The Daffodil Centre

The Australian Prevention Partnership Centre

Preventing liver cancer: A review of Australian prevalence data

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Contents

Prevalence of alcohol consumption in Australia

In 2017-18, eight in ten (78.8%) Australian adults drank, with alcohol consumption more common in men compared to women (84.5 versus 73.3%) as shown in Table 1(1). The age groups with the highest prevalence of alcohol consumption are men aged 25-34 years (88.3%) and women aged 18-24 years (83.3%)(1). 11.6% of Australian adults had never consumed alcohol in their lifetime and 8.5% had abstained from drinking alcohol over the last year. Aboriginal and Torres Strait Islander persons were more likely to have abstained in the past year compared to non-Indigenous Australians (14.5% compared to 8.5%; non-age-standardised) (2).

Table 1 Prevalence of alcohol consumption in adults aged 18 years and over (per cent) by category of alcohol consumption, age-group, and sex 2017-18

	Consumed alcohol in the last 12 months			Not consumed alcohol in the last 12 months			Never consumed alcohol (%)		
	Men	Women	All	Men	Women	All	Men	Women	All
Age group (years)	%	%	%	%	%	%	%	%	%
18–24	84.4	83.3	83.8	4.5	5.0	4.5	10.6	12.0	11.4
25–34	88.3	73.3	80.4	4.3	10.2	7.2	7.4	16.2	11.6
35–44	84.9	72.5	78.5	5.9	9.4	7.7	8.4	16.8	12.8
45–54	85.7	77.4	81.6	6.7	7.9	7.3	6.6	13.8	10.1
55–64	85.5	74.4	79.4	8.6	11.5	10.0	6.1	12.5	9.3
65–74	82.2	69.8	76.1	10.8	12.5	11.6	5.7	15.9	10.8
75-84	74.3	58.6	66.4	15.6	14.1	15.0	8.1	23.8	16.8
85 years and over	#66.3	#50.9	#58.2	9.6	17.7	15.6	16.2	23.3	21.8
Total 18 years and over	84.5	73.3	78.8	7.0	10.0	8.5	7.5	15.4	11.6

Adapted from the Australian Bureau of Statistics National Health Survey Data 2017-18 (1). # Indicates the proportion has a high margin of error and should be used with caution. Current drinkers were defined as people who had (a) exceeded guidelines for lifetime risk alcohol consumption in the past week (more than 2 drinks per day); (b) consumed alcohol but not exceeded lifetime risk guidelines in the past week and (c) those who had not consumed alcohol in the past week but did less than 12 months ago. Data are available for these subgroups of current drinkers.

Box 1.

A standard drink in Australia is defined as containing 10 grams (g) of pure alcohol. The 2020 National Health and Medical Research Council (NHMRC) Guidelines recommend that to reduce the risk of harm from alcohol-related disease or injury, healthy men and women should consume no more than 10 standard drinks a week and no more than four standard drinks on any one day (3). During the period of data collection (2017-18) NHMRC guidelines recommended drinking no more than two standard drinks a day to reduce lifetime risk of harm.

Lifetime risk alcohol consumption (>2 drinks per day, 7-day average)

Approximately one-sixth (16.1%) of Australian adults consume alcohol at levels which place them at lifetime risk of an alcohol-related disease or injury (see definition in Box 1) (Table 2) (1). Lifetime risk alcohol consumption is more common in men (23.7%) compared to women (8.8%); in those who live in outer regional and remote areas (24.4%) compared to inner regional areas (18.8%) and major cities (14.7%); and in Aboriginal and Torres Strait Islander people (20.0%) compared to non-Indigenous Australians (16.1%; non-age-standardised) (2).

Table 2 Exceedance of lifetime alcohol risk guidelines (>2 drinks per day, 7-day average) in adults aged 18 years and over (per cent), by age-group, sex, and time series 2001 to 2017-18

