

Preventive Health Unit
**Cardiovascular disease risk in
Queensland 2011–12: blood pressure,
cholesterol, obesity and diabetes**

About this report

This report is designed for a technical audience, and assumes knowledge of technical aspects of the measurement and monitoring of blood pressure, cholesterol, obesity and diabetes. It assumes familiarity with survey methodologies and cohort studies, including the national health survey series and the AusDiab study.

The objective of this report is to provide a snapshot of the key risks for cardiovascular disease in Queensland using two national measurement surveys/studies. These two sources are unique as they provide both physical and biomedical estimates of critical risk factors. Both studies have strengths and limitations and it is not the purpose of this report to critique the methodology of either, rather to use the data as effectively as possible to describe cardiovascular risk in the Queensland population. Methodological limitations, particularly in the diagnosis of diabetes, are noted and discussed.

This report includes survey data released publicly by the Australian Bureau of Statistics (ABS) and other publicly released documents. It also includes data provided on request.^{1,2} The Department of Health, Queensland Government was, however, solely responsible for the extraction, analysis and statistical interpretation of the data presented in this report. Statistical interpretation is based on methods described by the ABS as and Queensland Health.^{3,4}

Data from surveys conducted by the Queensland Government, Department of Health (formerly Queensland Health) are released publically and sources cited.⁵

This report was prepared by Preventive Health Unit (Margaret Bright and Catherine Harper). It was reviewed and advice provided by Associate Professor Dianna Magliano Baker IDI Heart and Diabetes Institute Melbourne and Dr Peter Abernethy Preventive Health Unit, Queensland Health. The investment and expertise associated with the data collections to inform this analysis is acknowledged.

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Summary

Cardiovascular disease is the largest cause of death in Queensland and second largest cause of premature death. This is the reason it has the greatest potential impact on life expectancy. Preventing cardiovascular disease will bring great benefits to Queenslanders through more years of healthy life, reduced burden of disability and savings in health system costs. Cardiovascular disease can be prevented and the most effective way of doing so is by reducing the level of risk in the community. The four key risk factors for cardiovascular disease have been called the 'deadly quartet': hypertension, high cholesterol or dyslipidaemia, obesity and diabetes. While each of these factors independently increases the risk of heart disease, it is the clustering of risks that has a more deadly effect. This report provides a snapshot of prevalence, incidence and trends. It includes actions taken by people to manage their cardiovascular disease risk. Later reports will focus on the clustering of chronic disease risk factors more broadly.

This report brings together data for adults from two national measurement surveys, the AusDiab cohort study and the Australian Health Survey 2011–12.

Diabetes:

- In 2011–12, about 1 in 12 adult Queenslanders had diabetes.
- For every four diagnosed cases there was one newly diagnosed case at survey.
- It is estimated that about 17,000 new adult cases of diabetes are diagnosed each year.
- It is estimated that the prevalence of diabetes has increased by about 25% in 12 years.
- Many people with diabetes (60%) were taking medications to manage their disease with about 1 in 5 (21%) using insulin daily.
- People with diabetes are undertaking lifestyle change to manage their condition—two-thirds (61%) had changed their diet, one-quarter exercised most days (24%) and one-fifth had lost weight (18%).

Hypertension:

- In 2011–12, about 1 in 3 adults was hypertensive (30%). This includes 13% who had untreated high blood pressure, 6% who were inadequately treated for high blood pressure, and 11% who were successfully treated for it.
- An estimated 93,000 new adult cases of hypertension are diagnosed each year.
- The prevalence of hypertension has increased by 33% in 12 years.
- About half of those with high blood pressure were taking medications for it, although the medication was effective for only about two-thirds.
- About 1 in 4 adults had their blood pressure checked in the previous 12 months (27%) with those who had been diagnosed with high blood pressure more likely to have had it checked (75%).
- People with hypertension were more likely to talk to their GP about lifestyle change than those with normal blood pressure—with 1 in 5 discussing reaching a healthy weight (19%), 1 in 8 discussing physical activity (12%) and 1 in 8 discussing their diet (13%).

Dyslipidaemia:

- In 2011–12, about 2 in 3 adults were dyslipidaemic (64%). This includes 51% who had untreated high cholesterol, 8% who were inadequately treated for it and 5% who were successfully treated.
- The level of blood lipids has improved in the past 12 years while the proportion taking lipid lowering medication has more than doubled.
- About one-quarter of those with high cholesterol were taking medications for it, although the medication was effective for only about half.
- About 2 in 3 adults had their cholesterol checked in the previous 12 months (68%) although those who had been diagnosed with high blood cholesterol were more likely to have done so (72%).

Obesity:

- In 2011–12, about 1 in 3 adults were obese (30%) and 35% who were overweight.
- It is estimated that there are about 43,000 new adult cases of obesity each year.
- The prevalence of measured obesity has increased by about 47% in 12 years.
- People who were obese were more likely to talk to their GP about lifestyle change than those who were a healthy weight, with 1 in 3 discussing reaching a healthy weight (31%), 1 in 6 discussing their physical activity (16%) and 1 in 6 discussing diet and healthy eating (17%).

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1. Background

Cardiovascular disease (CVD) is the largest cause of death nationally and the second largest cause of premature death (after cancer). In 2010 CVD caused 32% of all deaths in Queensland and 19% of all premature deaths. The risk factors for CVD are well known with the clustering of risk very important in the development of disease. The World Health Organization (WHO) has defined the clustering of the most dangerous CVD risk factors as the 'metabolic syndrome'. There are many definitions of metabolic syndrome but most include: diabetes and pre-diabetes, abdominal obesity, high cholesterol and high blood pressure. In Australia, these four risk factors have been described as 'the deadly quartet'.⁶

The impact of metabolic syndrome is evident worldwide⁷:

- A quarter of the world's adults have metabolic syndrome.
- People with metabolic syndrome are twice as likely to die from, and three times as likely to have a heart attack or stroke as those without the syndrome.
- People with metabolic syndrome have a fivefold greater risk of developing type 2 diabetes.
- Up to 80% of the 200 million people with diabetes globally will die of CVD.

Improvement in outcomes related to CVD, principally in declining death rates, have been the major contributor to increasing life expectancy in Australia. This is evident in the improvement of Australia in international life expectancy rankings over the past two decades.⁸ Ongoing improvements in disease reduction, including the prevention of CVD, must include a focus on reducing exposure to the 'deadly quartet'. Knowledge of the prevalence, incidence and trends in the population is necessary to target interventions and develop strategies to minimise risk. Monitoring these factors is complex. Self report data alone are insufficient for a full understanding of CVD risk in the population. The blood measurement of glucose and cholesterol is necessary as is the physical measurement of obesity and blood pressure. Over the past 10 to 15 years there have only been two major national data collections to monitor the deadly quartet—the AusDiab cohort study with its 1999–2000 baseline and two follow-up surveys^{6,9,10}, and the Australian Health Survey (AHS) undertaken by the Australian Bureau of Statistics (ABS) in 2011–12.

The AusDiab cohort study commenced in 1999–2000 with an objective to accurately determine by measurement the prevalence of diabetes, obesity and other CVD risk factors including hypertension and dyslipidaemia in the population.⁶ A five-year follow-up study was undertaken and, more recently, a 12-year follow-up report was released.^{11,12} The AusDiab baseline study provides population estimates of measured prevalence of the CVD risk factors, while the follow-up studies provide estimates of measured incidence since baseline.

The AHS was conducted in 2011–12. It was a complex survey, including three major components, and reports for the whole population as well as for Indigenous Australians. It included a national health survey⁹ (self report of a wide range of conditions and risk factors and physical measurement of height, weight, waist circumference and blood pressure), a national nutrition and physical activity survey¹³ and a national health measurement survey¹⁴ (included blood and urine tests such as diabetes biomarkers and blood lipids).

The objective of this report is to provide an epidemiological snapshot of measured prevalence of the four CVD risk factors, and to assess trends and incidence as data from the two studies allow. This report accepts the limitations of these studies.^{3,12} It does not attempt to critique each independently, recognising both studies were designed for multiple complex purposes and both were subject to design and methodological limitations.

