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Te Whare Wānanga o Otāgo

NEW ZEALAND

Using integrated data to examine alcohol related harm in Aotearoa New Zealand

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March 2024.

Acknowledgements and funding

This research was supported by a University of Otago Research Grant, approved October 2020.

We would also like to thank colleagues at the Department of Public Health at the University of Otago, Wellington for their thoughtful feedback on the development of this project.

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Suggested citation

Davies A., Mizdrak A., Herbert, S., Gibb S., & Jones A. (2024). *Using integrated data to examine alcohol related harm in Aotearoa New Zealand*. Wellington: University of Otago.

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IDI disclaimer: These results are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI) which is carefully managed by Stats NZ. For more information about the IDI please visit <https://www.stats.govt.nz/integrated-data/>.

Contents

Executive summary	4
1. Introduction	6
Alcohol consumption is a substantial contributor to health and social harms.	6
Māori experience inequitable harms from alcohol.	6
Measurement of alcohol related harm in Aotearoa New Zealand is limited.	6
Our research: can integrated data provide a broader picture of alcohol related harm?	7
3. Sources of alcohol information in the IDI	10
Scope and inclusions.....	10
Method for identifying sources.	10
Results: Collections with individual level information about specific alcohol harm	10
Summary of source limitations and gaps.....	15
4. Integrated measures of alcohol related harm – Methods.....	16
People and sources	16
Variables	16
Statistical analysis	19
5. Integrated measures of alcohol related harm – Results.....	20
Prevalence estimates – counts and percentages.....	20
Comparison with other prevalence estimates.....	22
Patterns by age and ethnic group, and age standardised percentages.....	23
Algorithm sources	25
6. Discussion.....	28
Conclusion.....	29
References	31
Appendix A: Condition list of all alcohol related harms: project inclusions and ICD-10-AM codes	33

Executive summary

Background

Alcohol has been ranked as Aotearoa New Zealand's most harmful drug, not only in terms of harm to the people who consume it, but also the harm to others [1]. Alcohol consumption is a substantial contributor to health and social harms, and is a leading cause of both morbidity and mortality for Aotearoa New Zealand [2, 3]. Māori are more likely than other groups in the population to have hazardous drinking patterns [4], and harms from alcohol are disproportionately experienced among Māori [5]. While alcohol use is a known problem, there is a lack of current, comprehensive quantifications of the harm from alcohol [6]. Alcohol research has underutilised Aotearoa New Zealand's world-class data available through the Integrated Data Infrastructure (IDI).

Aims

The aims of our research were:

1. to describe sources of information on alcohol related harm available within the IDI, and
2. to trial a method for integrating data from these sources to create a summary measure of alcohol related harm in Aotearoa New Zealand.

Methods

We identified the whole population collections and variables within the IDI with information about alcohol use disorder and alcohol related harm, for individuals in the IDI resident population at June 2018. Key collections identified included datasets from the Ministry of Health: the National Minimum Dataset (NMDS, named 'publicly funded hospitalisations' in the IDI), Programme for the Integration of Mental Health Data (PRIMHD) and predecessor the Mental Health Information National Collection (MHINC), the Mortality collection, and the Pharmaceutical Collection; Ministry of Justice Criminal Court Charges data; and Ministry of Social Development benefits data. We used a specific alcohol related harm framework developed by Wright [6] as a reference point for searching for information sources, and also for understanding gaps / biases.

We created two algorithms using the data collections in the IDI to flag individuals in the June 2018 IDI resident population with an indication of alcohol use disorder, or a broader indication of alcohol related harm (based on the person's own drinking, not including conditions such as foetal alcohol syndrome) and calculated point prevalence estimates (as at 30 June 2018) amongst IDI Aotearoa New Zealand residents. We compared these with prevalence estimates from Te Rau Hinengaro – the New Zealand Mental Health Survey [7], and NZ Health Survey rates of hazardous drinking [4]. To account for differences in age structure between ethnic populations, we also calculated directly age-standardised proportions. We calculated the percentage of people identified through each source collection, to examine differences in the ways the algorithms pick up people (and any associated potential bias).

Main findings

Just over 14,500 people met the criteria for alcohol use disorder in the 2017/18 year, and more than 35,000 people were recorded as experiencing some kind of alcohol related harm (including those with alcohol use disorder) in the same one-year period in IDI datasets. Our estimates of alcohol use disorder and alcohol related harm were lower than estimates derived from surveys (e.g. Te Rau Hinengaro 12-month prevalence estimates: 2.6 percent (alcohol abuse) and 1.3 percent (dependence) [7] are higher than the estimates obtained using our IDI-based alcohol use disorder (0.3 percent) and alcohol related harm measures (0.8 percent) for a one-year period). Differences

between ethnic groups persist even after underlying differences in population age structure are accounted for (age-standardised percent, alcohol use disorder, five-year lookback: Māori 2.0 %, European 1.0 %; age-standardised percent, alcohol related harm, one-year lookback: Māori 2.2 % European 0.9 %).

Over a five-year period, proportionally more Māori and Pacific peoples with an indication of an alcohol use disorder were identified solely through specialist mental health services (49 percent, and 62 percent respectively) than people in the European and Asian / MELAA / Other ethnic groups (33 percent and 41 percent respectively). A larger proportion of Māori (45 percent), Pacific (51 percent), and people in the Asian / MELAA / Other ethnic group (46 percent) were identified as experiencing alcohol related harm in one-year period solely through their criminal convictions, than people in the European ethnic group (30 percent).

Implications

Our algorithms are likely to underestimate alcohol use disorder and alcohol related harm due to gaps identified in source data (using Wright's [6] alcohol related harm framework), and historic and current problems with healthcare access. Because these algorithms underestimate alcohol use disorder and alcohol related harm, and because they are likely to reflect real-world biases (e.g., Māori are more likely to be convicted of an offence), we recommend that these algorithms are not used in their current form in research which seeks to use the algorithms as an 'exposure' measure (e.g. to explore differences between people with an indication of alcohol related harm and those without, in terms of other IDI variables). The five-year lookback algorithm for alcohol use disorder may be useful to examine treatment access (perhaps more at the severe end, given missing primary care diagnosis data). Capturing more complete PRIMHD diagnosis data and any primary care diagnosis data would improve this measure and could be a useful focus for future work in this area. The alcohol related harm algorithm may be useful as an 'outcome' measure in future research – as it does reflect some aspects of alcohol related harm – though researchers need to be mindful that bias most likely plays a part in this measure.

1. Introduction

Alcohol consumption is a substantial contributor to health and social harms.

In terms of both the harm to people who consume it, and harm to others, alcohol has been ranked as Aotearoa New Zealand's most harmful drug [1].

Alcohol was the fifth leading cause of morbidity and mortality for Aotearoa New Zealand in 2016 [2, 3]. The harms from an individual's drinking can be acute (e.g. physical injury) and chronic (e.g. alcohol dependence, multiple cancers including breast and colorectal, cirrhosis of the liver), and may also extend beyond the individual to harm others (e.g. members of the drinker's whānau, workmates, friends, and strangers) [8]. The health and wider social harms of alcohol are extensive, including foetal alcohol syndrome effects, child neglect, interpersonal violence, property damage offences, alcohol-impaired driving, relationship breakdowns, and numerous other harms [9].

In Aotearoa New Zealand in 2021/22, around four in five adults drank alcohol in the past year and nearly one in five adults reported drinking at hazardous levels: an estimated 19 percent of adults in the 2021/22 New Zealand Health Survey had an Alcohol Use Disorders Identification Test (AUDIT) score of 8 or more (which is based on frequency and amount of alcohol consumed), indicating patterns of drinking with a high risk of future physical or psychological ill-health. Men were nearly twice as likely than women to drink at hazardous levels, after adjusting for age [4].

Māori experience inequitable harms from alcohol.

Māori are more likely than other groups in the population to have hazardous drinking patterns. Around one in three Māori adults (33 percent) had an AUDIT score of 8 or more compared with one in five Europeans (20 percent) in the 2021/22 New Zealand Health Survey [4].

Harms from alcohol are disproportionately experienced among Māori, with rates of alcohol related death for Māori more than double that of European rates [5]. The impact of colonisation; including extensive land alienation, cultural marginalisation[10], racism and discrimination, socio-economic deprivation, and enduring and systemic inequities within the health system contribute to these disproportionate levels of harm [11, 12].

Measurement of alcohol related harm in Aotearoa New Zealand is limited.

While alcohol use is a known problem in Aotearoa New Zealand and impacts Māori disproportionately, there is a lack of current and comprehensive quantifications of the harm from alcohol [6]. Much of what is known about alcohol use and harm in Aotearoa New Zealand draws on single sources of information and presents analyses for these within a narrowly defined area. For example: the NZ Health Survey asks participants about their current average patterns of alcohol use; data from Police relating to alcohol use is presented in the context of crime (either for perpetrators or victims of crime); research around alcohol and injury often sits only within the context of wider injury data.