Population characteristics	Men		Women		All	
Age group (years)	%	CI	%	CI	%	CI
18–24	14.7	11–18.4	6.1	3.5–8.7	10.6	8.3–12.9
25–34	22.7	19.5–25.9	7.1	5.3–8.9	14.9	12.9–16.9
35–44	23.9	21.3–26.5	10.7	8.9–12.5	17.2	15.5–18.9
45–54	27.5	24.3–30.7	10.2	8.5–11.9	18.7	17.1–20.3
55–64	28.8	25.9–31.7	9.9	8.2–11.6	19.0	17.5–20.5
65–74	27.3	24.5–30.1	9.1	7.3–10.9	18.1	16.3–19.9
75 years and over	17.1	13.6–20.6	6.1	4.2–8	11.2	9.1–13.3
Total 18 years and over	23.7	22.5–24.9	8.8	8.1–9.5	16.1	15.4–16.8
Time series						
2001	29.0	27.8-30.2	8.5	7.8-9.2	18.5	17.8-19.2
2004–05	32.2	31.0–33.4	11.7	11.0–12.4	21.8	21.1–22.5
2007–08	30.2	28.8–31.6	11.7	10.8–12.6	20.9	20.0–21.8
2011–12	28.9	27.5–30.3	10.1	9.1–11.1	19.4	18.5–20.3
2014–15	25.6	24.0–27.1	9.2	8.3–10.1	17.3	16.4–18.2
2017–18	23.7	22.5–25	8.9	8.2–9.7	16.0	15.3–16.7

Adapted from the Australian Bureau of Statistics National Health Survey Data 2017-18 (1). Exceeding the lifetime risk guidelines for alcohol was defined as consuming more than 2 standard drinks per day (for both men and women) where 1 standard drink contained approximately 10 grams of pure alcohol. Alcohol risk was derived from an individuals' average daily consumption over the most 3 recent days they had consumed alcohol in the week before the interview. Data are available on remoteness (major cities, inner regional, outer regional and remote) and socioeconomic status (quartile 1 to quartile 5). CI; confidence interval.

Excessive alcohol consumption (>4 drinks per day, 7-day average)

6.3% of Australian adults (8.7% of men and 2.5% of women) consume on average more than four standard drinks per day (Table 3 and Table 4) (1). When stratified by 10-year age groups, excessive alcohol consumption is most common in men aged 55-64 (11.4%) and women aged 45-54 (3.8%) (Table 3) (1). Of people who drink on average more than 2 drinks per day, 13.1% consumed more than 4 to 5 drinks; 9.6% consumed more than 5 to 6 drinks; 4.5% consumed more than 6 to 7 drinks; and 12.2% consumed more than 7 drinks (Table 3 and Table 4) (1).

Table 3 Number of standard drinks consumed when drinking more than 2 standard drinks daily (7-week average) in adults aged 18 years and over (per cent), by sex 2017-18

Number of standard drinks	Men		Women		All	
	%	CI	%	CI	%	CI
More than 2 to 2.5 (approximately 20-25g/day)	19.9	-	30.1	-	22.8	-
More than 2.5 to 3 (approximately 25-30g/day)	15.6	-	19.4	-	16.6	-
More than 3 to 3.5 (approximately 30-25g/day)	10.5	-	14.3	-	11.7	-
More than 3.5 to 4 (approximately 35-40g/day)	10.2	-	8.7	-	9.9	-
More than 4 to 5 (approximately 40-50g/day)	13.3	-	13.2	-	13.1	-
More than 5 to 6 (approximately 50-60g/day)	11.1	-	5.6	-	9.6	-
More than 6 to 7 (approximately 60-70g/day)	5.0	-	3.6	-	4.5	-
More than 7 (more than approximately 70g/day)	14.2	-	6.2	-	12.2	-
Total more than 4 (more than approximately 40g/day)	43.6	-	28.6	-	39.4	-

Adapted from the Australian Bureau of Statistics National Health Survey Data 2017-18 (1). Exceeding the lifetime risk guidelines for alcohol was defined as consuming more than 2 standard drinks per day (for both men and women) over a 7-day average. The NHMRC defined one standard drink as approximately 10 grams of pure alcohol. NHMRC; National Health and Medical Research Council

Table 4 Prevalence of excessive alcohol consumption (more than 4 drinks per day, 7-day average) in adults aged 18 years and over (per cent), by age-group and sex 2017-18

	Men		Women		All	
Age group (years)	%	CI	%	CI	%	CI
18-24	#6.8	-	#1.5	-	4.2	-
25-34	#7.9	-	2.3	-	6.1	-
35-44	8.2	-	3.3	-	6.9	-
45-54	9.5	-	3.8	-	8.1	-
55-64	11.4	-	#2.1	-	7.2	-
65-74	7.3	-	2.1	-	7.5	-
75-84	#7.6	-	#1.7	-	3.7	-
85 years and over	2.7	-	#0.0	-	1.3	-
Total 18 years and over	8.7	-	2.5	-	6.3	-

Adapted from the Australian Bureau of Statistics National Health Survey Data 2017-18 (1). The NHMRC defined one standard drink as approximately 10 grams of pure alcohol. # Indicates the proportion has a high margin of error and should be used with caution. NHMRC; National Health and Medical Research Council

Changing trends in alcohol consumption in Australia

It is important to note that patterns of alcohol consumption in Australia have changed over time. According to time-series analyses since 2001, the proportion of Australian adults drinking at lifetime risk levels has decreased from a peak of 21.8% in 2004-05 to 16.1% in 2017-18 (Table 2) (1). World Health Organisation (WHO) reports corroborate that between 2007-8 to 2017-18 alcohol consumption in Australia dropped from 10.8 to 9.5 litres per capita per year (4).