A detailed epidemiological report on measured obesity and trends for adults and children in Queensland has been released¹⁵, so this report will include limited summary information about obesity. Self report data from the Queensland self report risk factor surveys⁴ and from the national health survey⁹ are included to inform and contrast prevalence where relevant. This report focuses on the four main CVD risk factors independently. The clustering of these and other chronic disease risks will be the subject of later reports.

2. Diabetes

Diabetes is a metabolic disorder characterised by chronically elevated blood sugar due to failure of insulin function. It interferes with metabolism and can cause long term damage, dysfunction and failure of various organs. It predisposes people to cardiovascular disease, vision loss, amputations and renal failure. The main types of diabetes are type 1, type 2 and gestational diabetes. The causes of type 1 diabetes differ from the causes of type 2 diabetes. Obesity is a key determinant of type 2 diabetes, along with a sedentary lifestyle, and hypertension. Genetics influences the development of about 10% of diabetes, particularly type 1.

Measurement

Diabetes is diagnosed by measurement of blood glucose. There are three main ways of detecting elevated blood glucose:

- The standard clinical test in Australia is the fasting plasma (blood) glucose test (FPG). This requires the subject to have fasted for eight hours prior to the test.
- More recently the measurement of HbA1c in the blood of a non-fasting person is being used to detect and monitor diabetes.¹⁴ HbA1c is a measure of exposure to elevated blood glucose in the previous three months. It is increasingly being used to detect diabetes and assess elevated risk.
- The gold standard test of diabetes is the oral glucose tolerance test (OGTT), where a subject is given a high oral dose of glucose and over a two-hour period, blood glucose is monitored to assess the effectiveness of the insulin mechanisms in the body to re-establish normal glucose levels.

The WHO recommends the use of both the FPG and OGTT tests to diagnose diabetes.¹⁶ FPG alone does not diagnose all cases. The WHO has determined that OGTT is necessary to diagnose around 30% of diabetes cases and other reports would suggest a higher proportion.^{16,17} However, for population monitoring and clinical assessment of diabetes internationally, FPG and HbA1c tests are increasingly being used.¹⁸⁻²⁰ In Australia the potential use of HbA1c is being assessed. The WHO has recently proposed the conditional use of HbA1c.²¹ There are a number of reasons for doing so including the cost of the OGTT test and because the OGTT is for the subject, intrusive and time consuming. In Australia the general practice guidelines for diagnosis of type 2 diabetes recommend use of OGTT when a person has an equivocal risk assessment and/or FPG result.²²

Diagnostic criteria

The AHS used the FPG to diagnose diabetes. It also separately reported on diabetes prevalence using HbA1c measurement.^{3,14} The diagnostic criteria for FPG diagnosis was as follows:

Known diabetes if:

- had ever been told by a doctor or nurse that they have diabetes and were taking diabetes medication (either insulin or tablets); or
- had ever been told by a doctor or nurse that they have diabetes and blood test result for FPG was ≥ 7.0 mmol/L.

Newly diagnosed diabetes if:

- no prior diagnosis of diabetes; and
- FPG ≥ 7.0 mmol/L.

At high risk of diabetes if:

- no prior diagnosis of diabetes, and
- FPG $\geq 6.1 - 7.0$ mmol/L

For HbA1c, the criteria were as above, except blood level criteria were:

- known or newly diagnosed cases: HbA1c ≥ 6.5 mmol/L
- at high risk: HbA1c $\geq 6.0 - 6.5$ mmol/L

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The AusDiab study used FPG and OGTT blood tests in combination to diagnose diabetes.⁶ The diagnostic criteria were:

Known diabetes if:

- receiving treatment in form of tablets or insulin or both at the time of the study; or
- had ever been told by a doctor or nurse that they have diabetes and blood test for FPG ≥ 7.0 mmol/L OR OGTT ≥ 11.1 mmol/L.

Newly diagnosed diabetes if:

- no prior diagnosis of diabetes nor currently receiving treatment for diabetes; and
- FPG ≥ 7.0 mmol/L or OGTT ≥ 11.1 mmol/L.

At high risk of diabetes if:

- no prior diagnosis of diabetes, and
- FPG $\geq 6.1 - 7.0$ mmol/L

Prevalence

It is estimated that about 1 in 12 adult Queenslanders had diabetes in 2011–12. This is an approximation based on several analytical approaches, in the absence of a comprehensive clinical assessment (that is, the use of both FPG and OGTT for diagnosis) for the Queensland population. The AHS is the most recent national survey to clinically assess diabetes prevalence, but it used FPG alone for diagnosis which is likely to underestimate the true prevalence. While the precise extent of under-diagnosis is unknown, using all available data, a conservative estimate of expected prevalence in 2012 was undertaken for Queensland as described in Appendix 1, page 19.

However, based on FPG test alone, in 2011–12, 5% of adult Queenslanders, or 1 in 20, were diagnosed with diabetes (Table 1) and 3% were at very high risk of developing diabetes.^{1,14} For every four known cases, there was one newly diagnosed case. Males were 60% more likely than females to be diagnosed with diabetes, and 3.5 times more likely to be a newly diagnosed case. They were twice as likely to be at high risk of developing diabetes.

The prevalence of FPG diagnosed diabetes increased with age from less than 1% in young adults (18–34 years) to 15% in older adults (65–74 years).¹ Generally the ratio of newly diagnosed cases to known cases, decreased with age: from 1 in 2 among young people to 1 in 10 among older people.

The prevalence of FPG diagnosed diabetes in Queensland did not differ from national prevalence in 2011–12 (5.0% and 5.1% respectively).¹⁴ The ratio of newly diagnosed to known cases was similar, that is 1 to 4, and the proportion at high risk of diabetes was similar (3.0% and 3.1% respectively).

By self report in a Queensland survey in 2011–12, 9% of adult Queenslanders had ever been told they had diabetes or high sugar levels (Table 2).²³ Males were 30% more likely than females to self report diabetes, older Queenslanders (65 years and older) were 4 times more likely than younger Queenslanders (18–44 years) and those in disadvantaged areas were 63% more likely than those in advantaged areas. In the national survey in 2011–12, the combined prevalence of self reported diabetes and high sugar levels in Queensland was similar to national prevalence (Table 2).¹ Although patterns of self reported diabetes and high blood sugar were similar to those by blood measurement, the limitation of self report is that it cannot identify undiagnosed cases, and may also be influenced by recall bias.

Incidence

The AusDiab study is the source of information on diabetes incidence in Australia because it tracked a cohort of individuals aged 25 years and older from baseline in 1999–2000, for 12 years, and because it used both FPG and OGTT tests to assess diabetes status in the study population at each time point.

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The incidence of diabetes nationally between 1999–2000 and 2011–12, was 0.7% per year based on FPG and OGTT diagnosis.¹² There were slightly more new male diabetes cases than female cases (0.8% and 0.6% respectively). Annual incidence increased with age from 0.3% per year in adults aged 25–44 years to 1.3% per year for 65–74 year olds. Those adults with higher risk of diabetes in 1999–2000, that is, they were diagnosed as pre-diabetes were about 10 times more likely to have developed diabetes in 2011–12 than those at low risk.

Incidence data for Queensland is not available, however applying the national age and sex specific incidence rates to the Queensland population, it is estimated that on average there were about 17,000 new cases of diabetes each year over the 12 years in Queensland—about 9,000 males and about 8,000 females.²⁴

Actions taken

In 2011–12 about 1 in 4 Australians who had ever been told they had diabetes consulted a GP in the previous two weeks (23%) and this was similar for the whole population (20% of all persons).²⁵ Similarly, when considering the previous 12 months, visiting a GP or specialist was similar for those with diabetes to the whole population (88% and 84% respectively consulted a GP and 26% and 32% consulted a specialist). Those with diabetes were however, more likely to consult selected allied health practitioners than the general population:

- 23 times more likely to consult a diabetes educator (19% and 1% respectively)
- 8 times more likely to consult a dietician/nutritionist (11% and 1% respectively)
- 4 times more likely to consult a chiroprapist/podiatrist (12% and 3% respectively)
- 80% more likely to consult an optician/optometrist (10% and 6% respectively).

