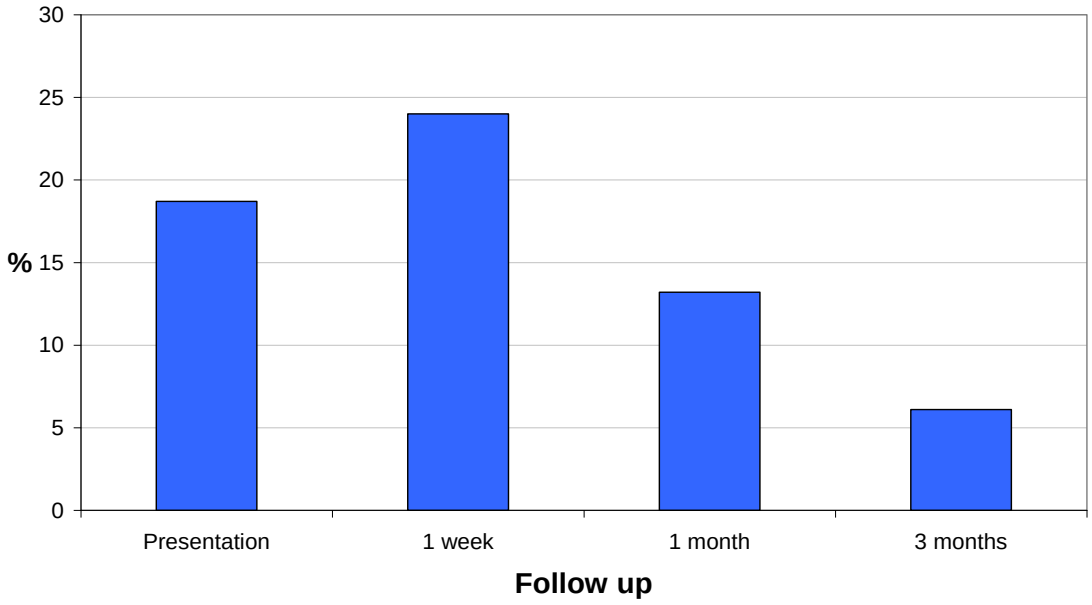


Fig. 3.9 Percentage of the total number participants with dizziness at Presentation, 1 week, 1 month, 3 months

A number of the 75 participants (7) reported that they had a previous history of regular dizziness before their mild head injury, while 4 reported having a family history of regular dizziness. Fig 3.10 shows the overlap between those with a previous history, those with a family history and those with dizziness present at follow up one (one week). One participant, due to being adopted, was unable to provide a family history. This participant was again excluded.

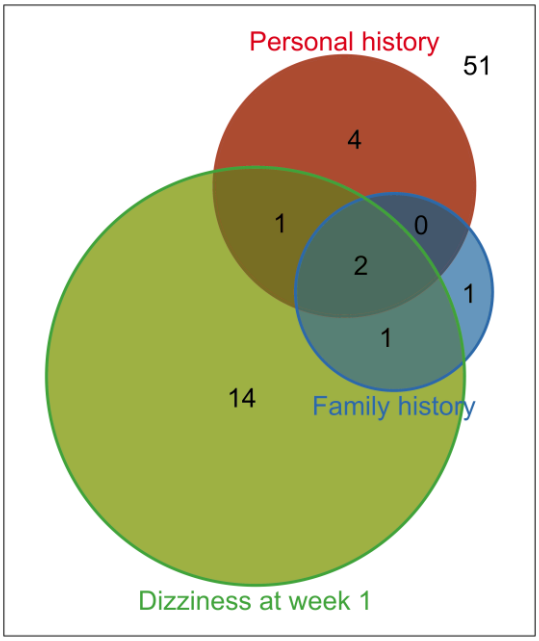


Fig 3.10 Overlap between number of participants with previous history of regular dizziness, a family history of dizziness and/or who reported dizziness present at follow up 1 (1 week). The number found outside of the Venn diagram (51) is the number of people who did not have a previous history of regular dizziness, did not have a family history of dizziness and did not report dizziness a follow up 1 (1 week).

At each follow up, the people with dizziness were categorised into those who experienced dizziness with position changes and those who experienced it without position changes (Table 3.1).

Table 3.1

	Number of people with dizziness	
Follow up period	Occurs with position changes	Occurs without position changes
1 week	12 (16%)	6 (8%)
1 month	7 (10.3%)	2 (2.9%)
3 months	3 (6.1%)	0 (0%)

The proportions of these are shown in Fig. 3.11

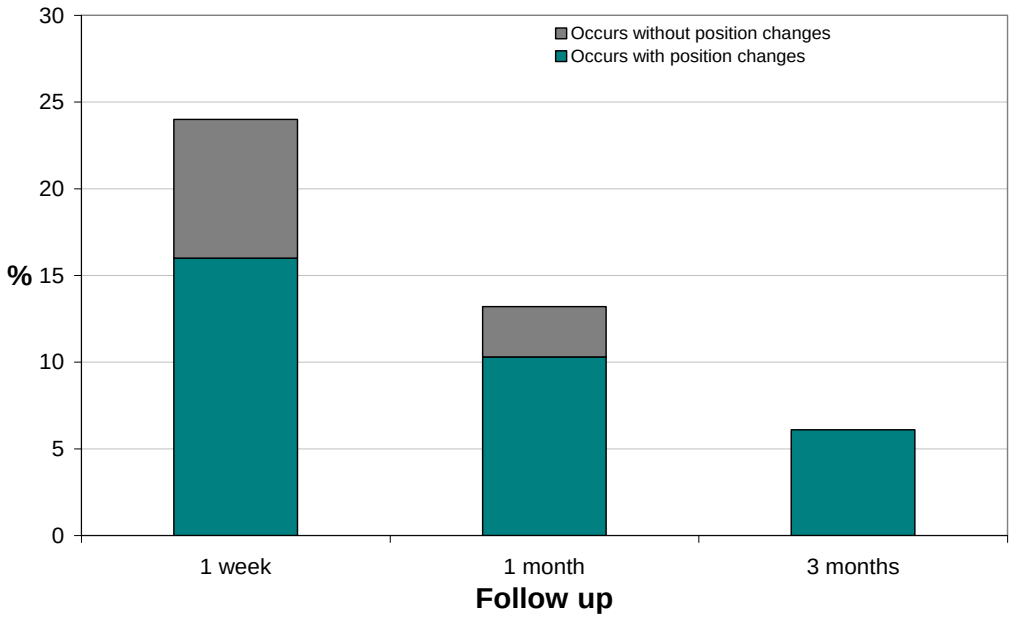


Fig. 3.11 Triggers of Dizziness
This figure shows the proportion of the total sample of participants who report dizziness occurring with or without position changes at 1 week, 1 month, and 3 months.

