Quantifying the disease burden of alcohol's harm to others: Research Protocol

Rationale for Research

Enhanced measurement of alcohol's harms to others needed

There is growing acknowledgment of the important contribution made by alcohol to the Global Burden of Disease and Injury. Alcohol is responsible for three million deaths globally every year and 5.1% of all DALYs in 2012 were attributable to alcohol (Global status report on alcohol and health 2014.[1,2] However, much of the quantification of harm, globally and within New Zealand,[1,8] relates to the impact of alcohol on the drinker him or herself whereas it is likely the contribution of alcohol's harm to others would, if adequately assessed, contribute a large part to overall harm.

Recent years have seen increased focus on the measurement of alcohol's harm to others overseas and in New Zealand; this has utilised survey data and administrative data bases.[9] A New Zealand survey of alcohol's harm to others (HRC# 08/268) found one in four reported a heavy drinker in their life and, after controlling for demographics and own drinking, there were significant negative impacts of others' heavy drinking on measures of health and wellbeing.[7] The same New Zealand HRC funded study, using a combination of available survey data, research and administrative data, quantified a range of types of harm and found, for example, 40% of those injured in alcohol related road crashes were not the drinking person responsible.[4]

Underpinning this proposal is the belief that taking a systematic approach to describing and quantifying harm to others from drinking is important for two reasons. The first is to identify problems for specific attention that might otherwise be invisible or neglected. The second is to provide a more complete picture of the burden of drinking in communities to inform decision making about policy on alcohol control. In the case of tobacco, the effects of second hand smoking were an important element in advocacy for healthier public policy, and it is likely alcohol's harm to others will also contribute to the policy debate.

Availability of new data for enhanced measurement

This proposed study takes advantage of the relatively new Statistics New Zealand Integrated Data Infrastructure (IDI). The IDI is a collection of datasets covering domains such as health, justice, welfare and demographics drawn from administrative, survey and census data. A system generated linking procedure allows individual records to be linked across datasets. The strength of using the Integrated Data Infrastructure (IDI) in this project is that the linked data allows a more comprehensive understanding and a better measurement of the impact of alcohol's harm to others by bringing together information about health events stored in different data systems. All relevant health-related incidents recorded in the IDI are coded using the International Classification of Disease, 10th Revision, Australian Modification (ICD-10- AM). There is an extensive list of codes relating to external causes of injury/death from assault or road crashes where the person injured/fatally injured is the victim. These codes will allow the severity of the injury to be assessed by linking the ICD code with the Abbreviated Injury Score 10.[10] The IDI also allows records to be linked with ethnicity data in the New Zealand Census and this permits the extent of alcohol harm to others to be measured for Maori and non-Maori.

The proposed study also takes advantage of recent research initiatives in New Zealand[4] and overseas,[11-13] which will allow increased confidence in the quantification of alcohol's harm to others in a number of areas.

Disability Adjusted Life Years Lost (DALYs)

An additional development in relation to previous research on alcohol's harm to others will be the inclusion of measures of the health burden associated with these harms. We will calculate the Disability Adjusted Life Years (DALYs) lost as a result of other's drinking in relation to three specific areas. The DALY is a measure of overall disease burden, made up of the sum of the Years of Life Lost (YLL) due to a condition and a weighted estimate of number of years lived with ill-health or

disability (YLD).[14-16] As has been done in previous New Zealand assessments of the burden of harm associated with alcohol, which focused primarily on the drinker,[3] this analysis will provide estimates for Maori and non-Maori, given the heightened risk of alcohol-related harm among Maori.

Alcohol's Harm to others: areas of importance

The three main areas of alcohol harm to others we will address reflect the likely size and of the contribution they make and the availability of data.

Fetal alcohol syndrome disorder
A key example of alcohol's harm to others is the harm caused by consuming alcohol during pregnancy. Prenatal alcohol exposure is an established cause of Fetal Alcohol Spectrum Disorder (FASD). A safe level of alcohol exposure during pregnancy has yet to be identified, nevertheless it is widely accepted that heavy drinking confers the greatest risk of FASD. Prenatal alcohol exposure results in a highly variable expression of adverse outcomes. As a result, the term FASD encompasses a group of disorders where alcohol exposure can affect any organ system.[17] FASD is an umbrella term that covers alcohol-related diagnoses, of which fetal alcohol syndrome (FAS) is the most severe and visibly identifiable form.

