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RESEARCH REPORT

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# Quantifying alcohol-attributable disability-adjusted life years to others than the drinker in Aotearoa/New Zealand: A modelling study based on administrative data

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## Abstract

**Background and aims:** Quantifying the health burden of alcohol has largely focused upon harm to drinkers, which is an underestimate. There is a growing literature on alcohol's harm to others (HTO), but it lacks the systematic transfer of HTO into a comparative risk assessment framework. This study calculated disability-adjusted life years (DALYs) for fetal alcohol spectrum disorder (FASD), interpersonal violence and traffic injury due to another's drinking.

**Design:** This study is a disease burden analysis, using modelling of DALYs for New Zealand in 2018.

**Setting and participants:** The study took place among the Aotearoa/New Zealand population in 2018.

**Measurements:** The involvement of others' drinking was obtained from prevalence, alcohol-attributable fraction studies and administrative data. Disability weights (DW) for FASD were adapted from fetal alcohol syndrome (FAS) weights using a Beta–Pert probability distribution; for interpersonal injury, DWs used hospital events linked with injury compensation; for traffic injury, DWs used hospital events. Populations were stratified by ethnicity, age group and gender. A descriptive comparison was made with a previous estimate of DALYs for drinkers.

**Findings:** In 2018, 78 277 healthy life years were lost in Aotearoa/New Zealand due to alcohol's HTO. The main contributor (90.3%) was FASD, then traffic crashes (6.3%) and interpersonal violence (3.4%). The indigenous population, Māori, was impacted at a higher rate (DALYs among Māori were 25 per 1000 population; among non-Māori 15 per 1000 population). The burden of HTO was greater than that to drinkers (DALYs HTO = 78 277; DALYs drinkers = 60 174).

**Conclusions:** Disability from fetal alcohol spectrum disorder (FASD) appears to be a major contributor to alcohol's harm to others in Aotearoa/New Zealand. Taking FASD into account, the health burden of harm to others is larger than harm to the drinker in Aotearoa/New Zealand, and ethnicity differences show inequity in harm to others.

Quantification of the burden of harm informs the value of implementing effective alcohol policies and should include the full range of harms.

KEYWORDS
Aotearoa New Zealand, disability-adjusted life years (DALYs), fetal alcohol spectrum disorders (FASD), interpersonal violence, quantifying alcohol harm to others, traffic injury

## INTRODUCTION

Much of the quantification of alcohol-attributable harm globally relates to the impact of alcohol upon the drinker themselves. The contribution of alcohol's harm to people other than the drinker has been largely missing from global comparative risk assessments, such as the Global Burden of Disease (GBD) studies and the global status reports on alcohol and health [1]. The total health impact of alcohol is therefore underestimated, both globally and within countries, in the calculations that play an important role in shaping global and national policy agendas.

The research literature indicates that drinkers impose considerable health harm on others [2]. New Zealand is not an exception here; for example, considerable numbers report requiring health services because of someone else's drinking and increased exposure to heavy drinkers predicted increased use of health services [3] and reduced health status as measured by the EQ5-D questionnaire [4].

Quantifiable areas of alcohol's harm to others result from drinking during pregnancy, violence and traffic crashes [2]. While there is emerging evidence of the role of alcohol in the disease burden of child maltreatment [5], more causal research is needed. We are still increasing our knowledge about the burden of disease that drinkers impose on themselves, but there is limited comprehensive estimation of the burden of alcohol harm to others. A World Health Organization (WHO) study from the European Union that assessed harm to others accounted for low birth weight, traffic injury and violence but fetal alcohol spectrum disorder (FASD), a key area of alcohol's harm to others, was not included [6].

The impact of alcohol use during pregnancy is a key area of alcohol's harm to others resulting from FASD [which includes fetal alcohol syndrome (FAS)]. While the causal role of alcohol has been studied comprehensively in FASD, to the best of our knowledge the disease burden in terms of disability-adjusted life years (DALYs) has not previously been calculated for FASD. This is because disability weights, needed to calculate DALYs, have not been developed. DALYs have, however, been calculated previously for FAS [7]. The current study is the first to include FASD as part of an assessment of the burden of disease in order to quantify alcohol's harm to others.