Of the participants with dizziness caused by position change at one week, 3 (25%) were caused by rolling body right or left, 1 (8.3%) by turning head left or right, 1 (8.3%) by looking up or head back position, 4 (33.3%) by bending over or head down, 6 (50%) by standing up and 1 (8.3%) by quick movement.

Of the participants with dizziness caused by position change at one month, 3 (42.9%) were caused by rolling body right or left, 2 (28.6%) by turning head left or right, 3 (42.9%) by looking up or head back position, 2 (28.6%) by bending over or head down, 1 (14.3%) by going from lying to sitting, 2 (28.3%) by standing up, 1 (14.3%) by walking up and down stairs, and 1(14.3%) by quick movement.

Of the participants with dizziness caused by position change at three months, 1 (33.3%) were caused by looking up or head back position, 2 (66.7%) by standing up

and 1 (33.3%) by tilting head to left or right. All these percentages can be seen in Fig. 3.12.

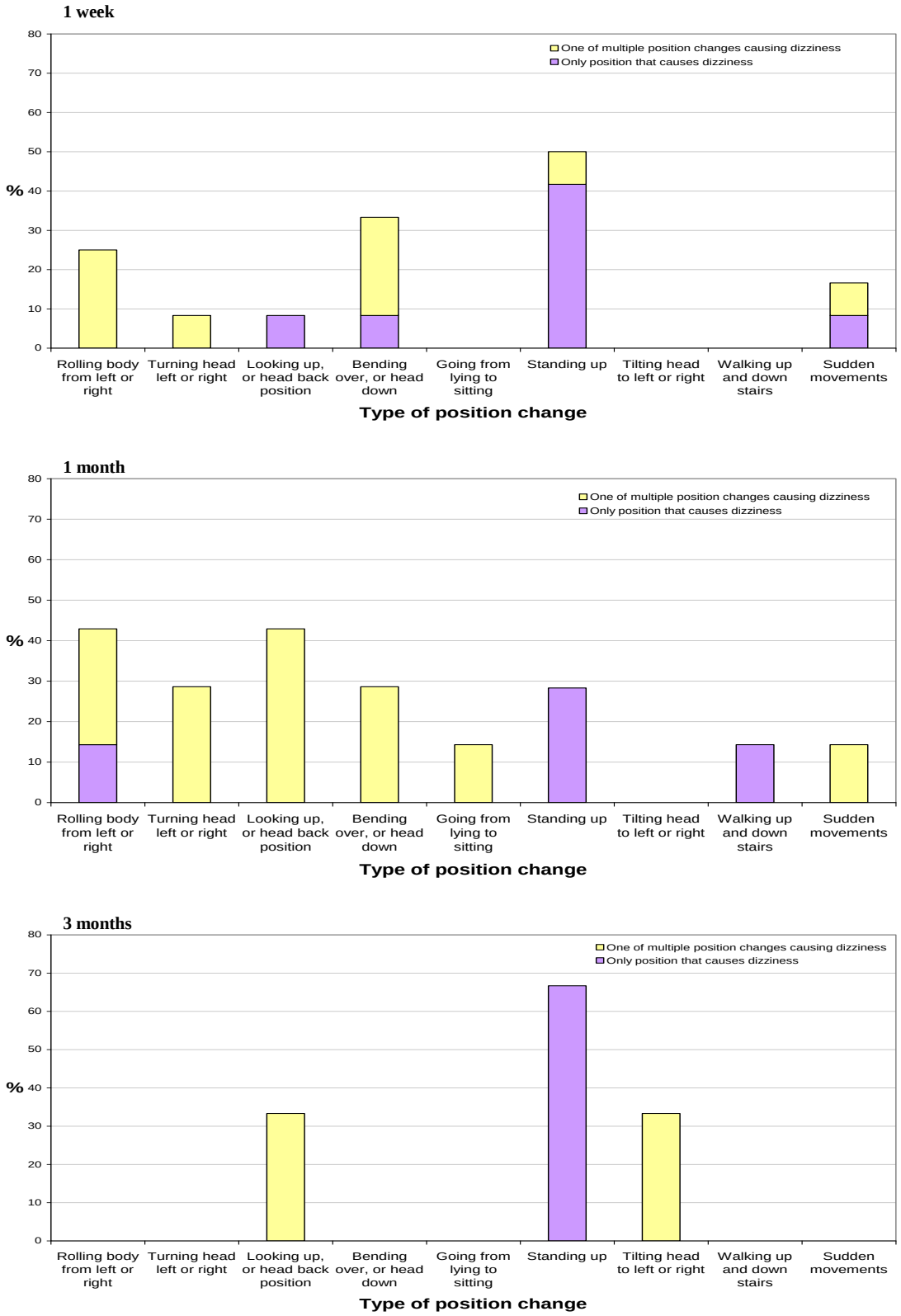


Fig. 3.12 Type of position change that causes dizziness at 1 week, 1 month, and 3 months
The percentage of the number of participants whose dizziness is caused by position change at each follow up.

Vignettes

Some representative descriptions for each type of dizziness are given below.

Dizziness occurring with position change:

1. A 43 year old female was hit in the head by a soccer ball, fell over, hit her head on the ground and lost consciousness for 10 seconds. At one week she was reported gradual attacks of dizziness lasting 5 – 10 minutes. These attacks were triggered by looking upwards, and were relieved by rest and keeping still. She experienced no nausea or vomiting with these attacks. This dizziness resolved between the 1 week and 1 month follow up periods.
2. A 57 year old male was working on a machine with a spring loaded arm which flipped back and struck him in the forehead but he did not lose consciousness. At one week he reported sudden attacks of dizziness lasting 5 seconds. These attacks were triggered by standing up, and relieved by not moving his head. He experienced no nausea or vomiting. This dizziness resolved between the 1 week and 1 month follow up periods.
3. A 16 year old female was pushed over, hit the right side of her head on a metal door handle and lost consciousness for 10-20 seconds. At one week she reported sudden attacks of dizziness lasting approximately 5 minutes. These attacks were triggered by rolling her body from left to right and vice versa, and they were relieved by rest. She experienced nausea but no vomiting. This dizziness resolved between the 1 month and 3 months follow up periods.

Dizziness occurring without position change:

1. A 41 year old male cyclist was hit by a car and lost consciousness for 5-6 minutes. At one week he reported sudden attacks of dizziness, lasting 3-4 minutes, that improved with rest. When having these attacks he experienced nausea but no vomiting. This dizziness resolved between the 1 week to 1 month follow up periods.
2. An 18 year old female was pushed over backwards, hit her head on the footpath and lost consciousness for about 30 seconds. At one week she reported sudden attacks of dizziness, lasting about 1 minute, and were relieved by sitting down. She experienced no nausea or vomiting. This dizziness resolved between the 1 week to 1 month follow up periods.
3. A 22 year old male dived onto the dance floor of a club, straight into the first step of a flight of stairs and lost consciousness for about 30 seconds. At one week he reported constant dizziness that was slightly improved with rest. He experienced nausea but no vomiting. This dizziness resolved between the 1 week to 1 month follow up periods.