FASD is associated with a wide range of physical, behavioural and learning problems including growth impairments, facial abnormalities, problems with brain function and developmental delays (Kraus et al 2017). Damage to the brain due to alcohol exposure is irreversible and is associated with behavioural deficits and disturbances in everyday life, including dropping out of school, drug and alcohol misuse, abnormal sexual behaviour, and delinquency.[18] Results of longitudinal studies indicate that children with FASD will not be able to compensate for their cognitive and linguistic deficits despite intensive care in foster families. Adolescents and young adults with FASD almost always exhibit deficits in behavioural, attentional and executive functioning.[19]

There are no prevalence data for FASD in New Zealand.[20] What evidence exists suggest that, as in many countries, FASD is the most important cause of non-genetic mental impairment in New Zealand.[20-22] There is research underway in New Zealand to undertake analysis of the effects of alcohol exposure during pregnancy and early childhood development outcomes among 8-9 year olds by using the Growing Up in New Zealand cohort study. However, findings will not be available for several years and the geographical area the cohort covers (District Health Boards of Auckland, Counties Manukau and Waikato),[23] will not provide a national level prevalence estimate. The lack of a national prevalence estimate of FASD is relatively common internationally as diagnosing FASD is difficult. For example, The World Health Organisation endorses assessment of FASD via observational study using physical and behavioural and dysmorphology assessment, neurodevelopmental testing and biomarkers of prenatal alcohol exposure.[24] Highly trained clinical teams may also diagnose FASD (in New Zealand this is happening in e.g. Hawkes Bay and Northland, however, this is via referrals and therefore not able to be extrapolated to population-level prevalence).[25] A methodology to estimate prevalence of FASD has been developed internationally and will be used to estimate prevalence of FASD in New Zealand[11] in the proposed study. (Conducting the type of assessment needed to accurately assess FASD nationally is not feasible in the current proposed study).

FASD is likely to be a considerable cause of alcohol's harm to others in New Zealand as the prevalence of drinking during pregnancy is estimated to be between 25% and 35%.[12,26] New Zealand research suggests that up to 60 per cent of women may drink 4+ drinks per occasion prior to pregnancy recognition, 28 per cent continue to drink some alcohol during their pregnancy, and 10 per cent continue to drink 4+ drinks per occasion.[21] A recent New Zealand and USA cross-cultural Infant Development, Environment and Lifestyle (IDEAL) longitudinal study, which compared high-risk mothers with non-high risk mothers, showed the prevalence of alcohol use by the New Zealand control group to be four times that of the matched USA cohorts.[27] Prevalence of drinking during pregnancy is higher among Maori women than European women: 17% of Maori women drink 4 or more drinks a week during the first trimester of pregnancy as compared to 6% of European women.[26]

Previous research has looked at the burden of FASD by examining the direct burden to the health, welfare and justice systems or the lost productivity due to FASD. For example, productivity losses in the New Zealand work force due to morbidity and premature mortality of individuals with Fetal Alcohol Spectrum Disorders (FASD) were estimated to range from $NZ49 million to $NZ200 million – 0.03%

to 0.09% of the annual gross domestic product.[17] However, the health burden for the population has not been estimated.

Road crash injuries and deaths due to someone else's drinking
Road traffic crashes involving alcohol in New Zealand, as elsewhere, cause considerable health burden and are the number one alcohol-attributable cause of life years lost among males (Maori and non-Maori) and second among Maori females.[3] Driving while intoxicated poses not only a risk to the drunk driver, but also to third parties. Other road users, such as pedestrians, cyclists, and other drivers or passengers have an elevated risk of injuries and death.[11] In New Zealand, through 2003-2007, road crashes involving someone else's drinking were responsible for an annual average of 5,535 injuries to innocent victims, including 60 deaths. 381 of those injured were children under 15 years of age. The estimated cost of crash injuries due to someone else's drinking in the 5-year period was 2.5 billion NZ dollars, or 0.5 billion dollars per year.[4]

Amongst 15–19 year olds, almost one in five of all road crash injuries (19%) were due to someone else's drinking, making up half of all alcohol-related crash injuries at this age. Amongst children under 15, virtually all injuries in alcohol-related crashes were attributable to someone else's drinking, and 90% were sustained as car passengers. For 90% of the children who died and more than 70% of those injured by a drinking driver, the responsible driver was in their car.[4]

The proposed study's ability to update and extend on previous estimates of harm to others due to traffic crash is facilitated by the crash analysis system dataset attributing alcohol to crashes and by the IDI allowing for linking to hospital discharges and mortality data to allow for the calculation of DALYs.