About 1 in 4 Australians who have been diagnosed with diabetes use insulin (or analogues) every day (23%), with prevalence of insulin use greater in young people (80% of those aged 0–34 years) than older (15–16% in persons 65 years and older), reflecting the relatively higher prevalence of insulin dependent diabetes in young people.²⁵ Among Queenslanders who have ever had a diagnosis of diabetes, 60% had taken some form of diabetes related medication in the previous two weeks including insulin and analogues, metformin and gliclazide, with 21% specifically using insulin.

The majority of Australians ever diagnosed with diabetes had their blood glucose levels checked in the previous month: 41% had it checked every day, 21% at least once a week, 8% at least monthly, and remainder less frequently.²⁵ Three-quarters (75%) had an HbA1c test in the previous 12 months.

Lifestyle change in response to having diabetes is common. In 2011–12 of those Australian adults who had been diagnosed with diabetes²⁵:

- 2 in 3 (66%) were currently following a changed diet or eating pattern because of their diagnosis, while a further 1 in 10 (9%) having done so in the past. Females were 9% more likely to have changed their diet than males, and persons aged 55–64 years were more likely than all other age groups (about 20% more likely than younger or older persons to have done so). One in 4 (25%), had not changed their diet or eating patterns.
- 1 in 3 (30%) had exercised on most days of the week
- 1 in 6 (17%) had lost weight in the previous 12 months.

Among adult Queenslanders who reported a diabetes diagnosis, 61% reported having changed their diet or eating pattern, 24% had exercised most days and 18% had lost weight.¹

Comparison between studies

The AusDiab study and the AHS differ in important ways particularly with respect to the measurement of diabetes. The fundamental difference is in blood measurement tests used to diagnose diabetes. It is recognised internationally that the diagnostic criteria are likely to have variable and sometimes quite large effects on the estimated prevalence of diabetes in different populations.²⁶ The FPG identifies different people as having diabetes to those identified by OGTT.

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The AusDiab survey used both FPG and OGTT to diagnose diabetes. The AHS used FPG alone, which does not diagnose all cases. In 1999–2000 the OGTT test diagnosed 34% of diabetes cases nationally, and 43% in Queensland. In 2011–12 the AHS reported an FPG diagnosed diabetes prevalence of 5.0% for Queensland and 5.1% nationally. This is expected to be a significant underestimate of the true prevalence of diabetes in these populations. Recognising the importance of monitoring diabetes and the limitations of currently available data, an estimation of current prevalence was undertaken for Queensland using all available data (Appendix 1, page 19).

The AusDiab survey commenced in 1999–2000 with a study population aged 25 years and older. By the time of the second follow-up assessment, the cohort was aged 37 years and older. In contrast the AHS included all persons aged two years and older although for the biomedical measurement survey only persons aged 12 years and older were included.

Trends

The data to accurately report on the change in prevalence of diabetes is limited because the diagnostic tests have not been consistently applied. However, based on FPG diagnosed diabetes, the prevalence for Queensland adults aged 25 years and older increased by 45% over 12 years (from 4.0% in 1999–2000 to 5.8% in 2011–12) (Table 3). For Australia there was a 12% increase in FPG diagnosed diabetes in persons aged 25 years and older. This data should be interpreted with caution as the estimates are based on FPG alone, and there are only two data collections for comparison, noting that all survey estimates have error and potential bias. A more robust estimate of change over the 12-years is based on modelled prevalence in 2011–12 (Appendix 1, page 19) compared with the FPG/OGTT estimate in 1999–2000. Using these two data points it is likely that the prevalence of diabetes in Queensland has increased by 25% over the period.

In 1999–2000, for every diagnosed case there was another undiagnosed case (Table 3). Twelve years on there were four diagnosed cases for every undiagnosed case. This change demonstrates the more effective monitoring of blood glucose and chronic disease risk assessment in the primary care setting in the past decade.

In 1999–2000, about 1 in 4 Australian adults aged 25 years and older managed their diabetes by diet alone, 55% by tablets and 18% by insulin and tablets.¹² Over the 12 years of follow-up, considering the original cases and those diagnosed over the intervening period, the proportion managing the condition by diet alone decreased to 10% in 2011–12, while management with tablets increased to 65% and insulin and tablets to 24%.

Table 1. Prevalence (95%CI) of measured diabetes, adults, Queensland and Australia, 2011–12^{1,14,25}

	Male	Female	Queensland Persons	Australia Persons
Diabetes				
Total diabetes (FPG)	6.4 (4.5-8.3)	3.6 (2.2-5.0)	5.0 (3.8-6.2)	5.1 (4.5-5.7)
Known diabetes (FPG)	5.1 (4.5-6.7)	3.2 (1.8-4.6)	4.2 (3.1-5.3)	4.2
Newly diagnosed (FPG)	*1.3 (0.4-2.2)	**0.4 (0-0.9)	*0.9 (0.4-1.4)	0.9
At risk of diabetes (FPG)			3.0 (2.3-3.7)	3.1 (2.6-3.6)
Self reported diabetes but no medication and no high FPG			1.3 (0.7-1.9)	1.0
Known diabetes (HbA1c)			5.0 (3.9-6.1)	5.4 (4.9-5.9)
At risk of diabetes (HbA1c)			5.6 (4.5-6.7)	5.4 (4.8-6.0)
Number of newly diagnosed diabetes cases for every diagnosed case			0.21	0.21

* estimate has a relative standard error between 25% and 50% and should be used with caution

** estimate has a relative standard error greater than 50% and is considered too unreliable for general use

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Table 2. Prevalence of self reported diabetes and high blood sugar, adults, Queensland and Australia, 2011–12

	Queensland			Australia		
	Males	Females	Persons	Males	Females	Persons
Ever told has diabetes	6.3	4.5	5.4	6.3	5.2	5.7
Reported using diabetes mellitus medication(a)	63.0	55.8	60.0	65.4	61.3	63.5
Reported using insulin to control condition	20.5*	20.8*	20.6*	20.8	19.3	20.1
Of all adults**:						
Ever told has high sugar levels in blood or urine	3.1	3.9	3.5	3.8	4.2	4
Reported using diabetes mellitus medication(a)	np	np	np	np	3.2*	2.0*
Ever told has diabetes or high sugar	9.4	8.4	8.9	10.1	9.4	9.7
Has been screened for diabetes in the last 3 years(b)	18	18.8	18.4	20.6	21.9	21.2
Of all adults***: Ever told have diabetes or high blood sugar	10.3	7.9	9.0			

* estimate has a relative standard error between 25% and 50% and should be used with caution

** AHS 2011-12

*** Queensland SRHS 2011-12

np not available for publication but included in totals where applicable, unless otherwise indicated

(a) Diabetes mellitus medication includes: Insulins and analogues (A10A), metformin (A10BA02) and gliclazide (A10BB09).

(b) Includes persons who reported a heart or circulatory condition, or was aged 50 years and over and did not have diabetes or high sugar levels.

Table 3. Prevalence (95% CI) of measured diabetes, persons 25 years and older, Queensland and Australia, 1999, 2011–12^{1,10,12}

	1999-2000	2011-12	% change
Australia			
Diabetes			
FPG/OGTT	7.5	n/a	
Known diabetes			
FPG	3.1 (2.3-4.0)	4.5 (3.9-5.1)	45.2
FPG/OGTT	3.7 (2.8-4.6)	n/a	
Newly diagnosed			
FPG	1.8 (1.4-2.3)	1.0 (0.7-1.3)	-44.4
FPG/OGTT	3.7 (3.0-4.4)	n/a	
Total			
FPG	4.9 (3.8-6.1)	5.5 (4.9-6.1)	12.2
FPG/OGTT	7.4 (5.9-8.8)	n/a	
% diagnosed by OGTT	33.8	n/a	
Queensland			
Diabetes			
FPG/OGTT	7	n/a	
Known diabetes			
FPG	2.9 (1.6-4.2)	4.8 (3.5-6.1)	65.5
FPG/OGTT	3.5		
Newly diagnosed			
FPG	1.1 (0.4-1.8)	*1.0 (0.4-1.4)	-9.1
FPG/OGTT	3.5		
Total			
FPG	4.0 (2.2-5.7)	5.8 (4.4-7.2)	45.0
FPG/OGTT	7		
% diagnosed by OGTT	42.9	n/a	

n/a not available

* estimate has a relative standard error of 25% to 50% and should be used with caution

3. High blood pressure

High blood pressure, often referred to as hypertension, is prolonged elevation of the blood pressure. Blood pressure represents the forces that blood exerts on the wall of the arteries and is written as systolic/diastolic, for example, 120/80 mmHg. Systolic blood pressure reflects the maximum pressure in the arteries when the heart muscle contracts to pump blood; diastolic blood pressure reflects the minimum pressure in the arteries when the heart muscle relaxes before its next contraction.