The reduction in alcohol consumption was mainly driven by people under 40 (Table 2) (1). This trend is supported by Australian modelling (5) and if continued to adulthood, could result in an overall reduction in average alcohol consumption among adults in Australia (6). There may also be shifts in consumption due to COVID-19 which are being monitored. (7).

Emerging evidence

In 2022, the Global Burden of Disease (GBD) Alcohol Collaborators released a report that examined population-level risks of alcohol consumption by amount, geography, age, sex, and year (8). For this analysis, the authors constructed burden-weight-dose-response relative risk curves to estimate the theoretical minimum risk exposure level (TMREL) and non-drinker equivalence level (NDE) (see Box 2 for a definition) (8). For Australia, the report found that:

- **Among individuals aged 15–39 years in 2020**, the mean TMREL ranged from 0 to 0.1 standard drinks per day, and the NDE varied between 0.0 to 0.7 standard drinks per day.
- **Among individuals aged 40 years and older in 2020**, the TMREL that ranged from 0.1 to 0.9 standard drinks per day and the NDE ranged between 0.2 to 4.9 standard drinks per day, where a standard drink was considered 10g of pure alcohol.

These results highlight that the level at which alcohol causes harm differs depending on age and there were no significant differences by gender (8). These results suggest that existing Australian guidelines to reduce the risk of alcohol-related harm (which recommend consuming no more than four drinks on any one occasion and 10 drinks across the week, are high for younger persons aged 15-39 years, given that consuming up to 0.7 standard drinks per day puts a person at greater risk compared to a non-drinker (8). As shown in Table 5, most individuals aged 15-39 years are consuming more than the NDE level (83.5% and 78.1% for men and women respectively) (8).

Table 5 Number and proportion of the Australian population consuming in excess of the non-drinker equivalence level, and percentage change since 1990 by age group and sex for 2020

	Females			Males		
Age group	**Number (thousands**	**Proportion of population (%)**	**Percentage change since 1990 (%)**	**Number (thousands**	**Proportion of population (%)**	**Percentage change since 1990 (%)**
15-39 years	3280 (2740 to 3490)	78·1% (65·3 to 83·2)	–3·65% (–12·7 to 2·99)	3500 (3000 to 3670)	83·5% (71·5 to 87·4)	–2·07% (–9·33 to 1·66)
40-64 years	2230 (1530 to 3050)	56·7% (38·7 to 77·5)	4·88% (–6·07 to 15·6)	2380 (1810 to 3050)	63·0% (47·9 to 80·7)	8·04% (–0·866 to 15·9)
>=65 years	439 (226 to 726)	19·7% (10·2 to 32·6)	10·7% (2·85 to 17·2)	656 (431 to 1040)	34·0% (22·3 to 53·8)	8·35% (0·612 to 15·4)

Estimates sourced from the GBD Study 2022 (8).

Box 2.

Theoretical minimum risk exposure level (TMREL): the level of alcohol consumption that minimises health loss for a population.

Non-drinker equivalence (NDE): the consumption level at which the health risk is equivalent to that of a non-drinker

National Alcohol Strategy

The National Alcohol Strategy 2019-28 provides a 10-year framework to achieve a 10% reduction in harmful alcohol consumption in Australia (9). Alcohol currently accounts 5% of Australia's cancer disease burden (10). Up to 2% of alcohol-related cancers (~29,600 cancers) could be avoided between 2013-37, if Australian adults consumed no more than two standard drinks per day (11).

Prevalence of excess body weight in Australia

Excess body weight is classified is using the body mass index (BMI) as outlined in Box 1. Defined as a person's weight in kilograms divided by the square of a person's height in metres (kg/m^2) BMI is an imperfect measure of body fatness as it does not distinguish between lean and fat mass; however, it can be easily measured and is a reliable indicator of the risk of many common diseases and conditions (12).

Box 1. Body mass index

The World health Organisation classifies excess body weight using the body mass index (BMI). It is defined as a person's weight in kilograms divided by the square of the person's heigh in metres (kg/m^2).

