Australian Government
Australian Institute of Health and Welfare

# Inequalities in overweight and obesity and the social determinants of health

2007–08 to 2017–18

AIHW

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**2007–08 to 2017–18**

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# Summary

Overweight and obesity is a major public health issue in Australia. It is associated with poorer health and wellbeing and an increased risk of chronic disease and associated health-care costs. In 2017–18, around 2 in 3 (67%) Australians aged 18 and over, and 1 in 4 (25%) children and adolescents aged 5–17, were overweight or obese.

Overweight and obesity can be influenced by individual factors—such as the type of food people eat and how much physical activity they do—as well as by other factors, including the environment and society in which they live. Social determinants of health—the circumstances in which people grow, live, work and age—can strengthen or undermine the health of individuals and communities. Therefore, social inequalities and disadvantage often contribute to unfair and avoidable differences in health outcomes across groups in society.

This report examines the associations between overweight and obesity and factors that include a person's level of education, occupation, household income and household make-up. It brings together data from 4 National Health Surveys (NHSs) held between 2007–08 and 2017–18 to examine how the prevalence of overweight and obesity has changed for children and adolescents aged 5–17, working age Australians aged 18–64 and older Australians aged 65 and over.

Overall, it finds that people with higher levels of education are less likely to be overweight or obese. Living in *Major cities* and in homes that are owned outright may also be associated with a reduced likelihood of overweight and obesity.

## Overweight and obesity is associated with lower levels of educational attainment

Between 2007–08 and 2017–18, the age-standardised prevalence of overweight and obesity was consistently higher for Australians of working age who had not completed or attended secondary school (ranging from 65–69% across the 4 surveys) than for those who held a bachelor degree or higher qualification (51–58%).

Similarly, for children and adolescents aged 5–17, the prevalence of overweight and obesity was generally higher for those whose parent had not completed or attended secondary school (24% in 2007–08, 29% in both 2011–12 and 2017–18) than for those whose parent held a bachelor degree or higher qualification (16% in 2007–08, 17% in 2011–12 and 21% in 2017–18).

When controlling for other social determinants of health and for individual factors examined in this report, working age Australians who did not complete or attend secondary school were between 1.4 to 2.1 times as likely to be overweight or obese as those with a bachelor degree or higher qualification.

## Home ownership may be associated with lower overweight and obesity

Between 2007–08 and 2017–18, the age-standardised prevalence of overweight and obesity was consistently higher for Australians of working age who lived in a home owned with a mortgage (ranging from 62–65% across the 4 surveys) than for those who lived in a home owned outright (55–61%).

When controlling for other social determinants of health and for individual factors examined in this report, working age Australians who lived in a home owned with a mortgage or being rented were around 1.2 times as likely to be overweight or obese as those who lived in a home owned outright.

## Living in *Major cities* may be associated with lower overweight and obesity

Between 2007–08 and 2017–18, the age-standardised prevalence of overweight and obesity was consistently higher for Australians of working age who lived in *Inner regional* (ranging from 65–70% across the 4 surveys) and *Outer regional* and *Remote* areas (64–69%) than for those who lived in *Major cities* (57–63%).

When controlling for other social determinants of health and for individual factors examined in this report, working age Australians who lived in *Inner regional* areas were around 1.2 times as likely to be overweight or obese as those who lived in *Major cities*.

## People in some occupations have higher rates of overweight and obesity but the strength of the association is unclear

Between 2007–08 and 2017–18, the age-standardised prevalence of overweight and obesity was consistently higher for Australians of working age whose occupation was classified as:

- labourers (ranging from 61–67% across the 4 surveys)
- machinery operators and drivers (71–79%)
- managers (65–68%)
- sales workers (60–68%)
- technicians and trades workers (64–72%)

than for those working in professional occupations (for example, health, education and business professionals) (55–58%).

When controlling for other social determinants of health and for individual factors examined in this report, there were no clear differences in the odds of overweight and obesity between occupation groups.

## Where to from here?

This report identifies various social determinants and their associations with overweight and obesity. Social and health factors are complex and interconnected. Understanding them and how they underpin overweight and obesity can help policy makers and health providers develop more targeted strategies to reduce inequalities and improve health-related outcomes.

# 1 Introduction

Overweight and obesity is recognised as a major public health issue globally and in Australia. People who are overweight or obese have a higher risk of having chronic diseases, such as cardiovascular disease (including heart disease and stroke), some cancers, chronic kidney disease, diabetes and musculoskeletal conditions (AIHW 2017; Forouzanfar et al. 2016). In 2015, 8.4% of the disease burden in Australia was due to overweight and obesity, making it the second leading risk factor contributing to disease burden after tobacco use (AIHW 2019).

The prevalence of overweight and obesity in Australia has increased over time from:

- 57% in 1995 to 67% in 2017–18 among adults
- 20% in 1995 to 25% in 2007–08 for children and adolescents aged 5–17 before remaining relatively stable up to 2017–18 (25%) (AIHW 2020e).

While the causes of overweight and obesity are varied and complex, many (including food and physical activity behaviours) are associated with the social determinants of health (Marmot & Bell 2019). For more information on these determinants, see Box 1.1.

This report looks at associations between overweight and obesity in Australians and selected social determinants of health over time (from 2007–08 to 2017–18) using the National Health Survey (NHS).

**Box 1.1: What are the social determinants of health?**

The social determinants of health include 'the circumstances in which people grow, live, work, and age, and the systems put in place to deal with illness', which are, in turn, influenced by political, social and economic forces (CSDH 2008).

Evidence gathered from the ways in which social, economic, political and cultural conditions create health inequalities led to the identification of key social determinants of health and wellbeing (CSDH 2008; Wilkinson & Marmot 2003). These include socioeconomic position, early life circumstances, social exclusion, social connections, relationships and values, employment and work, housing, and the residential environment (AIHW 2020b).

In this report, a selection of social determinants of health that were available and broadly comparable across survey periods were included for analysis to assess health inequalities. These were:

educational attainment—'highest level of education completed'

employment status and occupation—'whether they are employed or unemployed' and, if employed, 'what classification of employment they work in'

household type (composition)—'who lives in the household, including households with dependent children'

household income—'whether they are living in high- or low-income households'

*(continued)*

**Box 1.1 (continued): What are the social determinants of health?**

household tenure—'whether the house is owned with/without a mortgage, or is rented'

remoteness area—'where they live, including *Major cities, Inner regional* and *Outer regional/Remote* areas.'

Detailed information on the categories used for each social determinant are available in Appendix A.

# What is overweight and obesity?

Overweight and obesity refers to excess fat accumulation that presents health risks (WHO 2016). At a population level, it is often measured using body mass index (BMI) and waist circumference.

BMI is a common way to assess if a person is underweight, normal weight, overweight or obese. It is calculated by dividing a person's weight (in kilograms) by their height (in metres) squared. This report uses the BMI classifications for adults defined by the World Health Organization (WHO 2000a). Age-and sex-specific BMI cut-off points have been used for children and adolescents in accordance with the classifications developed by Cole and others (2000). It should be noted that BMI cut-offs for a healthy weight in older Australians and other ethnic groups can differ from the WHO (2000a) classifications (Queensland Health 2017; Visvanathan et al. 2012; WHO 2000b; WHO Expert Consultation 2004).

Waist circumference is another commonly used measure to assess overweight and obesity. A wider waist measurement (≥94 cm for men and ≥80 cm for women) is associated with a higher risk of metabolic complications.

To account for potential differences in the associations of social determinants of health and population measures of overweight and obesity, the current report presents findings by the following measures:

- overweight and obesity (BMI ≥25 kg/$m^2$)
- obesity (BMI ≥ 30kg/$m^2$)
- waist circumference risk (≥94 cm for men and ≥80 cm for women).