Measurement

Blood pressure is frequently measured by a clinician in a primary healthcare setting or at a pharmacy, but any person with a blood pressure cuff may monitor their own or another person's blood pressure. For the AHS it was measured by trained interviewers using an automated blood pressure monitor.³ This is described as a physical measurement.

Self report surveys which include the National Health Survey (NHS) rely on respondent recall of ever having been told they have high blood pressure or that they have hypertension. Due to the sequence of questions and structure of the NHS, respondents must first have identified that they have a circulatory or heart condition.

Diagnostic criteria

There are three criteria for diagnosis of hypertension. They are:

- systolic blood pressure of 140 mmHg or more or
- diastolic blood pressure of 90 mmHg or more or
- receiving medication for high blood pressure.

In the AHS, the first two criteria were assessed by physical measurement, the third by self report at interview.

Prevalence

In 2011–12, 30% of Queensland adults were hypertensive (Table 5).¹ This was similar to national prevalence (32%).⁹ The prevalence of hypertension was about 20% higher in males than females, and increased with age from 8% in young people (18–24 years) to 80% in older people (75 years and older) (Table 5).

By self report in 2011–12, 29% of Queensland adults reported having been told by a doctor or nurse they had high blood pressure. Females were 11% more likely to do so than males (Table 4). This survey cannot be compared with the NHS where adults were first asked if they had a circulatory or heart condition—the prevalence of ever reporting high blood pressure in this cohort was 18% for Queensland adults, similar to national (19%). The prevalence of self reported hypertensive disease (classified as a long term current health condition) was similar in Queensland in 2011–12 to nationally (9.5%, 9.6% respectively).

Incidence

The AusDiab study is the source of information on the incidence of hypertension in Australia because it tracked a cohort of individuals aged 25 years and older from baseline in 1999–2000, for 12 years, and because it used a similar methodology to measure blood pressure in the study population at each time point.

The incidence of hypertension nationally between 1999–2000 and 2011–12, was 2.9% per year.¹² The male incidence rate was 27% higher than the female rate (3.3% and 2.6% respectively). The annual incidence rate increased with age from 1.0% per year in adults aged 25–34 years to 7.5% per year for people 75 years and older.

Incidence data for Queensland is not available, however, applying the national age and sex specific incidence rates to the Queensland population, it is estimated that on average there were

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about 93,000 new cases of hypertension each year over the past 12 years in Queensland—about 48,000 males and about 45,000 females.²⁴

People with diabetes or with impaired FPG or impaired OGTT were 2.5 times more likely to develop hypertension over a 12-year period than those with normal glucose levels.¹² Similarly the incidence of hypertension was 65% higher in overweight adults and 2.4 times higher in obese adults than those of normal weight over 12 years.¹²

Actions taken

Over 50% of adult Queenslanders who were hypertensive in 2011–12 were treated for the condition, that is, on antihypertensive medications, and of all adults, 17% were treated for high blood pressure. However, not all people with high blood pressure were effectively treated and many were not treated at all. Among all Queensland adults in 2011–12 (Table 5):

- 1 in 7 (13%) had untreated high blood pressure
- 1 in 10 (11%) were on treatment for high blood pressure with effective control
- 1 in 17 (6%) were on treatment for high blood pressure without effective control
- 2 in 3 (70%) did not have high blood pressure and nor were they on treatment for it.

The Queensland prevalence was similar to national prevalence.

Adult males were 41% more likely to have untreated hypertension than females but in all other categories they were similar (Table 5). Middle aged people (45–74 years) were most likely to have untreated hypertension and older people were more likely to have effectively treated hypertension than young people.

About 3 in 4 adults (75%) who have ever been told they had high blood pressure were likely to have had their blood pressure checked in the previous 12 months. A similar proportion had it checked in the previous 2 years (76%). However among all adults, only about 1 in 5 had their blood pressure checked in the previous 12 months (21%), and slightly more in the previous 2 years (22%).

About 1 in 5 adults (22%) had consulted a GP in the previous two weeks although the majority had been to a GP in the previous 12 months (86%). Of those who had measured high blood pressure, slightly more had consulted a GP in the previous two weeks (27%) than the general population while in the previous 12 months, the proportion was similar (89%). Of those Australian adults with high blood pressure:

- 1 in 5 (18.7%) discussed reaching a healthy weight with their GP
- 1 in 8 (11.7%) discussed increasing their physical activity with their GP
- 1 in 8 (12.8%) discussed eating healthy food or improving their diet with their GP.

Those who had measured high blood pressure were more likely to talk to their GP about lifestyle factors to improve their health than those with normal or low blood pressure—they were about 50% more likely to discuss reaching a healthy weight, 50% more likely to discuss becoming more physically active and 30% more likely to discuss healthy eating.

Comparison between studies

The AusDiab study and AHS used similar measurement methods and protocols and the same diagnostic criteria to report high blood pressure and hypertension as discussed in section 6, page 16. Key differences between these two surveys relate to study design rather than measurement.

Trends

There is insufficient data to report on trends in measured hypertension either nationally or for Queensland, however, considering the only two data collections available for comparison, between 1999 and 2011–12 there was a 33% increase in measured hypertension in Queensland adults aged 25 years and older (23% increase nationally) (Table 6). This data should be interpreted with caution as both are survey estimates and likely to have some bias in measurement.

Cardiovascular disease risk factors in Queensland

For self reported hypertensive disease (long term health condition), the prevalence in Queensland did not change over the 10 year period between 2001 and 2011–12, but nationally it decreased by 7%. The reporting by Queensland adults of ever having been told by a doctor or nurse they have high blood pressure, decreased by 9% between 2006 and 2012, or about 1.3% per year.

Table 4. Prevalence of self reported hypertension by sex, adults, Queensland and Australia, 2011–12

	Queensland			Australia		
	Males	Females	Persons	Males	Females	Persons
Ever told	17.7	18.4	18.0	18.8	19.4	19.1
Current condition	13.3	13.1	13.2	13.5	13.9	13.7
Of those reporting a heart or circulatory condition*:						
Long term (6+ months) condition	12.9	12.8	12.9	13.1	13.5	13.3
Ever told and using hypertension medication	7.3	7.0	7.1	7.1	7.3	7.2
Ever told and checked in past 12 months			73.4			72.2
Ever told and checked in past 2 years			75.9			74.7
Of all adults*:						
BP checked in past 12 months	19.5	22.3	20.9	20.5	23.6	22.1
BP checked in past 2 years	20.3	24.2	22.3	21.7	25.2	23.5
Of all adults**:						
Ever told	27.5	30.5	29			

* AHS 2011-12

** Queensland SRHS 2011-12

Table 5. Prevalence of measured hypertension by age and sex, adults, Queensland and Australia, 2011–12^{1,14,25}

	Hypertension	Effectively treated hypertension	Ineffectively treated hypertension	Not taking hypertension medication	Not hypertensive
Queensland					
Males	32.8	12.0	5.7	15.1	67.2
Females	27.1	10.0	6.4	10.7	72.9
Persons	29.9	11.0	6.1	12.8	70.1
18–34 years	7.6				
35–44 years	19.4				
45–54 years	30.3				
55–64 years	48.0				
65–74 years	65.9				
75+ years	80.2				
Australia					
Males	34.1	10.5	7.4	16.2	65.9
Females	29.1	9.6	7.6	11.9	70.9
Persons	31.6	10.1	7.5	14.0	68.4
18–24 years	6.6	0.7	np	np	93.4
25–34 years	9.9	0.8	0.2	8.8	90.1
35–44 years	17.8	2.6	np	np	82.2
45–54 years	32.6	6.6	5.9	20.1	67.4
55–64 years	50.1	19.7	11.7	18.7	49.9
65–74 years	69.1	30.4	20.4	18.3	30.9
75–84 years	80.5	33.7	33.2	13.6	19.5
85+ years	87.7	34.9	40.8	12.0	12.3