Alcohol research has underutilised Aotearoa New Zealand's world-class data available through the Integrated Data Infrastructure (IDI). The IDI is a large research database of de-identified person-level data, curated by Statistics NZ. Importantly, data in IDI are linked at the individual level, allowing us to connect different sources of information to a single individual, for example information from the

health and justice systems. As at May 2023, the Statistics NZ Microdata Research database contains information on only four current or past IDI projects which included the word “alcohol” in their research summaries (excluding our research), with most being focussed on a specific topic (SUDI, impact of other people’s drinking on children, etc). The reasons for this lack of alcohol research using the IDI are unclear; it would be useful to examine the range and accuracy of alcohol-related data available in the IDI.

Our research: can integrated data provide a broader picture of alcohol related harm?

The aims of our research were:

1. to describe sources of information on alcohol related harm available within the IDI, and
2. to trial a method for integrating data from these sources to create a summary measure of alcohol related harm in Aotearoa New Zealand.

In our work, we sought to examine alcohol related harm separately from other substance-related harm. Some sources of alcohol related harm information have been identified and published as part of guides on mental health and addiction conditions in the IDI [13], and substance and alcohol use data in the IDI [14] – however, both guides bundle alcohol with other substances. As policy responses to alcohol may differ from responses to other substances (for example, because alcohol is legally available whereas other substance of abuse may not be), we sought to examine alcohol related harm separately.

While alcohol plays a role in many health conditions, we focussed on alcohol use disorder, and other wholly attributable alcohol related conditions – these are detailed in Appendix A. Further, our analyses focused on harms caused by the person’s own drinking (not through the drinking of others, e.g., foetal alcohol syndrome). The reason for this focus was that we are able to determine with confidence that people flagged as having experienced alcohol harm due to wholly alcohol attributable conditions actually did drink alcohol.

Given that Māori experience a disproportionate level of alcohol related health and social burden, our research was based around a conceptual framework that explicitly incorporated Te Ao Māori (Māori worldview) and Māori perspectives of health. We have chosen to use the framework proposed by Wright [6] which is specific to alcohol related harm and draws on four of the six key components in Te Pae Māhutonga [15], a Māori health promotion model developed by Mason Durie. The four components in Wright’s framework are: Hauora (health and wellbeing – though note that in Te Pae Māhutonga this is captured as Toiora – healthy lifestyles), Te Oranga (participation in society), Mauriora (access to Te Ao Māori / cultural identity), and Taiao (physical environment – though note that in Te Pae Māhutonga this is defined slightly differently as Waiora – environmental protection). The key elements of Ngā Manukura (community leadership) and Te Mana Whakahaere (autonomy) within Te Pae Māhutonga are not included in Wright’s framework. The alcohol related harms in each of the four spheres in Wright’s framework ripple through to be felt at the individual, whanau, and community levels. Examples of the kinds of harms felt in each of these spheres are shown in the alcohol related harm matrix in Table 1.

Table 1: Sourced from Wright [6], selected examples of indications / areas of harm: an alcohol related harm matrix:

	Hauora – Tinana, hinengaro + wairua <i>Wellbeing – physical, mental + spiritual</i>	Te Oranga <i>Participation in society</i>	Mauriora <i>Access to te ao Maaori / cultural identity</i>	Taiao <i>Physical environment</i>
Individual	<ul style="list-style-type: none"> - Close relationships/support people - Alcohol-related conditions causing harm to physical, mental, and spiritual wellbeing - Mortality from alcohol-related conditions - Alcohol-related drownings 	<ul style="list-style-type: none"> - Performance in education / work / parenting / relationships - Absenteeism from education/work - Employment / income - Criminal conviction / imprisonment - Marginalisation / stigmatisation – access and quality of healthcare and other services 	<ul style="list-style-type: none"> - Reduced opportunity for access to cultural institutions, social resources, and language (secondary to marginalisation / stigmatisation related to hazardous alcohol use) 	<ul style="list-style-type: none"> - Damage to personal property / possessions - Sub-optimal housing conditions
Whaanau	<ul style="list-style-type: none"> - Perinatal conditions: IUGR, FASD, preterm birth, miscarriage - Neglect of children – emotional + physical - Developmental / behavioural disorders related to abuse / neglect / FASD - Injury/trauma/violence to whaanau + friends - Whaanau quality of life 	<ul style="list-style-type: none"> - Productivity (secondary to loss of sleep, noise disturbance, emotional distress) - Current and future income / resources for whaanau - Loss of family member support (directly from hazardous alcohol use or indirectly through incarceration) 	<ul style="list-style-type: none"> - Reduced opportunity for whaanau to access cultural institutions, social resources, and language (secondary to marginalisation / stigmatisation related to hazardous alcohol use of whaanau member) 	<ul style="list-style-type: none"> - Damage to whaanau property / possessions - Sub-optimal housing conditions
Community	<ul style="list-style-type: none"> - Injury/trauma to others - Healthcare opportunity costs of alcohol-related harms to health and wellbeing 	<ul style="list-style-type: none"> - Loss of economic productivity as consequence of an individual’s hazardous alcohol use, and impact on workmates, employers and businesses - Opportunity cost of law, justice, welfare, child protection and education costs generated from alcohol-related social harms 	<ul style="list-style-type: none"> - Adverse effects at a collective level on religious and cultural practices 	<ul style="list-style-type: none"> - Damage to public property / amenities - Increased alcohol-related offences - Perception of unsafe public environment

Note 1: Table 1 (above) is reproduced exactly as presented by Wright [6], including use of double vowels, as per the dialect of Waikato-Tainui, the mana whenua of the area in which the framework was developed. In contrast, the rest of this report adopts the use of macros on relevant Māori terms, in line with University of Otago recommended practices.

Note 2: IURG = Intrauterine Growth Restriction; FASD = Foetal Alcohol Spectrum Disorder.

The framework was used not only as a reference point for searching for information on alcohol related harm, but also for understanding gaps (and associated bias).

The advantage of accessing this information within the IDI is that it allows information from different sources to be combined. Deidentified data for individuals across data collections within the IDI can be linked using a Statistics NZ ID – a ‘unique identifier’ for each person with records in the IDI. In terms of Wright’s framework, this means that much of the analysis possible using IDI data will work at the ‘individual’ level. However, geographic data is also available within the IDI, so analysis within the ‘community’ sphere (for geographically defined communities) may also be possible.

We aimed to create summary measures of alcohol related harm in Aotearoa New Zealand by integrating data across collections. Past research has utilised data integration methods to examine the prevalence of specific health conditions, such as diabetes[16], cardiovascular disease [17], and gout [18]. We trialled the use of similar data integration methods to examine the prevalence of alcohol use disorder, and alcohol related harm more broadly. An examination of potential uses of these methods also includes a discussion of sources of bias and data quality.

3. Sources of alcohol information in the IDI

Scope and inclusions

The IDI includes survey and administrative data from a range of government and non-government organisations [19]. The unique strength of the IDI is the ability to combine data across sources for individual people. To explore and make the most of this strength, we have focused on linking data from ‘whole population’ datasets, rather than survey datasets which contain data for much smaller samples of the population. A whole population dataset is information that relates to the whole of Aotearoa New Zealand on a specific subject. For example, the Mortality Collection contains information on all deaths in Aotearoa New Zealand.

Method for identifying sources.

We identified the whole population collections and variables within the IDI with information about alcohol use disorder and alcohol related harm, for individuals in the IDI resident population (IDI-ERP) as at June 2018 (the de-identified ‘list’ of all people living in Aotearoa New Zealand at June 2018, based on records of activity within administrative data at this point in time).

We scanned existing literature for information about alcohol related variables in the IDI, including the following publications:

- A technical guide produced by the Social Investment Agency in 2019 (*Using integrated data to understand mental health and addiction conditions*)[13]
- A user guide published by the Virtual Health Information Network (VHIN) in 2019 (*User guide to mental health and addiction data in the Integrated Data Infrastructure*) [20]
- A report published by the Health Promotion Agency (HPA) in 2019 (*Substance and alcohol use data in the Integrated Data Infrastructure*)[14]
- Specific information about Ministry of Justice court charges data relating to alcohol was identified in another HPA report from 2018 (*Health professionals driving under the influence*)[21]

In addition to the alcohol or addiction specific resources detailed above, we also scanned summary information about all collections in the IDI[22], and more detailed information on the Statistics NZ website (www.stats.govt.nz), to determine whether additional sources of alcohol related information existed. We only included sources where they contained information linked to individuals.

Results: Collections with individual level information about specific alcohol harm

Table 2 details the collections with alcohol related information for individuals, the key variables in these collections, as well as potential limitations, and placement in Wright’s alcohol related harm matrix.

Table 2: Collections and variables used to construct measures of alcohol use disorder and broader alcohol related harm: limitations, and position in the alcohol related harm matrix.

