Contents

Key Findings 1
Feature Article: Obesity and chronic disease 3
About the National Health Measures Survey 8
Structure of the Australian Health Survey 9
Release Schedule 11
Diabetes 13
Measuring diabetes – definitions 14
Diabetes prevalence 16
Diabetes management 19
Cardiovascular disease 22
Cholesterol 23
Triglycerides 27
Dyslipidaemia 30
Chronic kidney disease 31
Kidney disease biomarkers 32
Chronic kidney disease stages 35
Liver function 37
Exposure to tobacco smoke 42
Anaemia 44
Comparisons with other Australian surveys 46
Explanatory Notes 50
Glossary 56
Technical note 64
Abbreviations 67
Appendix A 68
Media Release 69
KEY FINDINGS

Results in this publication contain information from the National Health Measures Survey (NHMS), the biomedical component of the 2011–13 Australian Health Survey (AHS). Around 11,000 respondents aged 5 years and over across Australia voluntarily provided blood and/or urine samples, which were tested for a range of chronic disease and nutrition biomarkers. This publication is the first release of information from the NHMS and focuses on the test results for chronic diseases, including:

- Diabetes
- Cardiovascular disease
- Chronic kidney disease
- Liver function

Refer to Appendix A for the full list of tests conducted.

Diabetes

- In 2011–12, 5.1% of people aged 18 years and over had diabetes.
- This comprised 4.2% with known diabetes and 0.9% with diabetes newly diagnosed by the blood test results. This suggests that there was approximately one newly diagnosed case of diabetes for every four diagnosed cases.
- Men were more likely than women to have diabetes (6.3% compared with 3.9%). This was the case for both known diabetes and newly diagnosed diabetes.
- A further 3.1% of Australian adults were identified by their test results to be at high risk of diabetes.

Cardiovascular disease

- Around one in three Australian adults (32.8%) had high levels of total cholesterol according to their blood test results, yet only 10.1% of this group self-reported high cholesterol as a current health condition.
- One in three Australian adults (33.2%) had high levels of LDL ‘bad’ cholesterol and 23.1% had lower than normal levels of HDL ‘good’ cholesterol.
- In 2011–12, 13.9% of people aged 18 years and over had high triglycerides.
- Three in every four adults (76.4%) aged 45 years and over had dyslipidaemia. That is, they were taking cholesterol-lowering medication or had one or more of high total cholesterol, low HDL cholesterol, high LDL cholesterol or high triglyceride levels based on their test results.

Chronic kidney disease

- In 2011–12, one in ten (10.0%) Australian adults had test results that showed signs of chronic kidney disease, with similar rates for men and women.
- Around 4% of all adults were in Stage 1, 2.5% were in Stage 2 and less than 1% were in Stages 4–5.

Liver function

A range of factors, including fatty liver disease, infections and excessive alcohol consumption can prevent the liver from functioning properly. The NHMS included two tests for liver function: gamma glutamyl transferase (GGT) and alanine aminotransferase (ALT). These tests check the liver’s health and can detect liver damage.

- In 2011–12, 11.0% of Australian adults had abnormal levels of ALT in their blood, with men more likely to have the condition than women (13.8% compared with 8.3%).
• Around 2.1 million (or 12.4%) people aged 18 years and over were estimated to have abnormal levels of GGT.

**Exposure to tobacco smoke**

• In 2011–12, the pattern for cotinine exposure was very similar to that for self-reported smoking for most age groups.
• 87.0% of current smokers aged 18 years and over had cotinine levels indicating exposure to tobacco smoke, compared with only 5.7% of those who were ex-smokers and 0.3% of those who had never smoked.

**Anaemia**

Anaemia is caused from a decrease in either the number of red blood cells in the body or the quantity of haemoglobin within red blood cells. When a person is anaemic, their heart has to work harder to ensure that muscles and organs get the oxygen they need.

• In 2011–12, 4.5% of people aged 18 years and over had haemoglobin levels indicating a risk of anaemia, with women more likely to be at risk than men (6.4% compared with 2.5%).
**FEATURE ARTICLE: OBESITY AND CHRONIC DISEASE**

**INTRODUCTION**

The 2011–13 Australian Health Survey results to date have highlighted the growing problem of obesity in Australia. It is estimated that 62.8% of Australian adults are now overweight or obese, with this figure increasing over the past two decades (up from 56.3% in 1995).\(^1\)

The first biomedical results from the National Health Measures Survey (NHMS) showed that being overweight or obese increased the risk of abnormal test results for nearly every chronic disease tested in the NHMS. These differences remained even after age was taken into account.

This article looks more closely at how obesity was associated with cardiovascular disease, diabetes and liver disease.

![Image: Persons aged 18 years & over - Proportion with abnormal test results by Body Mass Index, 2011-12](image)

*Source(s):* Australian Health Survey: Biomedical Results for Chronic Diseases

**OBESITY AND CARDIOVASCULAR DISEASE**

**How many Australians are at risk of cardiovascular disease?**

Results from the Australian Health Survey showed that 6.2% of all adults had current and long-term heart, stroke or vascular disease.\(^1\) Most commonly this group of conditions is referred to under the broader term of 'heart disease' or 'cardiovascular disease'.
Cardiovascular disease remains one of the leading causes of death worldwide. In 2011, ischaemic heart disease, which includes angina, blocked arteries of the heart and heart attacks, was the leading cause of death for all Australians, representing 14.6% of all deaths registered in 2011.\textsuperscript{2}

The main indicators of cardiovascular disease that were measured in the NHMS were cholesterol, including LDL and HDL cholesterol, and triglycerides. In 2011–12, around one in three Australian adults (32.8%) had high levels of total cholesterol, with around one in four (23.1%) having lower than normal levels of HDL ‘good’ cholesterol and one in three (33.2%) having high LDL ‘bad’ cholesterol. Around 14% had high triglycerides.

Taking all these tests into account, around 63.2% of people aged 18 years and over had dyslipidaemia. That is, they were taking cholesterol-lowering medication or had one or more of high total cholesterol, low HDL cholesterol, high LDL cholesterol or high triglyceride levels based on their test results. This comprised 13.8% who took cholesterol-lowering medication and 49.4% who took no medication but had at least one abnormal test result.

**How much more at risk are people who are overweight or obese?**

Research shows that excess body weight is a major risk factor for heart disease, as high levels of body fat can raise blood lipid levels which can cause fatty deposits developing in the arteries, increasing the risk of heart attack or stroke.\textsuperscript{3} In 2011–12, people who were obese were nearly five times as likely as those who were of normal weight or underweight to have high triglycerides (25.3% compared with 5.3%) and more than twice as likely to have lower than normal levels of HDL ‘good’ cholesterol (36.2% compared with 14.1%). This pattern was also evident for total cholesterol but the relationship was not as strong.

**Is it just older people who are affected?**

It is well documented that the risk of cardiovascular disease increases after the age of 45 years.\textsuperscript{4} However, the NHMS shows that a significant number of adults under 45 years had indicators of cardiovascular disease, especially among those who were obese. For example, four in every ten (39.1%) obese adults under the age of 45 years had lower than normal levels of HDL ‘good’ cholesterol and nearly one in four (22.6%) had high triglycerides. This was substantially higher than for those aged 18–44 years who were of normal weight or underweight (15.4% and 4.5% respectively). This was also higher than the equivalent rates for all people aged 45 years and over (22.5% for lower than normal HDL cholesterol and 16.7% for high triglycerides).

**Does the risk of cardiovascular disease increase when obesity is combined with smoking?**

The risk of cardiovascular disease further increased when obesity was combined with smoking, particularly for younger people. Around half (51.7%) of those aged 18–44 years who were current daily smokers and obese had high LDL ‘bad’ cholesterol levels. This compared with only 15.8% of those who were both a non-smoker and of normal weight or underweight. Young smokers aged 18–44 years who were obese were also much more likely to have high triglycerides (27.0% compared with 3.7%) and abnormal levels of HDL ‘good’ cholesterol (52.3% compared with 14.8%).

Similarly, people aged over 45 years who smoked and who were obese were much more likely to have lower than normal HDL cholesterol (52.3%) and high triglycerides (36.8%) than people who did not smoke and who were of normal weight or underweight (10.8% and 5.9% respectively). However, the combination of smoking and obesity did not significantly increase rates of abnormal total cholesterol or LDL cholesterol for this age group.
Persons aged 18 years and over: Proportion with cardiovascular risk factors by Body Mass Index and smoker status, 2011–12

<table>
<thead>
<tr>
<th></th>
<th>Obese and current daily smoker</th>
<th>Normal and non-smoker</th>
<th>All persons who were obese</th>
<th>All persons who were of normal weight/underweight</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>18–44 YEARS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abnormal total cholesterol (≥5.5 mmol/L)</td>
<td>43.4</td>
<td>15.2</td>
<td>35.5</td>
<td>16.4</td>
</tr>
<tr>
<td>Abnormal HDL cholesterol (&lt;1.0 mmol/L for men and &lt;1.3 mmol/L for women)</td>
<td>52.3</td>
<td>14.8</td>
<td>39.1</td>
<td>15.4</td>
</tr>
<tr>
<td>Abnormal LDL cholesterol (≥3.5 mmol/L)(a)</td>
<td>51.7</td>
<td>15.8</td>
<td>39.5</td>
<td>17.5</td>
</tr>
<tr>
<td>Abnormal triglycerides (≥2.0 mmol/L)(a)</td>
<td>27.0</td>
<td>3.7</td>
<td>22.6</td>
<td>4.5</td>
</tr>
<tr>
<td><strong>45 YEARS AND OVER</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abnormal total cholesterol (≥5.5 mmol/L)</td>
<td>39.6</td>
<td>41.5</td>
<td>38.0</td>
<td>42.2</td>
</tr>
<tr>
<td>Abnormal HDL cholesterol (&lt;1.0 mmol/L for men and &lt;1.3 mmol/L for women)</td>
<td>52.3</td>
<td>10.8</td>
<td>34.4</td>
<td>11.8</td>
</tr>
<tr>
<td>Abnormal LDL cholesterol (≥3.5 mmol/L)(a)</td>
<td>34.2</td>
<td>38.7</td>
<td>35.3</td>
<td>39.7</td>
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<tr>
<td>Abnormal triglycerides (≥2.0 mmol/L)(a)</td>
<td>36.8</td>
<td>5.9</td>
<td>26.9</td>
<td>6.5</td>
</tr>
<tr>
<td>All persons</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

(a) Based on the fasting population.

**OBESITY AND DIABETES**

**How many Australians have diabetes?**

According to the NHMS, 5.1% of Australians aged 18 years and over had diabetes. This comprised 4.2% with known diabetes and 0.9% whose test results indicated diabetes, but who were previously unaware that they had the condition. A further 3.1% of adults were identified as not currently having diabetes, but were at high risk of having the condition.

**How much of a risk factor is obesity?**

Obesity is a known risk factor for diabetes as excess body weight can interfere with the body’s production of, and resistance to, insulin. In 2011–12, adults who were obese were seven times as likely as those who were of normal weight or underweight to have diabetes.
People who were obese were also more likely to be at high risk of diabetes. Around one in every twenty (5.8%) obese people who did not already have diabetes were at high risk of the condition, compared with less than 1% of those who were normal weight or underweight.

Source(s): Australian Health Survey: Biomedical Results for Chronic Diseases

OBESITY AND LIVER DISEASE

How many Australians have signs of liver disease?

A range of factors, including fatty liver disease, infections and excessive alcohol consumption can prevent the liver from functioning properly. The NHMS included two tests for liver function: gamma glutamyl transferase (GGT) and alanine aminotransferase (ALT). These tests check the liver’s health and can detect liver damage.

In 2011–12, around one in ten (11.0%) people aged 18 years and over had abnormal levels of ALT in their blood and 12.4% had abnormal levels of GGT.

Is liver disease more common among people who are obese?

Excess body fat is recognised as a risk factor for liver disease. In 2011–12, people who were obese were around four times as likely than those who were of normal weight or underweight to have abnormal ALT levels (19.5% compared with 4.6%). Likewise, around one in five (21.6%) people who were obese had abnormal GGT compared with only 6.0% who were of normal weight or underweight.

Does it just affect older people or are young people at risk too?

Similarly to cardiovascular disease, young people who were obese were also at higher risk of liver disease. Among those aged 18–44 years, obese people were five times as likely as those of normal weight or underweight to have high ALT levels (24.9% compared with 4.6%) and nearly six times as likely to have high GGT levels (19.0% compared with 3.2%).
For more information on how Body Mass Index and other lifestyle risk factors are associated with biomedical test results, see Table 8 on the Downloads page of this publication.

ENDNOTES

ABOUT THE NATIONAL HEALTH MEASURES SURVEY

The 2011–13 Australian Health Survey (AHS) is the largest and most comprehensive health survey ever conducted in Australia. The survey, conducted throughout Australia, collected a range of information about health related issues, including health status, risk factors, health service usage and medications. In 2011–13, the AHS incorporated the first ABS biomedical collection, the National Health Measures Survey (NHMS). It involved the collection of a range of blood and urine tests from over 11,000 participants across Australia, which were then tested for various chronic disease and nutrient biomarkers.

The AHS also included an additional representative sample of Aboriginal and Torres Strait Islander people. The Aboriginal and Torres Strait Islander Health Measures Survey will provide the first biomedical results for Aboriginal and Torres Strait Islander people aged 18 years and over at the population level and provides a unique opportunity to compare results with the non-Indigenous population. Results for the Aboriginal and Torres Strait Islander population will be released progressively from the end of 2013.

This publication is the first release of information from the NHMS. It focusses on biomarkers of chronic disease, including cardiovascular disease, diabetes and kidney disease. Information on nutrition biomarkers, such as vitamin D, iron and iodine, will be released in late 2013.

The NHMS has been made possible by additional funding from the Australian Government Department of Health and Ageing as well as the National Heart Foundation of Australia, and the contributions of these two organisations to improving health information in Australia through quality statistics are greatly valued.

The 2011–13 AHS, and particularly the NHMS component, was developed with the assistance of several advisory groups and expert panels. Members of these groups were drawn from Commonwealth and state/territory government agencies, non-government organisations, relevant academic institutions and clinicians. The valuable contributions made by members of these groups are greatly appreciated.

Finally, the success of the 2011–13 AHS was dependent on the very high level of cooperation received from the Australian public. Their continued cooperation is very much appreciated; without it, the range of statistics published by the ABS would not be possible. Information received by the ABS is treated in strict confidence as required by the Census and Statistics Act 1905.
THE STRUCTURE OF THE AUSTRALIAN HEALTH SURVEY

This publication is one of several ABS releases for the 2011–13 Australian Health Survey (AHS) and is the first publication of biomedical results.

The AHS is the largest, most comprehensive health survey ever conducted in Australia. It combines the existing ABS National Health Survey (NHS) and the National Aboriginal and Torres Strait Islander Health Survey together with two new elements - a National Nutrition and Physical Activity Survey (NNPAS) and a National Health Measures Survey (NHMS).