* estimate has a relative standard error of 25% to 50% and should be used with caution

** estimate has a relative standard error greater than 50% and is considered too unreliable for general use

Table 6. Prevalence of measured hypertension and blood cholesterol, persons 25 years and older, Queensland and Australia, 1999, 2011–12^{1,10,12}

		1999-2000	2011-12	% change
Australia	Hypertension	28.8	35.4	22.9
Queensland	Hypertension	25.1	33.4	33.1
Australia	High total cholesterol	51.2	35.7	-30.3
	High LDL	45.7	35.5	-22.3
	Low HDL	11.9	n/a	
	High triglycerides	20.6	15.2	-26.2
Queensland	High total cholesterol	49.7	33.6	-32.4
	High LDL	46.7	36	-22.9
	Low HDL	12.3	27.4	122.8
	High triglycerides	19.5	17.1	-12.3
Australia	On lipid lowering medication	7.3	13.8*	89.0
Queensland	On lipid lowering medication	5.7	13.6*	138.6

* persons 18 years and older

4. High cholesterol

Cholesterol is a fatty substance produced by the liver and carried by the blood to supply the rest of the body. Its natural function is to supply material for cell walls and hormones, but if levels in the blood become too high this can lead to atherosclerosis (hardening of the arteries) and heart disease.²⁷ Two components play an important role in the development of CVD:

- low-density lipoprotein (LDL) cholesterol, often known as 'bad' cholesterol
- high-density lipoprotein (HDL) cholesterol, often known as 'good' cholesterol.

The total cholesterol level is often used as an indicator of CVD risk and, as a general rule, the lower it is the better.

Triglycerides are a fatty substance in the blood, similar to cholesterol. High blood triglycerides are an independent risk factor for heart disease as they contribute to the development of atherosclerosis.

Measurement

Cholesterol is measured in a blood sample taken from a subject who has fasted for at least eight hours prior to collection. Blood cholesterol and triglycerides are measured by specialised procedures in a pathology laboratory. This testing is sometimes referred to as a clinical test. In contrast, self reported estimates are obtained from a survey where a respondent is asked whether they have ever been told by a doctor or nurse that they had high cholesterol. In the NHS, due to sequence of questions and the structure of the survey, respondents must first indicate they had a circulatory or heart condition.

Diagnostic criteria

Dyslipidaemia refers to a number of different lipid disorders, that is, conditions where there are too many fats in the blood. A person was classified as having dyslipidaemia if they had one or more of the following:

- taking lipid lowering medication
- total cholesterol ≥ 5.5 mmol/L
- HDL cholesterol < 1.0 mmol/L for males and < 1.3 mmol/L for females
- LDL cholesterol ≥ 3.5 mmol/L
- triglycerides ≥ 2.0 mmol/L.

Prevalence

In 2011–12, 64% of Queensland adults were dyslipidaemic (Table 7).¹ This was similar to national prevalence (63%).⁹ The prevalence of dyslipidaemia was similar in males and females (66% and 63% respectively), and increased with age from 45% in young people (18–24 years) to about 80% in older people (65–74 years) (Table 8).¹⁴

By self report in 2011–12, 29% of Queensland adults reported having been told by a doctor or nurse they had high blood cholesterol (Table 9). This survey cannot be compared with the NHS where adults were first asked if they had a circulatory or heart condition—and with this filter question, the prevalence of ever reporting high blood pressure was 13% for Queensland adults, similar to national (15%). The prevalence of self reported high cholesterol as a long term current health condition was similar in Queensland in 2011–12 to nationally (8% and 9% respectively).

Incidence

There is insufficient data to assess the incidence of dyslipidaemia in Queensland or nationally.

Actions taken

Of the 63% of adult Queenslanders who were dyslipidaemic in 2011–12, the majority were not taking lipid lowering medications. One in seven adults or 14% were taking medications for high cholesterol. However, not all people with high blood cholesterol were effectively treated and many were not treated at all. Among all Queensland adults in 2011–12:

Cardiovascular disease risk factors in Queensland

- 1 in 2 (51%) had untreated high blood cholesterol
- 1 in 20 (5%) were on treatment for high blood cholesterol with effective control
- 1 in 12 (8%) were on treatment for high blood cholesterol without effective control
- 1 in 3 (36%) were not dyslipidaemic, that is they had normal blood cholesterol and were not taking lipid lowering medications.

Queensland prevalence was similar to national prevalence.

There was no difference by sex in the prevalence of treated and untreated dyslipidaemia in Queensland in 2011–12 (Table 8). The prevalence of untreated dyslipidaemia was high across all age groups, and peaked at 60% in those aged 45–54 years (Figure 1). Treated dyslipidaemia increases with age with the pattern for effectively controlled and ineffectively controlled similar up to the age 65–74 years.

About 2 in 3 adults (68%) who have ever been told they had high blood cholesterol were likely to have had their cholesterol checked in the previous 12 months—and a similar proportion had it checked in the previous 5 years—72%. However, among all adults, only about 1 in 5 had their cholesterol checked in the previous 12 months (18%) and slightly more in the previous 5 years (21%).

Comparison between studies

The AusDiab 1999–2000 baseline study reported on prevalence of high blood cholesterol and lipid lowering medications. Such information has not been included in the subsequent follow-up studies. The AHS in 2011–12 similarly reported on dyslipidaemia and included treated and untreated categories. Both were based on direct blood measurements and while there are age group differences and study design differences the two surveys provide comparable data. Neither study/survey has routinely reported prevalence, standardised by age and sex to a reference population.

Self report surveys are not directly comparable with blood measurement surveys and efforts to better relate measured and self report data would be beneficial to improve monitoring of this key risk factor.

Trends

In 1999–2000, of Queenslanders aged 25 years and older¹⁰:

- 50% had elevated total cholesterol
- 47% had elevated LDL
- 12% had reduced HDL
- 20% had elevated triglycerides.

In the 12 years since this survey, and using the difference between the AusDiab survey and the AHS 2011–12 (Table 6), there have been improvements across all blood lipids for adults aged 25 years and older:

- Elevated total cholesterol has decreased by 32%.
- Elevated LDL has decreased by about 23%.
- Reduced HDL has more than doubled.
- Elevated triglycerides have decreased by about 12%.

These changes in blood lipids in Queensland were similar to those nationally. At the same time, the proportion of the population on lipid lowering medication has more than doubled, from 6% to 14% although the age groups for comparison differ—25 years and older in 1999–2000 and 18 years and older in 2011–12. This information should be interpreted with caution as it represents the difference between two studies only and both studies are subject to bias.

Cardiovascular disease risk factors in Queensland

Table 7. Prevalence (95%CI) of dyslipidaemia, adults, Queensland and Australia, 2011–12^{1,14,25}

	Queensland	Australia
Dyslipidaemia*	64.2 (61.0-67.4)	63.2 (61.3-65.1)
Not on lipid lowering medication	85.1	84.5
Measured normal cholesterol	34.4 (31.2-37.6)	35.1 (33.3-36.9)
Measured high cholesterol	50.7 (47.5-53.9)	49.4 (47.6-51.2)
On lipid lowering medication	13.6	13.8
Measured normal cholesterol	5.2 (4.3-6.1)	6.6 (6.0-7.2)
Measured high cholesterol	8.4 (6.9-9.9)	7.2 (6.5-7.9)
High total cholesterol	30.8 (28.3-33.3)	32.8 (31.5-34.1)
High LDL	34.0 (31.0-37.0)	33.2 (31.6-34.8)
Low HDL	26.5 (24.1-28.9)	23.1 (21.7-24.5)
High triglycerides	15.8 (13.5-18.1)	13.9 (12.7-15.1)

* high cholesterol or on lipid lowering medication

Table 8. Prevalence of dyslipidaemia by age and sex, adults, Queensland and Australia, 2011–12¹⁴