# What causes overweight and obesity?

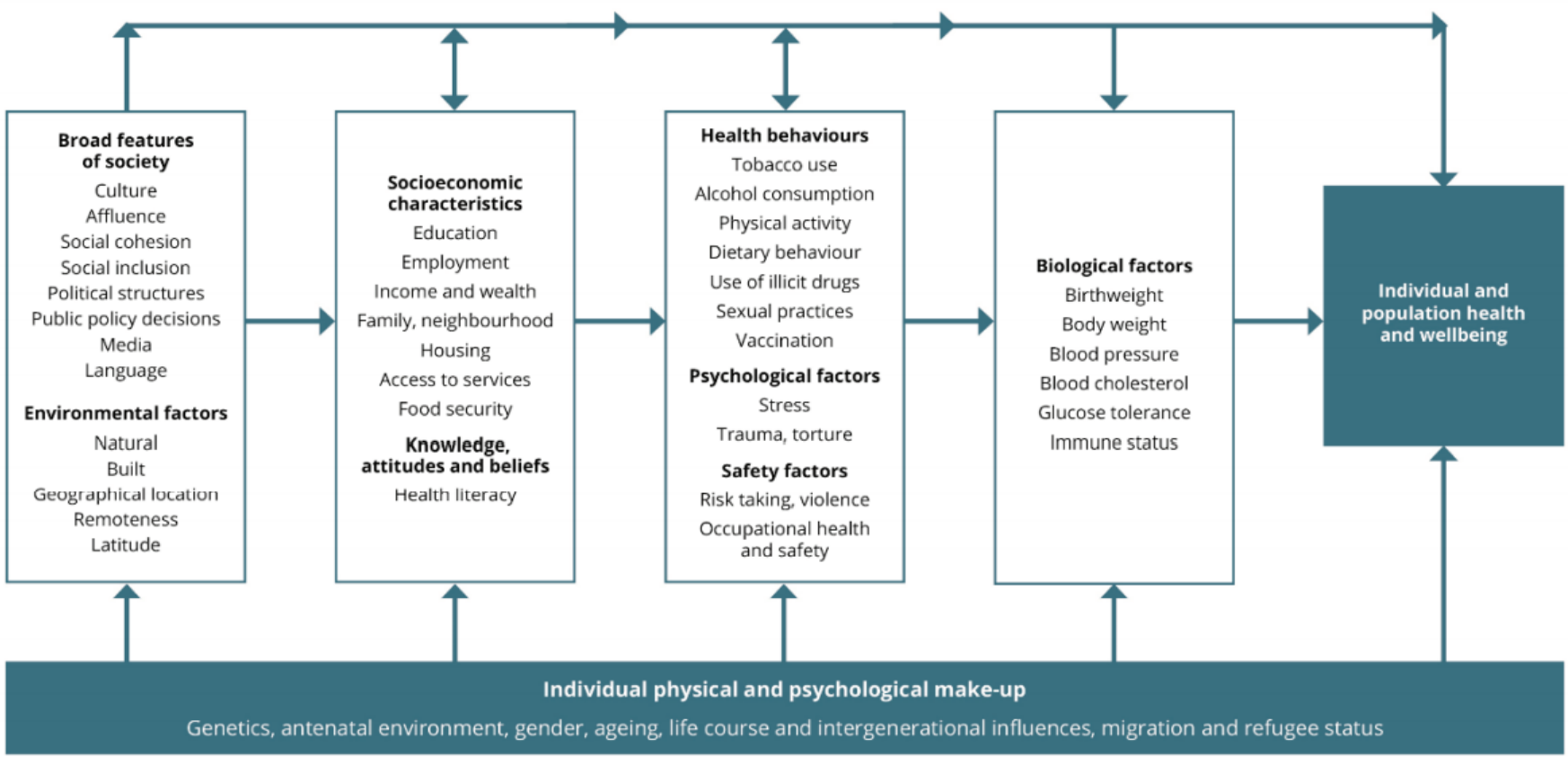
Overweight and obesity is caused by a sustained energy imbalance, where too much energy is taken in through food and drink and not enough is expended through physical activity. However, various other factors can also influence overweight and obesity, including:

- genetics/physiology (for example, metabolism, appetite, satiety and body fat distribution)
- health inequalities (for example, area of remoteness, socioeconomic disadvantage, ethnic/cultural groups)
- environmental factors (for example, availability of fast food outlets, portion sizes, home and neighbourhood environments)
- societal factors (for example, media and advertising, retail environments) (AIHW 2020b, 2021; Friel 2009; Friel & Goldman 2019; NHMRC 2013) (Figure 1.1).

Given its high prevalence in the Australian population and associated disease burden and health-care costs, overweight and obesity needs to be regularly monitored. The Australian Institute of Health and Welfare (AIHW) has developed a framework to support national surveillance and monitoring of overweight and obesity in Australia, which identified the social determinants of health as a priority to inform evidence-based programs and policies (AIHW 2020a).

This report examines associations between overweight and obesity in Australians and selected social determinants of health over a 10-year period. The results highlight key areas for policy makers and health professionals for which policies and interventions can be designed to tackle inequalities in overweight and obesity in the Australian population.

**Figure 1.1: Framework for determinants of health**




*Source*: AIHW 2020b.

# Data sources used in this report

The analyses in this report are based on data collected in the 4 national cross-sectional surveys conducted by the Australian Bureau of Statistics (ABS):

- 2007–08 National Health Survey (NHS)
- 2011–12 NHS component of the Australian Health Survey 2011–13
- 2014–15 NHS
- 2017–18 NHS.

These data sources were chosen because they provided measured height, weight and waist circumference data at the national level. Detailed information on the cross-sectional surveys is available in Appendix A.

# Data considerations

The data in this report are based on surveys and may not be representative of the entire population; that is, they are subject to sampling error. To show the range within which we are 95% confident that the entire population sits, we have included 95% confidence intervals (CIs) around prevalence and odds ratio (OR) estimates throughout the report and supplementary data tables.

Prevalence ranges presented in the text of this report represent the range of values across all 4 surveys (unless otherwise specified). Bar charts with 95% CI are used to present prevalence estimates, and tables to present OR with 95% CI for the logistic regression analyses.

Prevalence of overweight and obesity is considered to have differed by social determinants when the difference in prevalence between at least 2 groups (for example, those who lived in a home with a mortgage compared with those who owned their home outright) was statistically significant across 75% of the surveys or more (that is, at least 3 surveys). This cut-off was chosen to identify social determinants for which there were consistent inequalities in overweight and obesity.

Logistic regression was used to obtain ORs for binary outcomes (for example, overweight or obese versus not overweight or obese) in the presence of 1 or more predictor variable (for example, age and sex). In this report, an OR greater than 1 would indicate that the predictor increases the odds of overweight and obesity. (Note that the odds of overweight and obesity is not the same as the likelihood, or probability, of overweight and obesity. However, these concepts are directly related, and a factor that leads to increased odds also increases the likelihood.) For more information on logistic regression, see Appendix A.

Interpreting associations between social determinants of health and overweight and obesity should be considered with caution, as two-way relationships may exist between them. Additionally, a third factor that has not been considered in the models could potentially account for the association.

# Structure of this report

This chapter outlines the purpose and scope of the report and the key questions relevant to the social determinants of overweight and obesity in Australia.

**Chapter 2** presents the crude prevalence of overweight and obesity by select social determinant measures to show changes over time in children and adolescents (aged 5–17).

**Chapter 3** presents the age-standardised prevalence of overweight and obesity by select social determinant measures across the 4 survey periods for Australians of working age (aged 18–64). As well as, results from logistic regression analyses are presented for those in this age group who are actively participating in higher education and the workforce.

**Chapter 4** presents the age-standardised prevalence of overweight and obesity by select social determinant measures across the 4 survey periods for older Australians (aged 65 and over).

**Chapter 5** summarises available literature and discusses how the current project adds to existing knowledge on the impact of social determinants on overweight and obesity in Australia.

**Appendix A** provides a detailed description of the data sources and methodology used in this report.

Supplementary tables (tables S1–S11) for the data presented in figures and text in this report (including prevalence estimates, ORs and CIs), as well as additional demographic factors, are available at <https://www.aihw.gov.au/reports/overweight-obesity/inequalities-overweight-social-determinants-health>.

# 2 Children and adolescents (5–17 years)

Research shows that children and adolescents who are overweight or obese are more likely to be overweight or obese as adults (Simmonds et al. 2016; WCRF & AICR 2018). So, the earlier in life a child becomes overweight or obese, the greater the portion of their life they are likely to live with excess weight, increasing their exposure to the associated health risks (The Obesity Collective 2019; WCRF & AICR 2018).

The findings of this report show that the rate of overweight and obesity consistently differed only by highest level of parental educational attainment. That is, children of a parent with an education level of a bachelor degree or higher qualification had lower rates of overweight and obesity than those without it (see Box 2.1).

The rates of obesity consistently differed only by household income, with those living in the highest income households having lower rates than those living in the lowest income households.

**Box 2.1: Parental determinants of health**

In this chapter, the prevalence of educational attainment was based on the parent of the child.

In collecting household and person level information for the NHS, 1 adult and 1 child (where applicable) from each household were randomly selected for inclusion in the survey. As a result, the prevalence of weight-related outcomes from the responding adult was used to calculate the parental determinants of health reported in this chapter. In couple-parent households, this may not reflect the average education of the child's parents and should be considered with caution.

Additionally, for the periods 2007–08, 2011–12 and 2017–18, where we have reported parental determinants of health, the analyses were restricted to one-family households with dependent children only (that is, children under 15 or dependent students only with no other family or non-family members present). For the periods 2007–08 and 2011–12, these analyses were further restricted to include adults who reported their relationship in the household as a 'husband', 'wife', 'partner' or 'lone partner'. While this represented about 80% of all households with children aged 5–17 for these periods, care should be taken when trying to generalise these findings to other household types.

As we were unable to restrict our analyses to one-family households with dependent children only (that is, without other family members present) for 2014–15, we have not reported parental determinants for this period.

# Overweight and obesity

In the survey periods between 2007–08 and 2017–18, the crude prevalence of overweight and obesity differed across:

- **parental educational attainment**—lowest for children whose parent held a bachelor degree or higher qualification (16% in 2007–08, 17% in 2011–2012 and 21% in 2017–18), compared with children whose parent had not completed or attended secondary school (24% in 2007–08, 29% in both 2011–12 and 2017–18) (Figure 2.1).

There were no consistent differences in the prevalence of overweight and obesity for household type, household income, household tenure, parental employment status and occupation, or remoteness area. See Table S1 for the prevalence for these determinants.