The following diagram shows how the various elements combine to provide comprehensive health information for the overall Australian population. The content for each component survey is listed along with the ages of respondents for which topics were collected.

As shown in the above diagram, the AHS is made up of 3 components:

- the National Health Survey (NHS);
- the National Nutrition and Physical Activity Survey (NNPAS); and
- the National Health Measures Survey (NHMS)

All people selected in the AHS were selected in either the NHS or the NNPAS, however data items in the 'Core' were common to both surveys and therefore information for these data items is available for all persons in the AHS. All people aged 5 years and over were then invited to participate in the voluntary NHMS. This sample design allows comparisons across a wide range of information about
people's health, as well as use of this information in the estimation process.

The NHMS had approximately 11,000 participants aged 5 years and over across Australia. Respondents voluntarily provided blood and urine samples, which were then analysed for specific chronic disease and nutrition biomarkers. See Appendix A for the full list of tests conducted.

INFORMATION FOR ABORIGINAL AND TORRES STRAIT ISLANDER PEOPLE

The AHS also includes an additional representative sample of around 13,000 Aboriginal and Torres Strait Islander people, which was collected between April 2012 and July 2013. This is a separate collection of Aboriginal and Torres Strait Islander people living in remote and non-remote areas, including discrete communities. The structure is the same as outlined above, comprised of the National Aboriginal and Torres Strait Islander Health Survey component, the National Aboriginal and Torres Strait Islander Nutrition and Physical Activity Survey component and the National Aboriginal and Torres Strait Islander Health Measures Survey component. The Aboriginal and Torres Strait Islander Health Measures Survey will provide the first biomedical results for Aboriginal and Torres Strait Islander people at the population level and provides a unique opportunity to compare results with the non-Indigenous population.

The results from these surveys will be released progressively from November 2013. For more information on future releases see Release schedule.
RELEASE SCHEDULE

Released products

Results from the Australian Health Survey are being released progressively. The first results, released in October 2012, contained information on health risk factors (such as alcohol consumption, tobacco smoking and Body Mass Index); long-term health conditions; mental health and wellbeing and physical activity. See Australian Health Survey: First Results for more information.

Results from Australian Health Survey: Health Service Usage and Health Related Actions were released in March 2012 and presented information on general use of health services and actions people take for their health, as well as specific actions people take for particular long-term health conditions.

Updated results for some data items based on the AHS core sample (the full 32,000 people) were released in June 2013 in Australian Health Survey: Updated Results. Physical activity results from the National Nutrition Physical Activity Survey (NNPAS) were released in July 2013 in Australian Health Survey: Physical Activity.

This publication presents the first results from the National Health Measures Survey (NHMS). Information presented in this publication focusses on biomarkers of chronic disease, including cardiovascular disease, diabetes and chronic kidney function.

Future releases

Information on nutrition biomarkers, such as vitamin D, iron and iodine, will be released in late 2013.

Results for the Aboriginal and Torres Strait Islander population will be released progressively from November 2013.
## 2011–13 AUSTRALIAN HEALTH SURVEY, Release schedule

<table>
<thead>
<tr>
<th>Publications</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian Health Survey: First Results (cat. no. 4364.0.55.001)</td>
<td>Released 29 October 2012</td>
<td>Focus on long-term health conditions and health risk factors from NHS.</td>
</tr>
<tr>
<td>Australian Health Survey: Health Service Usage and Health Related Actions (cat. no. 4364.0.55.002)</td>
<td>Released 26 March 2013</td>
<td>Focus on health service usage, health related actions and medication use from NHS.</td>
</tr>
<tr>
<td>Australian Health Survey: Updated Results (cat. no. 4364.0.55.003)</td>
<td>Released 7 June 2013</td>
<td>Focus on key items from the 'core' based on the full AHS sample. Includes new estimates for some indicators published in the First Results publication.</td>
</tr>
<tr>
<td>Australian Health Survey: Physical Activity (cat. no. 4364.0.55.004)</td>
<td>Released 19 July 2013</td>
<td>Focus on physical activity data from NNPAS.</td>
</tr>
<tr>
<td>Australian Health Survey: Biomedical Results for Chronic Diseases (cat. no. 4364.0.55.005)</td>
<td>Released 5 August 2013</td>
<td>Focus on high level results for chronic diseases from the biomedical measures collected in the NHMS.</td>
</tr>
<tr>
<td>Australian Health Survey: Aboriginal and Torres Strait Islander First Results (cat. no. 4727.0.55.001)</td>
<td>27 November 2013</td>
<td>Focus on long-term health conditions and health risk factors.</td>
</tr>
<tr>
<td>Australian Health Survey: Biomedical Results for Nutrients (cat. no. 4364.0.55.006)</td>
<td>December 2013</td>
<td>Focus on high level results for nutrients from the biomedical measures collected in the NHMS.</td>
</tr>
<tr>
<td>Australian Health Survey: Nutrition First Results</td>
<td>First quarter 2014</td>
<td>Focus on high level results from the nutrition components of NNPAS. Similar to the 'Selected highlights' release from the 1995 National Nutrition Survey.</td>
</tr>
<tr>
<td>Australian Aboriginal and Torres Strait Islander Health Survey: Biomedical Data (cat. no. 4727.0.55.003)</td>
<td>Mid 2014</td>
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<tr>
<td>Australian Aboriginal and Torres Strait Islander Health Survey: Physical Activity (cat. no. 4727.0.55.004)</td>
<td>Second half 2014</td>
<td>--</td>
</tr>
<tr>
<td>Australian Aboriginal and Torres Strait Islander Health Survey: Nutrition (cat. no. 4727.0.55.005)</td>
<td>Second half 2014</td>
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</tr>
</tbody>
</table>
DIABETES

Diabetes is a chronic condition where insulin, a hormone that controls blood glucose levels, is no longer produced or not produced in sufficient amounts by the body. If left undiagnosed or poorly managed, diabetes can lead to coronary heart disease, stroke, kidney failure, limb amputations or blindness. In 2011, diabetes was the sixth leading cause of death in Australia.

The National Health Measures Survey (NHMS) provides an objective measurement of the number of people with diabetes in Australia. It included two tests to measure diabetes: a fasting plasma glucose test and a glycated haemoglobin test (commonly referred to as HbA1c).

Fasting plasma glucose measures the level of sugar in the person's blood at the time of testing. Participants were required to fast for 8 hours prior to the test in order to get an accurate reading. HbA1c, on the other hand, measures what the person's average blood glucose level has been in the previous three months. Participants were not required to fast for this test. A set of cut-offs are used for each test to determine whether a person has diabetes or is at high risk of diabetes. The cut-offs used in the NHMS are shown below.

<table>
<thead>
<tr>
<th>Cut-offs for Diabetes in the NHMS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fasting plasma glucose (mmol/L)</strong></td>
</tr>
<tr>
<td>Has diabetes</td>
</tr>
<tr>
<td>At high risk of diabetes</td>
</tr>
<tr>
<td>No diabetes</td>
</tr>
<tr>
<td><strong>HbA1c (%)</strong></td>
</tr>
<tr>
<td>has diabetes</td>
</tr>
<tr>
<td>At high risk of diabetes</td>
</tr>
<tr>
<td>No diabetes</td>
</tr>
</tbody>
</table>

(a) Based on World Health Organization cut-offs for fasting plasma glucose.
(b) An HbA1c level of greater than or equal to 6.5% is the WHO recommended cut-off point for diabetes.

ENDNOTES

MEASURING DIABETES - DEFINITIONS

In the National Health Measures Survey (NHMS), two blood tests for diabetes were performed: fasting plasma glucose and glycated haemoglobin (commonly referred to as HbA1c). The tables available on the Downloads page of this publication present diabetes prevalence rates for both tests, including a comparison of the two tests in Table 3. However, as fasting plasma glucose is the current standard test for diabetes in Australia, the results presented in the publication commentary focus on fasting plasma glucose only.

Diabetes prevalence was derived using a combination of blood test results and self-reported information on diabetes diagnosis and medication use.

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 their blood test result for fasting plasma glucose was greater than or equal to the cut off point for diabetes (that is, ≥7.0 mmol/L).

Note: people who had been told by a doctor or nurse that they have diabetes, but who were not taking medication for diabetes and did not have a fasting plasma glucose level ≥7.0 mmol/L, were classified as not having diabetes.

People with known diabetes were further classified as having Type I, Type II or Type unknown, based on the type of diabetes that a doctor or nurse told them they had. Women with gestational diabetes were excluded.

- A person was considered to have newly diagnosed diabetes if they reported no prior diagnosis of diabetes but had a fasting plasma glucose value ≥7.0 mmol/L.

Total persons with diabetes was defined as the total of known diabetes and newly diagnosed diabetes.

- A person was considered to be at high risk of diabetes if they did not currently have diabetes, but had an impaired fasting plasma glucose result, that is, a fasting plasma glucose level ranging from 6.1 mmol/L to less than 7.0 mmol/L.

The NHMS diabetes classification is outlined in Figure 1. More information on diabetes prevalence is presented in Tables 1, 2, 3, 8, 9, 11 and 15 on the Downloads page of this publication.

Information on diabetes prevalence using this same definition but based on HbA1c test results are also shown in Tables 1, 2, 3, 8, 9, 12 and 15. The relevant cut-offs for HbA1c are as follows:

- Indicates diabetes: ≥6.5%
- At high risk of diabetes: 6.0% to <6.5%
- Does not indicate diabetes: <6.0%. 

Figure 1: 2011–12 NHMS diabetes classification

* Cut-offs for FPG: Indicates diabetes ≥7.0 mmol/L; At high risk of diabetes 6.1 to <7.0 mmol/L; Does not indicate diabetes <6.1 mmol/L.

Cut-offs for HbA1c: Indicates diabetes ≥6.5%; At high risk of diabetes 6.0% to <6.5%; Does not indicate diabetes <6.0%.

ENDNOTES

DIABETES PREVALENCE

Diabetes prevalence was derived using a combination of blood test results and self-reported information on diabetes diagnosis and medication use. See the Measuring diabetes - definitions section for a detailed description.

**Data source and definitions**

Fasting plasma glucose is the current standard test for diabetes in Australia. The information on diabetes in the following sections is based on fasting plasma glucose results only. Information on diabetes prevalence using glycated haemoglobin (commonly referred to as HbA1c) test results is shown in Tables 1, 2, 3, 8, 9, 12 and 15 on the Downloads page of this publication.

In order to get an accurate reading for the fasting plasma glucose test, people were required to fast for 8 hours or more beforehand. The results presented here refer only to those people who did fast (approximately 79% of adults who participated in the National Health Measures Survey (NHMS)).

In 2011–12, 5.1% of Australians aged 18 years and over had diabetes. This comprised 4.2% with known diabetes and 0.9% with diabetes newly diagnosed from their test results. This indicates that there was approximately one newly diagnosed case of diabetes for every four diagnosed cases. A further 3.1% of adults had impaired fasting plasma glucose results, which indicates that they were at high risk of diabetes. This means that there were an extra three people at high risk of diabetes for every four people who had been diagnosed.

There was an additional 1% of people aged 18 years and over who did not have abnormal fasting plasma glucose test results and who were not taking diabetes medication, but self-reported having ever been told by a doctor or nurse that they had diabetes. This group was classified as not having diabetes.

Diabetes was more common for men than women in 2011–12 (6.3% compared with 3.9%). This was the case for both known diabetes (4.9% compared with 3.4%) and newly diagnosed diabetes (1.4% compared with 0.4%).
Overall, the prevalence of diabetes increased with age, with people aged 65–74 years having the highest rate (15.0%). Similarly, people aged between 55 and 74 years had the highest rates of newly diagnosed diabetes (2.3%). The proportion of people at high risk of diabetes also increased steadily with age, with the most 'high risk' group being those aged 75 years and over (7.5%).

One of the main risk factors for developing diabetes is being overweight or obese. Excess body weight can interfere with the body's production of, and resistance to, insulin. In 2011–12, people who were obese had much higher rates of diabetes (11.2%) than those who were overweight (4.1%) or normal weight or underweight (1.6%). A similar pattern was also evident for those at high risk of diabetes, with 5.8% of obese people being at high risk of diabetes compared with 0.9% of those of normal weight or underweight.

People with a family history of diabetes were also more likely to have the disease. The NHMS showed that over half of all people with diabetes (54.4%) and 39.9% of those at high risk of diabetes had a close family member who had the condition.

People with diabetes were more likely than those without diabetes to have signs of other chronic conditions. This was particularly the case with kidney disease, of which diabetes is a major cause. In 2011–12, 22.5% of people with diabetes had albuminuria, an early indicator of kidney disease, compared with 6.7% of those without diabetes. A further 12.8% had abnormal eGFR results, which measure how well the kidneys filter waste from the bloodstream, compared with 3.1% of those without diabetes. People at high risk of diabetes were also more likely than those without diabetes to have abnormal eGFR (7.2% compared with 3.1%).

Diabetes is also a major risk factor for cardiovascular disease. Diabetes increases the risk of developing atherosclerosis, which is the build up of fatty deposits in the blood vessels. This was
reflected in the NHMS results, where people with diabetes were more than twice as likely as those without diabetes to have abnormal levels of HDL 'good' cholesterol (48.6% compared with 21.7%) and high levels of triglycerides (31.5% compared with 12.5%). People who were at high risk of diabetes were also more likely than those without diabetes to have abnormal HDL cholesterol and triglyceride levels.

Source(s): Australian Health Survey: Biomedical Results for Chronic Diseases

More information on diabetes prevalence is presented in Tables 1, 2, 3, 8, 9, 11 and 15 on the Downloads page of this publication.

ENDNOTES

DIABETES MANAGEMENT

Glycated haemoglobin (HbA1c) is used to measure how well a person is managing their diabetes. This test gives an indication of the person's average blood glucose levels over the previous three months. The optimum management target for HbA1c for people with diabetes is a level of 7.0% or less. Maintaining this level decreases a person's risk of developing a range of complications from their diabetes, including problems with their circulation, kidneys, eyes and feet, and lowers the risk of heart attack and stroke. There is also a range of other optimum targets for diabetes management, including those for cholesterol levels, Body Mass Index (BMI) and blood pressure. These are listed in the Data source and definitions box below.

Data source and definitions

In the National Health Measures Survey (NHMS), information on diabetes management is presented for those with known diabetes. See the Measuring diabetes - definitions section for information on how this population is defined. The information in this section is based on fasting plasma glucose results only. Information on diabetes management using glycated haemoglobin (commonly referred to as HbA1c) test results is shown in Table 14 on the Downloads page of this publication.