Classification	BMI
Underweight	Below 18.5
Normal weight	18.5 to 24.99
Overweight	25.00 to 29.99
Obesity	30.00 or more

Two-thirds (67%) of Australian adults carry excess body weight (35.6% overweight, 31.3% obese) as shown in Table 6 (13). Excess body weight is more common in men compared to women and the age-groups with the highest prevalence of excess body weight are men aged 55-64 (83.6%) and women aged 65-74 (73.3%) (13). More than two-thirds (74.2%) of Aboriginal and Torres Strait Islander adults are overweight or obese (2). Substantially more individuals in this population are obese compared to overweight (45.1% and 29.0%) (2).

Table 6 Prevalence of excess body weight in adults aged 18 years and over (%) by body mass index, age-group, and sex 2017-18.

	Under/Normal weight			Overweight			Obesity			Overweight/Obesity		
Proportion (%)												
Age group	Men	Women	All	Men	Women	All	Men	Women	All	Men	Women	All
18–24	48.1	61.1	54.2	35.0	26.0	30.3	18.1	13.5	15.5	52.4	39.9	46.0
25–34	33.5	51	42.4	42.2	26.0	33.9	24.6	22.9	23.8	66.5	49.2	57.7
35–44	22.8	39.4	31.3	45.4	30.7	38.1	32.0	29.6	30.6	77.5	60.1	68.7
45–54	17.2	34.9	26.1	43.0	30.7	36.6	40.6	34.5	37.4	82.9	65.2	74.0
55–64	16.4	33.6	25.3	42.2	28.4	34.8	41.6	38.1	39.9	83.6	66.6	74.7
65–74	16.5	25.8	22.1	40.9	34.4	37.5	42.2	38.7	40.5	83.3	73.3	78.2
75-84	21.6	28.6	40.0	44.0	33.3	38.1	33.2	38.6	36.3	78.3	72.1	75.0
85+	37.9	37.7	44.0	#46.2	38.0	42.3	16.0	22.8	19.8	65.1	61.2	61.8
All	25.6	40.3	36.9	42.0	29.6	35.6	32.5	30.2	31.3	74.5	59.7	67.0

Adapted from the Australian Bureau of Statistics National Health Survey Data 2017-18. Age group reported in years. # Indicates the proportion has a high margin of error and should be used with caution. Data on Margin of Error of proportions are available. Underweight; BMI <18.5, normal weight; BMI 18.5-24.99; overweight 25.00-29.99; obesity >30.00; overweight/obesity >25.00. Data are available for underweight (<18.50); normal range (18.50-19.99); normal range (20.00-24.99); obesity class I (30-34.99); obesity class II (35.39.99); and obesity class III (40.00 or more).

Trends in excess body weight in Australia over time

Data on trends in adult BMI from 200 countries including Australia over the period 1975-2014 are available in the Lancet Non-Communicable Disease (NCD) Risk Factor Collaboration pooled analysis as shown in Table 7 (14). Recent global projections have indicated that the Australian prevalence of obesity will increase to 38% by 2030 (95% CI 37.2-38.9) (15). This is in line with previous projections to 2025 estimating a 35% obesity prevalence in Australian adults (16). However, there is also some evidence that the trend of increasing BMI may slow or plateau (17).

Table 7 Trends in BMI in Australia over the period 1975 to 2014.

Year	1975	1985	1995	2005	2014
	Age-standardised mean BMI (95% CI)				
Men	24.6 (23.9-25.4)	25.2 (24.9-25.6)	26.1 (25.8-26.4)	27.0 (26.7-27.3)	27.5 (26.9-28.1)
Women	23.4 (22.6-24.2)	24.3 (23.9-24.7)	25.3 (24.9-25.6)	26.2 (25.9-29.6)	26.8 (26.2-27.4)

Adapted from the Lancet pooled analysis of 1698 population-based measurement studies with 19.2 million participants.

Excess body weight and metabolic syndrome

It is important to note the association between excess body weight and metabolic syndrome (MetS). MetS refers to a cluster of metabolic risk factors including central obesity, type 2 diabetes mellitus, dyslipidaemia, elevated blood pressure, elevated blood glucose, and insulin resistance. There is no universal definition of MetS and current international consensus recommends that MetS is diagnosed in the presence of three or more metabolic risk factors (18). The prevalence of MetS in Australia is estimated to range from 13.4-30.7% depending on the diagnostic criteria used (7).

National Obesity Strategy

In March 2022, the National Obesity Strategy 2022-2032 was launched. It provides a 10-year framework to achieve two key goals: (1) halt the rise and reverse the trend in the prevalence of obesity in adults by 2030, and (2) reduce overweight and obesity in children and adolescents aged 2-17 years by at least 5% in 2030 as measured by age-standardised prevalence rates (19). If, over a 10-year period, the proportion of Australians who are overweight declined by 5% each year and the proportion of Australians who are obese declined by 10% each year, between 3,804-6,064 (9.4-15.0%) cases of liver cancer could be avoided (20).