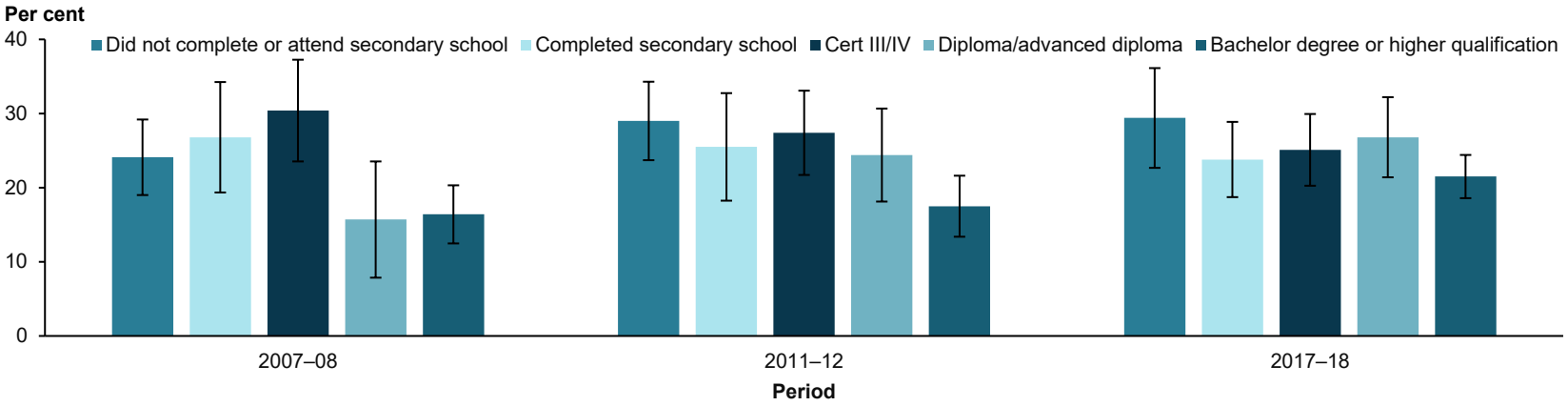
# Obesity

In the survey periods between 2007–08 and 2017–18, the crude prevalence of obesity differed across:

- **household income**—lowest for children living in the highest income households (fifth quintile; ranging from 2.8–4.7%), compared with those living in the lowest income households (first quintile; 4.3–13.7%) (Figure 2.2).

There were no consistent differences in the prevalence of obesity for household type, household tenure, parental educational attainment, parental employment status and occupation, or remoteness area. See Table S2 for the prevalence for these determinants.

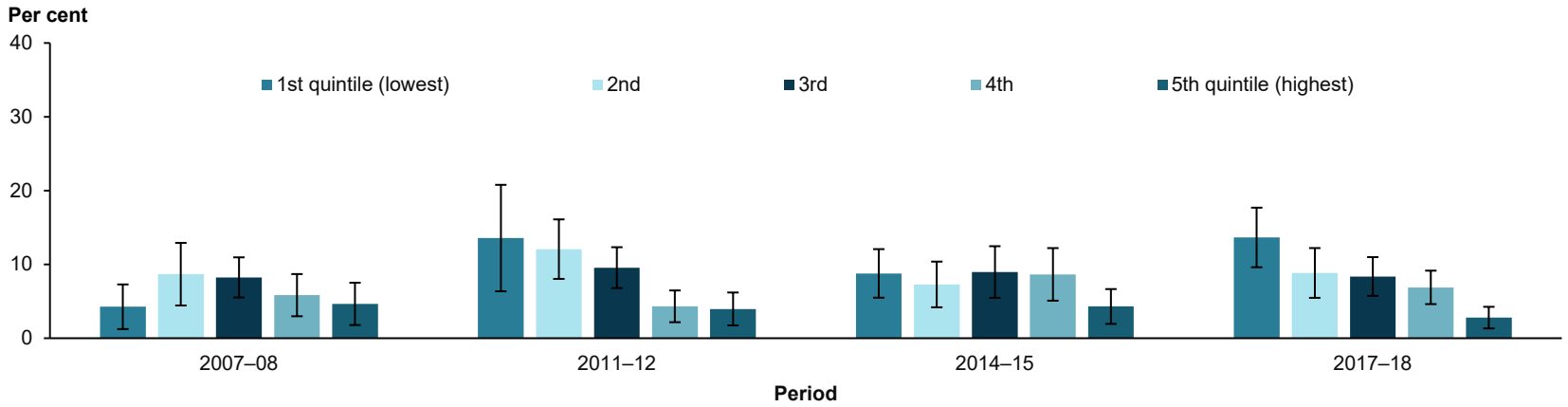
**Figure 2.1: Crude prevalence and 95% CI of overweight and obesity, by parent's highest level of education, Australian children and adolescents (aged 5–17), 2007–08 to 2017–18**




*Note:* Data on parent's educational attainment is based on 1 randomly selected adult for each period and may not reflect the average education of the child's parents for couple-parent households. Data were not considered comparable for 2014–15 and are not presented for this period.

*Source:* AIHW analysis of ABS 2009a, 2013b, 2016, 2019a; Table S1.

**Figure 2.2: Crude prevalence and 95% CI of obesity, by household income, Australian children and adolescents (aged 5–17), 2007–08 to 2017–18**




*Source:* AIHW analysis of ABS 2009a, 2013b, 2016, 2019a; Table S2.

# 3 Australians of working age (18–64 years)

Among adults, excess body weight is a risk factor for multiple chronic conditions, including cardiovascular disease, type 2 diabetes, and some cancers. While both overweight and obesity are risk factors for chronic conditions, being obese is associated with greater health risks than being overweight but not obese. For example, the risks of coronary heart disease, ischaemic stroke, and type 2 diabetes are greater among those who are obese than among those who are overweight but not obese (Bogers et al. 2007; Guh et al. 2009; Strazzullo et al. 2010).

A summary of the key differences in the age-standardised prevalence of selected social determinants for Australian adults of working age can be found in Table 3.1.

Overall, the rate (prevalence) of overweight and obesity, obesity, and an increased risk of metabolic complications due to waist circumference, consistently differed by highest level of educational attainment, remoteness area and occupation. That is, those with an education level of a bachelor degree or higher qualification had lower rates of all weight-related outcomes than those without. Those living in *Major cities* had lower rates than those in *Inner regional* and *Outer regional* and *Remote* areas, and those working in occupations classified as professionals had lower rates than managers, labourers, and machinery operators and drivers.

When controlling for other social determinants of health and for individual factors, highest level of educational attainment was the only social determinant considered to be a statistically significant predictor for overweight and obesity, obesity, and waist circumference risk across the 4 surveys. The odds of overweight and obesity, obesity, and waist circumference risk were increased for those who did not complete or attend secondary school, or whose highest qualification was a certificate III/IV compared with those who held a bachelor degree or higher qualification.

Household tenure and remoteness area were also associated with the weight-related outcomes, although not across all 4 surveys. In general, the odds of overweight and obesity, obesity, and waist circumference risk were increased for those who lived in homes being paid off with a mortgage or rented compared with those living in homes owned outright, and those living in *Inner regional* and *Outer regional* and *Remote* areas had increased odds of overweight and obesity, obesity, and waist circumference risk compared with those living in *Major cities*.

**Table 3.1: Summary of differences in prevalence of selected social determinants, Australians of working age, 2007–08 to 2017–18**

| | Increased prevalence (%) in at least 3 survey periods | | |
|---|---|---|---|
| **Compared with** | **Overweight or obesity** | **Obesity** | **Waist circumference risk** |
| Bachelor degree or higher qualification | Certificate III/IV<br>Completed secondary school<br>Did not complete or attend secondary school<br>Diploma/advanced diploma | Certificate III/IV<br>Completed secondary school<br>Did not complete or attend secondary school<br>Diploma/advanced diploma | Certificate III/IV<br>Completed secondary school<br>Did not complete or attend secondary school<br>Diploma/advanced diploma |
| Homeowners without a mortgage | Homeowners with a mortgage | – | – |
| Living in *Major cities* | *Inner regional*<br>*Outer regional* and *Remote* | *Inner regional*<br>*Outer regional* and *Remote* | *Inner regional*<br>*Outer regional* and *Remote* |
| Person living alone | – | – | Couple family with children<br>One parent family with children |
| Living in the highest income households (5th quintile) | – | 1st quintile (lowest income)<br>2nd quintile<br>3rd quintile<br>4th quintile | 2nd quintile<br>3rd quintile |
| Professionals | Managers<br>Labourers<br>Machinery operators and drivers<br>Sales workers<br>Technicians and trades workers | Managers<br>Clerical and administrative workers<br>Community and personal service workers<br>Labourers<br>Machinery operators and drivers<br>Not in labour force<br>Technicians and trades workers<br>Unemployed | Managers<br>Clerical and administrative workers<br>Community and personal service workers<br>Labourers<br>Machinery operators and drivers<br>Not in labour force<br>Sales workers |

# Overweight and obesity

In the survey periods between 2007–08 and 2017–18, the age-standardised prevalence of overweight and obesity differed across:

- **educational attainment**—lowest for those who held a bachelor degree or higher qualification (ranging from 51–58%) compared with those who held a diploma/advanced diploma (53–65%), had completed secondary school (58–66%), had not completed or attended secondary school (65–69%), or had a certificate III/IV (67–72%)
- **household tenure**—lowest for those who lived in a home owned outright (ranging from 55–61%) than for those who lived in a home being paid off with a mortgage (ranging from 62–65%)
- **employment status and occupation**—lowest for those whose occupation was classified as professionals (ranging from 55–58%) compared with sales workers (60–68%), labourers (61–67%), technicians and trades workers (64–72%), managers (65–68%) or machinery operators and drivers (71–79%)
- **remoteness area**—lowest for those who lived in *Major cities* (ranging from 57–63%), compared with those who lived in *Inner regional* (65–70%) and *Outer regional* and *Remote* areas (ranging from 64–69%) (Figures 3.1 and 3.2).

There were no consistent differences in the age-standardised prevalence of overweight and obesity for household type or household income. See Table S3 for the prevalence for these determinants.

Table 3.2 presents the results of the logistic regression analyses.

Educational attainment was the only selected social determinant that predicted overweight and obesity in all 4 survey periods that was statistically significant.