Goals for optimum diabetes management, as defined by the 2012–13 Diabetes Management in General Practice Guidelines, are as follows:

- Fasting blood glucose levels between 4.0–6.0 mmol/L
- HbA1c levels less than or equal to 7.0%
- Total cholesterol less than 4.0 mmol/L
- HDL 'good' cholesterol greater than 1.0 mmol/L
- LDL 'bad' cholesterol less than 2.0 mmol/L
- Non-HDL-C cholesterol less than 2.5 mmol/L
- Triglycerides less than 2.0 mmol/L
- Albumin creatinine ratio (a kidney function test) less than 3.5 mg/mmol for women and less than 2.5 mg/mmol for men
- Blood pressure less than or equal to 130/80 mmHg
- 'Normal' Body Mass Index (i.e. a BMI score of between 18.0 and 24.9)
- Non-smoker
- Alcohol intake less than or equal to 2 standard drinks per day*
- At least 30 minutes of physical activity 5 days per week*

*Note information on alcohol and physical activity targets have not been included in this release, as data for these variables are not available for all persons in the NHMS. However, this information can be sourced from the National Health Survey component and will be available at a later date.

In 2011–12, over half (55.7%) of people aged 18 years and over with known diabetes were effectively managing their condition, that is, they had an HbA1c test result of 7.0% or less. Older people were more likely than younger people to meet the HbA1c target, with 70.4% of those aged 75 years and over meeting the target. Overall, there was no significant difference in HbA1c levels between males and females.
Controlling other aspects of health, such as cholesterol and blood pressure, is also important for effective diabetes management. Among those with known diabetes in 2011–12, 37.9% met the management target for total cholesterol and 37.2% met the target for blood pressure. The majority of those with known diabetes met the management targets for triglycerides (70.0%) and albumin creatinine ratio, which measures kidney function (71.1%).

The diabetes management guidelines also outline optimum targets for health behaviours. While the majority of people with known diabetes met the management target for smoking in 2011–12 (85.6% were non-smokers), only 12.8% met the target for a normal Body Mass Index (i.e. a BMI score of between 18.0 and 24.9).
Persons aged 18 years & over - People with known diabetes meeting selected management targets, 2011-12

<table>
<thead>
<tr>
<th>Meets management targets</th>
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Source(s): Australian Health Survey: Biomedical Results for Chronic Diseases

For more information on diabetes management, see Table 13 on the Downloads page of this publication.

ENDNOTES

CARDIOVASCULAR DISEASE

Cardiovascular disease remains one of the leading causes of death worldwide. In 2011, ischaemic heart disease, which includes angina, blocked arteries of the heart and heart attacks, was the leading cause of death for all Australians, representing 14.6% of all deaths registered in 2011.¹ The onset of cardiovascular disease can be delayed or prevented through reducing risk factors such as lowering cholesterol, following a healthy diet and avoidance of smoking.

The main indicators of cardiovascular disease that were measured in the National Health Measures Survey (NHMS) were cholesterol, including total, high density lipoprotein (HDL) and low density lipoprotein (LDL), and triglycerides.

Blood pressure is also an important measure of cardiovascular risk and was measured for all persons in the Australian Health Survey (AHS). Detailed information on the prevalence of high blood pressure and hypertension for all Australians can be found in Australian Health Survey: Updated Results, 2011–12.

ENDNOTES

CHOLESTEROL

Cholesterol is a type of fat that circulates in the blood. It is essential for many metabolic processes, including the production of hormones and building cells. There are two main types of cholesterol: high density lipoprotein (HDL) and low density lipoprotein (LDL). HDL cholesterol is known as 'good' cholesterol, as it picks up excess cholesterol in the blood and takes it to the liver where it is broken down, helping to prevent blockages. Low levels of HDL may increase the risk of heart disease. LDL cholesterol, on the other hand, is known as 'bad' cholesterol, as high levels in the bloodstream can lead to fatty deposits developing in the arteries, increasing the risk of heart attack or stroke.

Data source and definitions

Cholesterol levels are measured using a blood test. Abnormal cholesterol levels are defined as follows:

- Total cholesterol greater than or equal to 5.5 mmol/L
- HDL cholesterol less than 1.0 mmol/L for men and less than 1.3 mmol/L for women
- LDL cholesterol greater than or equal to 3.5 mmol/L

In order to get an accurate reading for the LDL cholesterol, people were required to fast for 8 hours or more beforehand. The results presented here refer only to those people who did fast (approximately 79% of adults who participated in the National Health Measures Survey (NHMS)).

TOTAL CHOLESTEROL

Total cholesterol is a measure of all the different types of fats in the blood. Abnormal or high total cholesterol is a major risk factor for coronary heart disease and stroke.¹

In 2011–12, one in three Australians aged 18 years and over (32.8% or 5.6 million people) had abnormal or high total cholesterol levels according to their blood test results. Yet only 10.1% of this group self-reported having high cholesterol as a current long-term health condition, which suggests that the majority of people with high cholesterol results were either unaware that they had the condition or did not consider it to be a long-term or current problem. A further 19.1% of adults had a total cholesterol level that was close to the abnormal cut off (i.e. in the 5.0–5.4 mmol/L range).

The proportion of people with high total cholesterol levels increased with age, peaking at 55–64 years (47.8%), before decreasing in late adulthood. Overall there was no significant difference in rates of total cholesterol for men and women.

The NHMS also collected cholesterol information for children. Of those aged 12–17 years, 3.5% had high total cholesterol levels in 2011–12.
Research shows that certain lifestyle risk factors, such as smoking and obesity, are associated with high cholesterol. In 2011–12, current smokers were more likely to have high cholesterol than people who never smoked (38.1% compared with 30.4%). Similarly, adults who were obese were more likely to have high cholesterol than those who were normal weight or underweight (37.0% compared with 25.8%).

People with high total cholesterol were also likely to have other indicators of cardiovascular disease. For example, 84.7% of those with high total cholesterol also had high LDL ‘bad’ cholesterol. They were also more likely than those with normal total cholesterol levels to have high triglycerides (22.9% compared with 9.5%). Similarly, people with high blood pressure had higher rates of total cholesterol that those with normal blood pressure (40.8% compared with 31.0%).

**LDL CHOLESTEROL**

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.

In 2011–12, one in three Australian adults (33.2%) had abnormal or high LDL cholesterol. High levels of LDL cholesterol were more common among men (35.0%) than women (31.6%).

Like total cholesterol, people aged 55–64 years had the highest rates of LDL cholesterol (45.7%). Rates then sharply declined from 65 years onwards. One in twenty children aged 12–17 years (5.2%) had high LDL cholesterol in 2011–12.

The associations between LDL cholesterol and health risk factors were very similar to that for total cholesterol, with higher rates of abnormal LDL cholesterol among smokers and those who were...
overweight or obese.

People with high LDL cholesterol were more likely to have high triglycerides than those with normal LDL levels (15.7% compared with 11.7%). However, there was no association between high LDL cholesterol and lower than normal HDL ‘good’ cholesterol.

HDL CHOLESTEROL

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.\(^3\)

In 2011–12, 23.1% of Australian adults had abnormal or low levels of HDL cholesterol. Abnormal HDL cholesterol was more prevalent for women (27.2%) than men (18.9%).

Unlike the other measures of cholesterol, levels of low HDL cholesterol remained fairly stable across all age groups at between 21.0% and 24.7%.

Source(s): Australian Health Survey: Biomedical Results for Chronic Diseases

People with low HDL cholesterol had a greater likelihood of also having signs of other chronic diseases. For example, 10.5% of those with low levels of HDL cholesterol also had diabetes, compared with 3.4% of those with normal levels. They were also more likely than those with normal HDL cholesterol to have high triglycerides and abnormal alanine aminotransferase (ALT) and gamma glutamyl transferase (GGT) levels, increasing their risk of heart and liver diseases.
For more information on cholesterol, see Tables 1, 2, 3, 4, 8, 9 and 15 on the Downloads page of this publication.

ENDNOTES


TRIGLYCERIDES

Like cholesterol, triglycerides are a fatty substance in the blood. However, triglycerides work more like a type of fuel, circulating in the bloodstream to be used as energy by the cells. Research shows that high blood triglycerides are an independent risk factor for heart disease as they contribute to the development of atherosclerosis, which is the build up of fatty deposits in the blood vessels.\(^1\) High triglycerides are typically caused by a diet high in fat or kilojoules, but can also become elevated as a result of having other conditions, such as diabetes and kidney disease.

**Data source and definitions**

Triglycerides are measured using a blood test. Abnormal triglyceride levels were defined as greater than or equal to 2.0 mmol/L.

In order to get an accurate reading for triglycerides, people were required to fast for 8 hours or more beforehand. The results presented here refer only to those people who did fast (approximately 79% of adults who participated in the National Health Measures Survey).

In 2011–12, 13.9% of people aged 18 years and over had high triglyceride levels. High triglycerides were more common among men (19.0%) than women (9.0%).

The proportion of people with high triglycerides steadily increased with age until middle adulthood, before gradually declining in older age. Overall, rates were highest among those aged 45–54 years (18.5%).
Being overweight or obese, tobacco smoking and having high blood pressure were all associated with higher levels of triglycerides. In 2011–12, overweight or obese adults were more than three times as likely to have high triglyceride levels than those who were normal weight or underweight (19.1% compared with 5.3%). Likewise, people with high blood pressure had a greater likelihood of having high triglycerides levels (20.9%) than those with normal blood pressure (11.9%). Current smokers (20.6%) and ex-smokers (15.7%) were also more likely to have high triglycerides than people who had never smoked (11.4%).

Research shows that the risk of heart disease increases when high triglycerides accompany high LDL or 'bad' cholesterol. In 2011–12, 54.2% of adults with high triglycerides also had high total cholesterol. People with high triglycerides also had a greater likelihood of having low levels of 'good' HDL cholesterol (45.2%) and high levels of 'bad' cholesterol (37.6%) compared with people with normal triglyceride levels (20.0% and 32.5% respectively).

High levels of triglycerides are also associated with diabetes. In 2011–12, people with high triglycerides were nearly three times as likely as those with normal triglycerides to have diabetes (11.5% compared with 4.1%).

Similarly, high triglycerides are a known risk factor for liver disease. In 2011–12, 21.5% of adults with high triglycerides had abnormal alanine aminotransferase (ALT) levels (which measures liver function) compared with 9.6% of those with normal triglycerides.

For more information on triglycerides, see Tables 1, 2, 3, 4, 8, 9 and 15 on the Downloads page of this publication.
ENDNOTES


DYSLIPIDAEMIA

Dyslipidaemia refers to a number of different lipid disorders (that is, conditions where there are too many fats in the blood). Estimates of dyslipidaemia from the National Health Measures Survey (NHMS) can be used to determine how many Australians have at least one lipid disorder and therefore have an increased risk of heart disease.

Data source and definitions

In the NHMS, a person was classified as having dyslipidaemia if they had one or more of the following:

- Taking cholesterol-lowering medication
- Total cholesterol greater than or equal to 5.5 mmol/L
- HDL cholesterol less than 1.0 mmol/L for men and less than 1.3 mmol/L for women
- LDL cholesterol greater than or equal to 3.5 mmol/L
- Triglycerides greater than or equal to 2.0 mmol/L.

In 2011–12, 63.2% of people aged 18 years and over had dyslipidaemia. This comprised 13.8% who took some form of cholesterol-lowering medication and 49.4% who took no medication but had either high total cholesterol, low HDL cholesterol, high LDL cholesterol or high triglyceride levels based on their test results. There was no significant difference in rates of dyslipidaemia between men and women (63.7% compared with 62.8%).

The risk of heart disease generally increases with age, particularly after the age of 45. In 2011–12, 76.4% of people aged 45 years and over had dyslipidaemia. However, rates were also high for those aged under 45 years, with nearly half (49.8%) of those aged 18–44 having at least one lipid disorder.

Source(s): Australian Health Survey: Biomedical Results for Chronic Diseases

For more information on dyslipidaemia, see Table 10 on the Downloads page of this publication.
CHRONIC KIDNEY DISEASE

Kidney disease is a chronic disease in which a person’s kidney function is reduced or damaged. This affects the kidney’s ability to filter blood and therefore control the body’s water and other hormone levels, leading to increased fluid and waste within the body. This can cause high blood pressure, anaemia, and uremia. Kidney disease is also associated with several other chronic diseases such as diabetes and cardiovascular disease, and was the 10th leading cause of death in Australia in 2011.¹

The indicators of kidney disease that were measured in the National Health Measures Survey (NHMS) were estimated glomerular filtration rate (eGFR) and urinary albumin creatinine ratio (ACR). Chronic kidney disease stages were also determined through a combination of participants’ eGFR and ACR results.

It is important to note that while abnormal eGFR or ACR results in the NHMS may indicate impaired kidney function, they cannot provide a diagnosis for kidney disease based on a single test alone. Kidney disease can only be confirmed if albuminuria or eGFR of less than 60 mL/min/1.73 m² is persistent for at least three months.²

ENDNOTES

KIDNEY DISEASE BIOMARKERS

The National Health Measure Survey (NHMS) measured two aspects of kidney function: estimated glomerular filtration rate (eGFR) and the presence of albuminuria. eGFR uses a formula to estimate the amount of blood the kidneys filter per minute, which indicates if and to what extent kidney function is impaired. Albuminuria occurs when albumin (a protein) leaks into the urine from the blood through the kidneys. While abnormal levels on either test indicate the presence of some form of kidney damage, they alone cannot diagnose kidney disease.

**Data source and definitions**

The NHMS included two tests for kidney function: estimated glomerular filtration rate (eGFR) and the presence of albuminuria.

- **eGFR**
  - eGFR was measured via a blood test. Abnormal kidney function using eGFR is defined as a reading of less than 60 mL/min/1.73m².

- **Albuminuria**
  - Presence of albuminuria was measured via a urine test. The presence of albuminuria is defined as an albumin creatinine ratio (ACR) reading of greater than or equal to 2.5 mg/mmol for males and greater than or equal to 3.5 mg/mmol for females.

**IMPAIRED ESTIMATED GLOMERULAR FILTRATION RATE (eGFR)**

Estimated glomerular filtration rate measures the rate at which the kidneys filter wastes from the blood, and is considered to be the best measure of kidney function. Impaired eGFR levels indicate that the kidneys are not working properly.

In 2011–12, 3.6% or around 620,000 people aged 18 years and over had impaired eGFR, with no significant difference between men (3.3%) and women (3.9%). Rates of impaired eGFR were very low for people aged under 54 years (less than 1%) but then markedly increased to 29.6% of people aged 75 years and over.

Around one in ten adults (10.9%) with impaired eGFR self-reported that they had kidney disease as a current and long-term health condition.
High blood pressure is an important risk factor for chronic kidney disease as high blood pressure can damage the blood vessels supplying the kidneys. People who had high blood pressure in 2011–12 were more likely than those with normal blood pressure to have impaired eGFR (7.2% compared with 2.7%). The NHMS also showed that obesity, which is another risk factor for kidney disease, is also related to eGFR. In 2011–12, people who were obese had higher rates of impaired eGFR than those of normal weight or underweight (4.2% compared with 2.7%).