Collection	Key variable(s) for this work	Strengths and limitations of key variable(s) for this work	Wright's Alcohol related harm matrix
<p>Ministry of Health – National Minimum Dataset (NMDS) [23]: Publicly and privately funded hospital discharges (inpatient and day admission contacts with private and public hospitals – including admissions from the emergency department where treatment lasts longer than three hours).</p>	<p>Diagnoses and external cause fields*: Diagnoses include principal diagnosis (the main reason for the hospital admission) and additional diagnoses (any other conditions that may affect the management or treatment of the patient). The external cause fields describe the ways in which an injury was caused, grouped by intent (for example, accidents, or intentional harm).</p>	<p>Publicly funded discharges Strengths:</p> <ul style="list-style-type: none"> • Diagnosis data is reported using a standardised format for classifying health conditions: the International Statistical Classification of Diseases and Related Health Problems, Australian Modification (ICD-AM). • Contains publicly funded hospitalisation data from 1988. <p>Limitations:</p> <ul style="list-style-type: none"> • Prior to 2012, short stay emergency department (SSED) visits were inconsistently reported across district health boards (DHBs). Many events relating to addiction may be SSED visits, so may not be reliably reported prior to 2012 [20]. <p>Privately funded discharges Limitations:</p> <ul style="list-style-type: none"> • Privately funded hospital discharge information is not complete. It is not compulsory for privately funded hospital discharges to be reported to the NMDS, though some hospitals do report this. 	<p>Hospital discharge data is reported for an individual person in the NMDS, so this information sits in the Hauora (Wellbeing)/ Individual portion of Wright's matrix.</p> <p>As geographic information such as meshblock is available as part core IDI data for individuals, analysis at the (geographic) community level is also possible: the Hauora / Community portion of Wright's matrix.</p>
<p>Ministry of Health – Programme for the Integration of Mental Health Data (PRIMHD) / Mental Health Information National Collection (MHINC) [24]: Specialist mental health and addiction services provided by district health boards (DHBs) / Te Whatu Ora – Health NZ and non-government organisations (NGOs), where services are funded by the government through Vote Health). PRIMHD contains data from 2008. MHINC contains a similar but more limited set of data than PRIMHD, from 2000 to 2008.</p>	<p>Diagnosis* and team type fields: Diagnoses include principal diagnosis (the main reason for treatment) and additional diagnoses (any other conditions that may affect the management or treatment of the patient). 'Provisional' diagnoses are also possible. The team type described the kind of mental health and addiction team providing the service (e.g., an 'Alcohol and drug team' etc)</p>	<p>Strengths:</p> <ul style="list-style-type: none"> • Diagnosis data is reported using the standardised formats for classifying health conditions: the International Statistical Classification of Diseases and Related Health Problems, Australian Modification (ICD-AM) or the Diagnostic and Statistical Manual of Mental Health Disorders (DSM) <p>Limitations:</p> <ul style="list-style-type: none"> • Diagnosis data may be incomplete or non-specific for many PRIMHD records [20] • Early NGO reporting data is incomplete; more recent data is considered to be more complete (from around 2012 onwards) [13] • Due to differences in funding configurations, data on mental health and addiction service use for older people in the Central and Southern regions is likely to be incomplete [13] • Access to these services has long been a challenge [25, 26] – service use information is an underestimate of need, particularly for Māori. 	<p>PRIMHD and MHINC data is recorded for individuals, so this information sits in the Hauora (Wellbeing)/ Individual portion of Wright's matrix.</p> <p>With the addition of geographic information from IDI core datasets, analysis is also possible at the community level (i.e. Hauora (Wellbeing) / Community portion of Wright's matrix)</p>

Collection	Key variable(s) for this work	Strengths and limitations of key variable(s) for this work	Wright's Alcohol related harm matrix
<p>Ministry of Health – Mortality Collection [27]: Information on the underlying cause of death for all deaths registered in Aotearoa New Zealand, (including registered foetal deaths)</p>	<p>Underlying cause of death* A single ICD-AM code is recorded to indicate the underlying cause of death.).</p>	<p>Strengths:</p> <ul style="list-style-type: none"> • Cause of death information is coded using a standardised format for classifying health conditions: the International Statistical Classification of Diseases and Related Health Problems, Australian Modification (ICD-AM) <p>Limitations:</p> <ul style="list-style-type: none"> • Mortality information can take longer than other datasets to become available, due to the length of time it takes for coronial information about deaths to be determined and included to complete the mortality data for a particular year. • The collection also contains an 'alcohol involved' flag – we have not used this in our analysis as the high number of 'unknown' responses limits how useful this field may be [6]. 	<p>Mortality data is recorded for individuals, so this information sits in the Hauora (Wellbeing)/ Individual portion of Wright's matrix.</p> <p>With the addition of geographic information from IDI core datasets, analysis is also possible at the community level (i.e. Hauora (Wellbeing) / Community portion of Wright's matrix)</p>
<p>Ministry of Health – Pharmaceutical Collection [28]: Claim and payment information relating to publicly funded medications in Aotearoa New Zealand.</p>	<p>Chemical name / code: The primary active ingredient in the medication dispensed.</p>	<p>Strengths:</p> <ul style="list-style-type: none"> • Most recent dispensings contain a National Health Index (NHI) identifier (a code relating to a unique individual), so can be linked to other data in the IDI using the identifier – by 2010 about 97% of dispensings reported that year had an NHI [28] <p>Limitations:</p> <ul style="list-style-type: none"> • The collection doesn't contain information about the reason for the prescription (e.g., diagnosis information). • NHI coverage (the proportion of scripts with a legitimate NHI) was lower in earlier years (before 2010), limiting the amount of historical data available than can be linked to individuals. 	<p>Pharmaceutical claims data is recorded for individuals, so this information sits in the Hauora (Wellbeing)/ Individual portion of Wright's matrix.</p> <p>With the addition of geographic information from IDI core datasets, analysis is also possible at the community level (i.e. Hauora (Wellbeing) / Community portion of Wright's matrix)</p>

<p>Ministry of Health – SOCRATES [20]: Information on publicly funded needs assessments for disability support services.</p>	<p>Diagnosis* information SOCRATES diagnosis data contains information about the kinds of disabilities people have, including some mental health and addiction conditions</p>	<p>Limitations:</p> <ul style="list-style-type: none"> • Diagnosis data are not coded according to ICD or another standardised classification. • Historical data may have data quality issues; data from around 2010 onwards is more likely to be robust [20] • Dataset coverage is dictated by funding arrangements – which can change over time. • If access to needs assessment services is a challenge, this collection will underestimate true population need, including that of Māori. 	<p>Needs assessment data are recorded for individuals, so this information sits in the Hauora (Wellbeing)/ Individual portion of Wright’s matrix.</p> <p>If an alcohol related condition is recorded as being part of a person’s disability (and related needs assessment), this information may also sit within the Te Oranga (participation in society) / Individual portion of Wright’s matrix.</p> <p>With the addition of geographic information from IDI core datasets, analysis is also possible at the community level (i.e. Hauora (Wellbeing) / Community portion of Wright’s matrix).</p>
<p>Ministry of Justice – Criminal Court Charges: Data on all charges processed by criminal courts from 1992 onwards. Contains information on the outcome of the charge (e.g., conviction).</p>	<p>Offence codes These codes describe each type of offence under Aotearoa New Zealand law. These detailed offence codes also group up into ANZSOC codes.</p>	<p>Strengths:</p> <ul style="list-style-type: none"> • Charges can be grouped up into a standard way of classifying criminal charges: the Australian and New Zealand Standard Offence Classification (ANZSOC) <p>Limitations:</p> <ul style="list-style-type: none"> • ANZSOC codes are broad; to identify alcohol specific codes, data at the offence code level is necessary. • Note the risk of potential bias with some ethnic groups such as Māori more likely to be convicted than others [29] 	<p>Charges data are reported for the person charged with the offence, so this information sits in the Te Oranga (participation in society) / Individual portion of Wright’s matrix.</p> <p>With the addition of geographic information from IDI core datasets, analysis is also possible at the community level (i.e. Te Oranga (participation in society) / Community portion of Wright’s matrix)</p>

<p>Ministry of Social Development – Benefit Dynamics (BDD) data and Income Support Expenditure (ISE) data: Data on the administration of social welfare benefits, including data on individual benefit histories.</p>	<p>Incapacity codes within the Incapacity dataset: People who receive support via Job Seeker Health Conditions and Disability (JS-HCD) or the Supported Living Payment (SLP) are included in the Incapacity dataset. The reasons for receiving this support are listed in up to four incapacity code fields, based on medical certificates.</p>	<p>Strengths:</p> <ul style="list-style-type: none"> • Medical professionals provide incapacity data. <p>Limitations:</p> <ul style="list-style-type: none"> • Reasons for incapacity can be reported in broad or non-specific categories [20] • Reporting of incapacity codes may be influenced by eligibility for benefits (some reasons for incapacity may be more likely to be reported than others) 	<p>Incapacity data are reported for the person receiving the social welfare support, so this information sits in the Te Oranga (participation in society) / Individual portion of Wright’s matrix.</p> <p>With the addition of geographic information from IDI core datasets, analysis is also possible at the community level (i.e. Te Oranga (participation in society) / Community portion of Wright’s matrix)</p> <p>There may be some ability to link MSD data for individuals to other whanau members – we have not explored this in this work, as we are looking to integrate data across collections (and this whanau linkage may only be possible for people with MSD records)</p>
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*Diagnosis / external cause / underlying cause of death information: note that it is possible for health conditions to be wholly attributable to alcohol (e.g., Alcoholic liver disease) and others partially attributable to alcohol (e.g., cancers) – see Appendix A for specific information on inclusions in our research.

