Introduction

Children, adolescents, and young adults comprise 70% of all traumatic brain injuries (TBIs) in Aotearoa New Zealand. TBIs are defined as acute incidents that cause disruption to normal brain function. Injury is defined as transfer of energy to the human body at a force that exceeds the pathophysiological capacity of human tissues. TBI can present with loss of consciousness, headache, confusion, stroke-like symptoms, seizures, and can result in death. TBI can be clinically categorized into three types based on the symptoms and severity of injury: mild (synonymously labelled concussion), moderate, and severe. When classifying by mechanism of injury, the most common global causes of TBI are falls, assaults, and road vehicle crashes. These immediate mechanisms of injury are also prevalent in Aotearoa, with the addition of sports-related injuries and workplace injuries.

Accounting for almost half of global TBIs, falls are a predominant mechanism of injury within the paediatric and geriatric populations, but feature less in the adolescent demographic. Similarly, work-related injuries are a significant cause within the adult age groups and have a low prevalence amongst adolescents. A prospective birth cohort study of Aotearoa youth reported that the three major causes of TBI during mid-adolescence were road vehicle crashes, assaults, and sports-related injuries. The current literature lacks a discussion of social determinant pathways that lead to inequitable burden of TBI and hence, various upstream factors are missed in prevention strategies. This essay aims to highlight the ethnic and rural inequities along with providing a discussion of two negative and one positive social determinant pathways in the context of TBI in Aotearoa adolescents.

TBIs are a leading cause of death and disability worldwide. Conservative measures suggest that TBIs have an annual incidence of over 50 million cases globally. Although 90% of these cases are based in low- and middle-income countries, the incidence of TBI in Aotearoa is still significant, with over 36,000 annual cases. In 2010, TBI accounted for 27% of injury-related health loss (20,300 disability-adjusted life years) in Aotearoa, with disability-adjusted life years (DALY) loss rates higher in younger age groups. Amongst the adolescent population (10–19 years old), TBIs are the leading cause of mortality and are responsible for the greatest burden of disability in this age group. The Aotearoa adolescent population faces the greatest burden of TBI and hence this article aims to discuss the underlying inequity pathways and social determinants that drive the incidence of TBI in Aotearoa adolescents (Figure 1).

TBIs in Aotearoa bring along a significant economic burden in addition to the health impacts at individual level. The Accident Compensation Corporation (ACC) states that over half of serious injury claims in Aotearoa are related to TBI resulting in a cost of over 83.5 million New Zealand dollars in 2015. The New Zealand Treasury reports that TBIs are second only to strokes in terms of impact on employment and income. This impact is worse in the adolescent population as TBI can often lead to lifelong debilitating injuries and this group possesses more years of working life ahead of them compared to the adult population. In addition to the population-level mortality, morbidity, and financial burden, TBI have serious impacts at the individual-level from physical disabilities to social disconnect.

Overview of key health inequities

Within the adolescent age group, males, Māori, and rural adolescents experience disproportionately higher rates. These inequitable health outcomes may be attributed to various risk factors that either increase exposure to dangerous settings or promote high risk-taking behaviour. These factors are driven by upstream social determinants including colonisation, institutional racism, law enforcement agencies, government, socio-economic status (SES), and cultural environment, as illustrated below in Figure 1.

Traumatic brain injuries in Aotearoa New Zealand adolescents: Health inequity pathways from upstream factors to downstream causes

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POLITICAL CONTEXT
- Colonisation & institutional racism
- Tamaki uplifting
- Appropriation of Māori land/wealth
- Inequitable access to education, social and health services

SOCIO-CULTURAL CONTEXT
- Hazardous drinking culture
- Masculinity culture and gender-based norms
- Rugby culture promoting high-risk sports especially amongst Māori & Pasifika

ENVIRONMENTAL CONTEXT
- Climate change
- Adverse weather events
- Global scientific advancements in safety
- Better quality vehicles
- Safer occupational tools
- Safer sports equipment

International sports regulations
- Safety standards implementation

Government
- Funding and prioritization of transport infrastructure
- Policies & practices of government agencies (social development, education, health, corrections, police)

Legislation
- Road safety
- Alcohol & harm reduction
- Violence and child protection policies

Laws
- Road safety
- Alcohol & harm reduction
- Violence and child protection policies

Socioeconomic status
- Household income
- Occupation
- Age/gender/developmental status

Risk-taking behaviour
- Perpetuated in males by gender norms
- Alcohol-related
- Interpersonal violence
- Transport-related