Impaired eGFR was associated with a number of other biomarkers of chronic disease. This was particularly the case for diabetes, which is a major cause of kidney disease. In 2011–12, 17.5% of people with impaired eGFR had diabetes compared with only 4.6% of those with normal eGFR. Kidney disease was also associated with anaemia, as kidney malfunction can reduce the number of red blood cells produced by the body. One in five (19.7%) people with impaired eGFR were at risk of anaemia in 2011–12 compared with 4.0% of those with normal eGFR.

Overall, 31.2% of those with impaired eGFR also had albuminuria.

**PRESENCE OF ALBUMINURIA**

Albuminuria is the presence of albumin (a type of protein) in the urine. Low levels of albumin in the urine are normal, but elevated levels may occur when kidney damage is present.

In 2011–12, 1.3 million (or 7.7%) people aged 18 years and over had albuminuria, with higher rates for men than women (8.5% compared to 6.9%).

Like eGFR, the prevalence of albuminuria sharply increased from the age of 65 years, with people aged 75 years and over having the highest rates (22.5%).

Source(s): Australian Health Survey: Biomedical Results for Chronic Diseases
The relationship between albuminuria and the other chronic disease biomarkers was similar to that for eGFR. For example, people who had albuminuria were more likely than those without albuminuria to have diabetes (15.1% compared with 4.0%), and to be at risk of anaemia (10.1% compared with 4.0%).

People who had high blood pressure were also more likely to have albuminuria than those who did not have high blood pressure (13.8% compared with 6.2%).

For more information on kidney disease biomarkers, see Tables 1, 2, 3, 6, 8, 9, and 15 on the Downloads page of this publication.

ENDNOTES

CHRONIC KIDNEY DISEASE STAGES

Chronic kidney disease has a number of stages, ranging in severity from Stage 1 to Stage 5, with the early stages often showing no symptoms. An individual’s kidney function can improve or regress during the early stages of the disease but once Stages 4 and 5 are reached, also known as end stage kidney disease, kidney function is unlikely to improve. A person with end stage kidney disease is generally reliant on kidney replacement therapy in the form of dialysis or kidney transplant.

Data source and definitions

Chronic kidney disease stages were determined by combining the participants’ estimated glomerular filtration rate (eGFR) results with their albumin creatinine ratio (ACR) results. The different stages were defined as follows:

- No indicators of chronic kidney disease - eGFR ≥60 mL/min/1.73 m² and no presence of albuminuria
- Stage 1 - eGFR ≥90 mL/min/1.73 m² & albuminuria
- Stage 2 - eGFR 60–89 mL/min/1.73 m² & albuminuria
- Stage 3a - eGFR 45–59 mL/min/1.73 m²
- Stage 3b - eGFR 30–44 mL/min/1.73 m²
- Stage 4–5 - eGFR <30 mL/min/1.73 m²

In 2011–12, around 1.7 million people (10.0%) aged 18 years and over had indicators of chronic kidney disease, with similar rates for men (10.3%) and women (9.8%). Around 4% of all adults were in Stage 1, 2.5% were in Stage 2 and less than 1% were in Stages 4–5.

Among those who had indicators of chronic kidney disease in the National Health Measures Survey (NHMS), only 6.1% self-reported having the condition. However, this is not unexpected as unlike other tests for chronic disease, results for albuminuria or abnormal eGFR alone cannot provide a diagnosis for kidney disease and could indicate the presence of an acute kidney condition or infection instead. Kidney disease can only be confirmed if albuminuria or eGFR of less than 60 mL/min/1.73 m² are persistent for at least three months.1 The majority (65.3%) of people with indicators of chronic kidney disease who self-reported the condition had test results that indicated they were in Stages 3 to 5.

Like the patterns seen for the individual kidney disease biomarkers, the prevalence of chronic kidney disease markedly increased with age, with only 5.5% of people aged under 55 years having indicators of the disease compared with 42.2% of people aged 75 years and over.
Persons aged 18 years & over - Proportion with indicators of chronic kidney disease, 2011-12

Source(s): Australian Health Survey: Biomedical Results for Chronic Diseases

For more information on chronic kidney disease stages, see Tables 6 and 15 on the Downloads page of this publication.

ENDNOTES

LIVER FUNCTION

The liver works as the body’s filter, removing toxins from the blood, processing nutrients and regulating its metabolism. A range of factors, including fatty liver disease, infections and excessive alcohol consumption can prevent the liver from performing these functions and if left untreated, can lead to liver damage. When the liver is inflamed or damaged, enzymes including alanine aminotransferase (ALT) and gamma glutamyl transferase (GGT) leak from the liver cells into the bloodstream. As a result, elevated levels of ALT and GGT in the bloodstream can indicate the presence of liver disease.

Data source and definitions

The National Health Measures Survey (NHMS) measured the levels of two blood enzymes related to liver function: gamma glutamyl transferase (GGT) and alanine aminotransferase (ALT). While elevated levels for either test may indicate liver damage, they cannot diagnose the presence of liver disease.

Abnormal liver function as measured by ALT is defined as:
- an ALT reading of greater than 40 U/L for males and greater than 30 U/L for females

Abnormal liver function as measured by GGT is defined as:
- a GGT reading of greater than 30 U/L for children aged 12–14 years
- a GGT reading of greater than 40 U/L for males aged 15–17 years, and greater than 50 U/L for males aged 18 years and over.
- a GGT reading of greater than 35 U/L for females aged 15 years and over.

ALANINE AMINOTRANSFERASE (ALT)

ALT is an enzyme found mainly in the liver that helps the liver metabolise food into energy. Elevated levels of ALT in the blood can occur when the liver is damaged or diseased.

In 2011–12, around 1.9 million (11.0%) people aged 18 years and over had abnormal or elevated levels of ALT in their blood. Men were more likely than women to have elevated ALT (13.8% compared with 8.3%).

The proportion of people with abnormal ALT remained relatively steady through early and middle adulthood, peaking at 13.5% among people aged 45–54 years. Rates then significantly declined to a low of 1.9% among people aged 75 years or over.
Excess body fat is recognised as a risk factor for liver disease. This was reflected in the NHMS results, with 19.5% of those who were obese and 11.6% of people who were overweight having elevated ALT, compared with 4.6% of those who were of normal weight or underweight.

In 2011–12, many people with abnormal ALT also had risk factors for cardiovascular disease. They were more likely than those with normal ALT to have high total cholesterol (40.9% compared with 32.3%) and low HDL cholesterol (35.7% compared with 21.9%), as well as high triglycerides (26.6% compared with 12.3%). They were also more likely to have diabetes (9.2% compared with 4.6%). About two in five people (40.4%) who had elevated ALT also had high GGT.
The enzyme GGT is found in many tissues in the body. It exists in a relatively high concentration in the liver but is also found in the tissues of the kidneys, bile duct, pancreas, gallbladder, spleen, heart, and brain. When any of these tissues are damaged or diseased, GGT leaks from the tissue into the bloodstream. High GGT levels may therefore be indicative of a broader range of conditions and not just liver disease.4,5

In 2011–12, around 2.1 million people aged 18 years and over (12.4%) had abnormal or elevated levels of GGT in their blood. Unlike ALT, the proportion of people with abnormal GGT results generally increased with age, peaking at 20.5% among those aged 55–64 years. Overall, rates were similar for males and females (13.3% compared with 11.6%).

Source(s): Australian Health Survey: Biomedical Results for Chronic Diseases

GAMMA GLUTAMYL TRANSFERASE (GGT)

The enzyme GGT is found in many tissues in the body. It exists in a relatively high concentration in the liver but is also found in the tissues of the kidneys, bile duct, pancreas, gallbladder, spleen, heart, and brain. When any of these tissues are damaged or diseased, GGT leaks from the tissue into the bloodstream. High GGT levels may therefore be indicative of a broader range of conditions and not just liver disease.4,5

In 2011–12, around 2.1 million people aged 18 years and over (12.4%) had abnormal or elevated levels of GGT in their blood. Unlike ALT, the proportion of people with abnormal GGT results generally increased with age, peaking at 20.5% among those aged 55–64 years. Overall, rates were similar for males and females (13.3% compared with 11.6%).
Similar to ALT, excess body fat increased the likelihood of having abnormal GGT. Around one in five (21.6%) people who were obese had abnormal GGT compared with 12.2% of people who were overweight and 6.0% who were of normal weight or underweight.

However, unlike ALT, GGT was also associated with blood pressure and smoking. In 2011–12, people with high blood pressure were more likely to have abnormal GGT than people with normal blood pressure (20.2% compared to 10.3%). Similarly, 18.1% of current smokers had abnormal GGT compared with only 9.6% of people who had never smoked.

**Source(s):** Australian Health Survey: Biomedical Results for Chronic Diseases
People with abnormal GGT were more likely than those with normal GGT to have other chronic disease risk factors, including high total cholesterol (43.7% compared with 31.7%), high triglycerides (32.4% compared with 11.2%), and high LDL 'bad' cholesterol (39.0% compared with 32.4%). They were also more likely to have diabetes (11.5% compared with 4.2%) and to have abnormal results for the chronic kidney disease biomarkers, including albuminuria (12.2% compared with 7.0%) and eGFR (5.9% compared with 3.4%).

For more information on ALT and GGT, see Tables 1, 2, 3, 7, 8 and 9 on the Downloads page of this publication.

ENDNOTES

EXPOSURE TO TOBACCO SMOKE

The National Health Measures Survey (NHMS) included a test for cotinine as an objective measure of smoking status. The body produces cotinine in the process of breaking down, or metabolising, nicotine from tobacco smoke. Levels of cotinine are generally proportionate to the amount of tobacco exposure a person receives through smoking, or in some cases, through exposure to second hand smoke. However, cotinine levels only remain elevated for around 20 hours after exposure to tobacco smoke, therefore it can only provide a measure of short-term exposure.

Data source and definitions

Levels of cotinine were measured via a blood test. In the NHMS, cotinine levels of 140 nmol/L or greater indicate exposure to tobacco smoke.

The Australian Health Survey results for self-reported smoking show that 16.1% of Australians aged 18 years and over were current daily smokers in 2011–12. In the NHMS, the pattern for cotinine exposure was very similar to that for the self-reported smoking data for most age groups. Small differences were evident in the younger age groups, with people aged 18–24 years having slightly higher rates of cotinine exposure compared with their self-reported smoking status. However, the opposite was true for those aged 25–34 years, where the proportion of self-reported smokers was slightly higher than the proportion exposed to cotinine.

Overall, 87.0% of current smokers aged 18 years and over had cotinine levels indicating exposure to tobacco smoke, compared with only 5.7% of those who were ex-smokers and 0.3% of those who had never smoked.
Persons aged 15 years & over - Proportion exposed to cotinine & self-reported smoker status, 2011-12

Source(s): Australian Health Survey: Biomedical Results for Chronic Diseases

For more information on cotinine, see Table 8 on the Downloads page of this publication.

ENDNOTES

1 Benowitz, NL, 1996, Cotinine as a Biomarker of Environmental Tobacco Smoke Exposure, Epidemiologic Reviews <http://epirev.oxfordjournals.org/content/18/2/188.citation>, last accessed 02/07/2013.
Anaemia is caused by a decrease in either the number of red blood cells in the body or the quantity of haemoglobin within red blood cells. When a person is anaemic, their heart has to work harder to ensure that muscles and organs get the oxygen they need. Haemoglobin is a protein found in red blood cells. It contains a large amount of iron and helps transport oxygen from the lungs to the rest of the body. The National Health Measures Survey (NHMS) measured the concentration of haemoglobin in the blood, which can help diagnose anaemia.

**Data source and definitions**

Haemoglobin levels were measured using a blood test. Abnormal levels of haemoglobin indicating a risk of anaemia are defined differently for males and females, young people, and pregnant women, as based on World Health Organization guidelines:

- Less than 120 g/L for people aged 12-14 years and females aged 15 years or older who are not pregnant
- Less than 130 g/L for males aged 15 years or older
- Less than 110 g/L for pregnant women

In Australia in 2011–12, around 760,000 people aged 18 years and over (4.5%) were at risk of anaemia, with women more likely to be at risk than men (6.4% compared with 2.5%).

The risk of anaemia was highest among older Australians, with rates rapidly increasing after the age of 65 years. People aged 75 years and older were more likely to be at risk of anaemia than all other Australians, with 16.0% in the at risk range compared with 3.6% of Australians aged less than 75 years.
Research has shown that anaemia is associated with diabetes and chronic kidney disease. This was reflected in the NHMS results, where 12.6% of those at risk of anaemia had diabetes compared with 4.7% of those not at risk. They were also more likely to have abnormal eGFR, which is a measure of kidney function (16.1% compared with 3.1%).

For more information on haemoglobin, see Tables 1, 2, 3, 8 and 9 on the Downloads page of this publication.

ENDNOTES


COMPARISONS WITH OTHER AUSTRALIAN SURVEYS

The National Health Measures Survey (NHMS) is the first ABS survey to include a voluntary blood and urine collection. However, biomedical results have been collected at the population level in Australia before, most recently at the national level by BakerIDI Heart and Diabetes Institute and for Victoria only by the Victorian Department of Health. There is strong interest in how the results from the NHMS compare with these two studies.

The 1999–2000 Australian Diabetes, Obesity and Lifestyle Study (AusDiab) was conducted by BakerIDI. This was a national cross-sectional survey of around 11,000 people aged 25 years and over and was primarily designed to measure the prevalence of diabetes and associated risk factors.1

The 2009–10 Victorian Health Monitor (VHM) was conducted by the Victorian Department of Health. This was a cross-sectional, statewide survey of around 3,600 Victorians aged 18–75 years and included biomedical measures for diabetes, cardiovascular disease and indicators of chronic kidney disease.2

A summary of the surveys is shown below.

<table>
<thead>
<tr>
<th>Summary of surveys</th>
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<tbody>
<tr>
<td><strong>AusDiab</strong></td>
</tr>
<tr>
<td><strong>Year</strong></td>
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<tr>
<td><strong>Scope</strong></td>
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<tr>
<td><strong>Sample size</strong></td>
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</tbody>
</table>

Note: A Collection District (CD) is the second smallest geographic area defined in the Australian Standard Geographical Classification (ASGC), the smallest being the Mesh Block. The CD was designed for use in the Census of Population and Housing as the smallest unit for collection and processing.

The following sections outline how the results from these two surveys compare with those from the NHMS.

DIABETES

The NHMS and VHM both used fasting plasma glucose blood tests to determine diabetes status. For a detailed description of how diabetes was defined in the NHMS, see the Measuring diabetes - definitions section of this publication.