Summary of source limitations and gaps

Table 2 identifies the parts of Wright's alcohol related harm matrix for which we can potentially extract some data. There are notable gaps, including the lack of a reliable method to examine harm to whānau across the whole IDI resident population (not just those with MSD records). While some aspects of intergenerational research are possible, a representative measure for the whole population remains a challenge [30]. We recognise individual harms are likely to have broader whānau and/or community implications but we cannot quantify the extent of this impact based on the individual data alone.

In addition, Wright's matrix describes the section on Hauora as relating to physical, mental and spiritual wellbeing – it should be noted that much of the health data in the IDI relates to physical and mental illness, rather than a state of wellbeing and the health data in the IDI does not include spiritual wellbeing in particular. Ways to examine access to cultural identity are also limited. As noted by Wright, the loss of access to cultural identity is a potential secondary impact of alcohol related harm – a follow-on effect of the marginalisation and or stigma which may be felt due to a person's alcohol use.

The use of Wright's framework helps identify gaps in particular spheres (harms felt at the whanau level, gaps in information about spiritual wellbeing, and about access to cultural identity). However, broader information gaps are also evident from the health data missing from table 2. While much data exists on secondary care (publicly funded hospitalisations, and specialist mental health and addictions care), information at the primary care level is limited to subsidised pharmaceutical dispensings – without details of the person's diagnosis. Non-pharmaceutical primary care is missing, alongside broader diagnostic information. Information on Accident Compensation Corporation (ACC) claims for alcohol related injury is only picked up through a non-mandatory free-text field, which is unlikely to be a complete measure of alcohol related injury (and not part of the IDI ACC dataset). In addition, information is lacking on privately funded mental health and addiction services, and hospitalisations. People who don't seek care, or who seek care and are unable to access it (as in the case of mental health and addiction services[25, 26]), are also absent from health datasets – though may be identified through other routes, such as drink driving convictions in the Ministry of Justice Charges dataset.

4. Integrated measures of alcohol related harm – Methods

Our first goal was to identify sources of alcohol information in the IDI (section 2 above); our second goal was to trial a method for integrating data from these sources to create a summary measure of alcohol related harm. We undertook this work using the June 2022 IDI refresh.

People and sources

Our study included all people in the IDI NZ resident population (IDI-ERP) alive as at 30 June 2018, a total of 4.8 million people. We chose this time period because it was the most recent period for which data was available across all included source collections, at the time of the study. We drew on IDI sources including the ‘core’ datasets (the StatsNZ Resident Population table, the personal details table), datasets from the Ministry of Health (publicly funded hospitalisation dataset (NMDS), MHINC / PRIMHD, Mortality, Pharmaceutical Collection, SOCRATES), Ministry of Justice Criminal Court Charges data, and Ministry of Social Development benefits data.

Variables

Age and gender were defined using the information on the IDI’s personal details table, which holds demographic information on all individuals in the IDI, derived from contributing IDI sources. Age was calculated as at the 30 June 2018.

Prioritised ethnicity was also defined using data from the IDI personal details table. The personal details table contains demographic information for people in the IDI, drawn from a number of sources. StatsNZ uses an algorithm (the ‘source ranked’ method) to determine which ethnicity information is included in the personal detail table. An ethnicity profile is created for each person, based on the ranking of the ethnicity source data: census data has the highest ranking, followed by births data, then Ministry of Health data, and so on. The ethnicity profile from the highest ranked source is used to populate the ethnicity data in the personal detail table. The ethnicity data is recorded at ‘Level 1’ groupings: European, Māori, Pacific, Asian, MELAA (Middle Eastern / Latin American / African) and Other. People can have more than one of these groups as their ethnicity. In our study, we used prioritised ethnicity: based on the Level 1 ethnic groups codes on the IDI personal details table we grouped participants as either Māori (first priority), Pacific (second priority), Asian / MELAA / Other (third), or European (last). We trialled extracting data for Asian peoples separately, but the numbers were too small (in our numerators – described below) to include this as a separate ethnic group. We note that the ethnicity in the IDI personal details table may contrast to the ethnicity recorded in specific datasets.

Alcohol use disorder and alcohol related harm: We created two algorithms using the data collections in the IDI to flag individuals in the June 2018 IDI resident population with an indication of **alcohol use disorder**, or a broader indication of **alcohol related harm** (based on the person’s own drinking, not including cases where a person is harmed by other people’s drinking such as foetal alcohol syndrome). The specific criteria for the two algorithms are shown in tables 3 and 4 (below). People are flagged as having alcohol use disorder if they meet any one (or more) of the four criteria in table 3. People are flagged as having experienced alcohol related harm if they meet any one (or more) of the six criteria in table 4. Note that if someone is flagged as having alcohol use disorder, they are automatically flagged as having experienced alcohol related harm (people with alcohol use disorder are a subset of people who experienced alcohol related harm).

Table 3: Algorithm criteria for people with an indication of alcohol use disorder

Source data	Criteria
MOH: NMDS, PRIMHD, Mortality data	1. One or more ICD-10-AM diagnosis* of the following codes: G312 (Degeneration of nervous system due to alcohol), F101-F109 (Mental and behavioural disorders due to use of alcohol, harmful use, dependence syndrome, withdrawal state, withdrawal state with delirium psychotic disorder, amnesic syndrome, residual and late-onset psychotic disorder, other mental and behavioural disorders, & unspecified) during the period of interest.
MOH: Pharms	2. Two or more dispensings of 1432 (Disulfiram) in one year, during the period of interest
MOH: NMDS, PRIMHD, Mortality data	3. Three or more ICD-10-AM diagnoses / external cause code of any combination of: F100 (Mental and behavioural disorders due to use of alcohol, acute intoxication), X45 (Accidental poisoning by and exposure to alcohol), X65 (Intentional self-poisoning due to alcohol), Y15 (Poisoning by alcohol, undetermined intent) in one year, during the period of interest.
MOH: PRIMHD	4. Contact with secondary alcohol and drug mental health and addiction services (Team type codes = 03, 10, 11, 21, 23) in one year and a Criteria 1 alcohol use diagnosis the year before, where the contact with MHA services occurred during the period of interest.

* diagnoses only include those wholly attributable to alcohol as outlined by Wright [6] – see Appendix A for more detail

** People are flagged as having alcohol use disorder if they meet any one (or more) of the four criteria in table 3.

Table 4: Algorithm criteria for people with an indication of alcohol harm (due to their own drinking)

Source data	Criteria
MOH: NMDS, PRIMHD, Pharms, Mortality data	1. Criteria as for alcohol use disorder (table 3)
MOH: NMDS, PRIMHD, Mortality data	2. One or more ICD-10-AM diagnoses / external cause code* of any of the following codes: E244 (Alcohol-induced pseudo-Cushing’s syndrome), E512 (Wernicke’s encephalopathy), G621 (Alcoholic polyneuropathy), G721 (Alcoholic myopathy), I426 (Alcoholic cardiomyopathy), K292 (Alcoholic gastritis), K852 (Alcohol-induced acute pancreatitis), K860 (Alcohol-induced chronic pancreatitis), K70 (Alcoholic liver disease), Y90 (Evidence of alcohol involvement determined by blood alcohol level), Y91 (Evidence of alcohol involvement determined by level of intoxication), during the period of interest.
MOH: NMDS, PRIMHD, Mortality data	3. Three or more ICD-10-AM diagnoses of any combination of the following codes: R780 (Finding of alcohol in the blood, symptoms, and signs chapter), T510 (Toxic effect of alcohol, ethanol), T511 (Toxic effect of alcohol, methanol), T518 (Toxic effect of alcohol, other alcohols), T519 (Toxic effect of alcohol, unspecified) in one year, during the period of interest.
MOJ: Charges	4. A conviction during the period of interest for a drink-driving charge specific to alcohol (multiple codes)
MOH: Socrates	5. Any active classification during the period of interest with the following codes: 1301, 1403, during the period of interest.
MSD: Incapacity data	6. Any incapacity field with the following codes 007, 170 during the period of interest.

* diagnoses only include those wholly attributable to alcohol as outlined by Wright [6] – see Appendix A for more detail

** People are flagged as having experienced alcohol related harm if they meet any one (or more) of the six criteria in table 4.

We flagged all residents in the IDI with an indication of either of these two conditions (alcohol use disorder and / or alcohol related harm), as at particular points in time, using different ‘lookback’ periods (1 year and 5 year). A ‘lookback’ period is the amount time (or ‘period of interest’) used in a search to determine whether or not someone meets the above criteria.

Access to mental health and addiction services has long been a challenge [25, 26]. Ideally people with current alcohol use disorder or who are experiencing alcohol related harm will be seen by mental health and addiction services (if appropriate) when they experience the disorder / addiction. When access to services is limited, however, people with a current alcohol problem may not meet the threshold for service in the year (the threshold may be higher if demand for services is higher) and may face a long wait for access to addiction services. In addition, key sources of mental health and addictions data such as PRIMHD have incomplete reporting for addiction services. For these reasons, we investigated both one-year and five-year lookback periods. A key assumption for the five-year lookback is that if a person meets the criteria at any point in the five-year lookback period, they are likely to suffer from the same problem as at 30 June 2018.