Assaults
Excessive alcohol consumption is a risk factor for various kinds of aggression.[2] Acute and chronic alcohol use affects physical and cognitive functioning, leading to more extreme social responses, enhanced self-evaluations, and the relief of anxiety and depression. Acute intoxication leads to a state of weakened attentional capacity and limited information processing ability, resulting in immediate reaction and confrontation, often in the form of aggressive behaviour, rather than a reasoned response to everyday situations.[28] Assaults are included in the Global Burden of Disease Study which has established AAFs[2,8] acknowledging the causal relationship between interpersonal violence and alcohol.

In New Zealand, in 2014, the rate of assaults resulting in injury was 22 per 10,000 people in New Zealand[29] and an Emergency Department study in Auckland found that around 30% of all injury presentations were alcohol-related, and of those almost half were due to violence.[30] **Self-reported violence involves a drinking perpetrator in about half of cases in New Zealand, more likely in stranger violence than family violence but common in both.[4]** New Zealand has a comparatively high rate of family violence compared to other developed countries[31] of which at least 25% of intimate partner violence incidents involve alcohol.[32] Responding to family violence accounts for 41% of a frontline Police Officer's time in New Zealand.[33] The availability of comprehensive New Zealand Police assault data in the IDI allows for separation of family violence and will facilitate the improved analysis of the heath burden of interpersonal and family violence attributable to others drinking in the proposed study. Moreover, the linking ability in the IDI to hospital discharge and mortality data for assault will allow the calculation of DALY's.

Other potential areas of alcohol's harm to others
There are a number of possible areas where alcohol use by others may have an impact but in which data availability precludes inclusion in this proposed study. For example, while there are cross-sectional data showing reduced well-being for those with a heavy drinker in their life (e.g. Casswell et al 2011[7]), there are no available meta-analyses/causal data on the contribution of someone else's drinking to psychological harms to others e.g. anxiety, depression. Nor can psychological harms due to another's drinking be determined from data available in the IDI (or other data from New Zealand). While it would be valuable to be able include the effects of psychological harm due to others drinking, the lack of necessary data prevents inclusion in this type of study.

Estimating alcohol's harm to others using global burden of disease study methodology

The *Comparative Risk Assessment* (CRA) methodology that will be employed in this study was developed for the Global Burden of Disease and Injury Project (GBDI), as a systematic approach to

measuring and ranking the burden of disease and injury attributable to a range of important global risk factors, of which alcohol was one. It was designed for application at a global and regional level, but has also been applied at a country level and, in New Zealand, for Māori and non-Māori populations separately.[8] The CRA method estimates how much loss of health in a population is due to a specific risk factor, by adding up the burden caused for each of the conditions to which it contributes. Using the CRA method, the global burden of alcohol-related harm has been estimated, first in 2002 and repeatedly updated, allowing comparisons with other risk factors and between regions of the world. Some health conditions caused by drinking are wholly attributable to alcohol, and some are partially attributable to alcohol, meaning that if there was no alcohol consumed some conditions would completely disappear, and others would be reduced by a proportion (e.g. 30% less traffic crash deaths), known as the attributable fraction. To estimate the attributable fractions for conditions in a population, detailed alcohol consumption data and reliable estimates of risk factor-disease associations are needed.

The comparative risk assessments to date have been focused mainly on harms to the drinker, as it is difficult to reliably attribute harm suffered by one person to the level of drinking of another person at a population level. This research aims to assess the burden of harm due to three important conditions caused by the drinking of others that are more amenable to measurement: FASD (wholly attributable to alcohol) and road crash injuries/deaths and injuries/deaths from assault (partially attributable to alcohol). The impact of alcohol on population health by way of these three health outcomes can be estimated as attributable mortality and disability-adjusted life years lost (DALYs) as in the GBDI.

Aim: to estimate the New Zealand health burden of alcohol's harm to others in the following areas:

1. Fetal Alcohol Spectrum Disorder (FASD)
2. Road crash
3. Assault separated into
    - 3.1 Total assaults
    - 3.2 Intimate partner violence

Design and Methods

Overview: Estimation of the extent of FASD and deaths and injuries for road crashes and assaults due to alcohol's harm to others will be made for New Zealand separately for Maori and non-Maori. These estimates will form the basis of a burden of disease approach to quantifying the impact of alcohol consumption on others in New Zealand including the calculation of DALYs lost as a result of other's drinking in relation to these specific areas. As has been done in previous New Zealand assessments of the burden of harm associated with alcohol, which focused primarily on the drinker, this analysis will provide estimates for Maori and non-Maori (and combined).