As shown in the table below, the results from the two surveys were very similar. The NHMS found that 4.3% of people aged 18–75 years in Victoria had diabetes compared with 4.6% found in VHM. VHM had a slightly higher number of people with impaired fasting plasma glucose - 4.3% compared with 3.1% in the NHMS - however the overlapping confidence intervals for these two estimates suggest that this difference is not statistically significant.
### Persons aged 18–75 years in Victoria: Comparison of diabetes results for NHMS and VHM

<table>
<thead>
<tr>
<th></th>
<th>NHMS 2011–12(a)</th>
<th>VHM 2009–10(b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>95% CI</td>
</tr>
<tr>
<td>Known diabetes(c)</td>
<td>3.5</td>
<td>2.2 – 4.8</td>
</tr>
<tr>
<td>Newly diagnosed diabetes(d)</td>
<td>0.9</td>
<td>0.2 – 1.5</td>
</tr>
<tr>
<td><strong>Total with diabetes</strong></td>
<td><strong>4.3</strong></td>
<td><strong>3.0 – 5.7</strong></td>
</tr>
<tr>
<td>Impaired fasting plasma glucose(e)</td>
<td>3.1</td>
<td>2.0 – 4.2</td>
</tr>
</tbody>
</table>

(a) Based on the fasting population. Estimates are not age-standardised.
(c) 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 had ever been told by a doctor or nurse that they have diabetes and their blood test result for fasting plasma glucose was greater than the cut off point for diabetes (that is, ≥7.0 mmol/L).
(d) A person was considered to have newly diagnosed diabetes if they reported no prior diagnosis of diabetes but had a fasting plasma glucose value ≥7.0 mmol/L.
(e) A person was considered to have impaired fasting plasma glucose if they did not currently have diabetes, but had a fasting blood glucose level ranging from 6.1 mmol/L to less than 7.0 mmol/L.

The 1999–2000 AusDiab study used an Oral Glucose Tolerance Test (OGTT), together with self-reported information on doctor diagnosis and medication use, to determine diabetes. An OGTT involves an initial fasting plasma glucose blood test, followed by a drink of a solution containing 75g of glucose. The person’s blood sugar levels are then checked again two hours later. Participants who reported a history of physician diagnosed diabetes and who were 1) taking oral hypoglycemic tablets or insulin injections or 2) had a fasting plasma glucose (FPG) level ≥7.0 mmol/L or 2-hour plasma glucose (2hPG) level ≥11.1 mmol/L were classified as having known diabetes. Participants not reporting diabetes and who had FPG ≥7.0 mmol/L or 2hPG ≥11.1 mmol/L were classified as having newly diagnosed diabetes.

BakerIDI has supplied the ABS with previously unpublished 1999–2000 AusDiab diabetes figures based on FPG test results alone. This allows for a more direct comparison with the NHMS results. The FPG rate for AusDiab was slightly lower than that for the NHMS (5.5%), although this is unlikely to be a significant difference given that the confidence intervals overlap.

The largest difference between the surveys was for newly diagnosed diabetes. More people had newly diagnosed diabetes in AusDiab than in the NHMS, even when using the FPG test.

### Persons aged 25 years and over(a): Comparison of diabetes results for NHMS and AusDiab

<table>
<thead>
<tr>
<th></th>
<th>NHMS 2011–12(b)</th>
<th>AusDiab 1999–2000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FPG test</td>
<td>FPG test(c)</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Known diabetes</td>
<td>4.5</td>
<td>3.1</td>
</tr>
<tr>
<td>Newly diagnosed</td>
<td>1.0</td>
<td>1.8</td>
</tr>
<tr>
<td>diabetes</td>
<td>Total with</td>
<td></td>
</tr>
<tr>
<td>diabetes</td>
<td>5.5</td>
<td>4.9</td>
</tr>
<tr>
<td></td>
<td>4.9 – 6.1</td>
<td>3.8 – 6.1</td>
</tr>
</tbody>
</table>

(a) Based on the fasting populations.
(b) Estimates age-standardised to the 2001 standard population.
(c) Estimates are not age-standardised. Data has been weighted to match the age and sex distribution of the 1998 estimated resident population of Australia aged 25 years and over.

For other NHMS diabetes results, including for all Australians aged 18 years and over, see the Diabetes prevalence section of this publication.
CARDIOVASCULAR DISEASE

The NHMS and VHM included several blood tests for risk factors of cardiovascular disease, including cholesterol levels and triglycerides. Both surveys used the same cut-offs for normal and abnormal tests results and included the same definition of dyslipidaemia.

Again, there was little difference in the results between the two surveys for people aged 18–75 years in Victoria, particularly for total cholesterol and LDL cholesterol. The VHM had slightly higher rates of abnormal triglycerides and lower rates of abnormal HDL cholesterol than the NHMS.

Persons aged 18–75 years in Victoria: Comparison of cardiovascular test results for NHMS and VHM

<table>
<thead>
<tr>
<th></th>
<th>NHMS 2011–12(a)</th>
<th>95% CI</th>
<th>VHM 2009–10(b)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal total cholesterol (≥5.5 mmol/L)</td>
<td>33.6</td>
<td>30.8 – 36.3</td>
<td>35.6</td>
<td>33.4 – 37.9</td>
</tr>
<tr>
<td>Abnormal LDL cholesterol (≥3.5 mmol/L)(c)</td>
<td>32.5</td>
<td>28.8 – 36.3</td>
<td>32.3</td>
<td>29.6 – 35.1</td>
</tr>
<tr>
<td>Abnormal HDL cholesterol (&lt;1.0 mmol/L for men and &lt;1.3 mmol/L for women)</td>
<td>22.3</td>
<td>19.2 – 25.4</td>
<td>15.4</td>
<td>13.0 – 18.2</td>
</tr>
<tr>
<td>Abnormal triglycerides (≥2.0 mmol/L)(c)</td>
<td>10.5</td>
<td>8.2 – 12.9</td>
<td>14.0</td>
<td>12.5 – 15.8</td>
</tr>
<tr>
<td>Dyslipidaemia(c)</td>
<td>58.6</td>
<td>54.2 – 62.9</td>
<td>56.8</td>
<td>53.7 – 59.9</td>
</tr>
</tbody>
</table>

(a) Estimates are not age-standardised.
(b) Data sourced from Department of Health 2012, The Victorian Health Monitor, State Government of Victoria, Melbourne. Estimates are age-standardised to the 2006 population.
(c) Based on the fasting population.

AusDiab also included tests for cholesterol and triglycerides, using these same thresholds. The prevalence of abnormal total cholesterol and abnormal LDL cholesterol was higher in AusDiab than for the NHMS. AusDiab also had a higher proportion of people with elevated triglycerides. Rates of HDL cholesterol could not be compared due to the use of different cut-offs.

Persons aged 25 years and over: Comparison of cardiovascular test results for NHMS and AusDiab

<table>
<thead>
<tr>
<th></th>
<th>NHMS 2011–12(a)</th>
<th>95% CI</th>
<th>AusDiab 1999–2000(b)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal total cholesterol (≥5.5 mmol/L)</td>
<td>35.7</td>
<td>34.3 – 37.1</td>
<td>51.2</td>
<td>48.9 – 53.6</td>
</tr>
<tr>
<td>Abnormal LDL cholesterol (≥3.5 mmol/L)(c)</td>
<td>35.5</td>
<td>33.8 – 37.3</td>
<td>45.7</td>
<td>43.6 – 47.8</td>
</tr>
<tr>
<td>Abnormal triglycerides (≥2.0 mmol/L)(c)</td>
<td>15.2</td>
<td>13.9 – 16.6</td>
<td>20.6</td>
<td>18.0 – 22.9</td>
</tr>
</tbody>
</table>

(a) Estimates are age standardised to the 2001 standard population.
(b) Data sourced from International Diabetes Institute 2001, Diabetes & Associated Disorders in Australia - 2000. The Accelerating Epidemic, The Australian Diabetes, Obesity and Lifestyle Study (AusDiab), Melbourne. Estimates are not age standardised. Data has been weighted to match the age and sex distribution of the 1998 estimated resident population of Australia aged 25 years and over.
(c) Based on the fasting population.

For other NHMS cholesterol and triglycerides results, including for all Australians aged 18 years and over, see the Cardiovascular disease section of this publication.
KIDNEY FUNCTION

The NHMS and VHM included estimated glomerular filtration rate (eGFR) and presence of albuminuria as measures of kidney function. The prevalences of abnormal eGFR and albuminuria for people aged 18–75 years in Victoria were similar for both surveys.

Persons aged 18–75 years in Victoria: Comparison of kidney function test results for NHMS and VHM

<table>
<thead>
<tr>
<th></th>
<th>NHMS(a)</th>
<th>VHM(b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal eGFR(c)</td>
<td>%</td>
<td>95% CI</td>
</tr>
<tr>
<td></td>
<td>2.1</td>
<td>0.9 – 3.2</td>
</tr>
<tr>
<td>Presence of albuminuria(d)</td>
<td>6.0</td>
<td>4.2 – 7.7</td>
</tr>
<tr>
<td></td>
<td>3.5</td>
<td>2.7 – 4.6</td>
</tr>
<tr>
<td></td>
<td>6.4</td>
<td>5.3 – 7.6</td>
</tr>
</tbody>
</table>

(a) Estimates are not age-standardised.
(b) Data sourced from Department of Health 2012, The Victorian Health Monitor, State Government of Victoria, Melbourne. Estimates are age-standardised to the 2006 population.
(c) Abnormal kidney function using eGFR is defined as a reading of less than 60 mL/min/1.73m².
(d) The presence of albuminuria is defined as an albumin creatinine ratio (ACR) reading of ≥2.5 mg/mmol for males and ≥3.5 mg/mmol for females.

The NHMS also included information on chronic kidney disease stages, using a combination of participants’ eGFR and urinary albumin creatinine ratio (ACR) results. The AusDiab Kidney Study shows that the prevalence for chronic kidney disease based on the CKD-EPI equation was 11.5%. This was similar to the corresponding rate in the NHMS for people aged 25 years and over (10.4%).

Persons aged 25 years and over: Comparison of Chronic Kidney Disease results for NHMS and AusDiab

<table>
<thead>
<tr>
<th></th>
<th>NHMS(a)</th>
<th>AusDiab 1999–2000(b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic kidney disease</td>
<td>%</td>
<td>95% CI</td>
</tr>
<tr>
<td></td>
<td>10.4</td>
<td>9.7 – 11.1</td>
</tr>
<tr>
<td></td>
<td>11.5</td>
<td>9.4 – 14.1</td>
</tr>
</tbody>
</table>

(a) Estimates are age-standardised to the 2001 standard population.
(b) Data sources from White et al. 2010, Comparison of the Prevalence and Mortality Risk of CKD in Australia Using the CKD Epidemiology Collaboration (CKD-EPI) and Modification of Diet in Renal Disease (MDRD) Study GFR Estimating Equations: The AusDiab (Australian Diabetes, Obesity and Lifestyle) Study. Estimates are not age standardised. Data has been weighted to match the age and sex distribution of the 1998 estimated resident population of Australia aged 25 years and over.

For other NHMS kidney function results, including for all Australians aged 18 years and over, see the Chronic kidney disease section of this publication.

ENDNOTES

EXPLANATORY NOTES

INTRODUCTION

1 This publication is the first release of information from the 2011–12 National Health Measures Survey (NHMS), which forms part of the 2011–13 Australian Health Survey (AHS).

2 For more information on the structure of the AHS, see Structure of the Australian Health Survey. The following information focusses on the NHMS component of the survey only.

3 All people aged 5 years and over who participated in either the National Health Survey (NHS) or the National Nutrition and Physical Activity Survey (NNPAS) were invited to participate in the voluntary NHMS. The NHMS took place throughout Australia from March 2011 to September 2012. Participants voluntarily provided blood and urine samples, which were then analysed for specific biomarkers.

4 The 2011–12 NHMS collected information about:

- chronic disease biomarkers, including tests for diabetes, cholesterol, triglycerides, kidney disease and liver function; and
- nutrition biomarkers, including tests for iron, folate, iodine and vitamin D levels.

See Appendix A for the full list of tests conducted.

5 In addition, the broader survey collected a wide range of information about health conditions, risk factors (for example, obesity), health service usage, medications and demographic and socioeconomic factors, which can be analysed in relation to the NHMS results.

6 The statistics presented in this publication focus on biomarkers of chronic disease, including cardiovascular disease, diabetes and kidney disease. Information on nutrition biomarkers will be released in late 2013. Further publications from the Australian Health Survey are outlined in the Release Schedule, while the list of data items available from the survey will be available in the Australian Health Survey: Users’ Guide, 2011–13 (cat. no. 4363.0.55.001).

SCOPE OF THE SURVEY

7 The NHS and NNPAS included a combined sample of approximately 25,000 private dwellings across Australia. Urban and rural areas in all states and territories were included, while Very Remote areas of Australia and discrete Aboriginal and Torres Strait Islander communities (and the remainder of the Collection Districts in which these communities were located) were excluded. These exclusions are unlikely to affect national estimates, and will only have a minor effect on aggregate estimates produced for individual states and territories, except the Northern Territory where the population living in Very Remote areas accounts for around 23% of persons.

8 The 2011–13 AHS also included an additional representative sample of around 13,000 Aboriginal and Torres Strait Islander people, which was collected between April 2012 and July 2013. This is a separate collection of Aboriginal and Torres Strait Islander people living in remote and non-remote areas, including discrete Aboriginal and Torres Strait Islander communities. This survey also included a biomedical component. Results from this separate survey will be released progressively from November 2013.

9 Non-private dwellings such as hotels, motels, hospitals, nursing homes and short-stay caravan parks were excluded from the NHS and NNPAS. This may affect estimates of the number of people with some chronic conditions; for example, conditions which may require periods of hospitalisation, such as kidney disease.

10 Within selected dwellings of the NHS and NNPAS, a random sub-sample of residents was selected as follows:
- one adult (aged 18 years and over); and where applicable
- one child aged 0–17 years (NHS) or
- one child aged 2–17 years (NNPAS).

11 The following groups were also excluded from the NHS and NNPAS:

- certain diplomatic personnel of overseas governments, customarily excluded from the Census and estimated resident population;
- persons whose usual place of residence was outside Australia;
- members of non-Australian Defence forces (and their dependents) stationed in Australia; and
- visitors to private dwellings.

12 All selected persons aged 5 years and over were then invited to participate in the voluntary NHMS. Children aged 5–11 years were asked to provide a urine sample only, whereas people aged 12 years and over were asked to provide both a blood and urine sample.

**DATA COLLECTION**

13 The interview components of the NHS and NNPAS were conducted under the Census and Statistics Act (CSA) 1905. Ethics approval for the NHMS component was sought and gained from the Australian Government Department of Health and Ageing’s Departmental Ethics Committee.

14 At the completion of NHS or NNPAS questions, interviewers explained the voluntary NHMS component and provided a written information sheet.

15 Informed consent was sought from adults and from parents/legal guardians of children through completion of a consent form. A copy of the consent form was left with the respondent. Those that agreed to take part were provided a referral form to complete (including whether specific medications or supplements were regularly taken) to provide to the collection clinic.