Material circumstances
- Inability to afford safe vehicles
- Inability to afford sports equipment safety equipment
- Livelihoods of professional sports career

Exposure to hazards
- Hazardous rural driving conditions
- Exposure to violence & assault
- Gang affiliations
- Dangerous occupations

Differential exposure

Social Determinant Pathways of TBI in Aotearoa Adolescents

1. HIGH-RISK SPORTS: A NEGATIVE PATHWAY TO TBI

According to ACC, over 20% of TBI are sustained through sports-related injuries.1 Sports are an essential component of schooling in Aotearoa and have become embedded into the culture.2 The introduction of high-risk sports such as rugby, cricket, football, cycling, and equestrian sports has brought an increased likelihood of injuries and they are the leading cause of sports-related TBI in Aotearoa adolescents.3 These sports were introduced to Aotearoa under the process of colonisation with the aim of creating a collective cultural bond between Māori and the British Empire.4

Racism has historically occurred in conjunction with colonisation. As a result, many individuals and minorities have resorted to sports as a method to subvert racist ideologies.5,6 Sport has provided a relatively peaceful avenue for integration and a medium for minority groups to gain mana (prestige) in the Pākehā-dominated world.7,8 Amongst all sports, rugby has the highest incidence of TBI in Aotearoa but also holds a prestigious status with strong cultural roots in the Māori world today.9,10,11,12 Māori and Pasifika boys are more compatible with pursuing rugby.13,14,15

This consequently leads to a greater uptake of rugby compared to non-Māori and non-Pasifika populations and hence an increased risk of injuries such as TBI.16

Figure 1: The infographic to the left has been developed from a conceptual framework by Laflamme et al. and adapted for the context of TBI in Aotearoa adolescents.16 It depicts how various macro-level and social determinants enable intermediary mechanisms to give rise to immediate causes of TBI within this population.
A study has shown that lower-SES parents value sports as a means of keeping children out of trouble more than higher-SES parents (64% vs. 40%).35 Additionally, lower-SES parents value athletic scholarships more than higher-SES parents (26% vs. 8%).37 These findings could potentially mean that lower-SES can lead to increased uptake of sports and hence an increased risk of sports-related injuries such as TBI. The same study also shows that the biggest concern for both low-SES and high-SES parents was the risk of concussion/mild TBI.37 This SES gap continues to be the social driver to widen inequities, as Māori adolescents from lower SES backgrounds who play rugby may be less likely to afford appropriate safety equipment that is essential in the sport.36–38 This can lead to further disproportionate injuries in Māori adolescents and an increased risk of TBI.

2. TAMARIKI UPLIFTING AND COLONISATION: A NEGATIVE PATHWAY TO TBI

Colonisation has resulted in significant suffering for indigenous populations worldwide. The process of colonisation was methodical and included inhumane laws that worked to systematically suppress indigenous populations for generations.38 Tamaki (children) uplifting was an example of one such unethical process which had downstream consequences such as disproportionate rates of incarceration and homelessness, which are key determinants for risk of TBI (Figure 1).19,21–23,38–42

It is important to analyse how loss of whenua (land) due to colonisation and poor vagrancy laws acted in harmony to cause an intergenerational systemic inequity.38,41 As the land was appropriated by the British Empire via repeated breaches of Te Tiriti o Waitangi, Māori communities were left with no resources and often without shelter.20,21,38 Vagrancy laws adopted from the British legislation then came into action, making homelessness illegal. This saw many children of homeless families being separated from their whānau in vastly disproportionate numbers based on ethnicity.40,41 Between 1960 and 1980, 1 in 12 Māori boys were placed under state care compared to only 1 in every 1000 Pākehā boys.21 These factors consequently led to inequities in the SES of the Māori population which continue to increase the risk of TBI in this population.

Recent Waitangi Tribunal urgent inquiries Wai 2823 and Wai 2915 highlight the major inequities faced by members of the Māori population who were once uplifted as tamaki.21,39,42 According to Māori health advocate Katarina Jean Te Huia, 86% of prison inmates were once in state care, and a significant proportion of Aotearoa gang members (80% of Black Power members and 78% of Mongrel Mob members) were previously wards of the state.20,21,40 These statistics depict the negative impact of being a ward of the state and all the inequities that come with it. Due to these systemic injustices, roughly 50% of the prison population of Aotearoa are Māori despite only being 18% of the total Aotearoa population.21,43 Homelessness has also shown to be another significant downstream effect of tamaki uplifting. Many children who were once uplifted as victims of institutional racism are now left without any resources due to the intergenerational loss of wealth.38,39,41