Another important area for estimating the health burden of harm to others is traffic injury. The burden of alcohol on those other than the drinker has been studied in some detail for driving and other traffic participation [8] and was estimated globally [7].

With respect to interpersonal violence, the causal impact of alcohol on aggression and violence to others is well established [9–11]. Its quantification is complicated [8], because the drinking of the victim and of the perpetrator may contribute to the risk and severity of violent incidents [2]; nevertheless, early estimates indicate large effect sizes [8]. A WHO study estimate of alcohol's harm to others from violence accounted for 66 923 DALYs among the age group 15–64 years in 2004 in the European Union, which accounts for 14% of interpersonal violence [6].

While the health burden of harm to others impacts on all ethnicities in Aotearoa/New Zealand, this impact is not equally distributed. The indigenous people of Aotearoa experience disproportionate harm from alcohol, including harm to others. Māori are the indigenous population and have 35% increased odds of experiencing violence due to another's drinking [12]. Māori are also over-represented in serious traffic crashes involving alcohol, and tamariki Māori (Māori children) are more likely to be killed or seriously injured in alcohol crashes than non-Māori children [13]. Māori women have a significantly higher prevalence of drinking during pregnancy relative to other ethnic groups, leading to estimates of higher rates of FASD [14]. This suggests inequities in the disease burden of alcohol's harm to others for Māori relative to non-Māori.

Similar findings are reported for other indigenous peoples also experiencing processes of colonization. For example, DALY rates for violence were much higher for indigenous Australian males compared to the general population [15]. However, the health burden of harm to others has generally not been estimated separately for indigenous populations.

We do not have comprehensive estimates of the health burden that drinkers impose upon others. However, just as the second-hand effects of tobacco were important in the implementation of effective public health control policies so, too, will be estimating the burden of alcohol's harms to others. No previous analysis incorporating harm to others has used data similar to that available in New Zealand's Integrated Data Infrastructure (IDI) which links population-wide data sets in domains of health, welfare and demographics drawn from administrative, survey and census data. This is the first study, to our knowledge, to assess DALYs associated with FASD.

The aims of this study were to (1) estimate DALYs for three key areas of alcohol's harm to others in 2018: (i) FASD, (ii) interpersonal violence and (iii) traffic injury; (2) estimate these separately for Māori and non-Māori; and (3) compare alcohol-attributable DALYs for harm to others with those for the drinkers themselves.

# METHODS

## General considerations

Using DALYs, it is possible to compare the burden of a specific health condition with that of other diseases. DALYs are healthy life years lost, calculated by adding the adjusted number of years lived with disability (YLDs) and the number of years of life lost due to premature mortality (YLLs).

Calculating YLDs requires disability weights (DWs) and the duration of the disability in years. DWs represent the magnitude of health loss associated with a specific health outcome; the weights are measured on a scale from 0 to 1, where 0 equals a state of full health and 1 is a loss equivalent to death.

DALYs were calculated separately by each area of alcohol's harm to others (FASD interpersonal violence and traffic injury) The populations were stratified by ethnicity (Māori and non-Māori), age group and gender. New Zealand population (Census 2018) and life expectancy tables were obtained from Statistics New Zealand [16] by ethnicity, age group and gender. Total alcohol's harm to others DALYs for 2018 were calculated by adding up the specific DALYs for (i) FASD, (ii) interpersonal violence and (iii) traffic injury.

Stochastic DALY calculations were performed using the DALY calculator in the software R package DALY [17], which provides a generic tool for DALY calculation and the quantification of its uncertainty. Monte Carlo simulations are used to incorporate uncertainty [confidence intervals (CI)] by assuming probability distributions of the different epidemiological parameters involved in the DALYs calculation. The mean of those simulations was calculated as a point estimate (see Supporting information for details).