16 A follow-up reminder process was used for respondents who consented to the NHMS but had not yet attended a collection clinic. This process took the form of phone calls or letters arranged ten days apart from the interview date. Also, home visits and temporary clinics were offered to participants in certain circumstances to maximise participation rates, particularly in remote areas and for those who were incapacitated. To reduce expenses for travel, child-care or time off work, participants were able to claim a reimbursement of $50 paid into an Australian bank account.

17 Most blood and urine samples were collected at Sonic Healthcare collection clinics or via a home visit using standard operating procedures for phlebotomy collection.

18 In order to get an accurate reading for the fasting plasma glucose, LDL cholesterol and triglyceride tests, participants providing blood samples were asked to fast for 8 hours before their test. The results presented in this publication for these tests refer only to those people who did fast (approximately 79% of adults who participated in the NHMS).

19 All blood and urine samples were then analysed at a central laboratory at Douglass Hanly Moir (DHM) Pathology in Sydney, Australia on machines accredited by the National Association of Testing Authorities (NATA). DHM conducted Internal Quality Control (QC) analysis for all instruments used to conduct analysis on the samples. More information on NHMS quality assurance methods and procedures will be available in the Australian Health Survey: Users’ Guide, 2011–13 (cat. no. 4363.0.55.001).

20 All participants were provided with a pathology report of their results via post. Participants could also nominate for their results to be sent to their regular doctor. In cases where the results were outside the normal range, participants were contacted by a qualified health professional and encouraged to discuss their results with their doctor. If the test results showed a significantly high or low result which was dangerous to the person’s health, they were contacted immediately and advised on the best course of action.
RESPONSE RATES

21 In the NHS and NNPAS combined, there were a total of 25,080 households fully responding, giving a response rate of 81.6%. With the selection of one adult and one child aged 2–17 years where applicable, this resulted in a total of 31,837 persons in sample (or 30,329 aged 5 years and over and 27,636 aged 12 years and over).

<table>
<thead>
<tr>
<th>NHS/NNPAS RESPONSE RATES, 2011–12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households approached (after sample loss)</td>
</tr>
<tr>
<td>Households in sample</td>
</tr>
<tr>
<td>Household response rate</td>
</tr>
<tr>
<td>Persons in sample</td>
</tr>
<tr>
<td>2 years and over</td>
</tr>
<tr>
<td>5 years and over</td>
</tr>
<tr>
<td>12 years and over</td>
</tr>
</tbody>
</table>

22 The following table presents response rates for the NHMS.

<table>
<thead>
<tr>
<th>NHMS RESPONSE RATES, 2011–12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of persons</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>Persons in sample (NHS/NNPAS)</td>
</tr>
<tr>
<td>Participated in NHMS</td>
</tr>
<tr>
<td>Urine sample provided</td>
</tr>
<tr>
<td>Did not participate in NHMS</td>
</tr>
<tr>
<td>12 YEARS AND OVER</td>
</tr>
<tr>
<td>Persons in sample (NHS/NNPAS)</td>
</tr>
<tr>
<td>Participated in NHMS</td>
</tr>
<tr>
<td>Blood sample provided</td>
</tr>
<tr>
<td>Fasting sample</td>
</tr>
<tr>
<td>Non-fasting sample</td>
</tr>
<tr>
<td>Did not participate in NHMS</td>
</tr>
</tbody>
</table>

23 In 2011–12, 79% of persons aged 18 years and over who participated in the NHMS fasted. Data relating to fasting tests (for example, the fasting plasma glucose test) relate to the fasting population only. Analysis of the characteristics of people who fasted compared with those who did not fast showed no difference between fasters and non-fasters.

24 The following table compares characteristics of persons who participated in the NHMS with those who participated in the NHS and NNPAS.
COMPARISONS BETWEEN NHMS AND NHS/NNPAS SAMPLES, Persons aged 18 years and over, 2011–12

<table>
<thead>
<tr>
<th></th>
<th>NHMS (unweighted)</th>
<th>NHS/NNPAS (unweighted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married(a)</td>
<td>58.5</td>
<td>52.8</td>
</tr>
<tr>
<td>Born in Australia</td>
<td>70.9</td>
<td>71.4</td>
</tr>
<tr>
<td>Has a non-school qualification</td>
<td>62.5</td>
<td>59.1</td>
</tr>
<tr>
<td>In the Labour Force</td>
<td>63.6</td>
<td>66.5</td>
</tr>
<tr>
<td>Self-reported diabetes(b)</td>
<td>7.0</td>
<td>6.5</td>
</tr>
<tr>
<td>Self-reported high cholesterol</td>
<td>12.0</td>
<td>9.6</td>
</tr>
<tr>
<td>Excellent or Very Good self-assessed health</td>
<td>53.4</td>
<td>52.9</td>
</tr>
<tr>
<td>Current daily smoker</td>
<td>12.0</td>
<td>17.6</td>
</tr>
<tr>
<td>Overweight/obese(d)</td>
<td>66.4</td>
<td>64.9</td>
</tr>
</tbody>
</table>

(a) Includes de facto couples.
(b) Includes persons who self-reported they had diabetes, regardless if it was current or long-term (excludes gestational diabetes).
(c) Includes persons who self-reported they had high cholesterol and it was current and long-term.
(d) Includes only persons for whom height and weight were measured.


WEIGHTING, BENCHMARKING AND ESTIMATION

26 Weighting is a process of adjusting results from a sample survey to infer results for the in-scope total population. To do this, a weight is allocated to each sample person. The weight is a value which indicates how many population units are represented by the sample unit.

27 The first step in calculating weights for each person was to assign an initial weight, which was equal to the inverse of the probability of being selected in the survey. For example, if the probability of a person being selected in the survey was 1 in 600, then the person would have an initial weight of 600 (that is, they represent 600 others). An adjustment was then made to these initial weights to account for the time period in which a person was assigned to be enumerated.

28 The weights are calibrated to align with independent estimates of the population of interest, referred to as ‘benchmarks’, in designated categories of sex by age by area of usual residence. Weights calibrated against population benchmarks compensate for over or under-enumeration of particular categories of persons and ensure that the survey estimates conform to the independently estimated distribution of the population by age, sex and area of usual residence, rather than to the distribution within the sample itself. The selection of benchmarks was chosen to maximise the accuracy of the estimates of biomedical characteristics, by reducing both random and systematic errors as much as possible.

29 The NHMS results were benchmarked to the estimated resident population living in private dwellings in non-Very Remote areas of Australia at 31 October 2011. Excluded from these benchmarks were persons living in discrete Aboriginal and Torres Strait Islander communities, as well as a small number of persons living within Collection Districts that include discrete Aboriginal and Torres Strait Islander communities. The benchmarks, and hence the estimates from the survey, do not (and are not intended to) match estimates of the total Australian resident population (which include persons living in Very Remote areas or in non-private dwellings, such as hotels) obtained from other sources.

30 Survey estimates of counts of persons are obtained by summing the weights of persons with the characteristic of interest. Estimates of non-person counts (for example, number of conditions) are obtained by multiplying the characteristic of interest with the weight of the reporting person and aggregating.
31 The weights for the NHMS are different to the weights for the combined NHS/NNPAS due to the differing response patterns between the surveys.

32 An investigation was undertaken to determine whether the accuracy of NHMS estimates could be improved by weighting with any other variables collected in the NHS and NNPAS, including smoking status, Body Mass Index, self-assessed health, physical activity, employment status, marital status, country of birth and blood pressure. While the use of some of these variables would have improved the accuracy of some NHMS estimates (e.g. the use of smoker status in the weighting process would have ensured that totals relating to current daily smokers were identical in the NHMS to those in the combined NHS and NNPAS), they made no difference to the main variables of interest in the NHMS (i.e. estimates of diabetes, cholesterol) and even in some cases increased the measure of sampling error or Relative Standard Error (RSE).

33 The decision to maximise the accuracy of these main variables of interest in the NHMS by not including those other variables in the calculation of weights for the NHMS means that, while variables collected in the NHMS can be analysed with variables collected in either the NHS or NNPAS, the NHS and NNPAS should be used when reporting on the prevalence of these variables. For example, for self-reported medical conditions and risk factors such as smoking, the most accurate prevalences should be calculated using the combined NHS and NNPAS sample.

RELIABILITY OF ESTIMATES

34 All sample surveys are subject to sampling and non-sampling error.

35 Sampling error is the difference between estimates, derived from a sample of persons, and the value that would have been produced if all persons in scope of the survey had been included. For more information refer to the Technical Note. Indications of the level of sampling error are given by the Relative Standard Error (RSE) and Margin of Error (MoE).

36 In this publication, estimates with an RSE of 25% to 50% are preceded by an asterisk (e.g. *3.4) to indicate that the estimate has a high level of sampling error relative to the size of the estimate, and should be used with caution. Estimates with an RSE over 50% are indicated by a double asterisk (e.g. **0.6) and are generally considered too unreliable for most purposes. These estimates can be used to aggregate with other estimates to reduce the overall sampling error.

37 The MoEs are provided for all proportions to assist users in assessing their reliability. Users may find this measure is more convenient to use, rather than the RSE, in particular for small and large proportions. The proportion combined with the MoE defines a range which is expected to include the true population value with a given level of confidence. This is known as the confidence interval. This range should be considered by users to inform decisions based on the proportion.

38 Non-sampling error may occur in any data collection, whether it is based on a sample or a full count such as a census. Non-sampling errors occur when survey processes work less effectively than intended. Sources of non-sampling error include non-response or missing test results, errors in reporting by respondents or in recording of answers by interviewers, and occasional errors in coding and processing data.

39 Non-response can affect the reliability of results and can introduce a bias. The magnitude of any bias depends on the rate of non-response and the extent of the difference between the characteristics of those people who responded to the survey and those who did not.

CLASSIFICATIONS

40 Country of birth was classified to the Standard Australian Classification of Countries (cat. no. 1269.0).

41 Main language spoken at home was classified according to the Australian Standard Classification of Languages (cat. no. 1267.0).

42 Descriptions for data items such as diabetes, Body Mass Index and blood pressure are included in
the Glossary to this publication.

CONFIDENTIALITY

43 The Census and Statistics Act, 1905 provides the authority for the ABS to collect statistical information, and requires that statistical output shall not be published or disseminated in a manner that is likely to enable the identification of a particular person or organisation. This requirement means that the ABS must take care and make assurances that any statistical information about individual respondents cannot be derived from published data.

44 Some techniques used to guard against identification or disclosure of confidential information in statistical tables are suppression of sensitive cells, random adjustments to cells with very small values, and aggregation of data. To protect confidentiality within this publication, some cell values may have been suppressed and are not available for publication but included in totals where applicable. As a result, sums of components may not add exactly to totals due to the confidentialisation of individual cells.

ROUNDING

45 Estimates presented in this publication have been rounded. As a result, sums of components may not add exactly to totals.

46 Proportions presented in this publication are based on unrounded figures. Calculations using rounded figures may differ from those published.

ACKNOWLEDGEMENTS

47 ABS publications draw extensively on information provided freely by individuals, businesses, governments and other organisations. Their continued cooperation is very much appreciated; without it, the wide range of statistics published by the ABS would not be available. Information received by the ABS is treated in strict confidence as required by the Census and Statistics Act, 1905.

48 The 2011–13 AHS, and particularly the NHMS component, was developed with the assistance of several advisory groups and expert panels. Members of these groups were drawn from Commonwealth and state/territory government agencies, non-government organisations, relevant academic institutions and clinicians. The valuable contributions made by members these groups are greatly appreciated.

PRODUCTS AND SERVICES

49 Summary results from the NHMS are available in spreadsheet form from the Downloads tab in this release.

50 Special tabulations are available on request. Subject to confidentiality and sampling variability constraints, tabulations can be produced from the survey incorporating data items, populations and geographic areas selected to meet individual requirements. A list of data items is available from the Australian Health Survey: Users' Guide, 2011–13 (cat. no. 4363.0.55.001).

RELATED PUBLICATIONS

51 Other ABS publications which may be of interest are shown under the 'Related Information' tab of this release.

52 Current publications and other products released by the ABS are listed on the ABS website <www.abs.gov.au>. The ABS also issues a daily Release Advice on the website which details products to be released in the week ahead.
GLOSSARY

Age standardisation

Age standardisation is a way of allowing comparisons between two or more populations with different age structures, in order to remove age as a factor when examining relationships between variables. For example, the age structure of the population of Australia is changing over time. As the prevalence of a particular health condition (for example, arthritis) may be related to age, any increase in the proportion of people with that health condition over time may be due to real increases in prevalence or to changes in the age structure of the population over time or to both. Age standardising removes the effect of age in assessing change over time or between different populations. Age standardised proportions in this publication have been age-standardised to the 2001 standard population.

Albumin creatinine ratio (ACR)

The ratio of albumin (a protein) to creatinine (a waste product) in the urine can determine how well the kidneys are functioning. An elevated ACR result may indicate kidney disease or a reduction in kidney function. In this survey, abnormal ACR - also known as albuminuria - is defined as 2.5 mg/mmol or greater for males, and 3.5 mg/mmol or greater for females.

Albuminuria

Albuminuria is defined as the presence of albumin, a type of protein, in the urine. In this survey, the presence of albuminuria was defined as an ACR reading of greater than or equal to 2.5 mg/mmol for males and greater than or equal to 3.5 mg/mmol for females.

Also see Albumin creatinine ratio (ACR), Macroalbuminuria, Microalbuminuria and Normoalbuminuria.

Alanine aminotransferase (ALT)

ALT is an enzyme found mainly in the liver. When the liver is damaged or diseased, ALT leaks into the bloodstream. In this survey, abnormal ALT is defined as greater than 30 U/L for males aged 12–14 years, and greater than 40 U/L for males aged 15 and over. For females aged 12 years and over, abnormal ALT is defined as greater than 30 U/L.

Anaemia

Anaemia describes a decrease in either the number of red blood cells in the body or the quantity of haemoglobin within red blood cells.

Also see haemoglobin.

Apolipoprotein B (Apo B)

Apo B is a protein that helps form the structure of LDL and other “bad” cholesterol particles. Apo B is not found in HDL (‘good’) cholesterol particles. Therefore, measuring apolipoprotein B levels can indicate the concentration of ‘bad’ cholesterol in the blood. In this survey, abnormal Apo B is defined as greater than 1.2 g/L for males and greater than 1.3 g/L for females.

Atherosclerosis

Atherosclerosis is the build up of fatty deposits in the blood vessels. Arteries that have been narrowed by atherosclerosis can constrict the flow of blood through the body, increasing the risk of heart attack, stroke, and other conditions. Atherosclerosis is a common cause of heart disease.

At high risk of diabetes

In this survey, a person was considered to be at high risk of diabetes if they did not currently have diabetes, but had an impaired fasting plasma glucose result, that is, a fasting plasma glucose level ranging from 6.1 mmol/L to less than 7.0 mmol/L. The equivalent cut-off for the glycated haemoglobin
(HbA1c) test was a value of 6.0% to less than 6.5%.

Also see Diabetes, Known diabetes and Newly diagnosed diabetes.