Prevalence of ARLD in Australia

Alcohol-related liver disease (ARLD) is a common liver disease worldwide and is associated with chronic alcohol use (4). Although there is no standard definition of heavy drinking, ARLD is suspected in men who regularly drink more than 30 grams pure alcohol per day (g/d) and women who regularly drink more than 20g/d (21). A recent review estimated progression rates through disease stages of ARLD people who consume more than 40g/d (22).

Most (90-100%) chronic heavy drinkers develop alcohol-related steatosis or “fatty liver” (22). Only 10-35% of patients with alcohol-related steatosis develop alcohol-related steatohepatitis, which is inflammation of the liver (22). Of patients with alcohol-related steatohepatitis, 8-20% develop cirrhosis (22). Cirrhosis may be classified as compensated cirrhosis (asymptomatic; liver function can continue as normal) or decompensated (increased scarring, complications). Of patients with cirrhosis, 40% develop alcohol-related hepatitis, which has high mortality rates, and 2% develop alcohol-related hepatocellular carcinoma (HCC) (22).

Liver biopsy remains the gold standard method to diagnose ARLD (23). However, it is difficult to perform at a population level and consequently there are limited studies available, and none that have been performed in Australia(23). According to studies that have been done in Italy, China, Japan, Finland and the United States, estimates of the prevalence of ARLD range from 4-9%, alcohol-related steatosis 3-16%, and alcohol-related cirrhosis 0.4% in the general population (23).

In 2017, the Global Burden of Disease (GBD) study estimated prevalent cases of cirrhosis based on global rates of cirrhosis diagnoses from hospital admissions and claims data (24). For Australia, the data were adjusted to the population by sociodemographic index, and it

was estimated there were 38,384 (34,420-42,641) prevalent cases of alcohol-related compensated cirrhosis and 6,043 (5,500-6,583) prevalent cases of alcohol-related decompensated cirrhosis. This is equivalent to age-standardised prevalence rates of 126.3 (113.4-140.3) and 18.1 (16.5-19.58) per 100,000 persons respectively as shown in Table 8 (24).

Table 8 Australian prevalence of alcohol-related cirrhosis per 100,000, by disease stage (24).

Disease stage	Age-standardized prevalence rate per 100,000 persons
Alcohol-related compensated cirrhosis	126.3 (113.4-140.3)
Alcohol-related decompensated cirrhosis	18.1 (16.5-19.58)

Prevalence of ARLD among specific population groups in Australia

Characteristics of studies reporting on the prevalence of ARLD among specific population groups in Australia are provided in Table 9, with key findings outlined in the text below.

Patients with cirrhosis

A retrospective cohort study with 10,254 patients in Queensland found that the most common cause of cirrhosis was alcohol use. Alcohol consumption accounted for half (49.5%) of all cirrhosis cases (25). The prevalence of alcohol-related cirrhosis remained stable between the years 2008-2010 and 2014-2016 (25).

Aboriginal and Torres Strait Islander patients with cirrhosis

In the same cohort from Queensland, Valery et al. noted that a significantly higher proportion of Aboriginal and Torres Strait Islanders persons admitted to hospital for cirrhosis had alcohol-related cirrhosis, compared with non-Indigenous Australians (70% vs. 47%) (26).

Patients with chronic liver disease

In a long-term retrospective study with 5,556 patients in Western Australia, Huang et al. (2018) found that the prevalence of ARLD among chronic liver disease patients was 17% (27). Patients with ARLD had the highest 5-year risk of liver-related mortality (17.1%) and the second-highest cumulative risk of decompensation (29.2%) (27).

Patients with HCC

A prospective study in Victoria found a 39% prevalence of ARLD in a cohort of people recently diagnosed with HCC (28). Australian-born patients had a significantly higher prevalence of alcohol-related HCC compared to patients born overseas (61% vs. 25%, $p<0.001$) (28). A higher proportion of Aboriginal and Torres Strait Islander patients with HCC had alcohol-related HCC compared to non-Indigenous Australians (54.1% vs 39.6%, $p<0.001$) (29).

In a retrospective study with 272 HCC patients (130 who had undergone regular 6-monthly ultrasound surveillance prior to diagnosis and 142 who had not undergone surveillance), the proportion of patients with ARLD who had not undergone surveillance was high at 54.6% (30).