Statistics New Zealand Integrated Data Infrastructure (IDI)*:* This proposed study takes advantage of the relatively new Statistics New Zealand Integrated Data Infrastructure (IDI). The IDI is a collection of datasets covering domains such as health, justice, welfare and demographics drawn from administrative, survey and census data. A system generated linking procedure allows individual records to be linked across datasets. Information is linked together about the same identity across multiple data sources using a robust linking methodology (linking software performs millions of comparisons to identify which records are likely to belong to the same identity). Both 'probabilistic' and 'deterministic' linking methods are used in the IDI. Records with personal identifiers in common, such as National Health Index (NHI) numbers allow for exact 'deterministic' links to be made. 'Probabilistic' linking uses demographic variables such as name, date of birth, and sex, to infer two records belong to the same person. Individuals personal identities cannot be identified from the IDI.[34]

A number of relevant datasets are available in the IDI (e.g. hospital discharge data) and each dataset will have limitations therefore the initial phase of this project will evaluate the quality and completeness of the datasets. The most recent three years of complete data available will be utilised to ensure there are sufficient data.

Sensitivity analysis, to assess the extent to which results vary depending on contrasting assumptions or changing key parameters, will also be undertaken.

Stage 1: Evaluate the completeness and quality of the datasets

Data quality of relevant datasets in the IDI

Hospital discharges (road crash, assault): Initial scoping has found that where hospital discharge data on road crash and assaults are coded they are of good quality in the IDI (Pers. comm. Lewis 2017). Publicly funded hospital events are required to be loaded into the National Minimum Dataset (NMDS) within 21 days after the month of discharge.[35] Data is provided in an agreed electronic file format by public hospitals and by those private hospitals who provide publicly funded services. Paper forms and a cut-down electronic file format are also forwarded by other private hospitals. The IDI hospital discharge data set contain clinical coding relating to conditions using ICD-10-AM codes (including injury inflicted by others). Some relevant details are less complete e.g. perpetrator of assaults and this will be ameliorated by linking with other datasets (e.g. Police data) in the IDI. Possible limitations with hospital discharge data include whether clinicians code correctly e.g. if a patient does not admit injury due to assault or as a victim of road crash and it's not obvious a clinician may not code these as such. It is also possible that District Health Board management of information flow could affect coding for assault. It is not possible to quantify the effects of these aspects affecting data collection and coding (Pers. comm. Lewis 2017). However, it is likely that the vast majority of assaults/traffic crash that result in hospitalisation are covered in the IDI.

Mortality data (road crash, assault): Initial scoping of the mortality data in the IDI suggests it is of excellent quality and has excellent coverage of deaths (Pers. comm. Lewis 2017). The Mortality Collection classifies the underlying cause of death for all deaths registered in New Zealand, using the ICD-10-AM and the WHO Rules and Guidelines for Mortality Coding.[36] In more recent years, more information from Coronial Services has been included. Ethnicity data are accurate (Pers. comm. Lewis 2017).

Police data (assaults, family violence): Where assaults are reported to the Police, the quality and coverage in the IDI are very good. Data are collected by observation and face-to-face interview with the victim. The Police also use multiple operational methods including telephone and face-to-face interviews with informants and witnesses. Victim data on assault, including relationship of offender to victim are included (and represents the relationship from the perspective of the victim at the time of the offence).[37] Manslaughter and homicide victim data are also available in the IDI. Where victim data

are missing or not complete, an algorithm is used to impute data using additional details such as victim age, type of crime (Pers. comm. Cinco 2017). For the period of July 2016 to June 2017, the proportions of imputed victims were 12.6% for assault, 0% manslaughter, 1.7% homicide (data supplied by data@Police 2017). Not all assaults are reported to the Police, and this is more likely for domestic assaults.

New Zealand Transport Agency data (road crash): The crash analysis system (CAS) will be introduced into the IDI by 2019 (Pers. comm. Braniff 2017). The CAS system records all road crashes attended by NZ Police, and records the factors thought to be involved. Crashes involving other road users are included as well as car occupants. The CAS includes codes indicating if drivers of any vehicle were affected by alcohol, as measured by blood or breath alcohol, or by the attending officer's judgment. If pedestrians, cyclists, motorcyclists or passengers were known to be affected by alcohol this is also recorded. Injuries from crashes are categorised as fatal, serious or minor. The NZ Police now submit crash information electronically via iPhones which is forwarded to expert coders at the NZ Transport Agency who code the details using standard coding schemes to describe the movements of the vehicles involved in the crash and the factors that contributed to the crash. Not all injury crashes are reported to Police.[38]

Census data: will be used to provide accurate ethnicity data as for most other datasets, excluding mortality, ethnicity data are not necessarily accurate (the most recent NZ Census had 93% response rate).[39] Linking will occur using the IDI.