Chapter 4 Discussion

This study aimed to examine common symptoms, specifically headaches and dizziness, in the acute three month period following mild head injury. Despite the reasonably common occurrence of mild head injury, this three month time period has not been much studied, especially in relation to the specific characteristics of the headaches and dizziness present.

4.1 Headache prevalence

The percentage of people we found with headaches on presentation and each follow-up sometimes agreed and sometimes conflicted with previous studies. We found that 73% have headaches on presentation to the Emergency Department, diminishing to 49% at one week, 32% at one month and 27% at three months following the mild head injury. The prevalence at one week is similar to the findings of Yang et al. (2007), who reported that headaches were present in 45% of participants at one week, but whereas Yang et al. (2007) found the prevalence of headaches at four weeks to be only 4%, one third of the people in the present sample continued to experience headache. On the other hand, Lundin et al. (2006) reported the prevalence of headaches at 3 months to be 21%, almost identical to our figure of 27%. However, my three month sample was relatively small (due to the time constraints, with the necessity of analysing and writing up the data for the BMedSci within a year) and so the final three month follow up figure could still change, though any difference from the present (interim) estimated figure is likely to be relatively small.

4.2 Headache classification

Our characterisation of the types of acute post-traumatic headache does not have much to be compared with in the literature as there is scant information published. When compared with existing data on chronic post-traumatic headaches, there are some parallels, with tension-type headaches being the most prevalent type. For example Radanov et al. (2001) found that tension-type headaches made up 37% of chronic post-traumatic headaches, while we found that the percentage of tension-type headaches in the headaches present at one week was 35%, at one month, 26%, and at three months, 36%.

Meanwhile, tension-migraine headaches (the equivalent of mixed type headaches) were present in a larger proportion than found by Radanov et al. (2001). Radanov et al. (2001) reported mixed-type headaches to make up 18% of chronic post-traumatic headaches, while we found the prevalence of tension-migraine headaches to be 25% at one week, 26% at one month, and 29% at three months. Migraine-type headaches however, were present in substantially lower percentages in our study compared to others. We found the prevalence of migraine-type headaches at one week to be 5%, one month to be 13% and three months to be nil, as opposed to the 27% prevalence of migraines in chronic post-traumatic headache found by Radanov et al. (2001).

Cluster-type headaches have been reported by Packard (1999) to be present in a low percentage of chronic post-traumatic headaches, (6% - 10%). Consistent with this, we did not find any within our sample, either in the early acute or late acute stages. Comparisons are complicated by the more comprehensive list of headache types used in our study compared to previous ones. For example, what could have been classified

as a tension-type headache in the previous literature could fit into either the tension-type or tension-like categories in our study. We adopted these modified categories because reports by participants did not always fit exactly into the criteria set out by the International Headache Society (2005) for the classification of headaches. This discrepancy does raise a question about whether it is appropriate to employ the IHS classification system in this setting (i.e. post-traumatic headache) and indeed, whether post-traumatic headache has its own unique properties arising from a specific cause and pathophysiology (i.e. head injury). A much larger study and in-depth study would be necessary to answer this question.

4.3 Dizziness

The lack of definitive post-traumatic dizziness data in the literature gives us little to compare our results with. One study (Yang, et al., 2007), involving 130 patients, reported the dizziness present after mild head injury at one week and one month, so that comparison can be made with the present results. They showed a prevalence of 74% at one week and 18% at one month. This compares with a prevalence of 19% on presentation to the Emergency Department, 24% at week one, 13% at one month and 6% at three months in our study. It can be seen from our results that while some people have dizziness on presentation, the percentage of people with dizziness reaches a peak at one week and then diminishes after that. This may simply be because it takes time for the dizziness to manifest itself, or it is possible that whilst in the emergency department, the patients sit relatively still and thus if their dizziness is triggered with position change it might not be noticed until they are more active at home. It may also be possible that other symptoms, such as headache or confusion,

dominate on arrival, or that symptoms of dizziness may not have been specifically sought by the admitting team, as perhaps headache was.

There are no reports in the literature of the relationship of dizziness to positional changes, and so comparisons with our own data in this regard are not possible. Our results show that dizziness occurring with position change is more persistent (being present at all three follow periods) than dizziness that occurs without position change (which decreases dramatically between one week and one month and not present at all at three months). This is important as it is a novel finding. It suggests that there is some ongoing vestibular pathway disruption (either central or peripheral or both) whereas the non-positional dizziness may be a non-specific association with head injury and resolves in a similar manner to headache, this has prognostic implications. In other words patients with non-specific dizziness can be advised that it will likely resolve within a few weeks, whereas positional dizziness may need referral to GP/ENT/neurology for specific examination and potentially treatment with positioning manoeuvres.

4.4 Mild head injury causes

The distribution of causes of head injury in this study differs from that reported by Sosin et al. (1996), in which the sample size was 120, 032 participants. In our study, Sports Injuries (29%) and Physical Altercations (29%) were the most frequent causes of head injury while Traffic Accidents (8%) were one of the least frequent causes. Meanwhile Sosin et al. (1996) found motor vehicle accidents (28%) to be the most common cause of mild and moderate head injury, followed by sports (20%) and

assault (9%). From this we can deduce that it is likely that traffic accidents will more often give people moderate or severe head injury. It is also possible that those in traffic accidents are more likely to have severe facial injury and thus be excluded from our study. Our small percentage of traffic accidents also differs from that reported by Heitger (2004), who conducted a previous study on mild closed head injury in Christchurch, New Zealand. The Heitger (2004) study was a much smaller study, of 30 participants and its exclusion criteria were stricter, excluding anyone under the influence of alcohol or psychoactive drugs. This resulted in a smaller number of physical altercations being included and perhaps therefore showing the relative representation of traffic accidents within the sample.

A limitation of our study is that head injury causes are likely to be strongly seasonal, and therefore a 6 month study, conducted from 6th of June to 8th of December, may not capture a truly representative sample. For example, it is likely that sports injuries in New Zealand are more likely in winter, due to sports like rugby and hockey, while in summer there could be more physical altercations. It is important to note that head injury patterns in a drinking, sporting country with a high level of car ownership (such as New Zealand) are likely to differ significantly from countries where, say, alcohol is prohibited or where problematic drinking problems are less common, or where participation in contact sports is lower. Our recruitment stopped just before the holiday period of Christmas and New Year which might otherwise have lead to an increase in traffic accidents and physical altercations.