Table 9 Australian studies which estimate the prevalence of ARLD among specific population groups

Author (year)	Study period	Type of study	Location	Group	# Participants	Diagnostic tool	Outcome	Prevalence
Wigg et al. 2021 (29)	2000-2015	Cohort retrospective	QLD, SA, NT	Patients with HCC	299 Aboriginal and Torres Strait Islander patients and 3,587 non-Indigenous patients	ICD C22.0	Alcohol-related HCC	54.1% and 39.6%
Valery et al. 2021 (26)	2008-2016	Cohort retrospective	QLD	Patients with Cirrhosis	10,254	ICD-10-AM	Alcohol-related Cirrhosis	49.5%
Valery et al. 2020 (25)	2008-2017	Cohort retrospective	QLD	Patients with cirrhosis	779 Aboriginal and Torres Strait Islander patients and 10,642 non-Indigenous patients	ICD-10-AM	Alcohol-related Cirrhosis	70.0% and 47.0%
Huang et al. (2020 (27)	2004-2015	Cohort retrospective	WA	Patients with chronic liver disease	10,933	Hepascore (a serum fibrosis model)	ARLD	17%
Hong et al. 2018 (28)	2012-2013	Cohort prospective	VIC	Patients with HCC	272	NR	Alcohol-related HCC	39%
Huang et al. 2018 (30)	2006-2014	Cohort retrospective	WA	Patients with chronic liver disease	272	MRI, CT, bone scan	Alcohol-related HCC	55.4%

CT; computerized tomography, HCC; hepatocellular carcinoma, ICD-10-AM; International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification, MRI; magnetic resonance imaging, NT; Northern Territory, QLD; Queensland, SA; South Australia, VIC; Victoria, WA; Western Australia

Prevalence of NAFLD in Australia

Non-alcoholic fatty liver disease (NAFLD) has emerged as a rapidly growing cause of primary liver cancer, largely due to rising obesity and rates of the metabolic syndrome (31). The terminology for NAFLD was updated in 2019 to metabolic-associated fatty liver disease (MAFLD) in order to more accurately reflect patient heterogeneity (32,33). NAFLD is defined as the presence of hepatic steatosis (fatty infiltration in >5% of hepatocytes) in the absence of competing liver disease aetiologies (34). MAFLD is diagnosed using positive criteria which are the detection of hepatic steatosis in addition to one of the three following conditions: excess body weight, type 2 diabetes mellitus (T2DM) or evidence of metabolic dysregulation as outlined in Box 1 (32,33).

NAFLD and MAFLD refer to a spectrum of liver disease encompassing hepatic steatosis or “fatty liver”, steatohepatitis (inflammation), fibrosis (laying down of scar tissue) and cirrhosis (permanent liver damage) (34). Each stage of NAFLD or MAFLD may progress to primary liver cancer, with hepatocellular carcinoma (HCC; the most common form of primary liver cancer in Australia), most frequently occurring in the context of underlying liver cirrhosis (35).

Estimates of NAFLD or MAFLD prevalence can vary depending on the diagnostic tool used (35). Non-invasive imaging such as ultrasound (US), computerised tomography (CT) and magnetic resonance imaging (MRI) or liver biopsy are the preferred tools for diagnosis of steatosis in NAFLD and MAFLD (35). However, they are difficult to perform at a population level and consequently there are no imaging or liver biopsy studies available in Australia (35). Other tools such as the fatty liver index (FLI), Hepascore, transient elastography (TE) or liver function biomarkers (ALT; alanine aminotransferase and AST; aspartate aminotransferase), may be used to indicate the likelihood of the presence of steatosis or liver

fibrosis severity (35). Retrospectively, International Classification of Disease (ICD) codes can be used to determine prevalence.

Available evidence is presented using the terms NAFLD or MAFLD as reported in original studies. Prevalence estimates are described with reference to the diagnostic tool used.

The prevalence of NAFLD in Australia was estimated at 22.2% in 2020 (95% confidence interval (CI) 19.0-25.2%) based on body mass index (BMI) trends in the Australian population and global estimates of NAFLD prevalence (36,37). The proportion of NAFLD patients in fibrosis stage F0, F1, F2 and F3 was 84.8%, 7.7%, 4.2% and 2.5% (36). The proportion of patients with cirrhosis was estimated at 1.2% and those with decompensated cirrhosis, HCC and liver transplant combined 0.2% (36). The prevalence of NASH was 5.3% (95% CI 4.2-6.5%) in 2020 as shown in Table 10 (36).