## Estimating FASD

Estimates for 2018 of FASD number of cases by ethnicity were obtained from Romeo *et al*., and were based on prevalence of drinking during pregnancy [14] (see Table 1).

Following the GBD 2019 study [18], DWs are only available for FAS. They were estimated at 0.016 (95% CI = 0.008; 0.030), 0.056 (95% CI = 0.035; 0.083) or 0.179 (95% CI = 0.119; 0.257), depending on whether FAS is mild, moderate or severe, respectively. DW for FASD is estimated at 0.030 (95% CI = 0.001; 0.094) based on the assumption that DW for FASD follows a Beta–Pert distribution with parameters mode = 0, minimum = 0 and maximum = 0.180 (see Supporting information for details). FASD (ICD10 codes P04.3 and Q86.0), as underlying cause of death was not recorded during 2018 in New Zealand [18]; therefore, the estimates of DALYs for FASD are based on the morbidity component only.

**TABLE 1** Estimated prevalence and number of cases of FASD in general population in New Zealand, 2018, by ethnicity.

| Population | FASD prevalence | FASD cases |
|---|---|---|
| Māori | 2.06% | 15 959 |
| Non-Māori | 1.11% | 44 160 |
| Total | 1.34% | 60 119 |

Abbreviation: FASD = fetal alcohol spectrum disorder.

## Estimating interpersonal violence

Data on interpersonal violence by gender, ethnicity and age from 2014 to 2018 were compared to check consistency. They were obtained from the Statistics New Zealand IDI. The IDI is a collection of linked data sets covering domains such as health, welfare and demographics drawn from administrative, survey and census data. Data sets are linked to the IDI 'spine' using probabilistic linkage. The IDI spine aims to include all people who have ever been a resident in New Zealand. For health records linked to the spine, the linkage rate was estimated in 2018 to be 85% (88% among New Zealand residents) and the false-positive rate was estimated at 0.8% [19] (see Supporting information for details).

We selected ICD10 codes X85–Y09 associated with assaults as cause-of-injury from both hospital discharges and mortality data sets. For hospital events we used the main nature-of-injury event to assign respective disability weights injury health state. ICD codes mapped to nature of injury and duration of short-term disability were obtained from Haagsma *et al*. [20] Short-term durations were adjusted to reflect longer-term disability. To do so, we used the length of hospital stay and linked the hospital discharge event to the number of days that the individual has had their income compensated from the Accident Compensation Corporation (ACC) data set, which is also available in the IDI. Disability weights were obtained from WHO Global Health Estimates [21]. For assaulted individuals with multiple injuries comorbidity adjustments were applied to DWs (see Supporting information for details).

The estimation of alcohol involvement in interpersonal violence requires the alcohol-attributable fraction (AAF) approach to be used. We used AAFs from 2004/5 derived from an Australian study, as reported in Laslett *et al*. [22]. The AAF for others' drinking was estimated on average at 43.8% for men and 44.7% for women aged 15-+ years. For under age 15 years, AAF was considered as 27%. These estimates are similar to self-reported interpersonal violence related to another's drinking in New Zealand [12], and lower than other estimates for European countries [23]. Table 2 summarizes interpersonal violence events in 2018 by age group and ethnicity.

DWs and duration of disability associated with treated injury health states in 2018 were modelled by fitting beta and gamma distributions by age group and gender, respectively (see Supporting information for details).

## Estimating traffic injury

Data on reported traffic injuries are available from the crash analysis system (CAS) of Waka Kotahi New Zealand Transport Agency [24].

**TABLE 2** Hospitalizations and mortality associated with alcohol-attributable interpersonal violence in 2018, Statistics New Zealand IDI.

| | Hospital events | | | Mortality events | | | |
|---|---|---|---|---|---|---|---|
| Age (years) | Māori | Non-Māori | Total | Māori | Non-Māori | Total | AAF |
| 0–14 | 99 | 105 | 204 | S | S | S | 0.270 |
| 15+ | 2604 | 3696 | 6300 | 24 | 33 | 57 | 0.442 |

*Note*: S = values suppressed according to Statistics New Zealand IDI confidentiality rules (frequency < 20).
Abbreviations: AAF = alcohol attributable fraction; IDI = integrated data infrastructure.