It has been documented that the experience of state care in childhood is associated with behavioural issues later in life, including violent tendencies, gang affiliations and substance abuse problems.22,38,41 These are all serious risk factors for TBI. Moreover, the mild TBI faced by these populations are often undiagnosed and this puts them at an increased risk of more severe conditions such as chronic traumatic encephalopathy (CTE).42,43 Furthermore, TBI are also strongly linked with more aggressive behaviour in adolescence and hence, can perpetuate a cycle of violence and TBI.22

LEGISLATION, INSTITUTIONAL POLICIES AND ENFORCEMENT: A POSITIVE PATHWAY FOR REDUCING TBI

Not all pathways from upstream determinants result in negative statistics and inequities. Although institutional policies and enforcement agencies have been used as a tool for colonisation, another aspect of them has been the legislations that have proven to be protective against TBI. Globally and nationally, institutional policies and enforcement agencies have worked in tandem to produce a positive pathway to reduce the risk of TBI (Figure 1).43 Sporting institutions such as World Rugby and trained referees in sports have worked together to implement successful concussion guidelines that have made the sport much safer and dramatically reduced adverse outcomes such as TBI.44 The other major institution responsible for policies is the New Zealand Government. Policy development is guided by road toll and injury data collected by Crown entities such as ACC, WorkSafe and the New Zealand Transport Agency (NZTA).45 Evidence-based policy making is critical at the population level to ensure the optimal use of resources.

In 2011, NZTA introduced three major legislative changes in 2011 targeting risk-taking behaviour in adolescents related to driving.45 These four changes were: increasing the minimum age of driving from 15 to 16; introduction of more rigorous licensing provisions; zero blood alcohol concentration for drivers under 20; and increasing penalties for dangerous drink driving offences.45 This approach was taken to target the adolescent population as they are a high-risk population for road vehicle crashes.21,46 Although the efficacy of these changes are yet to be evaluated in Aotearoa, other countries have shown a reduction in TBI incidence due to similar legislative changes.45,46 The Warrant of Fitness to regularly test the safety of vehicles is another NZTA policy that has proven to be successful at reducing the road vehicle crashes which are a major cause of TBI.43

The Sale and Supply of Alcohol Act 2012 is another example of protective legislation which introduced restrictions on the licensing, promotion and supply of alcohol to young people.43 This Act also targeted the adolescent population by making it harder for young people to access alcohol which is a key driver of high-risk behaviour in the population.42,43 Alcohol intake is one of the greatest predictors of TBI and laws such as these help reduce the risk of TBI in adolescents at a population level.43,47 Additionally, ACC’s TBI Strategy and Action Plan (2017–2021), built in conjunction with the Ministry of Health, shows how regulatory bodies can help shape policies for intervention at the public-level for better outcomes.48 Law enforcement agencies such as the New Zealand Police act as the branch of government which ensures the laws are adhered to regarding road safety and criminal activity such as interpersonal violence. Hence, these act as another layer of protection for adolescents from serious injuries such as TBI.

However, unfavourable legislative changes can also result in worse outcomes as evident through Aotearoa’s decision to lower the minimum age for alcohol purchase from 20 years old to 18 years old in 1999. A study evaluating the long-term impact of this change showed that 18–19 year-olds had 21% higher odds of being in an alcohol-involved crash than 20–24 year-olds, and consequently the law change may have increased the risk of road crash related TBI.48 Therefore, it is important to understand that the protective ness of laws and regulations is only as good as their quality. Overall, these policies and enforcement agencies have built a strong framework and pathway that can reduce the risk for TBI when used appropriately.

Conclusion

There is a high TBI burden amongst adolescents in Aotearoa. The Māori adolescent population faces even more inequities originating from upstream determinants of health such as colonisation and its associated institutional racism and socioeconomic injustices. There are various pathways that lead to this inequitable outcome including the popularity of high-risk sports and inappropriate tamaki uplifting which has caused generational challenges increasing exposure to violence and hence the risk of TBI. Concurrently, there are positive upstream determinants such as international sports safety regulations against concussions and laws promoting safe driving practices amongst adolescents. In addition to the three social determinant pathways mentioned in this essay, there are also various other pathways that give rise to inequities in the context of TBI in Aotearoa adolescents.


About the author

Angad is a fifth-year medical student at the University of Otago, Wellington. He is interested in pursuing a clinical and academic career in neurosurgery. He likes to dedicate his spare time to sustainability and climate action initiatives. He also enjoys traveling and cooking various cuisines.

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