The categories we provided to indicate the causes of head injury were not sufficiently comprehensive to cover the variety of actual and specific causes. The number of

people in the “other” category who reported that their head injury was due to a fall was about the same as the number of people who reported household accidents and traffic accidents and so an explicit category of “falls” should be included in future studies.

4.5 Alcohol

Our study did not exclude those who were under the influence of alcohol at the time of the injury, but we did not specifically record this information systematically. This would have been useful information as it may have had some influence on the results. For example, alcohol might affect the types of symptoms that the participant experiences immediately after the head injury, on presentation to the Emergency Department. Perhaps the participant may be less likely to experience a headache but more likely to experience dizziness or nausea, or vice versa. It may also affect prevalence of headaches reported at one week due to possible alcohol-induced rather than injury induced headaches, dizziness, or nausea though, at one week, any effects of alcohol withdrawal as a factor in symptom expression is likely to have dissipated. It would be useful in future to have an actual question in the questionnaire about whether the participant was under the influence of alcohol at the time of the head injury.

4.6 Children

We excluded children from our study due to the difficulties with gaining consent, the problems that may arise with them using the phone, and their potential inability to understand the questionnaire. There is not, at the moment, a study that has

characterised post-traumatic headaches in children but it is an area that should be researched in future due to the short and long term impact of mild head injury on children, as seen in McKinlay et al. (2002).

4.5 Ascertainment

The decrease in number of participants at each follow up period was predominantly due to change in contact information or being unable to contact despite no knowledge of change in contact information. In future, it would be worthwhile considering getting e-mail addresses, if they have one, from the participants at the beginning of the study as this seems to be the contact information that is least likely to change and thus the number of drop outs might decrease.

4.5 Conclusion

In summary, this study provides further data on cause of mild head injury and the acute symptoms following it, with specific focus on headaches and dizziness. The most common headache following mild head injury was tension-type at each follow up time period, and the majority of all headaches reported on presentation had resolved by the three month follow up. Our comprehensive list of headache types adds new information to the characterisation of acute headache following mild head injury, the first step in finding satisfactory treatments for this common and debilitating symptom. The findings of most interest for dizziness were that the prevalence of dizziness increased from presentation to the Emergency Department to the one week follow up, and that the resolution between dizziness occurring with position change and dizziness occurring without position change were different, with dizziness

without position change resolving by three months and dizziness with position changes persisting.

An extension of this study with greater numbers of participants would most likely give a more in-depth look at the characteristics of headaches and dizziness.

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REFERENCES

ACC and the National Health Committee (1998). Traumatic brain injury rehabilitation guidelines.

Andersson, E. H., Bjorkland, R., Enmanuelson, I., & Stalhammar, D. (2003). Epidemiology of traumatic brain injury: a population based study in western Sweden. *Acta Neurochirurgica Scandinavica, 107*, 256-259.

Blinman, T. A., Houseknecht, E., Snyder, C., Wiebe, D. J., Nance, M. L., Blinman, Thane A., et al. (2009). Postconcussive symptoms in hospitalized pediatric patients after mild traumatic brain injury. [Research Support, Non-U.S. Gov't]. *Journal of Pediatric Surgery, 44*(6), 1223-1228.

Chamelian, L., & Feinstein, A. (2004). Outcome After Mild to Moderate Traumatic Brain Injury: The Role of Dizziness. *Archive of Physical Medicine Rehabilitation, 85*, 1662-1666.

Couch, J. R., & Bearss, C. (2001). Chronic daily headache in the posttrauma syndrome: relation to extent of head injury. *Headache, 41*(6), 559-564.

Dacey, R. G., Jr., Alves, W. M., Rimel, R. W., Winn, H. R., & Jane, J. A. (1986). Neurosurgical complications after apparently minor head injury. Assessment of risk in a series of 610 patients. *Journal of Neurosurgery, 65*(2), 203-210.

Davies, R. A. (1997). Disorders of balance. In L. Luxon & R. A. Davies (Eds.), *Handbook of vestibular rehabilitation* (pp. 30-40). London: Whurr Publishers Ltd.

De Benedittis, G., & De Santis, A. (1983). Chronic post-traumatic headache: clinical, psychopathological features and outcome determinants. *Neurosurgery Science, 3*, 177-186.

De Kruijk, J. R., Leffers, P., Menheere, P. P., Meerhoff, S., Rutten, J., Twijnstra, A., et al. (2002). Prediction of post-traumatic complaints after mild traumatic brain injury: early symptoms and biochemical markers. *Journal of Neurology, Neurosurgery & Psychiatry, 73*(6), 727-732.

Drake, A. I., McDonald, E. C., Magnus, N. E., Gray, N., Gottshall, K., Drake, Angela I., et al. (2006). Utility of Glasgow Coma Scale-Extended in symptom prediction following mild traumatic brain injury. *Brain Injury, 20*(5), 469-475.

Edna, T. H., & Cappelen, J. (1984). Hospital admitted head injury. A prospective study in Trondelag, Norway, 1979-80. *Scandinavian Journal of Social Medicine, 12*, 7-14.

Haas, D. C. (1996). Chronic post-traumatic headaches classified and compared with natural headaches. *Cephalalgia, 16*, 486-493.

Haydel, M. J., Preston, C. A., Mills, T. J., Luber, S., Blaudeau, E., & DeBlieux, P. M. (2000). Indications for computed tomography in patients with minor head injury. *New England Journal of Medicine, 343*(2), 100-105.

Headache Classification Subcommittee of the International Headache Society (2005). The International Classification of Headache Disorders 2nd Edition.

Heitger, M. H. W. (2004). *Motor deficits and recovery following mild closed head injury - contribution of computerized motor testing to patient assessment and outcome prediction.* University of Otago.

Hofman, P. A., Nelemans, P., Kemerink, G. J., & Wilmink, J. T. (2000). Value of radiological diagnosis of skull fracture in the management of mild head injury: meta-analysis. *Journal of Neurology, Neurosurgery & Psychiatry, 68*(4), 416-422.

Hughes, C. A., & Proctor, L. (1997). Benign paroxysmal positional vertigo. [Case Reports]. *Laryngoscope, 107*(5), 607-613.

Ingebrigtsen, T., Mortensen, K., & Romner, B. (1998). The epidemiology of hospital-referred head injury in northern Norway. *Neuroepidemiology, 17*, 139-146.

International Headache Society (2005). *International Classification of Headache Disorders, 2nd edition*.

Jennett, B. (1996). Epidemiology of Head Injury. *Journal of Neurology, Neurosurgery & Psychiatry, 60*, 362-369.

Jeret, J. S., Mandell, M., Anziska, B., Lipitz, M., Vilceus, A. P., Ware, J. A., et al. (1993). Clinical predictors of abnormality disclosed by computed tomography after mild head trauma. *Neurosurgery, 32*, 9-15.

Jessell, T. M. (1991). *Principles of neural science* (3rd ed.). Norwalk, Connecticut: Appleton & Lange.