Completeness of the datasets: will be determined by examining the relevant data in the IDI and the quality and completeness of the datasets will be evaluated by using descriptive statistics, quantifying missing values and checking for outliers and/or extreme values for each relevant dataset. Investigation will also allow for comparisons of the relevant linked data to identify inconsistencies. Following this process, consultation will occur where appropriate with the relevant data analysts at the appropriate agency to ensure all data issues are explored, understood and, if possible, resolved.

Stage 2: Estimation of alcohol attributable harm to others

Prevalence of FASD (Maori and non-Maori)
As there are no prevalence data for Fetal Alcohol Spectrum Disorder (FASD) in New Zealand prevalence based on international studies will be used.[12,13] These studies also provide estimates for the different world regions that will be explored for use. We will apply the methods of Kraus et al 2017 and estimates will be based on the results of a meta-analytical approach using data on the prevalence of FASD and the prevalence of alcohol use during pregnancy.[12,13] Since the prevalence of FASD is related to the proportion of women who drink and the quantity consumed whilst pregnant, international estimates will be adjusted for pattern of drinking while pregnant in New Zealand, using survey data.[40] The New Zealand Health Survey (NZHS) is a face-to-face continuous survey that each year provides data on approximately 13,000 respondents per year nationally (de-identified individual-level data are accessible via Statistics New Zealand). Drinking in pregnancy and patterns of drinking during pregnancy will be estimated separately for Maori and non-Maori women to allow for Maori and non-Maori FASD prevalence estimates. Around 1,500 Maori and 5,000 non-Maori females are available each year in the NZHS survey.[41]

Adjustment for drinking pattern will include estimating the quotient for the average number of pregnant women who consumed alcohol per one case of FASD for countries with available data.[12,13] The prevalences of FASD will then be predicted by applying this quotient to the New Zealand prevalence of alcohol use during pregnancy. The Monte Carlo method will be applied to derive the Confidence Intervals (CI) for the point estimates of the prevalence of FASD (for details on the methods, see[12,13]). The prevalence of alcohol use during pregnancy and FASD, will be weighted by the number of livebirths in New Zealand.[12] Adjusting prevalence estimates for more detailed of patterns of drinking will be investigated in collaboration with NI: Rehm.

Road crash (Maori and non-Maori)
The burden of injury or death of victims of road crashes where the responsible driver had been drinking will be calculated. A victim here will be a passenger, pedestrian or somebody controlling another vehicle where their own actions did not cause the crash.

Injury and deaths due to others drinking
The New Zealand Transport Agency Crash Analysis (CAS) system which records all road crashes attended by NZ Police, and records the factors thought to be involved will allow linking of alcohol-involvement in a crash to the diagnosis codes for injuries and death resulting from that crash via hospital discharge data and mortality data (using the IDI). Hospital discharge and mortality data contains a comprehensive set of V-codes which will inform any translation of the victim crash injury and death data into burden of disease estimates (DALYs) (see section Stage 1 above for reliability of external coding). These data will be linked to the Census in the IDI so that ethnicity can be assigned (or in the case of death, mortality data ethnicity will be used). This will allow the estimated harm to be measured separately for Maori and non-Maori. Comparison between CAS crashes and hospital discharges will be undertaken to assess and if necessary adjust for under-coverage, as not all crashes resulting in injury are reported to police.[38]

If CAS is not introduced into the IDI within the time frame of the study (inclusion currently planned within study timeframe - 2019), the approach used by Connor et al.[4] will be used using CAS data alone. This approach calculates the people injured/fatally injured in crashes which involved a drinking driver, who were not themselves a drinking driver/pedestrian/cyclist. This makes an assumption that the drinking of the driver contributed to the crash. Given that alcohol is a strong risk factor for crashes and the fraction of drink-driving crashes that are attributable to the drinking of a driver is high this seems a reasonable assumption to make.[4]

Assault (Maori and non-Maori)
The IDI hospital discharge and mortality data sets contain clinical codes relating to each assault. ICD-10-AM codes (between X85 - Y09) relate to incidents where the injured party was assaulted by others and will inform any translation of the victim injury and death data into burden of disease estimates (DALYs). The data will be linked to census records to obtain ethnicity for morbidity. Accurate ethnicity data are available in the mortality data sets.