We considered traffic injuries resulting from someone else's drinking by age group, ethnicity and severity (fatal, serious or minor injury) from 2016 to 2020 to check consistency. Alcohol involvement in traffic injury was assessed where a driver or other protagonist (e.g. pedestrian and cyclist) aged 20 years or over had either more than 250 μg of alcohol per litre of breath or more than 50 mg of alcohol per 100 ml of blood. If the driver was aged under 20 years a zero limit was used, consistent with the New Zealand legal alcohol limit for those aged under 20 years. As in Connor & Casswell [25], everyone who refused a test was counted as alcohol-involved, and those who had alcohol suspected by police but were either not tested or had no test result recorded were also counted. According to Waka Kotahi New Zealand Transport Agency [26], a serious injury (fracture, concussion, severe cuts or other injury) requires medical treatment or removal to and retention in hospital, whereas minor injuries are not 'serious' but require first aid, or cause discomfort or pain to the person injured. Numbers of serious and minor injuries were adjusted for under-reporting as in Connor & Casswell [25] (see Table 3).

The ethnicity of drivers in alcohol-involved traffic injury was identified as Māori (18.3%), non-Māori (34.3%) and missing (47.4%). We randomly assigned the missing ethnicity cases as either Māori or non-Māori by using the distribution of ethnicity associated with the Statistics New Zealand IDI data hospital discharge events. To do so, we selected all ICD10 codes V00–V89 events (causes of injuries associated to vehicle accidents) happening in 2018. The observed two ethnicity proportions (Māori 23.4%, non-Māori 76.6%) were used in a Bernoulli distribution to reflect the probability of being Māori (or non-Māori) among the missing cases.

For calculating DALYs, DWs associated with treated traffic injury health states were estimated by using Statistics New Zealand IDI data on hospital discharges. We included ICD10 codes V00–V89 from 2016 to 2018 by age group and gender, and beta distributions were fitted as for (ii) interpersonal violence. As minor injuries are less likely to be associated with disabilities [26], we calculated DALYs considering only crashes with serious and fatal outcomes. As a sensitivity analysis we also calculated DALYs for traffic injury with those missing ethnicity as a subpopulation (see Supporting information for details). Duration of disability was modelled assuming gamma distributions and the same methodology as for interpersonal violence (see Supporting information for details).

Extraction and linking of data sets in the IDI, as well as modelling of DWs and duration of disability, was carried out using SAS Enterprise Guide version 7.1.

**TABLE 3** Traffic injuries resulting from someone else's drinking, by road user type, crash analysis system (CAS) NZ 2018. Estimates are adjusted for under-reporting; [*n*] denotes numbers reported.

| | Drivers *n* (%) | Passengers *n* (%) | Others *n* (%) | Total |
|---|---|---|---|---|
| Fatal injuries | 22 (33.8) | 35 (53.8) | 8 (12.3) | 65 |
| Serious injuries | 251 (15.0) [70] | 984 (58.9) [275] | 437 (26.1) [122] | 1672 [467] |
| Minor injuries | 2867 (32.0) [458] | 4282 (47.7) [684] | 1821 (20.3) [291] | 8970 [1433] |
| Total | 3140 [550] | 5301 [994] | 2266 [421] | 10 707 [1965] |

### Comparison of the disease burden drinkers impose upon others and to themselves

We present a descriptive comparison of the total DALYs from harm to others estimated in this study, with DALYs estimated for all causes for drinkers from the Global Burden of Disease study 2016 (GBD 2018 data extract 2016) [7].

The analysis was not pre-registered and the results should be considered exploratory.