Johansson, E., Ronnkvist, M., & Fugl-Meyer, A. R. (1991). Traumatic brain injury in northern Sweden. Incidence and prevalence of long-standing impairments and disabilities. *Scandinavian Journal of Rehabilitation Medicine, 23*, 179-185.

Kraus, J. F., & McArthur, D. L. (1996). Epidemiologic aspects of brain injury. *Neurologic clinics, 14*(2), 435-450.

Kraus, J.F., & Nourjah, P. (1989). The Epidemiology of Mild Head Injury. In H.S. Levin, H.M. Eisenbery & A.L. Benton (Eds.), *Mild Head Injury* (pp. 8-22). NY: Oxford University Press.

Lee, L. S., Shih, Y. H., Chiu, W. T., Lin, L. S., Wu, C. M., Wang, Y.C., et al. (1992). Epidemiologic study of head injuries in Taipei City, Taiwan. *Chung Hua i Hsueh Tsa Chih - Chinese Medical Journal, 50*, 219-225.

Lew, H. L., Lin, P. H., Fuh, J. L., Wang, S. J., Clark, D. J., Walker, W. C., et al. (2006). Characteristics and treatment of headache after traumatic brain injury: a focused review. [Review]. *American Journal of Physical Medicine & Rehabilitation, 85*(7), 619-627.

Lundin, A., De Boussard, C., Edman, G, & Borg, J. (2006). Symptoms and disability until 3 months after mild TBI. *Brain Injury, 20*(8), 799-806.

Lyle, D. M., Quine, S., Bauman, A., & Pierce, J. P. (1990). Counting heads: estimating traumatic brain injury in New South Wales. *Community Health Studies, 14*, 118-125.

Madden, C., Witzkc, D. B., Arthur, Sanders, B., Valente, J., & Fritz, M. (1995). High-yield selection criteria for cranial computed tomography after acute trauma. *Academic Emergency Medicine, 2*(4), 248-253.

Maskell, F., Chiarelli, P., & Isles, R. (2006). Dizziness after traumatic brain injury: Overview and measurement in the clinical setting. *Brain Injury, 20*(3), 293 - 305.

McAllister, T. W., & Archiniegas, D. (2002). Evaluation and treatment of postconcussive symptoms. *NeuroRehabilitation, 17*, 265-283.

McCrea, M., Guskiewicz, K. M., Marshall, S. W., & et al. (2003). Acute Effects and Recovery Time Following Concussion in Collegiate Football Players: The NCAA Concussion Study. *JAMA, 290*(19), 2556-2563.

McKinlay, A., Dalrymple-Alford, J. C., Horwood, L. J., & Fergusson, D. M. (2002). Long term psychosocial outcomes after mild head injury in early childhood. [Research Support, Non-U.S. Gov't]. *Journal of Neurology, Neurosurgery & Psychiatry, 73*(3), 281-288.

Nagy, K. K., Joseph, K. T., Krosner, S. M., Roberts, R. R., Leslie, C. L., Dufty, K., et al. (1999). The utility of head computed tomography after minimal head injury. *Journal of Trauma-Injury Infection & Critical Care, 46*(2), 268-270.

Nell, V., & Brown, D. S. (1991). Epidemiology of traumatic brain injury in Johannesburg--II. Morbidity, mortality and etiology. *Social Science & Medicine, 33*(3), 289-296.

Nestvold, K., Lundar, T., Blikra, G., & Lonnum, A. (1988). Head injuries during one year in a central hospital in Norway: a prospective study. Epidemiologic features. *Neuroepidemiology, 7*, 134-144.

Ommaya, A. K. (1995). Head injury mechanisms and the concept of preventative management: a review and critical synthesis. *Journal of Neurotrauma, 12*, 527-546.

Packard, R. C. (1999). Epidemiology and Pathogenesis of Posttraumatic Headache. *Journal of Head Trauma Rehabilitation, 14*(1), 9-21.

Radanov, B. P., Di Stefano, G., & Augustiny, K. F. (2001). Symptomatic approach to posttraumatic headache and its possible implications for treatment. *European Spine Journal, 10*, 403-407.

Richardson, J. T. E (2000). *Clinical and Neuropsychological Aspects of Closed Head Injury* (2nd ed.): Hove (UK): Psychology Press.

Rimel, R. W., Giordani, B., Barth, J. T., Boll, T. J., & Jane, J. A. (1981). Disability Caused by Minor Head Injury. *Neurosurgery, 9*(3), 221 - 228.

Sahuquillo, J., Poca, M. A., & Amoros, S. (2001). Current aspects of pathophysiology and cell dysfunction after severe head injury. *Current Pharmaceutical Design, 7*, 1475-1503.

Servadei, P., Verlicchi, A, Soldano, F., Zanotti, B., & Piffer, S (2002). Descriptive epidemiology of head injury in Romagna and Trentino. Comparison between two geographically different Italian regions. *Neuroepidemiology, 21*, 297-304.

Sosin, D. M., Sniezek, J. E., & Thurman, D. J. (1996). Incidence of mild and moderate brain injury in the United States, 1991. *Brain Injury, 10*(1), 47-54.

Stein, S. C., & Ross, S. E. (1992). Mild head injury: a plea for routine early CT scanning. [Research Support, Non-U.S. Gov't]. *Journal of Trauma-Injury Infection & Critical Care, 33*(1), 11-13.

Tate, R. L., McDonald, S., & M., Lulham J. (1998). Incidence of hospital-treated traumatic brain injury in an Australian community. *Australian and New Zealand Journal of Public Health, 22*, 419-423.

Tiret, L., Hausherr, E., Thicoipe, M., Garros, B., Maurette, P., Castel, J. P., et al. (1990). The epidemiology of head trauma in Aquitaine (France), 1986: a community-based study of hospital admissions and deaths. *International Journal of Epidemiology, 19*(1), 133-140.

Uchino, Y., Okimura, Y., Tanaka, M., Saeki, N., & Yamaura, A. (2001). Computed tomography and magnetic resonance imaging of mild head injury--is it appropriate to classify patients with Glasgow Coma Scale score of 13 to 15 as "mild injury"? *Acta Neurochirurgica, 143*(10), 1031-1037.

Vazquez-Barquero, A., Vazquez-Barquero, J. L., Austin, O., Pascual, J., Gaite, L., & Herrera, S. (1992). The epidemiology of head injury in Cantabria. *European Journal of Epidemiology, 8*, 832-837.

Walker, W. C., Seel, R. T., Curtiss, G., Warden, D. L., Walker, William C., Seel, Ronald T., et al. (2005). Headache after moderate and severe traumatic brain injury: a longitudinal analysis. [Comparative Study, Multicenter Study,

Research Support, Non-U.S. Gov't, Research Support, U.S. Gov't, Non-P.H.S.]. *Archives of Physical Medicine & Rehabilitation, 86*(9), 1793-1800.