**Blood pressure**

See High blood pressure.

**Body Mass Index (BMI)**

Body Mass Index (BMI) is a simple index of weight-for-height that is commonly used to classify underweight, normal weight, overweight and obesity. It is calculated from height and weight information, using the formula weight (kg) divided by the square of height (m). To produce a measure of the prevalence of underweight, normal weight, overweight or obesity in adults, BMI values are grouped according to the table below which allows categories to be reported against both the World Health Organization (WHO) and National Health and Medical Research Council (NHMRC) guidelines.

<table>
<thead>
<tr>
<th>Category</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>Less than 18.50</td>
</tr>
<tr>
<td>Normal range</td>
<td>18.50 — 24.99</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.00 — 29.99</td>
</tr>
<tr>
<td>Obese</td>
<td>30.00 or more</td>
</tr>
</tbody>
</table>

Separate BMI classifications were produced for children. BMI scores were created in the same manner described above but also took into account the age and sex of the child. There are different cutoffs for BMI categories (underweight/normal combined, overweight or obese) for male and female children. These categories differ to the categories used in the adult BMI classification and follow the scale provided in Cole TJ, Bellizzi MC, Flegal KM and Dietz WH, Establishing a standard definition for child overweight and obesity worldwide: international survey, BMJ 2000; 320. For a detailed list of the cutoffs used to calculate BMI for children see the Australian Health Survey: Users' Guide, 2011-13 (cat. no. 4363.0.55.001).

**Cholesterol**

Cholesterol is a type of fat that circulates in the blood. It is essential for many metabolic processes, including the production of hormones and in building cells. There are two main types of cholesterol: high density lipoprotein (HDL) and low density lipoprotein (LDL).

Also see Total cholesterol, HDL cholesterol and LDL cholesterol.

**Chronic kidney disease stages**

Chronic kidney disease stages were derived using a combination of participants' estimated glomerular filtration rate (eGFR) results with their albumin creatinine ratio (ACR) results. The different stages were defined as follows:

- No indicators of chronic kidney disease - eGFR greater than or equal to 60 mL/min/1.73 m² and no presence of albuminurias
- Stage 1 - eGFR greater than or equal to 90 mL/min/1.73 m² & albuminuria
- Stage 2 - eGFR 60 to 89 mL/min/1.73 m² & albuminuria
- Stage 3a - eGFR 45–59 mL/min/1.73 m²
- Stage 3b - eGFR 30–44 mL/min/1.73 m²
- Stage 4–5 - eGFR less than 30 mL/min/1.73 m²
Collection District (CD)

A CD is the second smallest geographic area defined in the Australian Standard Geographical Classification (ASGC), the smallest being the Mesh Block. The CD was designed for use in the Census of Population and Housing as the smallest unit for collection and processing.

Cotinine

Cotinine is produced in the process of breaking down, or metabolising, nicotine. Elevated levels of cotinine in the blood can be used to determine exposure to tobacco smoke. However, cotinine levels only remain elevated for around 20 hours after exposure to tobacco smoke, therefore it can only provide a measure of short-term exposure. In this survey, cotinine levels of 140 nmol/L or greater indicate exposure to tobacco smoke.

Current daily smoker

A current daily smoker is a respondent who reported at the time of interview that they regularly smoked one or more cigarettes, cigars or pipes per day. Also see Smoker status.

Diabetes

Diabetes is a chronic condition where insulin, a hormone that controls blood glucose levels, is no longer produced or is not produced in sufficient amounts by the body. In this survey, diabetes prevalence was derived using a combination of blood test results and self-reported information on diabetes diagnosis and medication use.

Also see Known diabetes, Newly diagnosed diabetes and At high risk of diabetes.

Dyslipidaemia

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

- Taking cholesterol-lowering medication
- Total cholesterol greater than or equal to 5.5 mmol/L
- HDL cholesterol less than 1.0 mmol/L for men and less than 1.3 mmol/L for women
- LDL cholesterol greater than or equal to 3.5 mmol/L
- Triglycerides greater than or equal to 2.0 mmol/L

Estimated glomerular filtration rate (eGFR)

eGFR measures the rate at which the kidneys filter wastes from the blood. It is considered to be the best measure of kidney function. In this survey, abnormal kidney function using eGFR is defined as a reading of less than 60 mL/min/1.73m².

Employed

Persons aged 15 years and over who had a job or business, or who undertook work without pay in a family business for a minimum of one hour per week. Includes persons who were absent from a job or business. Also see Unemployed and Not in the labour force.

Fasting plasma glucose

A blood test that measures the amount of glucose (a sugar) in the blood. In this survey, fasting plasma glucose levels of 7.0 mmol/L or greater indicates diabetes. A fasting plasma glucose level from 6.1 mmol/L to less than 7.0 mmol/L is known as impaired fasting plasma glucose and indicates that a person is at high risk of diabetes.
Gamma glutamyl transferase (GGT)

GGT is an enzyme that is found in high concentrations in the liver, and in lesser concentrations in the kidneys, bile duct, pancreas, gallbladder, spleen, heart, and brain. When these tissues are damaged by disease or inflammation, GGT leaks from the tissue into the bloodstream. In this survey, abnormal GGT is defined as greater than 30 U/L for children aged 12–14 years. Abnormal GGT is defined as greater than 40 U/L for males aged 15–17 years, and as greater than 50 U/L for males aged 18 years and over. For females aged 15 years and over, abnormal GGT is defined as greater than 35 U/L.

Haemoglobin

Haemoglobin is an iron-containing protein and is found in the red blood cells and helps transport oxygen from the lungs to the rest of the body. Low haemoglobin levels in the blood may indicate anaemia. In this survey, the risk of anaemia is defined using haemoglobin levels. For children aged 12–14 years and for non-pregnant women aged 15 years or older, haemoglobin levels less than 120 g/L are defined as at risk of anaemia. For pregnant women, haemoglobin levels less than 110 g/L are defined as at risk of anaemia. For males aged 15 years or older, haemoglobin levels less than 130 g/L are defined as at risk of anaemia.

See also Anaemia.

HbA1c test

Glycated haemoglobin, commonly known as HbA1c, is a blood test that measures what the person's average blood glucose level has been in the previous three months. Results from the HbA1c test can be expressed either as a percentage (%) or as a measurement in mmol/mol. In this survey, normal HbA1c is defined as less than 6.0%; at high risk of diabetes is defined as 6.0% to less than 6.5% and levels greater than or equal to 6.5% indicate diabetes.

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 less than 1.0 mmol/L for males, and as less than 1.3 mmol/L for females.

High blood pressure

A measured blood pressure reading of 140/90 mm Hg (millimetres of mercury) or higher. Data on high blood pressure in this publication refer to measured blood pressure only, and do not take into account whether people who might otherwise have high blood pressure are managing their condition through the use of blood pressure medications.

Impaired fasting plasma glucose

A fasting plasma glucose level ranging from 6.1 mmol/L to less than 7.0 mmol/L. Also see At high risk of diabetes.

Index of Relative Socio-Economic Disadvantage

This is one of four Socio-Economic Indexes for Areas (SEIFA) compiled by ABS following each Census of Population and Housing. The indexes are compiled from various characteristics of persons resident in particular areas: the Index of Relative Socio-Economic Disadvantage summarises attributes such as low income, low educational attainment, high unemployment and jobs in relatively unskilled occupations. A lower Index of Relative Socio-Economic Disadvantage quintile (e.g. the first quintile) indicates relatively greater disadvantage and a lack of advantage in general. A higher Index of Relative Socio-Economic Disadvantage (e.g. the fifth quintile) indicates a relative lack of disadvantage and greater advantage in general. For further information about SEIFA see the Australian Health Survey: Users’ Guide, 2011-13 (cat. no. 4363.0.55.001).
Kidney disease stages

See Chronic kidney disease stages

Known diabetes

In this survey, 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 their blood test result for fasting plasma glucose was greater than or equal to the cut off point for diabetes (that is, greater than or equal to 7.0 mmol/L).

People who had been told by a doctor or nurse that they have diabetes, but who were not taking medication for diabetes and did not have a fasting plasma glucose level of 7.0 mmol/L or greater, were classified as not having diabetes.

People with known diabetes were further classified as having Type I, Type II or Type unknown, based on the type of diabetes that a doctor or nurse told them they had. Women with gestational diabetes were excluded.

The corresponding diabetes cut-off for HbA1c is a value of 6.5% or greater.

Labour force status

Refers to the employment situation of respondents at the time of the survey. Categories are:

- employed
- unemployed (aged 15 years and over, not employed and actively looked for work in the 4 weeks prior to the survey)
- not in the labour force (all children less than 15 years, and persons 15 years and over who were neither employed or unemployed).

See also Employed, Unemployed, Not in the labour force.

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. In this survey, abnormal LDL cholesterol is defined as 3.5 mmol/L or greater.

Also see Total cholesterol and HDL cholesterol.

Macroalbuminuria

An increased amount of albumin, a protein, in the urine. Macroalbuminuria is defined as an albumin creatinine ratio (ACR) of more than 25 mg/mmol for males, or more than 35 mg/mmol for females.

Also see Albumin creatinine ratio (ACR).

Margin of Error (MoE)

Describes the distance from the precision of the estimate at a given confidence level, and is specified at a given level of confidence (95% in this publication). In this publication, Margin of error has only been provided for proportions and averages tables. For more information see the Technical notes of this publication.
**Microalbuminuria**

A slightly increased amount of albumin, a protein, in the urine. Microalbuminuria is defined as an albumin creatinine ratio (ACR) of 2.5 to 25 mg/mmol for males, or 3.5 to 35 mg/mmol for females. Also see Albumin creatinine ratio (ACR).

**Newly diagnosed diabetes**

In this survey, a person was considered to have newly diagnosed diabetes if they reported no prior diagnosis of diabetes but had a fasting plasma glucose value of 7.0 mmol/L or greater. The equivalent cut-off for the HbA1c test is a value of 6.5% or greater.

Also see Known diabetes and At high risk of diabetes.

**Non-HDL Cholesterol**

Calculated by subtracting the level of HDL cholesterol from the level of total cholesterol. Non-HDL cholesterol levels are monitored as part of diabetes management as a tool to assess cardiovascular risk.

**Normoalbuminuria**

Normal levels of protein in the urine. Normoalbuminuria is defined as an albumin creatinine ratio (ACR) of less than 2.5 mg/mmol for males, or less than 3.5 mg/mmol for females. See also Albumin creatinine ratio (ACR).

**Normal weight**

See Body Mass Index (BMI).

**Not in the labour force**

Persons who are not employed or unemployed as defined, including persons who:

- are retired;
- no longer work;
- do not intend to work in the future;
- are permanently unable to work; or
- have never worked and never intend to work.

**Obese**

See Body Mass Index (BMI).

**Overweight**

See Body Mass Index (BMI).

**Relative Standard Error (RSE)**

The standard error expressed as a percentage of the estimate. For more information see the Technical notes in this publication.

**Remoteness**

The Remoteness Structure for the Australian Statistical Geography Standard (ASGS) 2011, has five categories based on an aggregation of geographical areas which share common characteristics of remoteness, determined in the context of Australia as a whole. These categories are:

- Major cities of Australia
- Inner regional Australia
- Outer regional Australia
- Remote Australia
- Very remote Australia

The five categories are generally aggregated in some way for use in output.

The 2011 Remoteness Structure has been built using the same principles as the 2006 Remoteness Structure. The primary difference is that it was built from ASGS Statistical Area Level 1 (SA1) regions rather than from 2006 Census Collection Districts (CCD).

**Smoker status**

The extent to which a respondent was smoking at the time of interview, and refers to regular smoking of tobacco, including manufactured (packet) cigarettes, roll-your-own cigarettes, cigars and pipes, but excludes chewing tobacco and smoking of non-tobacco products. Categorised as:

- Current daily smoker - a respondent who reported at the time of interview that they regularly smoked one or more cigarettes, cigars or pipes per day;
- Current smoker - Other - a respondent who reported at the time of interview that they smoked cigarettes, cigars or pipes, less frequently than daily;
- Ex-smoker - a respondent who reported that they did not currently smoke, but had regularly smoked daily, or had smoked at least 100 cigarettes, or smoked pipes, cigars, etc at least 20 times in their lifetime; and
- Never smoked - a respondent who reported they had never regularly smoked daily, and had smoked less than 100 cigarettes in their lifetime and had smoked pipes, cigars, etc less than 20 times.

**Total cholesterol**

Total cholesterol is a measure of all the different types of fats in the blood. In this survey, abnormal total cholesterol is defined as 5.5 mmol/L or greater.

Also see Cholesterol, HDL cholesterol, and LDL cholesterol.

**Triglycerides**

Triglycerides are a fatty substance in the blood typically caused by a diet high in fat and kilojoules. Triglycerides can also become elevated as a result of having other conditions, such as diabetes and kidney disease. In this survey, abnormal triglycerides are defined as 2.0 mmol/L or greater.

**Underweight**

See Body Mass Index (BMI).

**Unemployed**

Persons aged 15 years and over who were not employed and had actively looked for work in the four weeks prior to the survey, and were available to start work in the week prior to the survey.

**Waist circumference**

Waist circumference is associated with an increased risk of metabolic complications associated with obesity. The World Health Organisation (WHO) and National Health and Medical Research Council (NHMRC) approved the following guidelines for Caucasian men and women:
<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at risk</td>
<td>Waist circumference less than 94 cm</td>
<td>Waist circumference less than 80 cm</td>
</tr>
<tr>
<td>Increased risk</td>
<td>Waist circumference more than or equal to 94 cm</td>
<td>Waist circumference more than or equal to 80 cm</td>
</tr>
<tr>
<td>Greatly increased risk</td>
<td>Waist circumference more than or equal to 102 cm</td>
<td>Waist circumference more than or equal to 88 cm</td>
</tr>
</tbody>
</table>
TECHNICAL NOTE

RELIABILITY OF THE ESTIMATES

1 Two types of errors are possible in an estimate based on a sample survey: sampling error and non-sampling error. The sampling error is a measure of the variability that occurs by chance because a sample, rather than the entire population, is surveyed. Since the estimates in this publication are based on information obtained from a sample of persons they are subject to sampling variability; that is, they may differ from the figures that would have been produced if all persons had been included in the survey. One measure of the likely difference is given by the standard error (SE). There are about two chances in three that a sample estimate will differ by less than one SE from the figure that would have been obtained if all persons had been included, and about 19 chances in 20 that the difference will be less than two SEs.

2 Another measure of the likely difference is the relative standard error (RSE), which is obtained by expressing the SE as a percentage of the estimate. The RSE is a useful measure in that it provides an immediate indication of the percentage errors likely to have occurred due to sampling, and thus avoids the need to refer also to the size of the estimate.

\[
RSE\% = \left( \frac{SE}{\text{estimate}} \right) \times 100
\]

3 RSEs for the published estimates and proportions are supplied in the online version of this publication on the ABS website.