Compared with those who held a bachelor degree or higher qualification, the odds of being overweight or obese were higher for those who had:

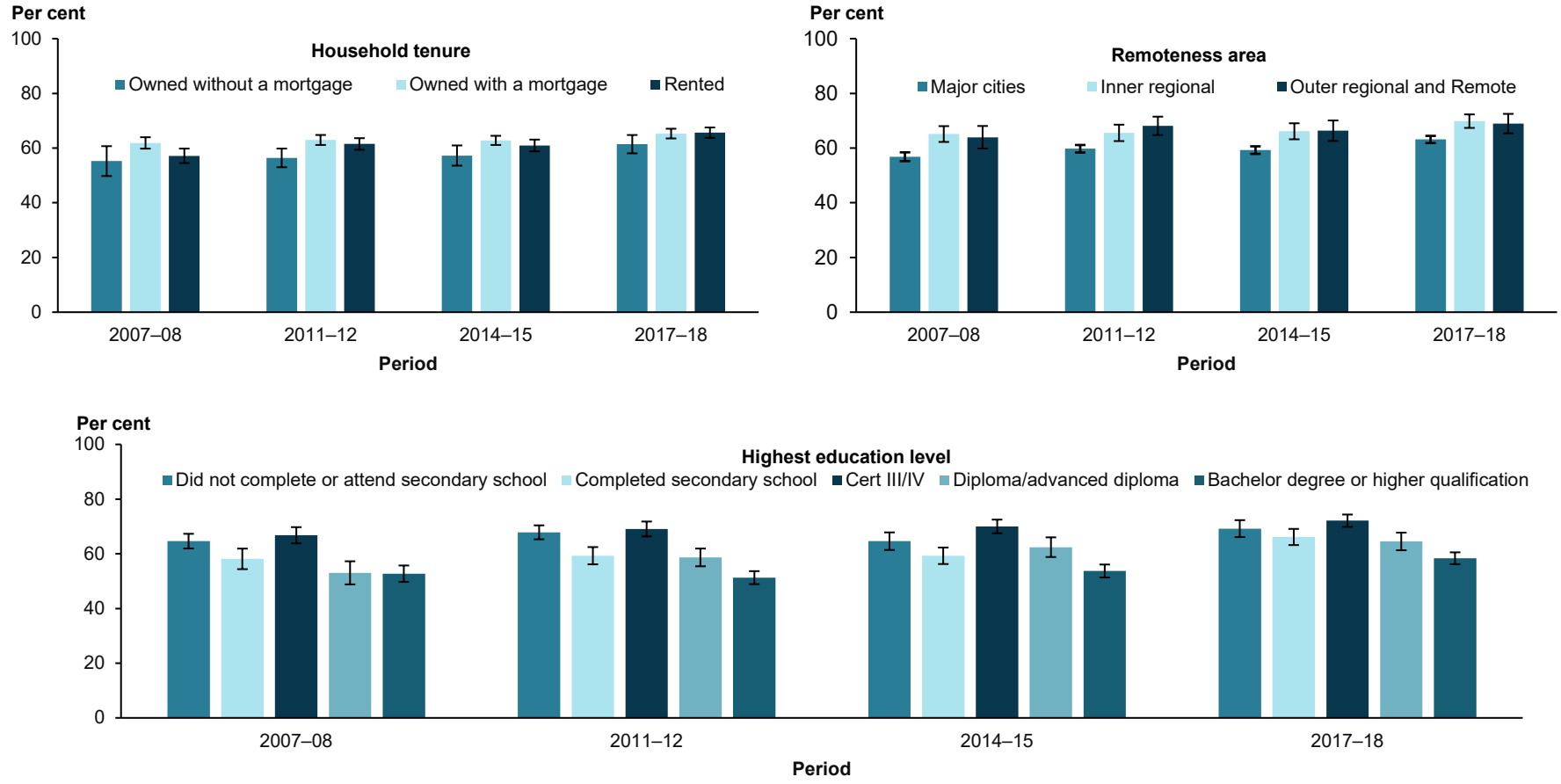
- a certificate III/IV (between 1.5 to 2.1 times higher)
- completed secondary school (between 1.2 to 1.5 times higher)
- not completed or attended secondary school (between 1.4 to 2.1 times higher)
- a diploma or advanced diploma (between 1.2 to 1.5 times higher).

Household tenure and remoteness area were statistically significant predictors of overweight and obesity in 3 of the 4 survey periods.

Compared with those who lived in a house owned outright, the odds of being overweight or obese were about 1.2 times higher for those who lived in a house owned with a mortgage or being rented.

In 2 of the survey periods, the odds of being overweight or obese were 1.2 times higher for those who lived in *Inner regional* areas than for those who lived in *Major cities*.

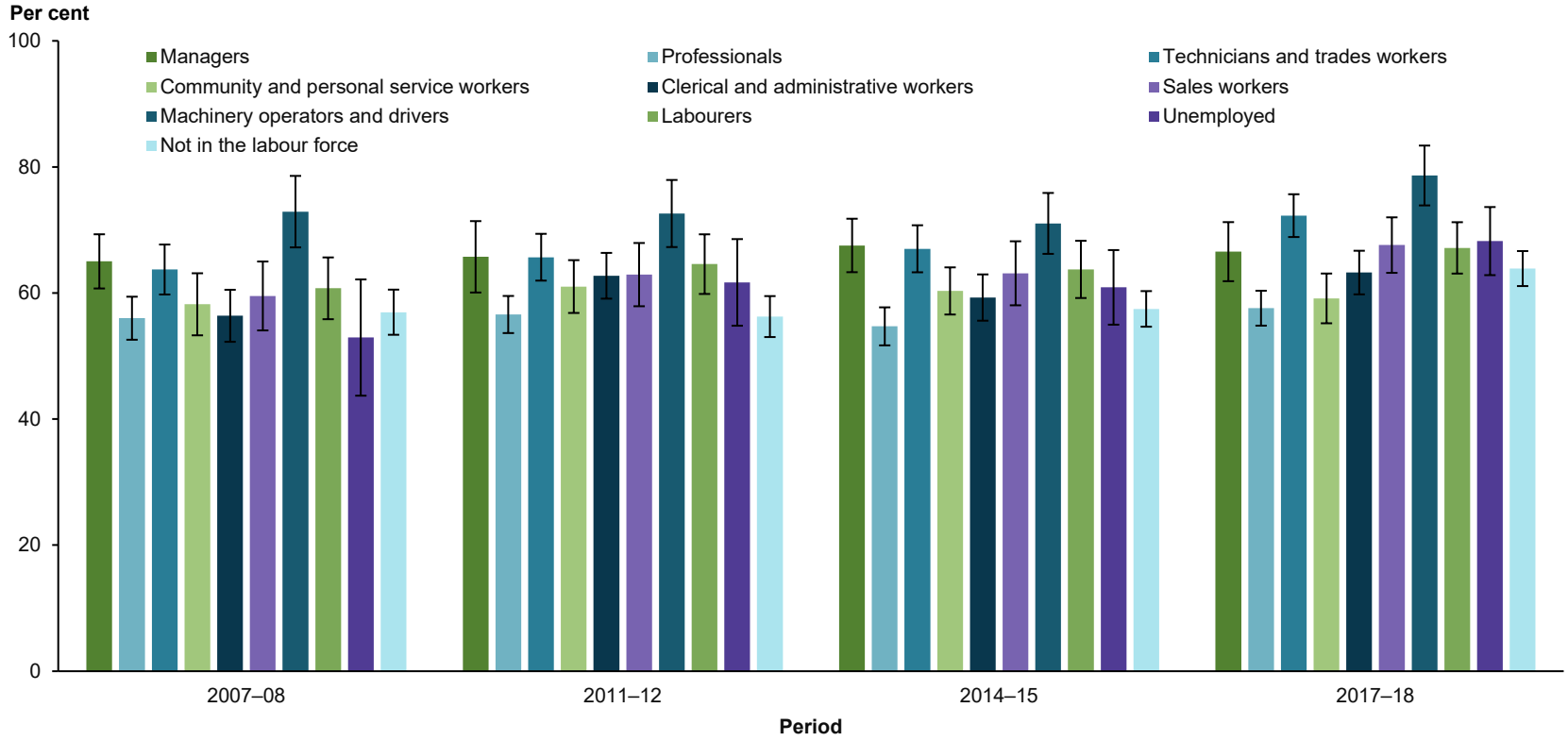
**Figure 3.1: Age-standardised prevalence and 95% CI of overweight and obesity, by household tenure, remoteness area and highest level of education, Australians of working age (aged 18–64), 2007–08 to 2017–18**




*Note:* Data have been age standardised to the 2001 Australian Standard Population.

*Source*: AIHW analysis of ABS 2009a, 2013b, 2016, 2019a; Table S3 for data and footnotes.

**Figure 3.2: Age-standardised prevalence and 95% CI of overweight and obesity, by employment status and occupation, Australians of working age (aged 18–64), 2007–08 to 2017–18**




*Note:* Data have been age standardised to the 2001 Australian Standard Population.

*Source:* AIHW analysis of ABS 2009a, 2013b, 2016, 2019a; Table S3 for data and footnotes.