Williams, S., Raghupathi, R., MacKinnon, M. A., McIntosh, T. K., Saatman, K. E., & Graham, D. I. (2001). In situ DNA fragmentation occurs in white matter up to 12 months after head injury in man. *Acta Neuropathologica, 102*, 581-590.

Wrightson, P., & Gronwall, D. (1998). Mild head injury in New Zealand: incidence of injury and persisting symptoms. *New Zealand Medical Journal, 111*(1062), 99-101.

Yang, C. C., Tu, Y. K., Hua, M. S., Huang, S. J., Yang, Chi-Cheng, Tu, Yong-Kwang, et al. (2007). The association between the postconcussion symptoms and clinical outcomes for patients with mild traumatic brain injury. [Research Support, Non-U.S. Gov't]. *Journal of Trauma-Injury Infection & Critical Care, 62*(3), 657-663.

Appendix 1

Personal Details

Full Name	
Study ID	
Address	
Phone Number	

Date of:			
Admission	Follow up 1	Follow up 2	Follow up 3

On Presentation

(to emergency department)

Date:_____

ID:_____

Consent given Y N

ID:_____

Date of:			
Admission	Follow up 1	Follow up 2	Follow up 3

A. Demographic details:

A1 Sex: M / F A2 D.O.B.:_____ A3 Age: __

B. Head Injury Details

B1 How did mild head injury occur?

_____

_____

_____

B2 Classification mild traumatic brain injury:

Traffic accident Sports injury Household accident Physical Altercation

Other:_____

B3 What time of day did head trauma occur?

12 am – 6 am 6 am – 12 pm 12 pm – 6 pm 6 pm – 12 am

B4 How long between when the head injury occurred and assessment? _____

B5 Did you have loss of consciousness? Y / N
If Y, for how long?_____

B6 Was there post traumatic amnesia: Y / N
If Y, how long? _____

B7 On admission, what was the score on Glasgow Come Scale? ____

B8 Previous Hx of mild traumatic head injury: Y / N
How many: ___

B9 Do you have any other central nervous system disorders? Y / N
If so, what kind?_____

B10 Do you have any facial injury? Y / N

C. Symptoms on Presentation

C1 On presentation, did you have any of the following:

Headache Dizziness Nausea Hearing Problems Photophobia

Tinnitus Sensitivity to noise Weakness Memory loss Blurred vision

Other:_____

ID:_____

D. 2006 Census question about ethnicity:

Which ethnic group do you belong to?
Mark the space or spaces which apply to you.

- NZ European
- Māori
- Samoan
- Cook Island Maori
- Tongan
- Niuean
- Chinese
- Indian
- other (such as *DUTCH, JAPANESE, TOKELAUAN). Please state:*

Follow up 1

(1 week following trauma)

Date:_____

ID:_____

ID:_____

E Previous history of headache

E1 Previous Hx of regular headache (incl. migraine): Y / N
If so, describe: _____
_____
_____

If Y, fill out Appendix A

F Family History of Headache

F1 FHx of headache: Y / N
If so, whom and what type? _____
_____

G Previous History of Dizziness

G1 Previous Hx of Dizziness: Y / N
If so, describe:_____
_____
_____

If Y, fill out Appendix B

H Family History of Dizziness

H1 Family Hx of Dizziness: Y / N
If so, whom and what type? _____
_____
_____

ID:_____

I Current Symptoms

I1 Do you have any of the following:

Headache Dizziness Nausea Hearing Problems Photophobia
Tinnitus Sensitivity to noise Weakness Memory loss Blurred vision
Decreased ability to work Irritability Trouble sleeping Sleeping too much
Other:_____

J Current Headache

J1 Describe Current Headache:_____
_____
_____

J2 Did your headaches always feel the same/follow the same pattern? Y / N

J3 Characteristics:

J3.1 Approximate frequency: 1x/mth 1x/wk 2-4x/wk daily constant

J3.2 Duration: brief 30-60 mins 1-2 hrs 2-6 hrs 6-24 hrs days

J3.3 Side: both Right Left changing (sometimes R, sometimes L)

J3.4 Starting location: eye forehead temple top of head
back of head face ear neck all over

J3.5 Overall location: eye forehead temple top of head
back of head face ear neck all over

J3.6 Quality: pounding throbbing/pulsating boring aching
tight band shooting pressure other:_____

J3.7 Associated complaints: flashing lights blurred vision
Dizziness nausea vomiting None

J3.8 Neurologic deficits: blindness one-sided paralysis vertigo
Numbness none

J3.9 Circle average and maximum severity: 1 2 3 4 5 6 7 8 9 10

J4 What time of day do you usually get headaches?
Morning Afternoon Night There is no pattern

J5 Are there any warning signs before the headache pain starts? Y / N
If so, what are they? _____
_____
_____

J6 How many headache-free days per week do you have? 1 2 3 4 5 6 7

ID:_____

J7 Any associated symptoms?

Nausea/inability to eat	Vomiting
Light sensitivity (Photophobia)	Noise sensitivity (Phonophobia)
Odour sensitivity	Numbness or tingling
Weakness on one side	Difficulty speaking
Confusion	Bloodshot eye
Agitation	Imbalance
Dizziness/Vertigo	Double/Blurred vision
Tearing from one eye	Drainage from one nostril
Paralysis	Droopy eyelid
Muscle spasm	Red eye
Other:_____	NONE

J8 Is there anything that triggers your headaches? _____
_____
_____

E.g. Foods, sunlight, cold wind, caffeine, perfume

J9 Factors that worsen the headaches:

Light Sound Movement Bending over Exertion Lying down Standing up

Other:_____

J10 Factors that better the headaches:

Lying down Darkened room Sleep Drinking water Other: _____

J11 Do your headaches ever awaken you from sleep? Y / N

Can you then go straight back to sleep or do you have trouble? S / T

K Current Dizziness

K1 Describe current dizziness:_____
_____
_____

K2 Symptoms that you are currently experiencing:

Dizziness Lightheadedness Vertigo (spinning) Imbalance
Unsteadiness Falling

K3 Was the onset of your problem:

Gradual Sudden Other:_____

K4 What time of day is the dizziness experienced?