Statistical analysis

Descriptive analysis and prevalence. We produced summary tables for three groups (those with an indication of alcohol use disorder, those with an indication of alcohol related harm, and all Aotearoa New Zealand residents in total), with counts and proportions by age, gender and prioritised ethnic group. Note that data from the IDI is suppressed if counts are lower than 6, and count data is randomly rounded to base 3.

To test if an algorithm can be used to successfully estimate true disease / condition prevalence, a common approach is to compare the prevalence generated using the algorithm with survey prevalence estimates or other measures (for example, algorithm testing for CHD[17], diabetes[16], or gout [18]). We tested how well our algorithms worked in terms of estimating overall alcohol use disorder prevalence and the prevalence of alcohol related harm by comparing our estimates with other sources of data on rates of alcohol abuse and dependence. To do this, we calculated point prevalence estimates (as at 30 June 2018) for alcohol use disorder and alcohol related harm amongst IDI Aotearoa New Zealand residents. We used the algorithms to extract numerator data, with the IDI resident population as the denominator, and compared these with prevalence estimates from Te Rau Hinengaro – the New Zealand Mental Health Survey [7], and NZ Health Survey rates of hazardous drinking [4]. Prevalence was calculated for age, gender, and prioritised ethnic groups.

Age-standardised percentages. To account for differences in age structure between ethnic populations, we also calculated direct age-standardised proportions in SAS using the *proc stdrate* procedure (SAS v9.4, SAS Institute Inc., USA). We used the IDI resident Māori population as the standard (reference) population, to frame prevalence estimates for other ethnic groups in relation to this Indigenous standard (age structure) [31].

Summary of contribution by source. To examine differences in the ways the algorithms pick up people (and any potential bias related to this), we calculated the percentage of people identified through each source collection (singular and in each combination) for those with an indication of alcohol use disorder, and those with an indication of alcohol related harm.

All statistical analysis was conducted in SAS (SAS Institute Inc., USA) and Microsoft Excel (Microsoft Corp., USA). Ethical approval for the study was received from the University of Otago Human Ethics Committee – Health (reference #H22/018)

5. Integrated measures of alcohol related harm – Results

Prevalence estimates – counts and percentages.

Just over 14,500 people met the criteria for alcohol use disorder in the 2017/18 year, and more than 35,000 people were recorded as experiencing some kind of alcohol related harm (including those with alcohol use disorder) in the same period (one-year lookback, Table 5). Table 5 shows people who met the algorithm criteria for alcohol use disorder and alcohol related harm in the 2017/2018 year (one-year lookback), and people who met the criteria any time during the five-year period from 1 July 2013 to 30 June 2018 (five-year lookback). The IDI estimated resident population is also shown. People were included in this analysis if they were alive as at 30 June 2018.

Variations in prevalence were observed for different age, gender and ethnic groups. Of those with an indication of alcohol use disorder in 2017/18, a higher proportion were male (66 percent), compared to the total population (50 percent). In terms of ethnic groups, Māori made up a larger proportion of people with an indication of alcohol use disorder (26 percent) compared to the proportion of Māori in the total population (17 percent) in this period. While people in the Asian / MELAA / Other ethnic group made up 19 percent of the total population, they accounted for only 7 percent of the people with an indication of alcohol use disorder in 2017/18. European people made up 57 percent of the IDI resident population and accounted for a similar proportion of people with alcohol use disorder in 2017/18 (59 percent). People aged 25-44 made up a larger proportion of the alcohol use disorder group (40 percent) compared to the total population (27 percent).

Similar patterns were observed for people with an indication of alcohol related harm in 2017/18: 70 percent were male (50 percent in the total population), 35 percent of this group was Māori (compared to total population 17 percent), and 44 percent were aged 25-44 years (27 percent in the total population). The proportion of people with an indication of alcohol related harm in 2017/18 who were European (48 percent) was lower than the proportion of European people in the total population (57 percent) in 2017/18.

Table 5: Counts and percentages for alcohol use disorder and alcohol related harm, one-year (July 2017 – June 2018) and five-year (July 2013-June 2018) lookback periods, by prioritised ethnicity, gender, and age group.

	One-year Lookback				Five-year Lookback				Total Population	
	Alcohol use disorder		Alcohol harm indication		Alcohol use disorder		Alcohol harm indication		Number	Percent
	Number	Percent	Number	Percent	Number	Percent	Number	Percent		
<i>Total</i>	14589	0.30	35664	0.74	39174	0.81	111813	2.32	4815198	100.00
Ethnicity										
<i>Māori</i>	3849	26.4	12609	35.4	11388	29.1	40635	36.3	838392	17.4
<i>Pacific</i>	1086	7.4	3177	8.9	2856	7.3	9963	8.9	326238	6.8
<i>Asian / MELAA / Other</i>	1011	6.9	2625	7.4	2505	6.4	8247	7.4	890217	18.5
<i>European</i>	8643	59.2	17253	48.4	22425	57.2	52968	47.4	2760351	57.3
Gender										
<i>Female</i>	5016	34.4	10629	29.8	13269	33.9	33066	29.6	2418372	50.2
<i>Male</i>	9573	65.6	25035	70.2	25905	66.1	78747	70.4	2396826	49.8
Age group										
<i>0-14</i>	9	0.1	18	0.1	6	0.0	48	0.0	931686	19.3
<i>15-24</i>	1728	11.8	7176	20.1	4638	11.8	20082	18.0	647406	13.4
<i>25-44</i>	5820	39.9	15711	44.1	15453	39.4	52287	46.8	1290465	26.8
<i>45-64</i>	5304	36.4	10578	29.7	13914	35.5	31929	28.6	1206270	25.1
<i>65+</i>	1728	11.8	2181	6.1	5163	13.2	7467	6.7	739371	15.4

Notes: Ethnicity: MELAA = Middle Eastern / Latin American / African; prioritised ethnicity is used (Māori > Pacific > Asian > MELAA > Other > European)

Comparison with other prevalence estimates

In general, our estimates of alcohol use disorder and alcohol related harm were lower than estimates derived from surveys. In 2003/04, the 12-month prevalence for clinical definitions of alcohol dependence and abuse¹ were estimated as part of Te Rau Hinengaro (TRH)– the New Zealand Mental Health Survey. At 2.6 percent (alcohol abuse) and 1.3 percent (dependence) [7], the TRH prevalence estimates are higher than the estimates obtained using our IDI-based alcohol use disorder (0.3 percent) and alcohol related harm measures (0.8 percent) which use a one-year look back period.

As noted, access to mental health and addiction services has long been an issue [25, 26] . As our alcohol use disorder indicator in particular is based on service use and service access is difficult, a longer lookback period may be needed to estimate alcohol use disorder more accurately. Our estimate for alcohol use disorder based on a five-year lookback period is 0.8 percent, which is closer to but still lower than TRH estimates of either abuse or dependence, indicating that the five-year lookback is likely to be a better measure of alcohol use disorder than the one-year lookback but does not provide a complete picture of the prevalence of this disorder.

Another source of comparison data is the hazardous drinking measure from the NZ Health Survey (NZHS). While not all hazardous drinking will result in alcohol related harm of the type we captured in the IDI, it may be anticipated that the general age pattern would be similar. And indeed it is: Table 6 shows that the overall estimate of alcohol related harm for 2017/18 peaks around 25-34 years (1.3 percent), and that this age group also has one of the highest rates of hazardous drinking according to the NZHS (25.5 percent). The 25-34 age group also has the highest proportion of harm as a percentage of hazardous drinking (5.2 percent).

Table 6: Alcohol harm indication as a percentage of hazardous drinking prevalence, 2017/18.

Age group	Alcohol harm 2017/18 – 1 year estimate prevalence (%)	Hazardous drinking – total population -2017 (%)	Hazardous drinking – total population -2018 (%)	Average NZHS for 2017 + 2018 (%)	Alcohol harm as a percentage of hazardous drinking (%)
<i>Source</i>	<i>IDI</i>	<i>NZHS</i>	<i>NZHS</i>	<i>Calculation</i>	<i>Calculation</i>
15-24	1.1	24.7	26.6	25.65	4.3
25-34	1.3	25.6	25.4	25.5	5.2
35-44	1.1	22.3	22.6	22.45	4.9
45-54	1.0	22.4	22.4	22.4	4.6
55-64	0.7	16.2	18	17.1	4.1
65-74	0.4	12.6	11.8	12.2	3.0
75+	0.2	5.1	4.1	4.6	4.4

¹ Note that Te Rau Hinengaro defines of alcohol abuse and alcohol dependence using DSM-IV – both conditions are aspects of an alcohol use disorder using the ICD-10-AM codes in our algorithm criteria for alcohol use disorder (F101 to F109). In terms of our alcohol related harm measure, there is some alignment with the DSM-IV criteria for alcohol abuse and dependence, but our measure includes some people who may not meet the DSM-IV criteria, which stresses the **recurrent** nature of problems stemming from alcohol. For example, our alcohol related harm measure includes people if they only have one drink driving conviction, rather than recurrent convictions.