**Table 3.2: OR (95% CI) of overweight and obesity, by selected social determinants, Australians of working age (aged 18–64), 2007–08 to 2017–18**

| | | Period | | | |
|---|---|---|---|---|---|
| | | 2007–08[a] | 2011–12[b] | 2014–15[c] | 2017–18[d] |
| **Social determinant** | **Category** | **OR (95% CI)** | **OR (95% CI)** | **OR (95% CI)** | **OR (95% CI)** |
| **Highest level of education** | | | | | |
| | Bachelor degree or higher qualification | Reference | Reference | Reference | Reference |
| | Did not complete or attend secondary school | 1.6 (1.3–1.9)* | 2.1 (1.7–2.5)* | 1.5 (1.2–1.8)* | 1.4 (1.2–1.7)* |
| | Completed secondary school | 1.2 (1.0–1.5)* | 1.5 (1.2–1.8)* | 1.2 (1.0–1.4) | 1.2 (1.0–1.5)* |
| | Cert III/IV | 1.6 (1.3–1.9)* | 2.1 (1.6–2.6)* | 1.7 (1.5–2.0)* | 1.5 (1.3–1.8)* |
| | Diploma/advanced diploma | 1.1 (0.8–1.3) | 1.5 (1.3–1.8)* | 1.4 (1.2–1.6)* | 1.2 (1.0–1.4)* |
| **Household tenure** | | | | | |
| | Owner without a mortgage | Reference | Reference | Reference | Reference |
| | Owner with a mortgage | n.a. | 1.2 (1.1–1.5)* | 1.2 (1.1–1.4)* | 1.2 (1.1–1.4)* |
| | Renter | n.a. | 1.3 (1.1–1.5)* | 1.2 (1.0–1.4)* | 1.3 (1.1–1.5)* |
| **Employment status and occupation** | | | | | |
| | Professionals | Reference | Reference | Reference | Reference |
| | Managers | n.a. | 1.1 (0.9–1.4) | n.a. | 1.3 (1.0–1.5)* |
| | Technicians and trades workers | n.a. | 0.7 (0.6–0.9)* | n.a. | 1.1 (0.8–1.4) |
| | Community and personal service workers | n.a. | 1.0 (0.8–1.3) | n.a. | 0.9 (0.7–1.2) |
| | Clerical and administrative workers | n.a. | 1.1 (0.9–1.4) | n.a. | 1.1 (0.9–1.4) |
| | Sales workers | n.a. | 0.9 (0.7–1.2) | n.a. | 1.3 (1.0–1.8) |
| | Machinery operators and drivers | n.a. | 0.9 (0.6–1.4) | n.a. | 1.6 (1.2–2.2)* |

*(continued)*

**Table 3.2 (continued): OR (95% CI) of overweight and obesity, by selected social determinants, Australians of working age (aged 18–64), 2007–08 to 2017–18**

| | | Period | | | |
|---|---|---|---|---|---|
| | | 2007–08[a] | 2011–12[b] | 2014–15[c] | 2017–18[d] |
| **Social determinant** | **Category** | **OR (95% CI)** | **OR (95% CI)** | **OR (95% CI)** | **OR (95% CI)** |
| **Employment status and occupation** | | | | | |
| | Professionals | Reference | Reference | Reference | Reference |
| | Labourers | n.a. | 0.9 (0.7–1.2) | n.a. | 1.0 (0.8–1.3) |
| | Unemployed | n.a. | 0.9 (0.6–1.3) | n.a. | 1.4 (1.0–1.9) |
| | Not in the labour force | n.a. | 0.9 (0.7–1.1) | n.a. | 1.2 (0.9–1.5) |
| **Remoteness area** | | | | | |
| | *Major cities* | Reference | Reference | Reference | Reference |
| | *Inner regional* | 1.2 (1.0–1.5)* | n.a. | 1.2 (1.0–1.4) | 1.2 (1.0–1.4)* |
| | *Outer regional and Remote* | 1.1 (0.9–1.5) | n.a. | 1.2 (1.0–1.4) | 1.1 (0.9–1.3) |

* ORs that are statistically different from the reference group at a 95% confidence limit.

n.a. This determinant is not applicable for this period; that is, it did not reach statistical significance and was not retained in the final model (see Appendix A for more information on model specification).

(a) Final model for this period included the following variables: age, country of birth, highest level of education, main language spoken at home, remoteness and sex.

(b) Final model for this period included the following variables: age, country of birth, highest level of education, household tenure, employment status and occupation, sex and social marital status.

(c) Final model for this period included the following variables: age, country of birth, highest level of education, household tenure, main language spoken at home, remoteness, sex and social marital status.

(d) Final model for this period included the following variables: age, country of birth, highest level of education, household tenure, main language spoken at home, employment status and occupation, remoteness and sex.

*Source*: AIHW analysis of ABS 2009a, 2013b, 2016, 2019a; see Table S4 for additional footnotes and demographic OR retained in the final model for each period.

# Obesity

In the survey periods between 2007–08 and 2017–18, the age-standardised prevalence of obesity consistently differed across:

- **educational attainment**—lowest for those who held a bachelor degree or higher qualification (ranging from 17–21%) compared with those who held a diploma/advanced diploma (18–32%), had completed secondary school (22–31%), had a certificate III/IV (29–35%) or had not completed or attended secondary school (29–38%)
- **household income**—lowest for those who lived in households with the highest incomes (5th quintile; ranging from 22–25%), compared with those who lived in households with the second highest incomes (4th quintile; 22–30%), the third lowest incomes (3rd quintile; 26–30%), the second lowest incomes (2nd quintile; 26–33%), or the lowest incomes (1st quintile; 29–34%)
- **employment status and occupation**—lowest for those whose occupation was classified as professionals (ranging from 19–23%), compared with clerical and administrative workers (21–30%), community and personal service workers (21–31%), technicians and trades workers (24–30%), managers (24–32%), those who were not in the labour force (26–33%), those who were unemployed (26–33%), labourers (28–32%), or machinery operators and drivers (35–39%)
- **remoteness area**—lowest for those who lived in *Major cities* (ranging from 22–28%), compared with those who lived in *Inner regional* areas (26–36%) and *Outer regional* and *Remote* areas (32–35%) (figures 3.3 and 3.4).

There were no consistent differences in the age-standardised prevalence of obesity for household composition or household tenure. See Table S5 for the prevalence for these determinants.

Table 3.3 presents the results of the logistic regression analyses.

Educational attainment was the only selected social determinant that predicted obesity in all 4 surveys that was statistically significant.

Compared with those who held a bachelor degree or higher qualification, the odds of being obese were generally higher for those who had:

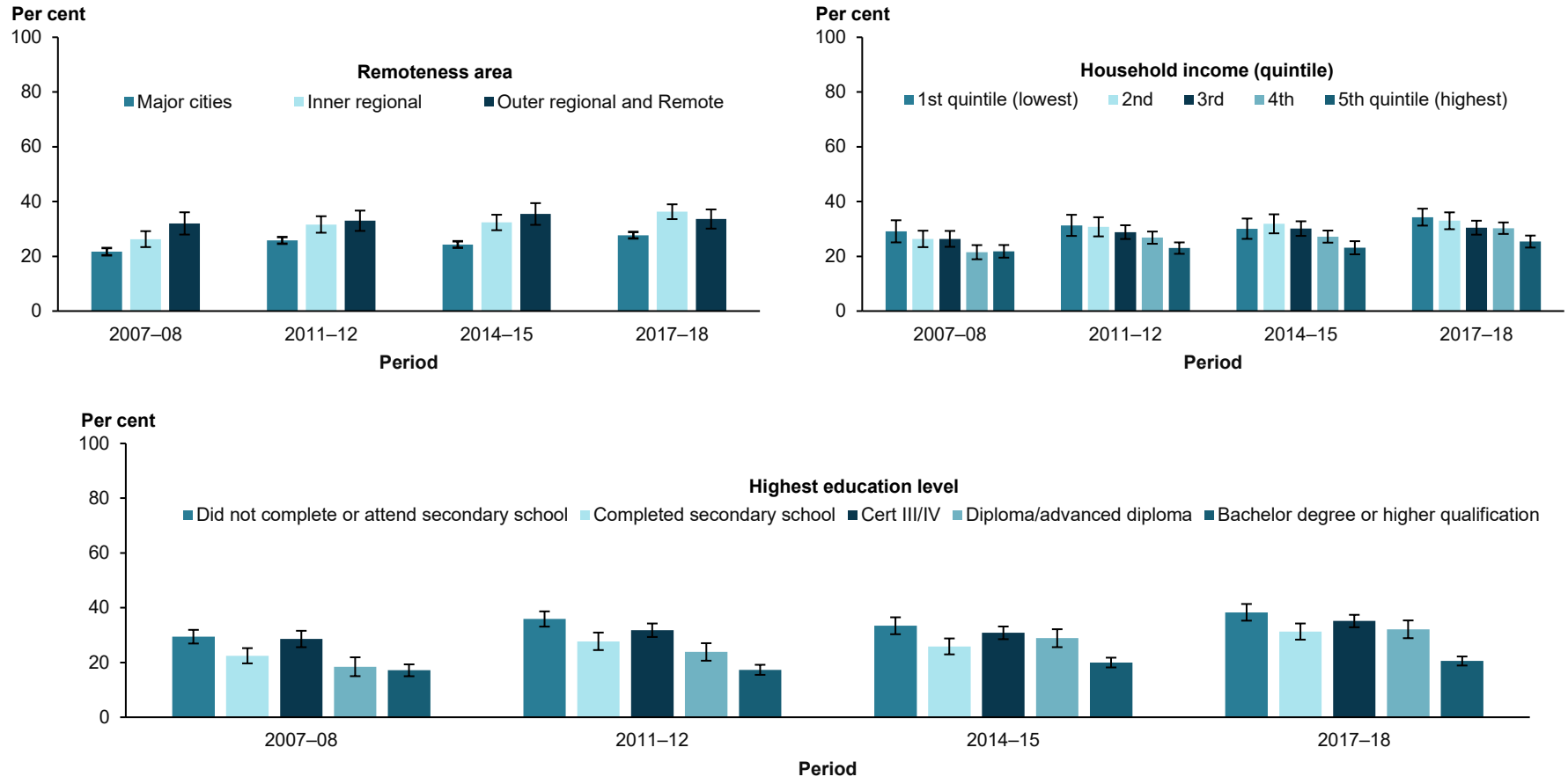
- a certificate III/IV (between 1.4 to 2.1 times)
- completed secondary school (between 1.4 to 1.9 times)
- not completed or attended secondary school (between 1.5 to 2.3 times)
- a diploma or advanced diploma (between 1.4 to 1.7 times).