Morning Afternoon Night There is no pattern

ID:_____

K5 Is your dizziness/imbalance: a)Constant b)It comes and goes in spells or attacks

K5.1 If b): They occur every: ___ hrs ___ days ___ wks ___ mths

K5.2 Duration: ___ secs ___ mins ___ hrs ___days ___mths

K5.3 Are there any warning signs before the dizziness starts? Y / N

If so, what are they? _____

_____

_____

K5.4 Are you completely free of dizziness between attacks? Y / N

K7 Is there anything that relieves your dizziness? Y / N

If Y: Not moving head Rest

Medication: _____ Other: _____

K6 Does your dizziness occur with position changes? Y / N

If Y: Rolling your body right or left Turning your head left or right

Looking up, or head back position Bending over, or head down

Going from lying to sitting position Other: _____

K8 Is there anything that exacerbates your dizziness? Y / N

If Y: Moving your head Riding or driving in the car

Large crowds or busy walkways When your hungry /haven't eaten

Other: _____

K9 Is your dizziness currently: Getting better Same Getting worse Variable

If variable, rate the severity of your symptoms at the best times and the worst times on a scale of 1-10 with 10 being the worst.

____ Best ____ Worst

K10 Do your symptoms limit your daily activities? Y / N

Has is lead to falls? Y / N

K11 When dizzy, must you support yourself to stand or walk? Y / N

If Y, how do you support yourself?

K12 Have you experienced any of the following due to your dizziness?

Nausea Y / N

VomitingY / N

Follow up 2

(1 month following trauma)

Date:_____

ID:_____

ID:_____

I Current Symptoms

I1 Do you have any of the following:

Headache Dizziness Nausea Hearing Problems Photophobia
Tinnitus Sensitivity to noise Weakness Memory loss Blurred vision
Decreased ability to work Irritability Trouble sleeping Sleeping too much
Other:_____

J Current Headache

J1 Describe Current Headache:_____
_____
_____

J2 Did your headaches always feel the same/follow the same pattern? Y / N

J3 Characteristics:

J3.1 Approximate frequency: 1x/mth 1x/wk 2-4x/wk daily constant

J3.2 Duration: brief 30-60 mins 1-2 hrs 2-6 hrs 6-24 hrs days

J3.3 Side: both Right Left changing (sometimes R, sometimes L)

J3.4 Starting location: eye forehead temple top of head
back of head face ear neck all over

J3.5 Overall location: eye forehead temple top of head
back of head face ear neck all over

J3.6 Quality: pounding throbbing/pulsating boring aching
tight band shooting pressure other:_____

J3.7 Associated complaints: flashing lights blurred vision
Dizziness nausea vomiting None

J3.8 Neurologic deficits: blindness one-sided paralysis vertigo
Numbness none

J3.9 Circle average and maximum severity: 1 2 3 4 5 6 7 8 9 10

J4 What time of day do you usually get headaches?
Morning Afternoon Night There is no pattern

J5 Are there any warning signs before the headache pain starts? Y / N
If so, what are they? _____
_____
_____

J6 How many headache-free days per week do you have? 1 2 3 4 5 6 7

ID:_____

J7 Any associated symptoms?

Nausea/inability to eat	Vomiting
Light sensitivity (Photophobia)	Noise sensitivity (Phonophobia)
Odour sensitivity	Numbness or tingling
Weakness on one side	Difficulty speaking
Confusion	Bloodshot eye
Agitation	Imbalance
Dizziness/Vertigo	Double/Blurred vision
Tearing from one eye	Drainage from one nostril
Paralysis	Droopy eyelid
Muscle spasm	Red eye
Other:_____	NONE

J8 Is there anything that triggers your headaches? _____
_____
_____

E.g. Foods, sunlight, cold wind, caffeine, perfume

J9 Factors that worsen the headaches:

Light Sound Movement Bending over Exertion Lying down Standing up

Other:_____

J10 Factors that better the headaches:

Lying down Darkened room Sleep Drinking water Other: _____

J11 Do your headaches ever awaken you from sleep? Y / N

Can you then go straight back to sleep or do you have trouble? S / T

K Current Dizziness

K1 Describe current dizziness:_____
_____
_____

K2 Symptoms that you are currently experiencing:

Dizziness Lightheadedness Vertigo (spinning) Imbalance
Unsteadiness Falling

K3 Was the onset of your problem:

Gradual Sudden Other:_____

K4 What time of day is the dizziness experienced?

Morning Afternoon Night There is no pattern

ID:_____

K5 Is your dizziness/imbalance: a)Constant b)It comes and goes in spells or attacks

K5.1 If b): They occur every: ___ hrs ___ days ___ wks ___ mths

K5.2 Duration: ___ secs ___ mins ___ hrs ___days ___mths

K5.3 Are there any warning signs before the dizziness starts? Y / N

If so, what are they? _____

_____

_____

K5.4 Are you completely free of dizziness between attacks? Y / N

K7 Is there anything that relieves your dizziness? Y / N

If Y: Not moving head Rest

Medication: _____ Other: _____

K6 Does your dizziness occur with position changes? Y / N

If Y: Rolling your body right or left Turning your head left or right

Looking up, or head back position Bending over, or head down

Going from lying to sitting position Other: _____

K8 Is there anything that exacerbates your dizziness? Y / N

If Y: Moving your head Riding or driving in the car

Large crowds or busy walkways When your hungry /haven't eaten

Other: _____

K9 Is your dizziness currently: Getting better Same Getting worse Variable

If variable, rate the severity of your symptoms at the best times and the worst times on a scale of 1-10 with 10 being the worst.

____ Best ____ Worst

K10 Do your symptoms limit your daily activities? Y / N

Has is lead to falls? Y / N

K11 When dizzy, must you support yourself to stand or walk? Y / N

If Y, how do you support yourself?

K12 Have you experienced any of the following due to your dizziness?

Nausea Y / N

VomitingY / N

Follow up 3

(3 months following trauma)

Date:_____

ID:_____

ID:_____

I Current Symptoms

I1 Do you have any of the following:

Headache Dizziness Nausea Hearing Problems Photophobia
Tinnitus Sensitivity to noise Weakness Memory loss Blurred vision
Decreased ability to work Irritability Trouble sleeping Sleeping too much
Other:_____

J Current Headache

J1 Describe Current Headache:_____
_____
_____

J2 Did your headaches always feel the same/follow the same pattern? Y / N

J3 Characteristics:

J3.1 Approximate frequency: 1x/mth 1x/wk 2-4x/wk daily constant

J3.2 Duration: brief 30-60 mins 1-2 hrs 2-6 hrs 6-24 hrs days

J3.3 Side: both Right Left changing (sometimes R, sometimes L)

J3.4 Starting location: eye forehead temple top of head
back of head face ear neck all over

J3.5 Overall location: eye forehead temple top of head
back of head face ear neck all over

J3.6 Quality: pounding throbbing/pulsating boring aching
tight band shooting pressure other:_____

J3.7 Associated complaints: flashing lights blurred vision
Dizziness nausea vomiting None

J3.8 Neurologic deficits: blindness one-sided paralysis vertigo
Numbness none

J3.9 Circle average and maximum severity: 1 2 3 4 5 6 7 8 9 10

J4 What time of day do you usually get headaches?
Morning Afternoon Night There is no pattern

J5 Are there any warning signs before the headache pain starts? Y / N
If so, what are they? _____
_____
_____

J6 How many headache-free days per week do you have? 1 2 3 4 5 6 7

ID:_____

J7 Any associated symptoms?