Patterns by age and ethnic group, and age standardised percentages

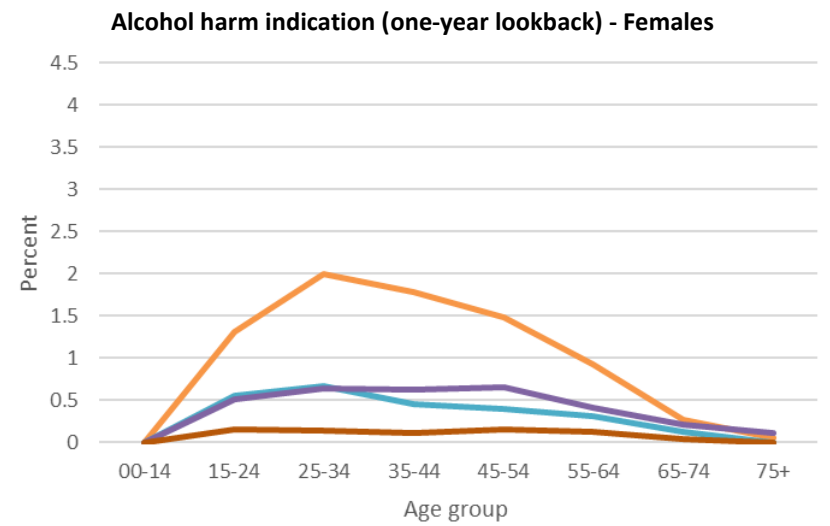
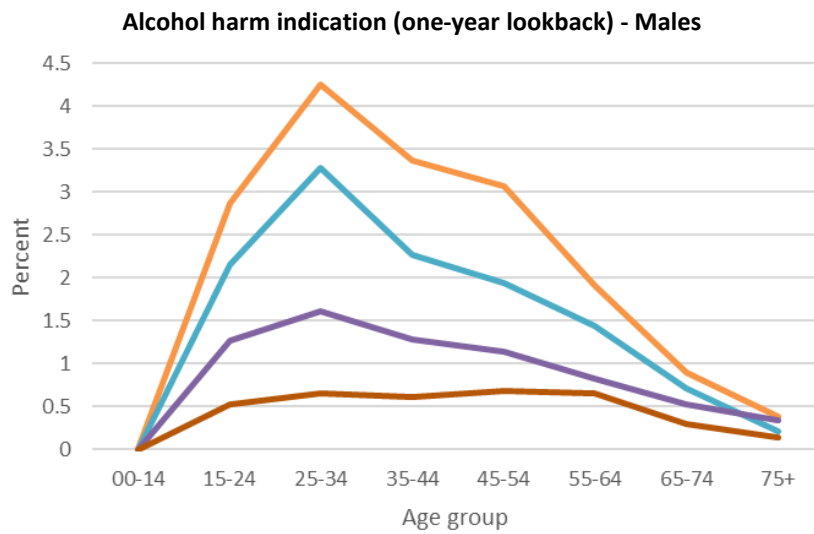
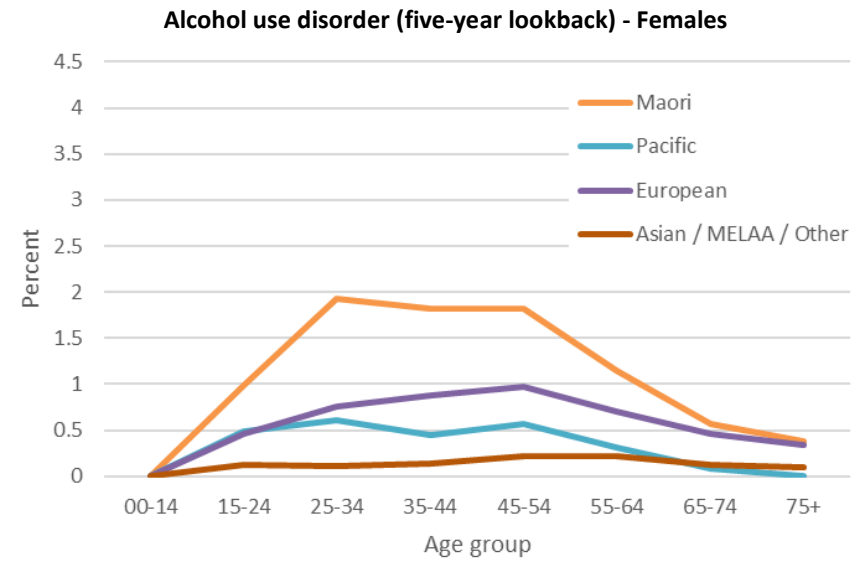
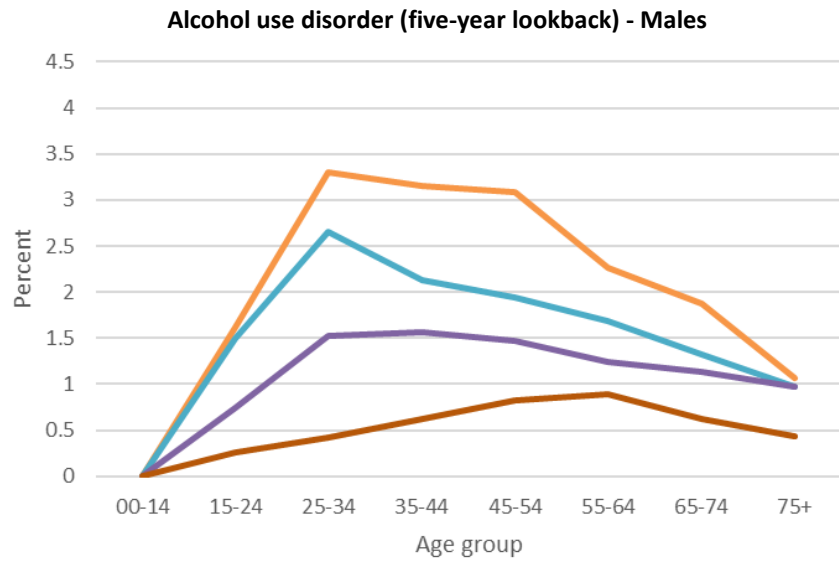
Understanding differences across age groups is particularly important in examining data for ethnic groups with different population age structures. Figure 1 shows age specific prevalence estimates by gender and ethnic group, for alcohol use disorder order (five-year lookback) and alcohol related harm, (1 year lookback). For both alcohol use disorder (five-year lookback) and alcohol related harm (one-year lookback), prevalence estimates peak around the 25-34 age with two main exceptions: estimates for men in the Asian / MELAA / Other ethnic group peak later - around 55-64 years (alcohol use disorder) and 45-54 years (alcohol related harm) and estimates for women in the Asian / MELAA / Other ethnic group and for European women peak in the 45-54 year age group.

Differences between ethnic groups persist even after underlying differences in population age structure are accounted for (table 7). The overall Māori age standardised prevalence estimate for alcohol use disorder (2 percent) is double the age standardised estimate for Europeans (1 percent); the age standardised prevalence estimate for alcohol related harm for Māori (2.2 percent) is more than double the European figure (0.9 percent).

Table 7: Counts, crude and age-standardised (AS) prevalence estimates of alcohol use disorder (five-year lookback, July 2013 – June 2018) and alcohol related harm (one-year lookback, Jul 2017 – June 2018), by ethnic group and gender

	Female			Male			Total		
	n	Crude %	AS %	n	Crude %	AS %	n	Crude %	AS %
Alcohol use disorder (five- year lookback)									
Māori	4146	1.4	1.4	7236	2.5	2.5	11382	2.0	2.0
Pacific	531	0.5	0.5	2325	1.9	1.9	2856	1.2	1.2
Asian / MELAA / Other	525	0.1	0.2	1980	0.5	0.5	2505	0.3	0.3
European	8067	0.7	0.7	14358	1.3	1.2	22425	1.0	1.0
Alcohol harm (one-year lookback)									
Māori	4101	1.4	1.4	8496	3.0	2.9	12597	2.2	2.2
Pacific	540	0.5	0.5	2637	2.2	2.1	3177	1.3	1.3
Asian / MELAA / Other	444	0.1	0.1	2181	0.6	0.6	2625	0.4	0.4
European	5544	0.5	0.5	11703	1.0	1.2	17247	0.7	0.9

Figure 1: Estimated prevalence (percent) of alcohol use disorder (five-year lookback, July 2013 – June 2018) and alcohol related harm (one-year lookback, Jul 2017 – June 2018), for males and females, by prioritised ethnic group and ten-year age group