Occupation and remoteness area were statistically significant predictors of obesity in 3 of the surveys, while household tenure was a statistically significant predictor in 2 of the surveys.

In 2 of the surveys, the odds of being obese were:

- higher for those who lived in *Inner regional* areas (between 1.2 to 1.3 times) and *Outer regional* and *Remote* areas (between 1.4 and 1.5 times) than for those who lived in *Major cities*
- about 1.3 times higher for those who lived in houses being rented than for those who lived in houses owned outright.

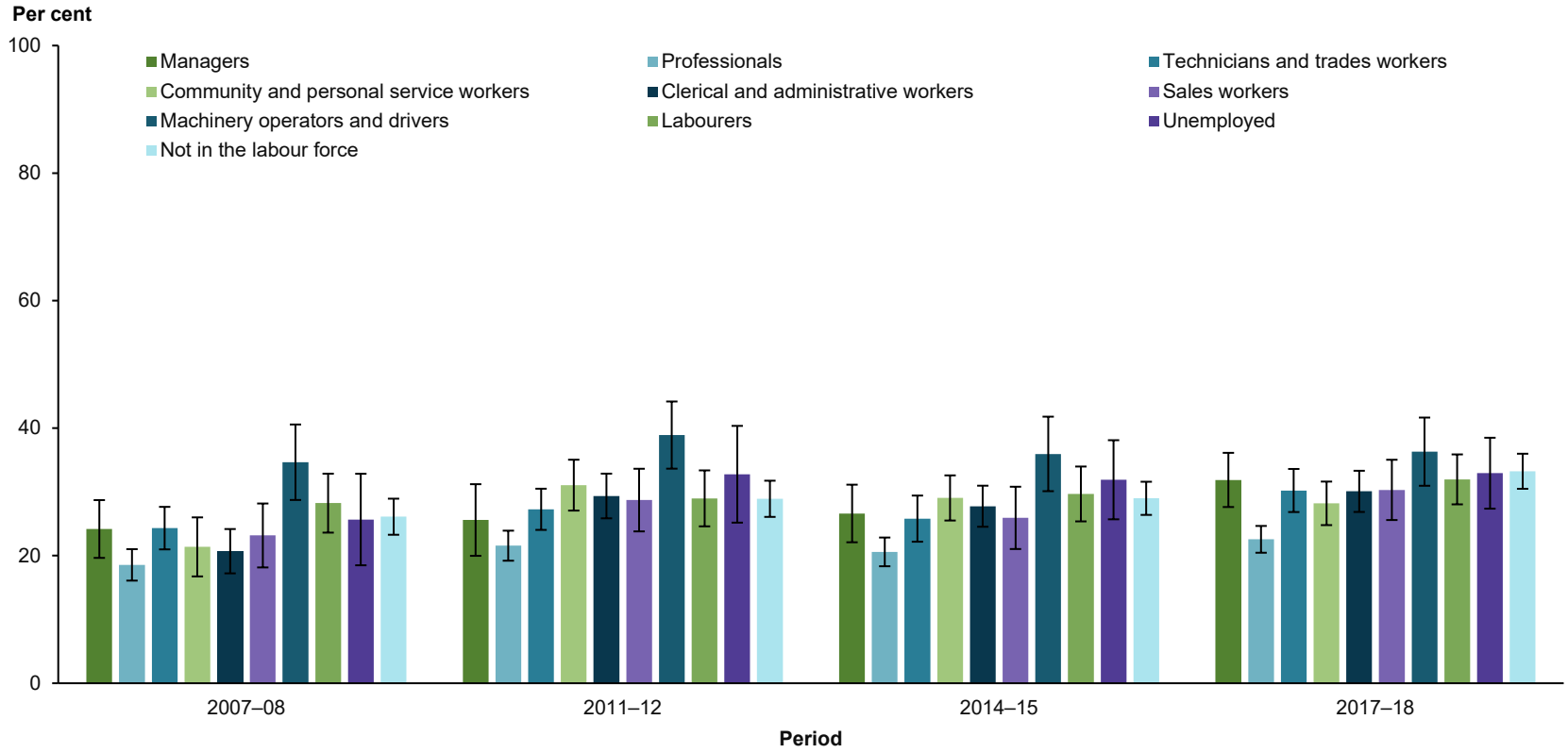
**Figure 3.3: Age-standardised prevalence and 95% CI of obesity, by remoteness area, household income and highest level of education, Australians of working age (aged 18–64), 2007–08 to 2017–18**




*Note:* Data have been age standardised to the 2001 Australian Standard Population.

*Source*: AIHW analysis of ABS 2009a, 2013b, 201, 2019a; Table S5 for data and footnotes.

**Figure 3.4: Age-standardised prevalence and 95% CI of obesity, by employment status and occupation, Australians of working age (aged 18–64), 2007–08 to 2017–18**




*Note:* Data have been age standardised to the 2001 Australian Standard Population.

*Source:* AIHW analysis of ABS 2009a, 2013b, 2016, 2019a; Table S5 for data and footnotes.

**Table 3.3: OR (95% CI) of obesity, by selected social determinants, Australians of working age (aged 18–64), 2007–08 to 2017–18**

| Social determinant | Category | 2007–08[a] OR (95% CI) | 2011–12[b] OR (95% CI) | 2014–15[c] OR (95% CI) | 2017–18[d] OR (95% CI) |
|---|---|---|---|---|---|
| **Highest level of education** | | | | | |
| | Bachelor degree or higher qualification | Reference | Reference | Reference | Reference |
| | Did not complete or attend secondary school | 2.0 (1.6–2.5)* | 2.3 (1.9–2.9)* | 1.5 (1.2–1.9)* | 2.1 (1.6–2.6)* |
| | Completed secondary school | 1.4 (1.1–1.7)* | 1.9 (1.5–2.4)* | 1.2 (1.0–1.5) | 1.6 (1.3–2.0)* |
| | Cert III/IV | 1.9 (1.6–2.3)* | 2.1 (1.7–2.6)* | 1.4 (1.2–1.8)* | 1.9 (1.5–2.3)* |
| | Diploma/advanced diploma | 1.1 (0.8–1.5) | 1.5 (1.1–1.9)* | 1.4 (1.2–1.7)* | 1.7 (1.4–2.1)* |
| **Household type** | | | | | |
| | Couple family with children | Reference | Reference | Reference | Reference |
| | Person living alone | n.a. | n.a. | n.a. | 0.9 (0.8–1.1) |
| | Couple only | n.a. | n.a. | n.a. | 1.0 (0.9–1.3) |
| | One parent family with children | n.a. | n.a. | n.a. | 1.1 (0.8–1.4) |
| **Household income** | | | | | |
| | 5th quintile (highest) | Reference | Reference | Reference | Reference |
| | 4th quintile | n.a. | n.a. | n.a. | 1.2 (1.0–1.4)* |
| | 3rd quintile | n.a. | n.a. | n.a. | 1.2 (1.0–1.5) |
| | 2nd quintile | n.a. | n.a. | n.a. | 1.3 (1.1–1.7)* |
| | 1st quintile (lowest) | n.a. | n.a. | n.a. | 1.4 (1.1–1.8)* |
| **Household tenure** | | | | | |
| | Owner without a mortgage | Reference | Reference | Reference | Reference |
| | Owner with a mortgage | n.a. | 1.2 (1.0–1.4) | 1.2 (1.0–1.4) | n.a. |

*(continued)*

**Table 3.3 (continued): OR (95% CI) of obesity, by selected social determinants, Australians of working age (aged 18–64), 2007–08 to 2017–18**

| Social determinant | Categories | 2007–08[a] OR (95% CI) | 2011–12[b] OR (95% CI) | 2014–15[c] OR (95% CI) | 2017–18[d] OR (95% CI) |
|---|---|---|---|---|---|
| **Household tenure** | | | | | |
| | Owner without a mortgage | Reference | Reference | Reference | Reference |
| | Renter | n.a. | 1.3 (1.1–1.5)* | 1.3 (1.1–1.5)* | n.a. |
| **Employment status and occupation** | | | | | |
| | Professionals | Reference | Reference | Reference | Reference |
| | Managers | n.a. | 1.0 (0.8–1.2) | 1.1 (0.9–1.4) | 1.2 (0.9–1.5) |
| | Technicians and trades workers | n.a. | 0.9 (0.7–1.1) | 1.0 (0.8–1.4) | 0.8 (0.6–1.0) |
| | Community and personal service workers | n.a. | 1.2 (0.9–1.6) | 1.2 (0.9–1.6) | 1.0 (0.8–1.2) |
| | Clerical and administrative workers | n.a. | 1.1 (0.8–1.4) | 1.2 (0.9–1.6) | 1.1 (0.8–1.3) |
| | Sales workers | n.a. | 1.0 (0.7–1.4) | 1.0 (0.7–1.5) | 1.0 (0.7–1.3) |
| | Machinery operators and drivers | n.a. | 1.3 (1.0–1.8) | 1.6 (1.1–2.4)* | 1.1 (0.8–1.5) |
| | Labourers | n.a. | 1.2 (0.9–1.6) | 1.2 (0.8–1.8) | 0.9 (0.7–1.2) |
| | Unemployed | n.a. | 1.3 (0.8–2.0) | 1.5 (1.1–2.2)* | 1.0 (0.7–1.6) |
| | Not in the labour force | n.a. | 1.1 (0.9–1.4) | 1.3 (1.0–1.7)* | 1.0 (0.8–1.3) |
| **Remoteness area** | | | | | |
| | *Major cities* | Reference | Reference | Reference | Reference |
| | *Inner regional* | 1.1 (0.9–1.4) | n.a. | 1.3 (1.0–1.5)* | 1.2 (1.0–1.4)* |
| | *Outer regional* and *Remote* | 1.5 (1.2–1.9)* | n.a. | 1.4 (1.2–1.8)* | 1.0 (0.9–1.3) |

* ORs that are statistically different from the reference group at a 95% confidence limit.

n.a. This determinant is not applicable for this period; that is, it did not reach statistical significance and was not retained in the final model (see Appendix A).