Nausea/inability to eat	Vomiting
Light sensitivity (Photophobia)	Noise sensitivity (Phonophobia)
Odour sensitivity	Numbness or tingling
Weakness on one side	Difficulty speaking
Confusion	Bloodshot eye
Agitation	Imbalance
Dizziness/Vertigo	Double/Blurred vision
Tearing from one eye	Drainage from one nostril
Paralysis	Droopy eyelid
Muscle spasm	Red eye
Other:_____	NONE

J8 Is there anything that triggers your headaches? _____
_____
_____

E.g. Foods, sunlight, cold wind, caffeine, perfume

J9 Factors that worsen the headaches:

Light Sound Movement Bending over Exertion Lying down Standing up

Other:_____

J10 Factors that better the headaches:

Lying down Darkened room Sleep Drinking water Other: _____

J11 Do your headaches ever awaken you from sleep? Y / N

Can you then go straight back to sleep or do you have trouble? S / T

K Current Dizziness

K1 Describe current dizziness:_____
_____
_____

K2 Symptoms that you are currently experiencing:

Dizziness Lightheadedness Vertigo (spinning) Imbalance
Unsteadiness Falling

K3 Was the onset of your problem:

Gradual Sudden Other:_____

K4 What time of day is the dizziness experienced?

Morning Afternoon Night There is no pattern

ID:_____

K5 Is your dizziness/imbalance: a)Constant b)It comes and goes in spells or attacks

K5.1 If b): They occur every: ___ hrs ___ days ___ wks ___ mths

K5.2 Duration: ___ secs ___ mins ___ hrs ___days ___mths

K5.3 Are there any warning signs before the dizziness starts? Y / N

If so, what are they? _____

_____

_____

K5.4 Are you completely free of dizziness between attacks? Y / N

K7 Is there anything that relieves your dizziness? Y / N

If Y: Not moving head Rest

Medication: _____ Other: _____

K6 Does your dizziness occur with position changes? Y / N

If Y: Rolling your body right or left Turning your head left or right

Looking up, or head back position Bending over, or head down

Going from lying to sitting position Other: _____

K8 Is there anything that exacerbates your dizziness? Y / N

If Y: Moving your head Riding or driving in the car

Large crowds or busy walkways When your hungry /haven't eaten

Other: _____

K9 Is your dizziness currently: Getting better Same Getting worse Variable

If variable, rate the severity of your symptoms at the best times and the worst times on a scale of 1-10 with 10 being the worst.

____ Best ____ Worst

K10 Do your symptoms limit your daily activities? Y / N

Has is lead to falls? Y / N

K11 When dizzy, must you support yourself to stand or walk? Y / N

If Y, how do you support yourself?

K12 Have you experienced any of the following due to your dizziness?

Nausea Y / N

VomitingY / N

Appendices A & B

Date:_____

ID:_____

ID:_____

Appendix A

Previous history of headache

E2 Did your headaches always feel the same/follow the same pattern? Y / N

E3 Characteristics:

E3.1 Approximate frequency: 1x/mth 1x/wk 2-4x/wk daily constant

E3.2 Duration: brief 30-60 mins 1-2 hrs 2-6 hrs 6-24 hrs days

E3.3 Side: both Right Left changing (sometimes R, sometimes L)

E3.4 Starting location: eye forehead temple top of head
back of head face ear neck

E3.5 Overall location: eye forehead temple top of head
back of head face ear neck

E3.6 Quality: pounding throbbing/pulsating boring aching
tight band shooting pressure

E3.7 Associated complaints: flashing lights blurred vision
Dizziness nausea vomiting

E3.8 Neurologic deficits: blindness one-sided paralysis vertigo
numbness

E3.9 Circle average and maximum severity: 1 2 3 4 5 6 7 8 9 10

E4 What time of day did you usually get headaches?
Morning Afternoon Night There is no pattern

E5 Were there any warning signs before the headache pain starts? Y / N
If so, what were they? _____
_____

E6 How many headache-free days per week did you have? 1 2 3 4 5 6 7

E7 Any associated symptoms?

Nausea/inability to eat	Vomiting
Light sensitivity (Photophobia)	Noise sensitivity (Phonophobia)
Odour sensitivity	Numbness or tingling
Weakness on one side	Difficulty speaking
Confusion	Bloodshot eye
Agitation	Imbalance
Dizziness/Vertigo	Double/Blurred vision
Tearing from one eye	Drainage from one nostril
Paralysis	Droopy eyelid
Muscle spasm	Red eye
Other:_____	NONE

ID:_____

E8 Was there anything that triggers your headaches? _____
_____
_____

Eg. Foods, sunlight, cold wind, caffeine, perfume

E9 Factors that worsened the headaches:

Light Sound Movement Bending over Exertion Sexual intercourse Lying down

Standing up Other:_____

E10 Factors that improved the headaches:

Lying down Darkened room Sleep Drinking water Other: _____

E11 Did your headache ever awaken you from sleep? Y / N

Can you then go straight back to sleep or do you have trouble? S / T

ID:_____

Appendix B

Previous history of dizziness

G2 What symptoms did you are experience?

Dizziness Lightheadedness Vertigo (spinning) Imbalance

Unsteadiness Falling

G3 Onset of problem:

Gradual Sudden Other:_____

G4 What time of day was the Dizziness experienced?

Morning Afternoon Night There is no pattern

G5 Was your dizziness/imbalance: a)Constant b)It comes and goes in spells or attacks

G5.1 If b): They occurred every: ___ hrs ___ days ___ wks ___ mths

G5.2 Duration: ___ secs ___ mins ___ hrs ___days ___mths

G5.3 Were there any warning signs before the dizziness starts? Y / N

If so, what were they? _____

_____

_____

G5.4 Were you completely free of dizziness between attacks? Y / N

G6 Did your dizziness occur with position changes? Y / N

If Y: Rolling your body right or left Turning your head left or right

Looking up, or head back position Bending over, or head down

Going from lying to sitting position Other: _____

G7 Was there anything that relieves your dizziness? Y / N

If Y: Not moving head Rest

Medication: _____ Other: _____

G8 Was there anything that exacerbates your dizziness? Y / N

If Y: Moving your head Riding or driving in the car

Large crowds or busy walkways When your hungry /haven't eaten

Other: _____

G9 Was your dizziness currently: Getting better Same Getting worse Variable

If variable, rate the severity of your symptoms at the best times and the worst times on a scale of 1-10 with 10 being the worst.

____ Best ____ Worst

G10 Did your symptoms limit your daily activities? Y / N

Has is lead to falls? Y / N

G12 Had you experienced any of the following due to your dizziness?

Nausea Y / N

VomitingY / N