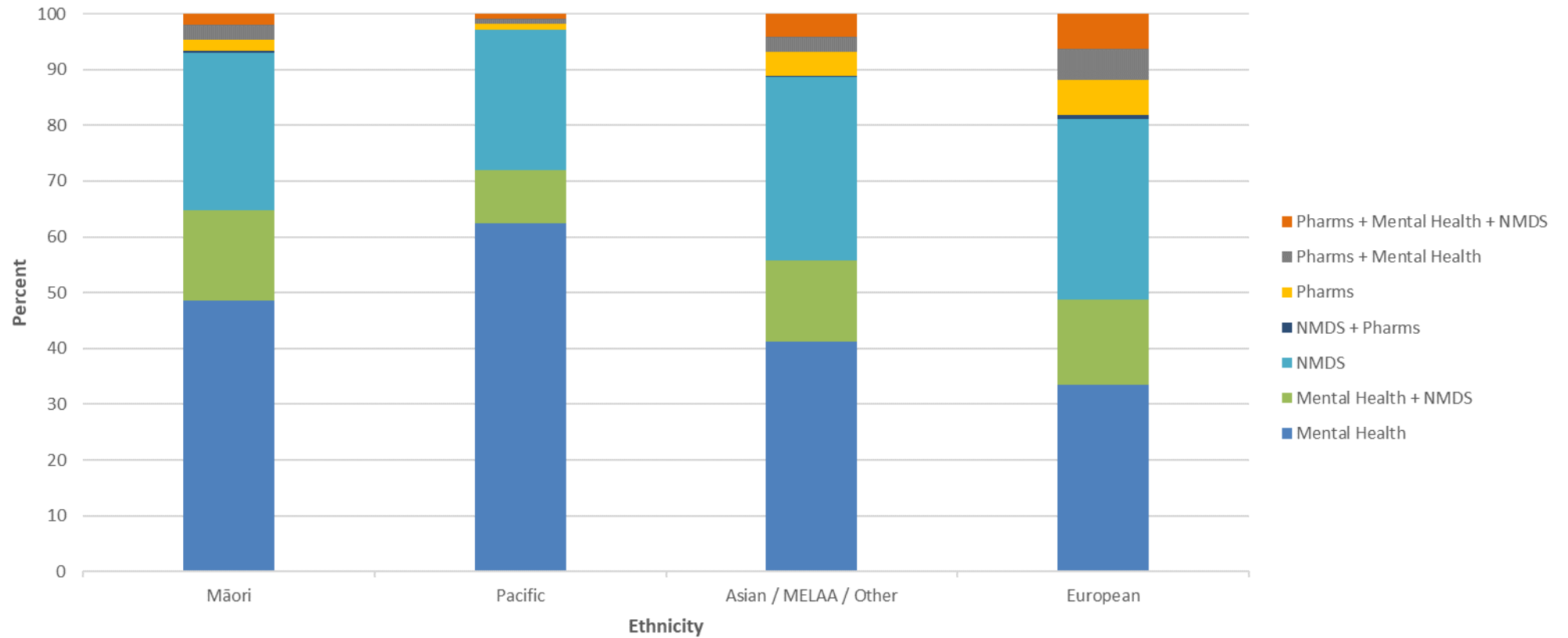


Algorithm sources

Of people with an indication of an alcohol use disorder (five-year lookback), for each ethnic group we calculated the percentage of people identified through each source collection. Figure two shows the proportion of people in each ethnic group according to whether they met the alcohol use disorder algorithm criteria based on data on pharmaceutical dispensings (the Pharmaceutical Collection), hospitalisations (NMDS), specialist mental health services (MHINC / PRIMHD), or a combination of these sources. Proportionally more Māori and Pacific peoples with an indication of an alcohol use disorder were identified solely through specialist mental health services (49 percent, and 62 percent respectively) than people in the European and Asian / MELAA / Other ethnic groups (33 percent and 41 percent respectively). In contrast, proportionally more people with an indication of alcohol use disorder in the European and Asian / MELAA / Other ethnic groups were flagged solely through their pharmaceutical dispensing records (6 and 4 percent respectively), than Māori and Pacific peoples (2 and 1 percent respectively).

Figure 3 shows the percentage of people with an indication of alcohol related harm (one-year look back) identified through each source agency (Ministry of Social Development benefits data; Ministry of Health pharmaceutical dispensings, hospitalisations, specialist mental health and addictions data; Ministry of Justice criminal court charges data) or combination of sources, for each ethnic group. A larger proportion of Māori (45 percent), Pacific (51 percent), and people in the Asian / MELAA / Other ethnic group (46 percent) were identified as experiencing alcohol related harm solely through their criminal convictions, than people in the European ethnic group (30 percent).

Figure 2: Sources for indications of alcohol use disorder (five-year lookback), by ethnic group.

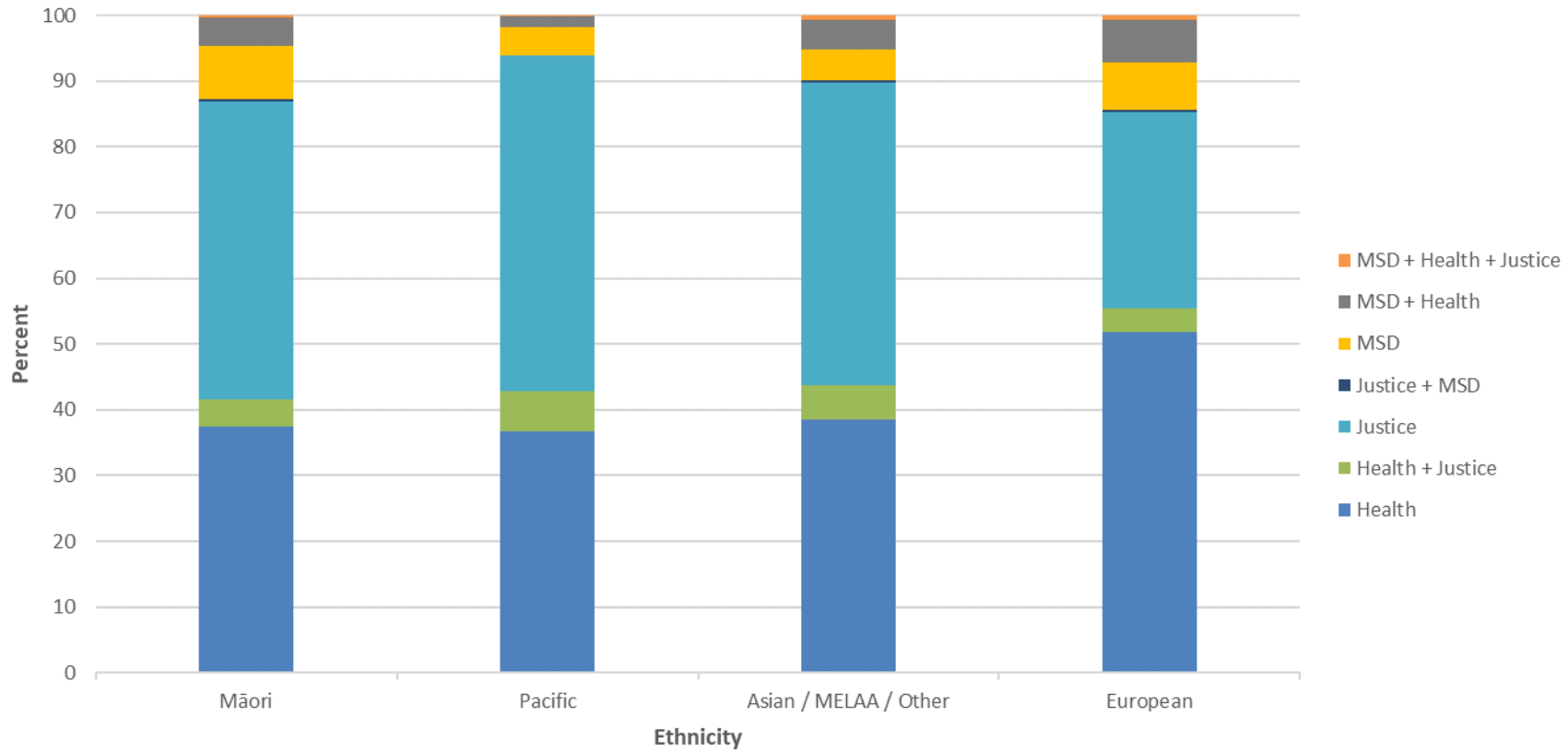


Notes

Ethnicity: MELAA = Middle Eastern / Latin American / African; prioritised ethnicity is used (Māori > Pacific > Asian > MELAA > Other > European)

Sources: NMDS = National Minimum Dataset – publicly funded hospitalisations, Pharms = Pharmaceutical Collection – dispensings, Mental Health = MHINC / PRIMHD specialist mental health and addiction services

Figure 3: Sources for indications of alcohol related harm (one-year lookback), by ethnic group.



Notes

Ethnicity: MELAA = Middle Eastern / Latin American / African; prioritised ethnicity is used (Māori > Pacific > Asian > MELAA > Other > European)

Sources: Health = Ministry of Health datasets, MSD = Ministry of Social Development Benefits data, Justice = Ministry of Justice Criminal Court data

6. Discussion

Based on the algorithms we created to combine and summarise data on alcohol related harm in the IDI, we identified just over 35,000 people in 2017/18 in Aotearoa New Zealand who experienced some kind of alcohol related harm (one-year lookback). This included more than 14,500 people who met the criteria for alcohol use disorder in that year (one-year lookback). While these numbers are concerning from a health loss perspective, the algorithms produced estimates that are lower than national survey results, including the New Zealand Health Survey [4] and Te Rau Hinengaro (TRH)– the New Zealand Mental Health Survey [7]. For example, the 2003/04 TRH prevalence estimates for alcohol abuse (2.6 percent) and alcohol dependence (1.3 percent) are higher than our one-year lookback alcohol use disorder (0.3 percent) and alcohol related harm estimates (0.8 percent). Even after adjusting the alcohol use disorder measure to use a five-year lookback period (to account for historical and present problems with access to mental health and addiction services), the resulting estimate of 0.8 percent is still lower than TRH prevalence for either alcohol abuse or dependence. This indicates that while the five-year lookback is likely to be a better measure of alcohol use disorder than the one-year lookback, it does not provide a complete picture of the prevalence of this disorder.