(a) Final model for this period included the following variables: age, highest level of education and remoteness.

(b) Final model for this period included the following variables: age, country of birth, highest level of education, household tenure, main language spoken at home, occupation and social marital status.

(c) Final model for this period included the following variables: age, country of birth, highest level of education, household tenure, occupation and remoteness.

(d) Final model for this period included the following variables: age, highest level of education, household type, household income, main language spoken at home, occupation, remoteness and sex.

*Source*: AIHW analysis of ABS 2009a, 2013b, 2016, 2019a; see Table S6 for additional footnotes and demographic OR retained in the final model for each period.

# Waist circumference risk

In the survey periods between 2007–08 and 2017–18, the age-standardised prevalence for an increased risk of metabolic complications due to waist circumference consistently differed across:

- **educational attainment**—lowest for those who held a bachelor degree or higher qualification (ranging from 47–53%) compared with those who had completed secondary school (55–59%), held a diploma/advanced diploma (54–61%), had a certificate III/IV (58–64%) or had not completed or attended secondary school (62–69%)
- **household type**—lowest for those living alone (ranging from 50–57%) compared with couple family households with children (57–62%) or one parent family households with children (58–62%)
- **household income**—lowest for those who lived in households with the highest incomes (5th quintile; ranging from 52–57%) compared with those who lived in households with the third lowest incomes (3rd quintile; 58–64%) or the second lowest incomes (2nd quintile; 59–62%)
- **employment status and occupation**—lowest for those whose occupation was classified as professionals (ranging from 49–54%) compared with managers (56–61%), labourers (56–62%), community and personal service workers (56–62%), clerical and administrative workers (57–67%), sales workers (59–62%), machinery operators and drivers (59–65%) and those not in the labour force (60–63%)
- **remoteness area**—lowest for those who lived in *Major cities* (ranging from 53–58%), compared with those who lived in *Inner regional* areas (61–66%) and *Outer regional* and *Remote* areas (62–66%) (figures 3.5 and 3.6).

There were no consistent differences in the prevalence for an increased risk of metabolic complications due to waist circumference by household tenure. See Table S7 for the prevalence for this determinant.

Table 3.4 presents the results of the logistic regression analyses.

Educational attainment and remoteness area were the only selected social determinants that predicted an increased risk of metabolic complications due to waist circumference in all 4 surveys that were statistically significant. Household tenure was a statistically significant predictor in 3 surveys.

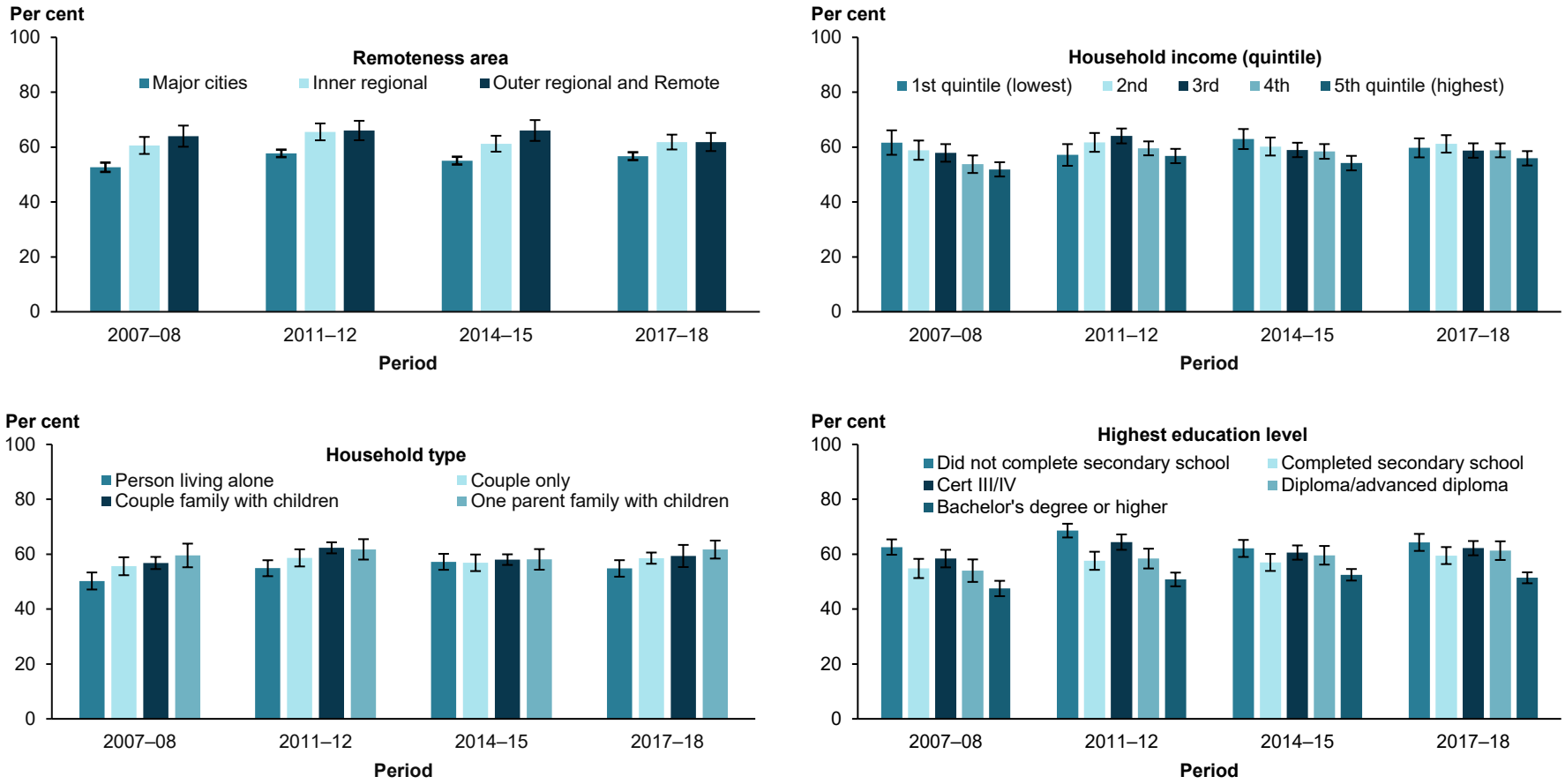
Compared with those who held a bachelor degree or higher qualification, the odds of an increased risk of metabolic complications due to waist circumference were higher for those who had:

- a certificate III/IV (between 1.3 to 1.8 times)
- completed secondary school (between 1.3 to 1.4 times)
- not completed or attended secondary school (between 1.4 to 2.0 times)
- a diploma or advanced diploma (between 1.2 to 1.5 times).

In 2 of the surveys, the odds of an increased risk of metabolic complications due to waist circumference were higher for those who lived in:

- *Inner regional* areas (around 1.2 times) and *Outer regional* and *Remote* areas (around 1.4 times) than for those who lived in *Major cities*
- houses owned with a mortgage or rented (around 1.2 times) than for those who lived in houses owned outright.

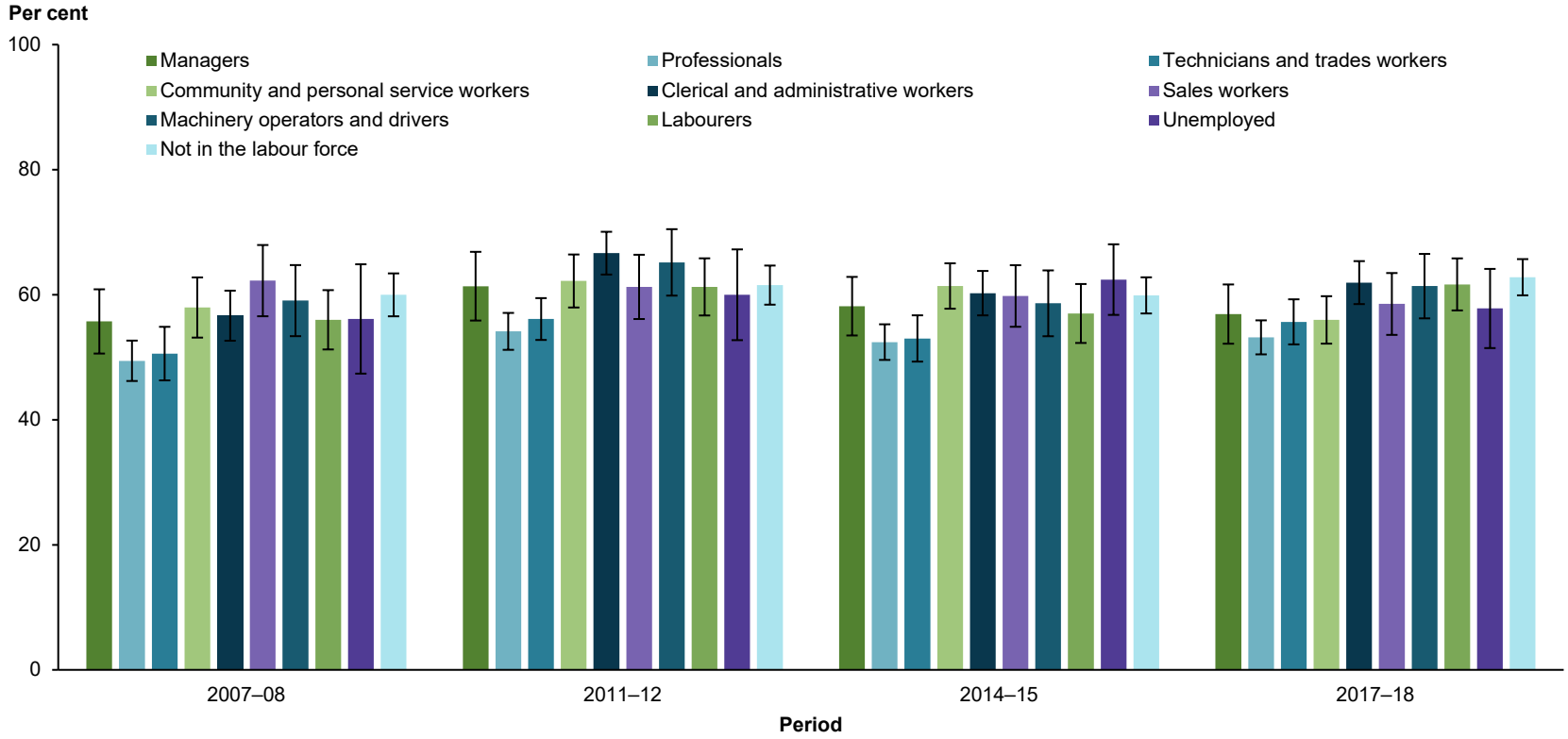
**Figure 3.5: Age-standardised prevalence and 95% CI of waist circumference risk, by remoteness area, household income, household composition and highest level of education, Australians of working age (aged 18–64), 2007–08 to 2017–18**