Queensland	Age group (years)						Sex		
	18–34	35–44	45–54	55–64	65–74	75+	Males	Females	Persons
Has dyslipidaemia	45.2	62.6	72.8	77.5	81.9	78.1	65.7	62.8	64.2
Effectively treated dyslipidaemia									5.2
Ineffectively treated dyslipidaemia									8.4
Not taking lipid lowering medication									50.7
Does not have dyslipidaemia									35.8
Australia	18–34	35–44	45–54	55–64	65–74	75+	Males	Females	Persons
Has dyslipidaemia	44.3	59.2	70.9	78.9	81.0	77.7	63.7	62.8	63.2
Effectively treated dyslipidaemia	0.0	*1.7	3.7	10.4	19.0	29.8	6.9	6.3	6.6
Ineffectively treated dyslipidaemia	*1.0	3.0	6.2	13.4	19.0	17.7	7.7	6.7	7.2
Not taking lipid lowering medication	43.3	54.5	61.1	55.1	42.9	30.3	49.1	49.7	49.4
Does not have dyslipidaemia	53.8	38.7	28.2	19.8	17.5	20.2	34.8	35.5	35.1

* estimate has a relative standard error of 25% to 50% and should be used with caution

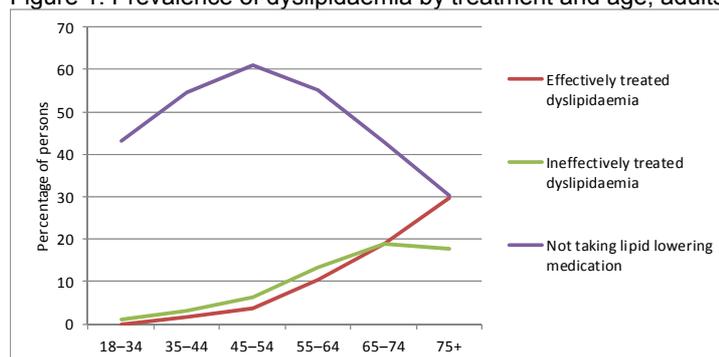
Table 9. Prevalence of self reported high cholesterol, adults, Queensland and Australia, 2011–12

	Of those reporting a heart or circulatory condition:	Queensland			Australia		
		Males	Females	Persons	Males	Females	Persons
Of those reporting a heart or circulatory condition*:	Ever told	13.8	11.2	12.5	15.4	13.6	14.5
	Current condition	9.2	7.5	8.4	9.5	9	9.2
	Long term (6+ months) condition	8.6	7.3	7.9	9	8.6	8.8
	Ever told and using lipid lowering medication	74.7	69.2	72.2	63.7	65.6	64.6
	Ever told and checked in past 12 months			67.6			62.6
	Ever told and checked in past 5 years			73.1			69.9
Of all adults*:	Cholesterol checked in past 12 months	17.5	17.5	17.5	17.9	18.4	18.2
	Cholesterol checked in past 5 years	19.9	21.1	20.5	20.7	22.7	21.7
Of all adults**:	Ever told	30.1	27.9	29.0			
	Cholesterol checked in past 5 years						

* AHS 2011-12

** Queensland SRHS 2011-12

Figure 1. Prevalence of dyslipidaemia by treatment and age, adults, Australia, 2011–12¹⁴



5. Obesity

Overweight and obesity have been increasing in prevalence in Queensland and Australia and most OECD countries for at least the past 30 years. The already high and increasing prevalence has significant current and future health, social and economic impacts as overweight and obesity increases the risk of type 2 diabetes, CVD, osteoarthritis, some cancers and a number of other conditions. A more detailed assessment of obesity in Queensland has been recently released.¹⁵

Measurement

The classification of overweight and obesity is based on body mass index (BMI) which is derived from height and weight. Such data can be collected by self report survey or by physical measurement. While physical measurement is a more accurate approach, less costly self report surveys are routinely used to monitor trends in BMI risk. Self report data is likely to underestimate the true level of overweight and obesity in the population due to potential bias in reporting height and weight, but, noting this limitation, data from self report surveys are used in Queensland and most jurisdictions to demonstrate overall trends.

Diagnostic criteria

BMI is derived by dividing the weight in kilograms by square of height in metres.²⁸ For adults, BMI is categorised as follows²⁹:

- underweight BMI <18.5
- normal weight BMI \geq 18.5 to <25
- overweight BMI \geq 25 to <30
- obese BMI \geq 30

Prevalence

By physical measurement in 2011–12, 30.4% of Queensland adults were obese and 34.5% were overweight, a total of 64.9% overweight or obese (Table 10).³⁰ By self report in 2012, 22.7% of Queensland adults were obese, 35.0% overweight, a total of 57.7% overweight or obese.³¹

The prevalence of measured obesity in Queensland more than doubled between young adults (16% in 18–24 years) and middle-aged adults (35% in 65–74 year olds), while the prevalence did not differ by sex (31.3% for adult males and 28.6% for adult females).³⁰ The prevalence of overweight and obesity combined increased with age from 41% in 18–24 year olds and peaked in middle-aged groups (55–74 years) at about 78%. The adult male prevalence was 18% higher than the female prevalence (70% and 60% respectively).

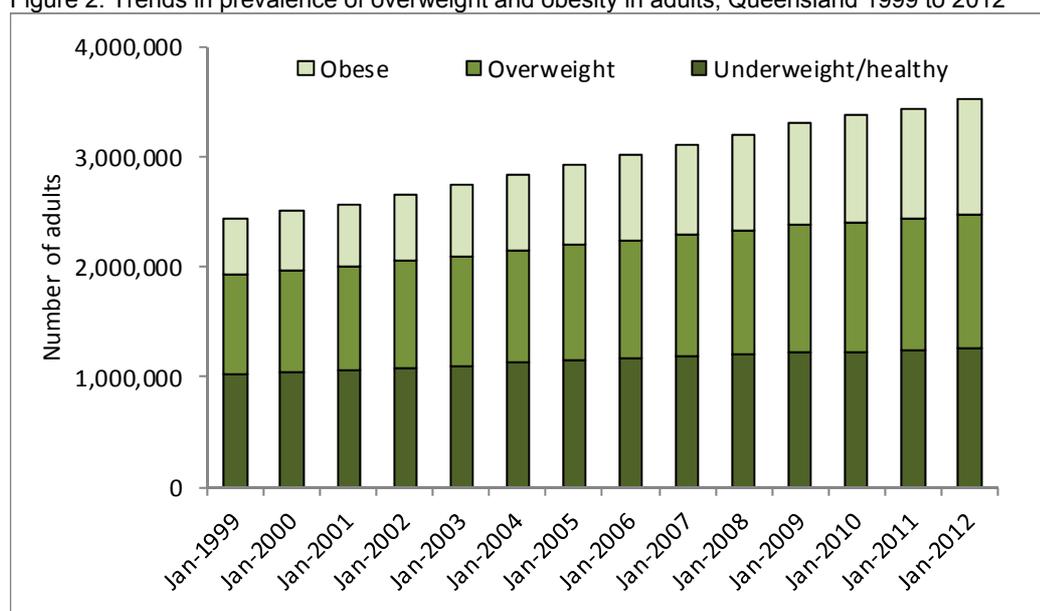
By self report in Queensland in 2012, the prevalence of self reported adult obesity tripled with age from 9% in 18–24 years to 30% in 55–64 years, while there were no sex differences. The prevalence of overweight and obesity combined doubled between younger adults and older adults (32% in 18–24 years and 68% in 65–74 years) and was 28% higher for males than females (65% and 51% respectively).³¹

Incidence

The incidence of overweight and obesity is based on estimated prevalence with limited measured data collections to inform trend. Three surveys were used to forecast trends: a quasi estimate for persons 18 years and older from the Ausdiab Queensland estimates (as the survey included persons 25 years and older) of 1999–2000¹⁰, the NHS 2007–08 estimates³² and AHS 2011–12.³⁰ Over the period 2001–2012 the annual average increase in overweight and obese Queensland adults was 67,000 (24,000 overweight and 43,000 obese) (Figure 2). This data is based entirely on measured estimates of BMI.