Our algorithms are likely to underestimate alcohol use disorder and alcohol related harm for a number of reasons – many of which relate to the gaps identified in source data using Wright’s [6] alcohol related harm framework. In terms of health and wellbeing data, while we are able to include much data on secondary care (publicly funded hospitalisations, and specialist mental health and addictions care), historic and current barriers to access these services limit the number of people picked from these sources. Information at the primary healthcare level is limited to subsidised pharmaceutical dispensings; diagnostic data at the primary care level is not available in the IDI so people seeking non-pharmaceutical treatment at the primary care level for alcohol use disorder / other alcohol related harms will not be picked by our algorithms via this route. Other sources of missing health information include privately funded mental health and addiction services, privately funded hospitalisations, ACC injury claims not resulting in hospitalisation, and people who don’t seek healthcare. While some of these people may be identified through other routes, such as drink driving convictions in the Ministry of Justice Charges dataset, it is likely that many are not picked up by the algorithms we have developed – but are likely to be picked up as part of surveys like the NZHS. Much of the health data focuses on physical and mental illness, rather than on wellbeing, and broader aspects of health, such as wairua (spiritual health) are not captured. In terms of information gaps for other aspects of Wright’s framework: data at the whānau level in particular is missing, so the wider impact of alcohol related harm is underestimated in this respect. Finally, our algorithms also underestimate alcohol-related harm as they do not capture all alcohol attributable conditions (only the wholly attributable ones).

The estimates from our algorithms showed variations by population group. Compared to the total population, Māori, men, and people aged 25-44 years were overrepresented in both alcohol use disorder and alcohol related harm groups. After adjusting for age, Māori still experienced higher rates of alcohol use disorder and alcohol related harm (age-standardised % alcohol use disorder, five-year lookback: Māori 2.0 %, European 1.0 %; age-standardised % alcohol related harm, one-year lookback: Māori 2.2 % European 0.9 %). When examining these differences, it is important to consider that these variations may reflect differences in the likelihood of appearing in the source datasets such as health service and benefit use, and convictions for drink driving.

We looked at the proportion of people identified through each dataset source for both alcohol use disorder and alcohol related harm algorithms and found differences by ethnic group. For example, in terms of alcohol use disorder, Māori and Pacific peoples were more likely to be identified solely through specialist mental health and addiction services than people in the European and Asian / MELAA / Other ethnic groups, and less likely to be identified solely through pharmaceutical dispensings. This aligns with evidence about health service use amongst Māori in relation to mental health and addiction, with underdiagnosis of mental health conditions in primary care (where many prescriptions originate), and resulting higher rates of hospital admissions, seclusion, compulsory treatment, and use of forensic mental health and addiction services compared to other ethnic groups [32]. For people with an indication of alcohol related harm, Māori, Pacific and people in the Asian / MELAA / Other ethnic group were more likely to be identified as experiencing alcohol related harm solely through their criminal convictions than people in the European ethnic group. This may reflect real world bias and racism. For example, research indicates that Māori are more likely to be convicted of an offence (even after adjusting for socioeconomic status and offending history) than others [29].

The potential for bias (in terms of who is included) and the underestimation of the size of the alcohol use disorder and alcohol related harm groups limit the use of the algorithms we have developed in future research. In terms of the alcohol use disorder measure, using the five-year lookback is preferable to the one-year look back and likely somewhat mitigates some of the effects of historical issues with access to secondary mental health and addiction services. If identified gaps in the source data were reduced – in particular more complete diagnosis data in PRIMHD – this could mean that this algorithm has some use as a measure of alcohol use disorder **treatment** – albeit at the more severe end (as primary care data would still be incomplete). Complete primary care data – specifically diagnosis information - would vastly improve the identification of treatment for alcohol use disorder in Aotearoa New Zealand. However, if inequities in healthcare access persist, even if primary care and other data were complete, any algorithm based on healthcare use would be a biased measure of overall harm (treated and untreated) and not reflect the true extent of alcohol related harm in populations less likely to access or seek healthcare.

The measure of alcohol related harm resulting from our algorithm is likely to reflect some real-world bias relating to likelihood of drink-driving conviction. This may mean that untangling the potential for bias amongst people who do or do not meet the algorithm criteria for alcohol related harm makes it too difficult to use as part of research focused on examining differences between these two groups (or using this as an ‘exposure’ measure). However, the algorithm may be of more use as an outcome measure – to some extent the algorithm does reflect alcohol related harm (even if these harms are result from bias). For example, it may be useful to examine the effect of changes in alcohol availability on the extent of alcohol related harm at the community level (combining the alcohol related harm algorithm with geographical data in the IDI). Addressing some of the data gaps we identified may make the alcohol related harm algorithm more useful. In particular, being able to include harm at the whānau level may make the measure more relevant in a Te Ao Māori context and provide a more comprehensive picture of the harmful impacts of alcohol.

Conclusion

The algorithms we created produced estimates of alcohol related harm and alcohol use disorder prevalence lower than national survey results. The algorithms are likely to underestimate the extent of alcohol related harm in Aotearoa New Zealand, due to both gaps in source data and problems

with healthcare access. Because these algorithms underestimate alcohol use disorder and alcohol related harm, and because they are likely to reflect real-world biases (e.g., Māori are more likely to be convicted of an offence), we recommend that these algorithms are not used in their current form in research which seeks to use the algorithms as an 'exposure' measure (e.g. to explore differences between people with an indication of alcohol related harm and those without, in terms of other IDI variables). The five-year lookback algorithm for alcohol use disorder may be useful to examine treatment access (perhaps more at the severe end, given missing primary care diagnosis data). Capturing more complete PRIMHD diagnosis data and any primary care diagnosis data would improve this measure and could be a useful focus for future work in this area. The alcohol related harm algorithm may be useful as an 'outcome' measure in future research – as it does reflect some aspects of alcohol related harm – though researchers need to be mindful that bias most likely plays a part in this measure.

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Appendix A: Condition list of all alcohol related harms: project inclusions and ICD-10-AM codes

Condition	ICD-10 code	Partially attributable to alcohol, with detrimental effect [33]	Wholly attributable to alcohol [6]	Included in our research
Mouth cancer	C00–C08	✓		
Nasopharynx cancer and other pharynx cancers	C09–C13	✓		
Oesophagus cancer	C15	✓		
Stomach cancer	C16	✓		
Colon and rectum cancers	C18–C21	✓		
Liver cancer	C22	✓		
Larynx cancer	C32	✓		
Trachea, bronchus, and lung cancers	C33–C34	✓		
Breast cancer (women only)	C50	✓		
Ovarian cancer	C56	✓		
Prostate cancer	C61	✓		
Other neoplasms	D00–D48 (except D09.9, D37.9, D38.6, D39.9, D40.9, D41.9, 48.9)	✓		
Alcohol-induced pseudo-Cushing's syndrome	E24.4		✓	✓
Wernicke's encephalopathy	E51.2		✓	✓
Mental and behavioural disorders due to use of alcohol	F10		✓	✓
Unipolar depressive disorders	F32–F33, F34.1	✓		
Degeneration of nervous system due to alcohol	G31.2		✓	✓
Epilepsy	G40–G41	✓		
Alcoholic polyneuropathy	G62.1		✓	✓
Alcoholic myopathy	G72.1		✓	✓
Hypertensive heart disease	I11–I13	✓		
Alcoholic cardiomyopathy	I42.6		✓	✓
Alcoholic gastritis	K29.2		✓	✓
Alcoholic liver disease	K70		✓	✓
Alcohol-induced acute pancreatitis	K85.2		✓	✓
Alcohol-induced chronic pancreatitis	K86.0		✓	✓
Foetal alcohol syndrome (dysmorphic)	Q86.0, O35.4, P04.3		✓	
Excess alcohol blood levels	R78.0		✓	✓
Toxic effect of alcohol, Ethanol	T51.0		✓	✓
Toxic effect of alcohol, Methanol	T51.1		✓	✓
Toxic effect of alcohol, other alcohols	T51.8		✓	✓
Toxic effect of alcohol, unspecified	T51.9		✓	✓
Accidental poisoning by and exposure to alcohol	X45		✓	✓
Intentional self-poisoning by and exposure to alcohol	X65		✓	✓
Poisoning by and exposure to alcohol undetermined intent	Y15		✓	✓
Evidence of alcohol involvement determined by blood alcohol level	Y90		✓	✓
Evidence of alcohol involvement determined by level of intoxication	Y91		✓	✓