The Global Burden of Disease (GBD) study estimated prevalent cases of cirrhosis in 2017 based on global rates of cirrhosis diagnoses from hospital admissions codes and claims data. For Australia, the data were adjusted to the population by sociodemographic index, and prevalence was estimated to be 19,811 (17,504 - 22,388) cases of NASH-related compensated cirrhosis and 3,099 (2,806-3,441) cases of NASH-related decompensated cirrhosis. This is equivalent to age-standardised prevalence rates of 65.4 (57.5-73.8) and 9.3 (8.4-10.4) cases per 100,000 persons respectively as shown in Table 11Table 8 (24).

Changing trends in NAFLD prevalence

The prevalence of NAFLD in Australia is predicted to reach 23.6% (95% CI 19.6-26.5%) and the prevalence of NASH 6.2% (4.8-7.6%) by 2030 as shown in Table 10 (36). The age-group with the largest increase in prevalent cases is expected to be people aged 60-64 years, with NAFLD more common in men compared to women (36). These findings align with trends in the global prevalence of NAFLD which has increased from 25.2% (95% CI 22.1-28.7%) to 29.8% (95% CI 28.6-31.1%) to 33.9% (95% CI 23.4-46.2%) according to meta-analyses in 2016, 2019 and 2022 (37–39).

Table 10 Estimated and projected prevalence of NAFLD in Australia in 2020 and 2030.

Year	2020	2030
Australian population (n)	25,710,000	27,794,000
NAFLD prevalent cases (n)	5,710,000 (4,879,000 – 6,483,000)	7,026,000 (5,842,000 – 7,890,000
F0	4,818,000 (4,009,000 – 5,515,000)	5,741,000 (4,557,000 – 6,581,000)
F1	438,000 (295,00 – 619,000)	582,000 (389,000 – 812,000)
F2	238,000 (149,000 – 361,000)	347,000 (218,000 – 524,000)
F3	140,000 (83,600 – 204,000)	223,000 (134,000 – 322,00)
Compensated cirrhosis	67,000 (39,900 – 111,000)	115,000 (68,700 – 190,000)
Decompensated cirrhosis, HCC, liver transplant	9,100 (6,000 – 15,500)	16,000 (11,000 – 25,700)
NAFLD prevalence rate (%)	22.2% (19.0-25.2%)	23.6% (19.6-26.5%)
NASH prevalent cases (n)	1,366,000 (1,078,000 – 1, 681,000)	1,848,000 (1,439,00 – 2,256,000)
NASH prevalence rate (%)	5.3% (4.2-6.5%)	6.2% (4.8-7.6%)

HCC; hepatocellular carcinoma, NAFLD; non-alcoholic fatty liver disease, NASH; non-alcoholic steatohepatitis. Source: Adams et al. (2020) (36).

Table 11 Estimated prevalence of NASH-related cirrhosis in Australia in GBD Study 2017.

Disease stage	Number of cases	ASR per 100,000 persons
Compensated cirrhosis	19,811 (17,504 - 22,388)	65.4 (57.5-73.8)
Decompensated cirrhosis	3,099 (2,806-3,441)	9.3 (8.4-10.4)

ASR; age-standardised rate, HCC; hepatocellular carcinoma, NAFLD; non-alcoholic fatty liver disease, NASH; non-alcoholic steatohepatitis. Source: Sepanlou et al., 2020 (24).

Prevalence of MAFLD in Australia

The Australian prevalence of MAFLD was estimated at 37% in a large Australian prospective cohort (40). Farell et al. used data from the 2012 AusDiab cohort, a nation-wide population-based study originally designed to investigate the prevalence of diabetes, obesity, hypertension, and kidney disease in Australian adults aged over 25 years, to calculate the FLI (40).

The FLI is an accepted and validated tool for detecting NAFLD in large epidemiologic studies. It has been shown to have good concordance with hepatic US for detecting steatosis in older, Caucasian populations, but less accuracy in Asian populations (41). Farrell et al. noted that the high prevalence of MAFLD may be reflective of the older age, frequency of excess body weight (69%) and T2DM (10%) in the AusDiab follow-up cohort, which were higher than for the Australian population at the time (63% and 4% respectively) (40). Nonetheless, the estimate by Farrell et al. aligns with findings from global meta-analyses which estimate a global prevalence of MAFLD at 39.2% (40). Patients have significantly higher odds of being diagnosed with MAFLD compared to NAFLD (odds ratio 1.37 (1.16-1.63), p<0.001, due to the more inclusive diagnostic criteria (40).