## RESULTS

### FASD

We estimated that FASD was responsible for a loss of 70 668 healthy life years in New Zealand in 2018, equivalent to a loss of 15 healthy life years per 1000 population (Table 4). As FASD as an underlying cause of death was not observed in 2018, FASD DALYs are 100% attributable to years lived with disability (YLD). Note that the impact of FASD in healthy life years lost is higher among Māori than non-Māori per 1000 population, which is explained by the higher estimated FASD prevalence among Māori.

### Traffic injury

We estimated a total of 10 707 road traffic injuries resulting from someone else's drinking in 2018 (see Table 3). By ethnicity, this

comprised 23.5% Māori and 76.5% non-Māori. Based upon serious and fatal injuries, DALYs were estimated as a loss of 4943 healthy life years. These years included the equivalent of 1924 full healthy life years lost due to living in a less-than-optimal health state (YLDs), and 3019 healthy life years lost due to premature death (YYLs); that is, 39% YLD and 61% YLL, respectively. Relative to per 1000 population, Māori lost more years of healthy life than non-Māori (see Table 5).

## Interpersonal violence

Alcohol-attributable interpersonal violence included hospital events and mortality events (see Table 2) and contributed a loss of 2666 healthy life years. These 2666 DALYs lost are the sum of 1531 full healthy life years lost due to living in a less-than-optimal health state (YLDs) and 1135 healthy life years lost due to premature death (YLLs); that is, 57% YLD and 43% YLL, respectively. The Māori population lost more years of healthy life than non-Māori due to interpersonal violence per 1000 population (see Table 6).

## Summary

In 2018, 78 277 healthy life years overall were lost due to alcohol's harm to others in New Zealand. This is equivalent to 16 healthy years lost per 1000 population. The main contributor to the overall DALYs was FASD (90.3%), followed by traffic injuries resulting from someone else's drinking (6.3%) and alcohol-attributable interpersonal violence (3.4%). Among years of life lost due to premature mortality (YLLs), traffic injuries were the main contributor (72.7%), followed by interpersonal violence (27.3%). When comparing ethnicities, the Māori population was disproportionately impacted by alcohol's harms to others per 1000 population; see Table 7.

## Comparison of DALYs for harm to others with DALYs for drinkers

The burden of disease attributable to harm to others estimated in this study (78 277 DALYs) was greater than the total health burden drinkers impose upon themselves, all causes (60 174 DALYs) in New Zealand.

**TABLE 4** Estimates of years lived with disability (YLD), years of life lost to premature mortality (YLL) and disability-adjusted life years (DALY) lost due to FASD, NZ, 2018, by ethnicity. Lower and upper 95% confidence interval for DALYs in parentheses.

| FASD | YLD | YLL | DALY | DALY per 1000 population |
|---|---|---|---|---|
| Māori | 17 441 | 0 | 17 441 (112–64 143) | 22 (0.1–82) |
| Non-Māori | 53 227 | 0 | 53 227 (353–195 264) | 13 (0.1–48) |
| Total | 70 668 | 0 | 70 668 (465–259 407) | 15 (0.1–54) |

Abbreviation: FASD = fetal alcohol spectrum disorder.

**TABLE 5** Estimates of years lived with disability (YLD), years of life lost to premature mortality (YLL) and disability-adjusted life years (DALY) lost due to alcohol-attributable traffic injury (serious injuries and fatalities) resulting from someone else's drinking, NZ, 2018, by ethnicity. Lower and upper 95% confidence interval for DALYs in parentheses.

| Traffic injury | YLD | YLL | DALY | DALY per 1000 population |
|---|---|---|---|---|
| Māori | 543 | 626 | 1169 (641–3841) | 1.5 (0.8–5.0) |
| Non-Māori | 1381 | 2393 | 3774 (2443–9946) | 0.9 (0.6–2.5) |
| Total | 1924 | 3019 | 4943 (3084–13 787) | 1.0 (0.6–2.9) |

**TABLE 6** Estimates of years lived with disability (YLD), years of life lost to premature mortality (YLL) and disability-adjusted life years (DALY) lost due to alcohol-attributable interpersonal violence, NZ, 2018, by ethnicity. Lower and upper 95% confidence interval for DALYs in parentheses.