Cardiovascular disease risk factors in Queensland

Figure 2. Trends in prevalence of overweight and obesity in adults, Queensland 1999 to 2012



Actions taken

Obese Australian adults were about 30% more likely to have visited a GP in the previous two weeks than healthy weight and underweight adults and 19% more likely to have visited a specialist in the previous 12 months.²⁵ They were about 20% more likely than healthy weight and underweight adults to have visited a medical facility in the previous 12 months including as an outpatient (38% more likely), an admitted patient (34% more likely) emergency department (30% more likely) or a day clinic (27% more likely). They were 20% more likely to have had time away from school or study as a result of illness than healthy weight and underweight adults.

Of those Australian adults who were measured as obese²⁵:

- 1 in 3 (31%) discussed reaching a healthy weight with their GP
- 1 in 6 (16%) discussed increasing their physical activity with their GP
- 1 in 6 (17%) discussed eating health food or improving their diet with their GP.

Those who were measured as obese were more likely to talk to their GP about key lifestyle factors associated with weight than those who were healthy weight or underweight—they were about 2.8 times more likely to discuss reaching a healthy weight, 2.6 times more likely to discuss becoming more physically active and 50% more likely to discuss healthy eating.

Trends

The prevalence of measured adult obesity in Queensland increased significantly from 24.9% in 2007–08 to 30.4% in 2011–12. The increase in obesity in Queensland was also observed nationally, however, the increase was greater in Queensland, 22% over the four years, compared to 12% nationally. The prevalence of measured overweight and obesity combined increased by 7% in Queensland and by 2% nationally between 2007–08 and 2011–12.¹⁵

Over the longer term, between 1995 and 2011–12 there was a 0.4 percentage point per year increase in the prevalence of measured overweight and obesity in Australia.¹⁵ While the prevalence of overweight remained steady, that of obesity increased by 0.5 percentage points per year. This data should be interpreted with caution as it is based on only three data points nationally. For Queensland, also with limited data sources it is estimated that the prevalence of measured overweight and obesity has increased 17% over the 12 years and the prevalence of measured obesity by 47% (Figure 2). While this is consistent with the reported increase in self reported overweight and obesity³³ and also described below, caution should be exercised as this is based on three data points.

Cardiovascular disease risk factors in Queensland

Considering long term trends in self reported overweight and obesity in Queensland and Australia, the rate of change since the early collections of the 1990s is very similar—with obesity tripling from about 8% in 1990 to about 24% in 2012—an increase of 0.7 percentage points per year for Australia and Queensland¹⁵, with very little change in prevalence of overweight. This resulted in an overall increase of 1 percentage point per year in the prevalence of self reported overweight and obesity over the two decades. The more frequent self report surveys enable more reliable trend reporting, in contrast with the limited measurement surveys. Detailed analysis of trends in self reported BMI in Queensland will be released in late 2014

Table 10. Self reported and measured overweight and obesity in adults, Queensland

Measured (national survey)	2007-08		2011-12		
Overweight	35.9		34.5		
Obese	24.9		30.4		
Overweight and obese	60.8		64.9		
Self report (state survey)	2008	2009	2010	2011	2012
Overweight	33.9	34.1	34.2	34.5	35.0
Obese	20.8	21.3	21.4	22.9	22.7
Overweight and obese	54.7	55.3	55.6	57.4	57.7
Relative difference (self report/measured)					
Overweight	0.94		1.01		
Obese	0.84		0.75		
Overweight and obese	0.90		0.89		

6. Measurement and survey methods

The data for this report is primarily based on publicly available information from the surveys as described below and data provided on request.¹ Queensland Health was fully responsible for the interpretation and secondary analysis of such data to inform this assessment of CVD risk. Detailed information on survey scope and associated methodologies and data collection to report physical and biomedical estimates are documented. Comparing response rates between surveys is limited by definitions and in the more complex designs the inclusions and exclusions to generate a rate.

The Australian Diabetes, Obesity and Lifestyle Study (AusDiab)

The Australian Diabetes, Obesity and Lifestyle (AusDiab) study is the largest Australian longitudinal population-based study examining the natural history of diabetes, pre-diabetes (in which glucose metabolism is impaired but not to the level to cause diabetes), heart disease and kidney disease.

The baseline study conducted in 1999-2000 provided benchmark national data on the prevalence of diabetes, obesity, hypertension and kidney disease in Australia. The second phase of AusDiab, completed in December 2005, was a five year follow-up of the people who participated in the baseline survey. The twelve year follow-up was completed in 2012, with the results released in August 2013. The results include the incidence (or number of new cases) of diabetes, cardiovascular disease and kidney disease over twelve years, and an assessment of the factors that increase the risk of these conditions.

Methods for the AusDiab baseline and follow-up studies have been published.^{6,10-12} The study response rate for participation in the physical (and biochemical) measurement survey was 55%.

The Australian Health Survey (2011–12)

The 2011-13 Australian Health Survey (AHS) is the largest and most comprehensive health survey ever conducted in Australia. This survey was designed to collect a range of information from Australians about health related issues, including health status, risk factors, actions, and socioeconomic circumstances. In 2011–13, the AHS collected new information on nutrition and physical activity, as well as the first national biomedical information collection.

Information was collected by face-to-face interview, and by telephone for some follow-up modules, from usual residents of private dwellings in urban and rural areas of Australia, covering about 97% of the people living in Australia.

Methods for the AHS including blood and physical measurements have been published.³ Of the 30,329 respondents aged 5 years and over in the combined sample (that is, national health survey and national nutrition and physical activity survey), 11,246 (37.1%) participated in the biomedical component.

Queensland self reported health status surveys

The annual Queensland self reported health status survey series commenced in 2009, although prior to that less regular omnibus surveys had been conducted by Queensland Health. Data are collected by computer assisted telephone interview from a random sample of Queensland adults. Data for key health indicators are collected annually (healthy weight, physical activity, fruit and vegetable consumption, alcohol consumption, daily smoking, unsafe sun exposure) with additional health modules included on a rotational or one-off basis.

Methods for the Queensland self report surveys have been published.³⁴ Response rates vary from year to year from about 70% to about 80%.

7. Definitions and abbreviations

Australian Health Survey (AHS): The AHS 2011–12 is composed of three separate surveys:

- National Health Survey (NHS) 2011–12
- National Nutrition and Physical Activity Survey 2011–12
- National Health Measures Survey) 2011–12.

Blood pressure: The force exerted by the blood on the walls of the arteries as it is pumped around the body by the heart. It is written, for example, as 134/70 mmHg, where the upper number is the systolic pressure (the maximum force against the arteries as the heart muscle contracts to pump the blood out) and the lower number is the diastolic pressure (the minimum force against the arteries as the heart relaxes and fills again with blood). Levels of blood pressure can vary greatly from person to person and from moment to moment in the same person.

Cardiovascular disease (CVD): Any disease of the circulatory system, namely the heart (cardio) or blood vessels (vascular). This includes heart attack, angina, stroke and peripheral vascular disease. Also known as circulatory disease

Diabetes (diabetes mellitus): A chronic condition in which the body cannot properly use its main energy source, the sugar glucose. This is due to a relative or absolute deficiency in insulin, a hormone that is produced by the pancreas and helps glucose enter the body's cells from the bloodstream where they will be processed. Diabetes is marked by an abnormal build-up of glucose in the blood, and it can have serious short- and long-term effects. There are three main types of diabetes: type 1 diabetes, type 2 diabetes and gestational diabetes

Dyslipidaemia: Refers to a number of different lipid disorders (that is, conditions where there are too many fats in the blood). A person was considered to have dyslipidaemia if they had one or more of the following:

- taking cholesterol-lowering medication
- total cholesterol ≥ 5.5 mmol/L
- HDL cholesterol < 1.0 mmol/L for men and < 1.3 mmol/L for women
- LDL cholesterol ≥ 3.5 mmol/L
- triglycerides ≥ 2.0 mmol/L.

FPG: Fasting plasma glucose: A blood test that measures the amount of glucose (a sugar) in the blood. Fasting plasma glucose levels of ≥ 7.0 mmol/L indicate diabetes.