NAFLD	MAFLD
Steatosis (fatty infiltration in >5% of hepatocytes) AND	
No excessive alcohol consumption (>30grams per day (g/d) for men and >20g/d for women is generally considered the threshold for excessive drinking). **No other causes of hepatic steatosis** (e.g., viral hepatitis B and C, hemochromatosis, autoimmune disease, Wilsons' disease)	**One of the following criteria:** • Excess body weight (overweight/obesity) • Type 2 diabetes mellitus (T2DM) • Metabolic dysregulation **Metabolic dysregulation refers to at least two features of:** • Waist circumference ≥102/88 cm in Caucasian men and women (or ≥90/80 cm in Asian men and women), • Blood pressure ≥130/85 mmHg or specific drug treatment • Plasma triglycerides ≥150 mg/dl (≥1.70 mmol/L) or specific drug treatment • Plasma high density lipoprotein-cholesterol 2 mg/L • Prediabetes (i.e., fasting glucose levels 100 to 125 mg/dl [5.6 to 6.9 mmol/L], or 2-hour post-load glucose levels 140 to 199 mg/dl [7.8 to 11.0 mmol] or HbA1c 5.7% to 6.4% [39 to 47 mmol/mol]) • Homeostasis model assessment of insulin resistance score ≥2.5 • Plasma high-sensitivity C-reactive protein level >2 mg/L

Box 1 Diagnostic criteria for NAFLD and MAFLD.
Source: Chalasani et al., 2018 (34) *and Eslam et al., 2020* (32,33)

Prevalence of NAFLD and MAFLD in specific population groups in Australia

The following section outlines estimates of the prevalence of NAFLD or MAFLD from recent cohort studies conducted in specific population groups in Australia.

People living in a regional setting

A 2021 cross-sectional analysis in regional Victoria estimated an age- and sex- standardised prevalence of NAFLD of 36% using FLI (42). Using data from the same cohort, a subsequent study in 2022 estimated the age- and sex- standardised prevalence of MAFLD at 47.2% (43). The high prevalence of NAFLD and MAFLD may be explained in part because people living in regional and rural areas are more likely to have excess body weight compared to those

living in metropolitan areas with 1.18 (1.08-1.29), p<0.001 greater odds of being overweight and 1.31 (1.07-1.60), p=0.01 greater odds of being obese (44).

Patients with cirrhosis

A retrospective cohort study in Queensland found that the prevalence of NAFLD/NASH among cirrhosis patients was 4.8% (26). This is lower than estimated in the 2017 GBD study which found that 12.5% of compensated and 12.8% of decompensated cirrhosis cases were due to NASH (24). Valery et al. noted that 28.5% of cirrhosis cases in their Queensland study were classified as 'cryptogenic' or unspecified (26) and it has been previously observed that NAFLD/NASH prevalence can be unreported by up to 42.9% using hospital codes (45).

Aboriginal and Torres Strait Islander people

Valery et al. (2020) found that lower proportion (3%) of Aboriginal and Torres Strait Islander patients with cirrhosis in the aforementioned Queensland study had NAFLD/NASH-related cirrhosis, compared with non-Indigenous Australians (5%) (46). This result was not statistically significant due to low patient numbers (N=583 persons with NAFLD or NASH) (46). A subsequent study in 2021 with 3,816 participants across three Australian jurisdictions found that 6.1% of Aboriginal and Torres Strait Islander patients with HCC had NAFLD/NASH-related HCC, compared with non-Indigenous patients (7.8%)(29).

Patients screened for existing liver disease

A study with 10,933 participants in Western Australia 2004-15 found the prevalence of NAFLD among chronic liver disease patients was 14.6% (27). Patients with NAFLD had a significantly lower risk of liver-related death and decompensation compared to patients with HCV infection (hazard ratio 0.67 (95% CI 0.48-0.95) and 0.70 (95% CI 0.52-0.94)) (27). A similar study of 2,050 patients attending liver clinics at two Melbourne hospitals between 2014-16 found that 148 (7%) of people screened had NAFLD (47). Over half of the NAFLD patient group had components of the metabolic syndrome, including T2DM, impaired glucose tolerance and hypertension (47). The authors suggested that the low prevalence of NAFLD at the liver clinics may be due to lack of screening and low referral rates of NAFLD patients to specialist clinics (47).

Patients with HCC

A prospective study in Victoria found a 14% prevalence rate of NAFLD among 272 patients recently diagnosed with HCC across seven tertiary hospitals in 2012-13 (48).

Patients who are morbidly obese

Among Australian patients who were morbidly obese (BM ≥35), the prevalence of NAFLD was estimated at 83-96% (49,50). Among morbidly obese NAFLD patients, the prevalence of NASH was 15-20% and advanced fibrosis (F3-F4) estimated at 3-10% (49,50).

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