4 The smaller the estimate the higher the RSE. Very small estimates are subject to such high SEs (relative to the size of the estimate) as to detract seriously from their value for most reasonable uses. In the tables in this publication, only estimates with RSEs less than 25% are considered sufficiently reliable for most purposes. However, estimates with larger RSEs, between 25% and less than 50% have been included and are preceded by an asterisk (e.g. *3.4) to indicate they are subject to high SEs and should be used with caution. Estimates with RSEs of 50% or more are preceded with a double asterisk (e.g. **0.6). Such estimates are considered unreliable for most purposes.

5 The imprecision due to sampling variability, which is measured by the SE, should not be confused with inaccuracies that may occur because of imperfections in reporting by interviewers and respondents and errors made in coding and processing of data. Inaccuracies of this kind are referred to as the non-sampling error, and they may occur in any enumeration, whether it be in a full count or only a sample. In practice, the potential for non-sampling error adds to the uncertainty of the estimates caused by sampling variability. However, it is not possible to quantify the non-sampling error.

STANDARD ERRORS OF PROPORTIONS AND PERCENTAGES

6 Proportions and percentages formed from the ratio of two estimates are also subject to sampling errors. The size of the error depends on the accuracy of both the numerator and the denominator. For proportions where the denominator is an estimate of the number of persons in a group and the numerator is the number of persons in a sub-group of the denominator group, the formula to approximate the RSE is given below. The formula is only valid when x is a subset of y.

\[
RSE\left( \frac{X}{Y} \right) = \sqrt{RSE(X)^2 - RSE(Y)^2}
\]

COMPARISON OF ESTIMATES

7 Published estimates may also be used to calculate the difference between two survey estimates. Such an estimate is subject to sampling error. The sampling error of the difference between two estimates depends on their SEs and the relationship (correlation) between them. An approximate SE
of the difference between two estimates \((x-y)\) may be calculated by the following formula:

\[
\text{SE}(x - y) = \sqrt{\text{SE}(x)^2 + \text{SE}(y)^2}
\]

8 While the above formula will be exact only for differences between separate and uncorrelated (unrelated) characteristics of sub-populations, it is expected that it will provide a reasonable approximation for all differences likely to be of interest in this publication.

9 Another measure is the Margin of Error (MoE), which describes the distance from the population value of the estimate at a given confidence level, and is specified at a given level of confidence. Confidence levels typically used are 90%, 95% and 99%. For example, at the 95% confidence level the MoE indicates that there are about 19 chances in 20 that the estimate will differ by less than the specified MoE from the population value (the figure obtained if all dwellings had been enumerated). The 95% MoE is calculated as 1.96 multiplied by the SE.

10 The 95% MoE can also be calculated from the RSE by:

\[
\text{MoE}(y) = \frac{\text{RSE}(y) \times y}{100} \times 1.96
\]

11 The MoEs in this publication are calculated at the 95% confidence level. This can easily be converted to a 90% confidence level by multiplying the MoE by

\[
\frac{1.645}{1.96}
\]

or to a 99% confidence level by multiplying by a factor of

\[
\frac{2.576}{1.96}
\]

12 A confidence interval expresses the sampling error as a range in which the population value is expected to lie at a given level of confidence. The confidence interval can easily be constructed from the MoE of the same level of confidence by taking the estimate plus or minus the MoE of the estimate.

**EXAMPLE OF INTERPRETATION OF SAMPLING ERROR**

13 Standard errors can be calculated using the estimates and the corresponding RSEs. For example, in the 2011-12 AHS: Biomedical results for chronic diseases, the estimated proportion of males aged 18 years and over who have abnormal levels of total cholesterol is 32.4%. The RSE for this estimate is 3.2%, and the SE is calculated by:

\[
\text{SE of estimate} = \left(\frac{\text{RSE}}{100}\right) \times \text{estimate} = 0.032 \times 32.4 = 1.0
\]

14 Standard errors can also be calculated using the MoE. For example, the MoE for the estimate of the proportion of males aged 18 years and over who have abnormal levels of total cholesterol is +/- 2.0 percentage points. The SE is calculated by:
15 Note due to rounding the SE calculated from the RSE may be slightly different to the SE calculated from the MoE for the same estimate.

16 There are about 19 chances in 20 that the estimate of the proportion of males aged 18 years and over who have abnormal levels of total cholesterol is within +/- 2.0 percentage points from the population value.

17 Similarly, there are about 19 chances in 20 that the proportions of males aged 18 years and over who have abnormal levels of total cholesterol is within the confidence interval of 30.4% to 34.4%.

**SIGNIFICANCE TESTING**

18 For comparing estimates between surveys or between populations within a survey it is useful to determine whether apparent differences are ‘real’ differences between the corresponding population characteristics or simply the product of differences between the survey samples. One way to examine this is to determine whether the difference between the estimates is statistically significant. This is done by calculating the standard error of the difference between two estimates (x and y) and using that to calculate the test statistic using the formula below:

\[
\frac{|x - y|}{SE(x - y)}
\]

19 If the value of the statistic is greater than 1.96 then we may say there is good evidence of a statistically significant difference at 95% confidence levels between the two populations with respect to that characteristic. Otherwise, it cannot be stated with confidence that there is a real difference between the populations.
ABBREVIATIONS

The following symbols and abbreviations are used in this publication:

. . . not applicable
AATSIHS Australian Aboriginal and Torres Strait Islander Health Survey
ACR Albumin Creatinine ratio
ABS Australian Bureau of Statistics
AHS Australian Health Survey
ALT Alanine aminotransferase
ASGC Australian Standard Geographical Classification
AusDiab Australian Diabetes, Obesity and Lifestyle Study, 1999-2000
BMI Body Mass Index
CD collection district
CKD Chronic kidney disease
CKD-EPI Chronic Kidney Disease Epidemiology Collaboration
cm centimetre
CVD Cardiovascular disease
DHM Douglass Hanly Moir
DoHA Commonwealth Department of Health and Ageing
eGFR estimated glomerular filtration rate
FPG fasting plasma glucose
g/L grams per litre
GGT Gamma glutamyl transferase
HbA1c Glycated haemoglobin test
HDL High-density lipoprotein
kg kilogram
LDL Low-density lipoprotein
mL/min millilitres per minute
mm Hg millimetre of mercury
mmol/L millimoles per litre
MoE Margin of Error
na not available
nec not elsewhere classified
NHMS National Health Measures Survey
NHS National Health Survey
nmol/L nanomoles per litre
NNPAS National Nutrition and Physical Activity Survey
OGTT Oral Glucose Tolerance Test
RSE relative standard error
SE standard error
SEIFA Socio-Economic Indexes for Areas
VHM Victorian Health Monitor
WHO World Health Organization
## APPENDIX A

### SUMMARY OF CHRONIC DISEASE BIOMARKERS

<table>
<thead>
<tr>
<th></th>
<th>Age</th>
<th>Test type</th>
<th>Fasting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cardiovascular disease biomarkers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>12+</td>
<td>Blood</td>
<td>No</td>
</tr>
<tr>
<td>HDL cholesterol</td>
<td>12+</td>
<td>Blood</td>
<td>No</td>
</tr>
<tr>
<td>LDL cholesterol</td>
<td>12+</td>
<td>Blood</td>
<td>Yes</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>12+</td>
<td>Blood</td>
<td>Yes</td>
</tr>
<tr>
<td>Apolipoprotein B</td>
<td>12+</td>
<td>Blood</td>
<td>No</td>
</tr>
<tr>
<td><strong>Diabetes biomarkers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fasting plasma glucose</td>
<td>12+</td>
<td>Blood</td>
<td>Yes</td>
</tr>
<tr>
<td>HbA1c</td>
<td>12+</td>
<td>Blood</td>
<td>No</td>
</tr>
<tr>
<td><strong>Kidney disease biomarkers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACR (Albumin creatinine ratio)</td>
<td>5+</td>
<td>Urine</td>
<td>No</td>
</tr>
<tr>
<td>eGFR (estimated glomerular filtration rate)</td>
<td>18+</td>
<td>Blood</td>
<td>No</td>
</tr>
<tr>
<td><strong>Liver function biomarkers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALT (alanine aminotransferase)</td>
<td>12+</td>
<td>Blood</td>
<td>No</td>
</tr>
<tr>
<td>GGT (gamma glutamyl transferase)</td>
<td>12+</td>
<td>Blood</td>
<td>No</td>
</tr>
<tr>
<td><strong>Anaemia</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haemoglobin</td>
<td>12+</td>
<td>Blood</td>
<td>No</td>
</tr>
<tr>
<td><strong>Tobacco use</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotinine</td>
<td>12+</td>
<td>Blood</td>
<td>No</td>
</tr>
</tbody>
</table>

### SUMMARY OF NUTRIENT BIOMARKERS

<table>
<thead>
<tr>
<th></th>
<th>Age</th>
<th>Test type</th>
<th>Fasting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Folate</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum folate</td>
<td>12+</td>
<td>Blood</td>
<td>No</td>
</tr>
<tr>
<td>Red cell folate (RCF)</td>
<td>12+</td>
<td>Blood</td>
<td>No</td>
</tr>
<tr>
<td><strong>Vitamin B12</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum B12</td>
<td>12+</td>
<td>Blood</td>
<td>No</td>
</tr>
<tr>
<td><strong>Iron</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum ferritin</td>
<td>12+</td>
<td>Blood</td>
<td>No</td>
</tr>
<tr>
<td>Soluble transferrin receptor (sTIR)</td>
<td>12+</td>
<td>Blood</td>
<td>No</td>
</tr>
<tr>
<td>Haemoglobin</td>
<td>12+</td>
<td>Blood</td>
<td>No</td>
</tr>
<tr>
<td>Inflammation marker (CRP)</td>
<td>12+</td>
<td>Blood</td>
<td>No</td>
</tr>
<tr>
<td><strong>Vitamin D</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum 25(OH)D</td>
<td>12+</td>
<td>Blood</td>
<td>No</td>
</tr>
<tr>
<td><strong>Iodine</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iodine</td>
<td>5+</td>
<td>Urine</td>
<td>No</td>
</tr>
<tr>
<td><strong>Sodium</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium concentration</td>
<td>5+</td>
<td>Urine</td>
<td>No</td>
</tr>
<tr>
<td><strong>Potassium</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium concentration</td>
<td>5+</td>
<td>Urine</td>
<td>No</td>
</tr>
</tbody>
</table>
One case of undiagnosed diabetes for every four diagnosed

Around one in five adults with diabetes do not know they have the condition, a new report from the Australian Bureau of Statistics (ABS) shows.

Dr Paul Jelfs, head of the Social, Health & Labour Division at the ABS, said the results from the ground-breaking biomedical collection in the Australian Health Survey allows us to look 'under the skin' of Australians to see how healthy they really are.

"We know from our survey that around four per cent of Australian adults have been told they have diabetes. The voluntary blood test results showed that an extra one per cent had diabetes but were not previously aware of it. This suggests that there was around one newly diagnosed case of diabetes for every four diagnosed cases," Dr Jelfs said.

"The results also showed that a further three per cent of adults were at high risk of diabetes. This means that there were an extra three people at high risk of diabetes for every four people who had been diagnosed.

"In 2011–12, people who were obese had much higher rates of diabetes than other Australians. In fact, they were seven times as likely as those who were of normal weight or underweight to have the condition," Dr Jelfs said.

The results also revealed that many people with diabetes also had signs of other chronic conditions. Nearly one in four people with diabetes had albuminuria, an early indicator of kidney disease, and around half had lower than normal levels of good cholesterol.

Further information is available in Australian Health Survey: Biomedical Results for Chronic Diseases, 2011–12 (cat. no. 4364.0.55.005) available for free download from the ABS website (www.abs.gov.au).

Media note
When reporting ABS data, the Australian Bureau of Statistics (or ABS) must be attributed as the source.
MEDIA RELEASE

5 Aug 2013
Embargoed: 11.30 am Canberra Time
142/2013

5.6 million Australian adults have high total cholesterol

Many Australians may not be aware that they have high cholesterol, according to figures released by the Australian Bureau of Statistics (ABS) today.

Dr Paul Jelfs, head of the Social, Health & Labour Division at the ABS, said the results from the ground-breaking biomedical collection in the Australian Health Survey give an important insight into Australia's heart health.

"The blood test results showed that one in three Australian adults, or 5.6 million people, had high total cholesterol levels. Yet only one in every ten people in this group already knew they had it," Dr Jelfs said.

The range of cardiovascular tests in the survey showed that the majority of Australians aged 45 and over were at risk of heart disease.

"The results showed that around three in every four Australians aged 45 and over had risk factors for heart disease. That is, they were either taking cholesterol-lowering medication, or their blood test results showed that they had one or more of high total cholesterol, high 'bad' cholesterol, low 'good' cholesterol or high triglycerides (fats in the blood).

"Interestingly, the picture was not much brighter for younger people, with nearly half of those aged under 45 having at least one of these risk factors," Dr Jelfs said.

Further information is available in Australian Health Survey: Biomedical Results for Chronic Diseases, 2011–12 (cat. no. 4364.0.55.005) available for free download from the ABS website (www.abs.gov.au).

Media note
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Obesity a major risk factor for cardiovascular disease

Obese people were much more likely than their normal weight counterparts to have signs of cardiovascular disease, according to a report released by the Australian Bureau of Statistics (ABS) today.

Dr Paul Jelfs, head of the Social, Health & Labour Division at the ABS, said that the results from the ground-breaking biomedical collection in the Australian Health Survey revealed some concerning facts about the heart health of overweight and obese Australians.

"The results showed that obese adults were nearly five times more likely than normal weight or underweight adults to have high triglycerides (fats in the blood), and more than twice as likely to have lower than normal levels of good cholesterol. These are significant risk factors for cardiovascular disease," Dr Jelfs said.

"Worryingly, many younger obese adults showed signs of cardiovascular disease. One in every three obese people aged under 45 had high total cholesterol. This was twice the rate for people aged 18–44 years who were of normal weight or underweight.

"Obese people aged 18–44 years were also five times more likely than their normal weight or underweight peers to have high triglycerides.

"Add in smoking and the situation gets worse. More than half of those aged 18–44 year olds who were current daily smokers and obese had high levels of 'bad' cholesterol. This compares with only 16 per cent of normal weight or underweight non-smokers," Dr Jelfs said.

The survey also showed that obesity was a major risk factor for other chronic health conditions, such as diabetes and liver disease. In 2011–12, obese adults were seven times more likely to have diabetes and four times more likely to have signs of liver disease than normal weight or underweight adults.

Further information is available in Australian Health Survey: Biomedical Results for Chronic Diseases, 2011–12 (cat. no. 4364.0.55.005) available for free download from the ABS website (www.abs.gov.au).

Media note
When reporting ABS data, the Australian Bureau of Statistics (or ABS) must be attributed as the source.
Some components have been made possible through additional funding from the Australian Government Department of Health and Ageing and the National Heart Foundation of Australia.

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