Assault: Injury and deaths due to others drinking
Alcohol involvement in assaults requires the Alcohol Attributable Fraction (AAF) approach to be used. The AAF will be calculated following the method of Kraus et al. (2017)[11] with input from NI Rehm. The estimation of the number of injuries and fatalities of third parties from interpersonal violence caused by alcohol will be based on the relevant injury and mortality data and determined using the alcohol fraction methodology. Generally, the number of assault injuries and deaths caused by consumption is calculated using an alcohol-attributable fraction (AAF), which is defined as the fraction of morbidity and mortality that would not be present if exposure to alcohol was 0, i.e., if every person was a lifetime abstainer. AAFs will be calculated using the etiological fraction methodology.[42] Population level alcohol survey data with prevalence and patterns of consumption are available (eg NZ Health Survey providing drinking patterns for Maori/non-Maori). Survey data may be adjusted for the under-coverage of total consumption in the population, where data on average daily alcohol intake are triangulated with data on adult *per capita* consumption using a gamma distribution.[43] The shape and scale parameters of the gamma distribution are calculated from the mean and standard deviation of the triangulated consumption data.[44] The gamma distribution is then integrated and gender- and disease-specific AAFs can be estimated (for Maori and non-Maori separately). Risk relations for alcohol will be deduced using recent meta-analyses.[45] The upper boundary of the integral will be capped to ensure that relative risk functions are used only in the range in which they have been defined. The AAFs will then be multiplied with injury and mortality data to obtain estimates for the number of assault injury and deaths that are attributable to alcohol consumption.

Intimate partner assault: Injury and deaths due to others drinking
These assault injuries and deaths will be further broken down to allow the burden of intimate partner violence to be identified. This will be done by linking hospital discharge and mortality data with Police data recording relationship of offender to victim in the IDI. Where sufficient data exists AAFs will be calculated separately for intimate partner violence (following the methods of Kraus et al 2017[11]).

Police data will be accessed through the IDI using standard data access protocols.[46] As such, strong collaborative working relationships with the Police departments to ensure data access is not a prerequisite. However, we do have strong working collaborations with Auckland Police in the alcohol area and have carried out initial scoping work with the Police data analytics group (Pers. comm. Cinco

2017). We also have previously consulted with key data analysts with regard to hospital discharge, mortality and road crash data.

Stage 3: Disability Adjusted Life Years

An additional development in relation to previous research on alcohol's harm to others will be the inclusion of measures of the health burden associated with these harms. We will calculate the DALYs lost as a result of other's drinking in relation to the three specific areas addressed above. The DALY is a measure of overall disease burden, made up of the sum of the Years of Life Lost (YLL) due to a condition and a weighted estimate of number of years lived with ill-health or disability (YLD).[15,16]

To compute years lived with disability for a particular health outcome in a given population, the number of people living with that outcome is multiplied by a disability weight that represents the magnitude of health loss associated with the outcome. Disability weights are measured on a scale from 0 to 1, with 0 implying a state that is equivalent to full health and 1 a state equivalent to death.[47] The severity of the injury/outcome will be assessed by linking the ICD code with the Abbreviated Injury Score 10.[10] We will use disability weights taken or adapted from Global Burden of Disease and Injury studies to estimate impairment.[47]

The approach taken here is to measure the burden of disease in the form of DALYs when summed across all individuals and conditions (WHO provides an Excel template for this deterministic DALY calculation). A stochastic approach for estimating DALYs is also available, where different distributions for the inputs can be provided, instead of a specific value[15,16] and differences in findings between the approaches will be explored.

DALYs will be estimated for Maori, non-Maori and combined.

Stage 4: Sensitivity analysis

Sensitivity analysis will be conducted to assess the extent to which results vary depending on contrasting assumptions or changing key parameters. For example, the use of IDI datasets will require restrictions to be defined on the data included in the analysis. Also, the FASD prevalence based on international studies will be adjusted for drinking patterns among pregnant women in New Zealand. The calculus of AAFs for assaults will also be adjusted for drinking patterns in New Zealand and will test the appropriateness of using a specific probability distribution (Gamma) for the average amount of alcohol consumed. All these "uncertainties" can be addressed by sensitivity analysis. The sensitivity analysis will allow us to determine how values of AAFs, Relative Risks and prevalence estimated under different assumptions will impact the robustness of DALYs outcome(s).