| Interpersonal violence | YLD | YLL | DALY | DALY per 1000 population |
|---|---|---|---|---|
| Māori | 626 | 484 | 1110 (500–3993) | 1.4 (0.6–5.1) |
| Non-Māori | 905 | 651 | 1556 (674–5937) | 0.4 (0.2–1.5) |
| Total | 1531 | 1135 | 2666 (1174–9930) | 0.6 (0.2–2.1) |

**TABLE 7** Estimates of years lived with disability (YLD), years of life lost to premature mortality (YLL) and disability-adjusted life years (DALY) lost due to alcohol's harm to others, NZ, 2018, by outcome and ethnicity. Lower and upper 95% confidence interval for DALYs in parentheses.

| Outcome | YLD | YLL | DALY | DALY per 1000 population |
|---|---|---|---|---|
| FASD | 70 668 | 0 | 70 668 (465–259 407) | 15 (0.1–54) |
| Interpersonal violence | 1531 | 1135 | 2666 (1174–9930) | 0.6 (0.2–2.1) |
| Traffic injury | 1924 | 3019 | 4934 (3084–13 787) | 1.0 (0.6–2.9) |
| Total Māori | 18 610 | 1110 | 19 720 (1253–71 977) | 25 (2–93) |
| Total non-Māori | 55 513 | 3044 | 58 557 (3470–211 147) | 15 (1–53) |
| Total | 74 123 | 4154 | 78 277 (4723–283 124) | 16 (1–59) |

## DISCUSSION

This study quantifies three key aspects of alcohol's harm to others using DALYS as the metric and compares the estimates with the harm to the drinker. The findings support claims that the harm to those other than the drinker is substantial, and estimates of harm that have largely focused upon damage to the drinker are considerable underestimates of alcohol harm. These findings also support the need to consider inequities in the disease burden of alcohol's harm to others for Māori relative to non-Māori.

The results indicate that in 2018 New Zealanders who were victims of harm experienced due to another's consumption of alcohol lost 78 000 healthy years of life. This suggests a contribution of approximately 56% to overall alcohol harm in Aotearoa/New Zealand, given estimates of 60 174 DALYs lost based on harm to the drinker in 2016 [27]. Other research supports a large contribution of harm to others to total harm, such as an Australian study which found that the economic costs from others' drinking are of much the same magnitude as the costs that drinkers impose upon themselves [28]. A WHO study from Europe estimated that harm to others made up only 5.4% of total alcohol-attributable DALYs (200 000 DALYs for harm to others relative to 4 043 000 healthy life years lost for harm to the drinker [29]). However, this European study did not include FASD, which in our study was the largest contributor to health years of life lost. If FASD was excluded in the present study, harm to others would represent approximately 13% of total alcohol-related harm in Aotearoa.

The disability experienced throughout their lives by those born with FASD, given that there is no cure but only management of the impairment [30], makes this is a major contributor to the harm alcohol products cause to those other than the drinker. There is substantial spillover harm to those caring for those with FASD [31]. The estimate of life years lost from FASD in the current analysis was zero; codes for FAS and newborn affected by maternal use of alcohol (ICD10 codes P04.3 and Q86.0) as underlying cause of death were not observed during 2018 in Aotearoa/New Zealand. However, there is some evidence of significantly reduced life expectancy among those diagnosed with FAS, probably to reflect the difficulties experienced, as people with FASD are over-represented in Justice and Corrections populations and more at risk of suicide [32, 33].

DALYs from traffic injury were higher than those contributed by interpersonal violence. This was largely because mortality was more likely among the victims of alcohol-related traffic crashes. New Zealand is a high-income country with similar levels of harm to others from traffic crashes as other high-income countries (approximately 40%) [25]. However, this level of harm may differ from countries with other characteristics.