HbA1c test: The HbA1c test provides an indication of the presence and management of diabetes. Also referred to as glycated haemoglobin, it measures the amount of glucose in the blood that binds to the haemoglobin present in red blood cells. If glucose amounts are below 7% and stable then tests should be performed every six months; if they are higher than that tests should be performed every three months.

HDL cholesterol: High density lipoprotein (HDL) cholesterol is the measure of 'good' cholesterol. HDL picks up excess cholesterol in the blood and takes it to the liver where it is broken down. High levels of HDL cholesterol reduce the risk of heart disease, while low levels increase the risk. In this survey, abnormal HDL cholesterol is defined as < 1.0 mmol/L for males, and < 1.3 mmol/L for females.

High blood pressure: A measured blood pressure reading of 140/90 mm Hg (millimetres of mercury) or higher.

Hypertension: A systolic blood pressure of 140 mmHg or more or a diastolic blood pressure of 90 mmHg or more, or receiving medication for high blood pressure.

Impaired fasting plasma glucose: A fasting plasma glucose level ranging from ≥ 6.1 mmol/L to < 7.0 mmol/L indicates that a person is at high risk of diabetes.

Cardiovascular disease risk factors in Queensland

Incidence: The number of new events, for example new cases of cancer, during a given period in a specified population. Incidence is expressed as a percentage of the population in this report.

Known diabetes: A person was considered to have known diabetes if:

- they had ever been told by a doctor or nurse that they have diabetes and they were taking diabetes medication (either insulin or tablets) or
- they had ever been told by a doctor or nurse that they have diabetes and had a blood test result that confirmed diabetes, that is, FPG ≥ 7.0 mmol/L, or OGTT > 11.1 mmol/l or HbA1c $\geq 6.5\%$.

LDL cholesterol: Low density lipoprotein (LDL) cholesterol is the measure of 'bad' cholesterol in the blood. Over time, LDL cholesterol can build up in the blood vessels and arteries, blocking the passage of blood flow. Abnormal LDL cholesterol is defined as ≥ 3.5 mmol/L or greater.

Newly diagnosed diabetes: A person is considered to have newly diagnosed diabetes that is FPG ≥ 7.0 mmol/L, or OGTT ≥ 11.1 mmol/l or HbA1c $\geq 6.5\%$.

OGTT (oral glucose tolerance test): The oral glucose tolerance test (OGTT) is described as the gold standard for the diagnosis of diabetes. The recommended preparation for and administration of the OGTT are important to ensure that test results are not affected. Interpretation is based on venous plasma glucose results before and two hours after a 75 gram oral glucose load.

Prevalence: The number of events such as cases of diabetes in a given population at a designated time. Prevalence is expressed as a percentage of the given population in this report.

8. Appendix 1: an estimation of diabetes prevalence

The most recent data on diabetes prevalence is the clinical measurement from the AHS 2011–12. It is likely that this is an underestimate because the AHS used the FPG test alone to diagnose diabetes whereas WHO and other reports including Australian clinical guidelines recommend the use of FPG and OGTT tests in combination. The AusDiab survey used both OGTT and FPG, but this survey was conducted more than 12 years ago. The problem is evident in the following conundrum: in 1999–2000 7% of Queenslanders aged 25 years and older were diagnosed with diabetes where half of these were only diagnosed at survey. Assuming no cases in the age group 18–24 years, the prevalence in Queensland adults was 6.1%. After a decade of steadily increasing obesity the reported prevalence from measurement in the AHS for Queensland adults was 5.0%. It is highly unlikely that the prevalence of diabetes decreased over this period, noting that rising obesity is driving diabetes prevalence up in many similar developed nations worldwide, and in the United States prevalence almost doubled in a 15-year period.^{35,36} The broad expectation is that diabetes is rising and is a very significant public health challenge in Australia and internationally.^{37,38} For example, the prevalence of diabetes in American adults aged 20 years and older in 2010 was 11.3%³⁹, in 2008–09, 7% of all Canadians were reported to have diabetes⁴⁰, and 6% of the total English population in 2012.⁴¹

On the assumption that the AHS estimate does not fully represent the current diabetes burden in 2011–12, three different approaches were used to estimate the prevalence in Queensland:

1. Using incidence data from the AusDiab survey to predict prevalence in 2011–12.

The incidence data collected from follow-up studies of the 1999–2000 baseline was based on FPG and OGTT.

The age and sex specific incidence rates from the AusDiab study were applied to the Queensland population¹² to generate the expected number of prevalent cases each year, where baseline prevalence was established for Queensland from the AusDiab baseline study¹⁰, taking into account population growth and changing age distribution⁴², and adjusting the prevalent cases for the number of diabetes deaths each year.⁴³ Making these assumptions, it is estimated that in 2012 the prevalence of diabetes in Queensland would be about 10%.²⁴ This is double the 5% measured estimate using FPG from the AHS.

2. Approximating the proportion of undiagnosed cases when FPG alone is used to report prevalence.

The WHO estimates that about 30% of diabetes cases are only diagnosed using OGTT.¹⁶ However it is likely that the proportion may vary between populations and over time.²⁶ In 1999–2000 4.9% of Australians 25 years and older were diagnosed with diabetes based on FPG alone, while 7.4% were diagnosed using FPG combined with OGTT—FPG alone was a 34% under-diagnosis.¹⁴ For Queensland there was a 43% under-diagnosis (4% diagnosed with FPG alone, 7% diagnosed with FPG and OGTT).² Using these estimates of under-diagnosis for persons 25 years and older and applying the fraction to the 5% adult FPG diagnosed diabetes prevalence for Queensland from AHS 2011–12 release:

- Assuming FPG diagnoses in 70% of all cases (WHO reported fraction), the prevalence of diabetes in Queensland in 2012 would be about 7.1%.
- Assuming FPG diagnoses in 66% of cases, (1999–2000 Australia), the prevalence of diabetes in Queensland in 2012 would be about 7.6%.
- Assuming FPG diagnoses in 57% of cases, (1999–2000 Queensland), the prevalence of diabetes in Queensland in 2012 would be about 8.8%.

3. Expected increase in diabetes prevalence based on impact of rising levels of obesity.

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Obesity is a major contributor to diabetes and was estimated to cause 69% of disease burden in 2007.⁴⁴ There was a substantial increase in the prevalence of obesity in Australia and in Queensland between 1999–2000 and 2011–12 (based on AusDiab 1999–2000, NHS 2007–08 and AHS 2011–12):

- The prevalence of measured overweight and obesity in Australian adults increased by 8% and prevalence of obesity alone by 30% based on linear modelled data.
- The prevalence of overweight and obesity in Queensland adults increased by 17% and prevalence of obesity alone by 47% based on linear modelled data.

Modelling the predicted impact of higher rates of diabetes in overweight and obese persons (prevalence data reported for Australia from AHS¹⁴) and assuming no change in the prevalence of diabetes by BMI category over the 12 years, it is expected that increasing rates of overweight and obesity would increase the prevalence of diabetes in Queensland by about 25%.²⁴ This modelled increase is based entirely on the reported FPG diagnosed diabetes prevalence by BMI category for Australia from AHS and independently measured obesity change in Queensland. If the impact of obesity on diabetes were to be applied to the published prevalence of diabetes from AusDiab in 1999–2000, that is, 7% of persons 25 years and older, the expected prevalence would be 8.8%. Making the assumption that there were no diabetes cases in persons aged 18–24 years, diabetes prevalence in Queensland adults would be predicted to increase from 6.1% in 1999–2000 to 7.6% in 2011–12.

In summary, the true prevalence of diabetes in 2012 is unknown. The AHS reported adult prevalence in Queensland in 2011–12 was 5%. This is based on a test that does not diagnose all cases. It is more likely that the true prevalence is between 7% and 10%. The lower estimate is based on an assumption that FPG diagnoses 70% of cases, while the upper estimate assumes the baseline prevalence rate and the incidence rates from the AusDiab survey follow-up are accurate and applicable to Queensland. Furthermore, modelling the impact of obesity on diabetes prevalence would suggest the prevalence in adults in 2011–12 was about 8%. It is not possible to use these estimations to report a precise estimate of diabetes prevalence, however, there is sufficient evidence to suggest conservatively that about 1 in 12 Queensland adults had diabetes in 2012.

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