The experiences of Māori from harm caused by the drinking of others are an indicator of inequity related to the burden of harm from alcohol. We estimated that Māori experienced almost twice the rate of DALYs relative to non-Māori per head of population. This is similar for harms to the drinker, where Māori are twice as likely to die prematurely from alcohol-attributable causes compared with non-Māori [34], and reflects a history of colonization which impacts in similar ways among other indigenous peoples [35].

There has been less attention paid to the second-hand effects of alcohol compared with tobacco, where it has played an important role in policy development [2]. An analysis in New Zealand in 2010 of DALYs as consequence of second-hand smoke found an estimated 1989 DALYs [36]. This is considerably less than the 78 000 DALYs experienced from just three of the aspects of alcohol's harm to others in 2018. The majority (84%) of the second-hand smoke DALYs were due to premature death, whereas the majority (94.6%) of alcohol's harm to others DALYs were attributable to lives lived with disability. This illustrates the importance of taking into account differences in the nature of the harms from different health-harming products and ensuring that the full burden is included in quantification and policy recommendations.

### Limitations

FASD is estimated based upon self-reported prevalence of drinking in pregnancy and may be an under- or overestimate [14]. The contribution of FASD in the YLL part of the DALYs is likely to be underestimated, given that deaths are not recorded with their associated codes, but there is some evidence of premature mortality [33].

For interpersonal violence, the drinking of the victim and of the perpetrator may both contribute to the risk and severity of violent incidents. This complicates the assessment of violent injuries

attributable to someone else's drinking and is a limitation. We used Australian AAF estimates from 2004/5 and applied them to 2018 Aotearoa New Zealand data. AAFs may be context-specific; this is the reason for using data from Australia, which is similar to Aotearoa/New Zealand. AAFs may also change over time [37] and this may have introduced some inaccuracy. However, our estimates are lower than estimates from European countries [23].

The data used for calculating road crashes DALYs (NZTA CAS) had considerable missing ethnicity information. We randomly assigned the missing ethnicity cases as either Māori or non-Māori by using the ethnicity proportions associated with the Statistics New Zealand IDI data hospital discharge events, but it will have fallen short of self-identified ethnicity.

Māori-specific life expectancies were used for the calculation of YLL, which will have resulted in conservative estimates as they are markedly lower than non-Māori estimates. This reflects the situation of indigenous peoples experiencing processes of colonization.

Finally, only three conditions from harm to others were included in the study, leading to an underestimation. For example, others drinking has been causally linked to more injury categories than traffic.

## CONCLUSION

To our knowledge, this is the first analysis of DALYs from alcohol's harm to others which included the impacts of FASD. The findings of harm from FASD, interpersonal violence and traffic injury suggest that the impact on disability-adjusted years of life lost for those impacted by other's drinking were as high as alcohol's impacts on the drinkers themselves. This suggests a substantial underestimation of the burden from alcohol if harm to others is not taken into account. The findings also show the ongoing health inequity disadvantaging indigenous people, and this exacerbates the injustices of colonization for Māori. The findings highlight the importance of including measures of harm to others, the impacts of FASD and health inequities in policy discussions in order to properly assess the benefits of implementing effective alcohol policy.

### AUTHOR CONTRIBUTIONS

**Sally Casswell:** Conceptualization (equal); formal analysis (supporting); writing—original draft (equal). **Taisia Huckle:** Conceptualization (equal); formal analysis (supporting); validation (equal); writing—original draft (equal). **Jose Romeo:** Formal analysis (equal); validation (equal); writing—original draft (supporting). **Helen Moewaka Barnes:** Writing—review and editing (supporting). **Jennie Connor:** Writing—review and editing (supporting). **Jurgen Rehm:** Writing—review and editing (supporting).

### DECLARATION OF INTEREST

None to declare. The funding agency had no influence on data collection, analysis, interpretation, writing of the manuscript and the decision to submit.

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### DATA AVAILABILITY STATEMENT

Data sharing: The data that support the findings of this study are not publicly available due to the conditions of data access from the data custodians (Statistics New Zealand).

### DATA SHARING

The data that support the findings of this study are not publicly available due to the conditions of data access from the data custodians (Statistics New Zealand).

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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