*Note:* Data have been age standardised to the 2001 Australian Standard Population.

*Source:* AIHW analysis of ABS 2009a, 2013b, 2016, 2019a; Table S7 for data and footnotes.

**Figure 3.6: Age-standardised prevalence and 95% CI of waist circumference risk, by employment status and occupation, Australians of working age (aged 18–64), 2007–08 to 2017–18**




*Note:* Data have been age standardised to the 2001 Australian Standard Population.

*Source:* AIHW analysis of ABS 2009a, 2013b, 2016, 2019a; Table S7 for data and footnotes.

**Table 3.4: OR (95% CI) of large waist circumference, by selected social determinants, Australians of working age (aged 18–64), 2007–08 to 2017–18**

| Social determinant | Category | 2007–08[a] OR (95% CI) | 2011–12[b] OR (95% CI) | 2014–15[c] OR (95% CI) | 2017–18[d] OR (95% CI) |
|---|---|---|---|---|---|
| **Highest level of education** | | | | | |
| | Bachelor degree or higher qualification | Reference | Reference | Reference | Reference |
| | Did not complete or attend secondary school | 1.7 (1.4–2.1)* | 2.0 (1.6–2.5)* | 1.4 (1.1–1.6)* | 1.7 (1.4–2.0)* |
| | Completed secondary school | 1.3 (1.0–1.5)* | 1.3 (1.1–1.7)* | 1.1 (0.9–1.3) | 1.4 (1.2–1.6)* |
| | Cert III/IV | 1.5 (1.3–1.8)* | 1.8 (1.4–2.2)* | 1.3 (1.2–1.6)* | 1.6 (1.4–1.8)* |
| | Diploma/advanced diploma | 1.2 (1.0–1.5) | 1.4 (1.1–1.8)* | 1.2 (1.0–1.5)* | 1.5 (1.3–1.7)* |
| **Household type** | | | | | |
| | Couple family with children | Reference | Reference | Reference | Reference |
| | Person living alone | n.a. | n.a. | n.a. | 0.7 (0.6–0.9)* |
| | Couple only | n.a. | n.a. | n.a. | 0.9 (0.7–1.0) |
| | One parent family with children | n.a. | n.a. | n.a. | 0.9 (0.7–1.0) |
| **Household tenure** | | | | | |
| | Owner without a mortgage | Reference | Reference | Reference | Reference |
| | Owner with a mortgage | 1.3 (1.1–1.6)* | 1.3 (1.1–1.6)* | 1.1 (1.0–1.3)* | n.a. |
| | Renter | 1.2 (1.0–1.5) | 1.3 (1.1–1.5)* | 1.2 (1.0–1.4) | n.a. |

*(continued)*

**Table 3.4 (continued): OR (95% CI) of large waist circumference, by selected social determinants, Australians of working age (aged 18–64), 2007–08 to 2017–18**

| Social determinant | Categories | 2007–08[a] OR (95% CI) | 2011–12[b] OR (95% CI) | 2014–15[c] OR (95% CI) | 2017–18[d] OR (95% CI) |
|---|---|---|---|---|---|
| **Employment status and occupation** | | | | | |
| | Professionals | Reference | Reference | Reference | Reference |
| | Managers | 1.3 (1.0–1.6) | 1.2 (1.0–1.5) | n.a. | n.a. |
| | Technicians and trades workers | 1.0 (0.8–1.2) | 0.9 (0.7–1.1) | n.a. | n.a. |
| | Community and personal service workers | 1.2 (0.9–1.5) | 1.1 (0.9–1.5) | n.a. | n.a. |
| | Clerical and administrative workers | 1.0 (0.8–1.4) | 1.4 (1.1–1.7)* | n.a. | n.a. |
| | Sales workers | 1.4 (1.0–1.9)* | 0.9 (0.7–1.3) | n.a. | n.a. |
| | Machinery operators and drivers | 1.4 (1.1–1.9)* | 1.2 (0.8–1.7) | n.a. | n.a. |
| | Labourers | 1.1 (0.8–1.5) | 1.1 (0.8–1.4) | n.a. | n.a. |
| | Unemployed | 1.1 (0.7–1.5) | 1.1 (0.7–1.6) | n.a. | n.a. |
| | Not in the labour force | 1.3 (1.0–1.6)* | 1.1 (0.9–1.5) | n.a. | n.a. |
| **Remoteness area** | | | | | |
| | Major cities | Reference | Reference | Reference | Reference |
| | Inner regional | 1.2 (1.0–1.4)* | 1.2 (1.0–1.4) | 1.2 (1.1–1.4)* | 1.1 (1.0–1.3) |
| | Outer regional/*R*emote | 1.4 (1.2–1.8)* | 1.1 (0.9–1.4) | 1.4 (1.1–1.8)* | 1.1 (0.9–1.3) |

* Ratios that are statistically different from the reference group at a 95% confidence limit.

n.a. This determinant is not applicable for this period; that is, it did not reach statistical significance and was not retained in the final model (see Appendix A).

(a) Final model for this period included the following variables: age, country of birth, highest level of education, household tenure, main language spoken at home, occupation, remoteness and sex.

(b) Final model for this period included the following variables: age, country of birth, highest level of education, household tenure, main language spoken at home, occupation, remoteness, sex and social marital status.

(c) Final model for this period included the following variables: age, country of birth, highest level of education, household tenure, remoteness, sex and social marital status.

(d) Final model for this period included the following variables: age, highest level of education, household type, main language spoken at home, remoteness and sex.

*Source*: AIHW analysis of ABS 2009a, 2013b, 2016, 2019a; see Table S8 for additional footnotes and demographic OR retained in the final model for each period.

# 4 Older Australians (65 years and over)

Excess weight in older people can have negative effects on their daily functioning, such as on their mobility, social lives and mental health (AIHW: Bennett et al. 2004; Visvanathan et al. 2012). However, weight loss should never be recommended in older people purely because of their BMI or waist circumference measurements and, where it is recommended, care should be taken with any weight loss interventions in order to preserve muscle mass (Visvanathan et al. 2012).

The current report uses World Health Organization guidelines for classifying overweight and obesity (that is, BMI ≥25 kg/m$^2$) for all adults. There are no existing evidence-based practice guidelines for classifying BMI in elderly populations; however, some evidence suggests that a BMI of >30 kg/m$^2$ (which would be considered obese in this report) might be more appropriate when categorising overweight in those aged 65 and over (Queensland Health 2017).

The findings of this report are that the rate of overweight and obesity consistently differed only by household type. That is, older Australians living alone, had lower rates of overweight and obesity than those living as a couple (with no children living in the house).

The rates of obesity, and an increased risk of metabolic complications due to waist circumference, consistently differed only by highest level of educational attainment, with lower rates for those who held a bachelor degree or higher qualification compared with those who did not complete or attend secondary school.

## Overweight and obesity

In the survey periods between 2007–08 and 2017–18, the age-standardised prevalence of overweight and obesity consistently differed across:

- **household type**—lowest for those living alone (ranging from 64–72%) compared with those who were living as a couple (that is, with no children living in the house) (73–77%) (Figure 4.1).

There were no consistent differences in the age-standardised prevalence of overweight and obesity for educational attainment, employment status, household income, household tenure or remoteness area. See Table S9 for the prevalence for these determinants.

## Obesity

In the survey periods between 2007–08 and 2017–18, the age-standardised prevalence of obesity consistently differed across:

- **educational attainment**—lowest for those who held a bachelor degree or higher qualification (ranging from 24–29%), compared with those who had not completed or attended secondary school (31–40%) (Figure 4.2).

There were no consistent differences in the age-standardised prevalence of obesity for employment status, household type, household income, household tenure or remoteness area. See Table S10 for the prevalence for these determinants.

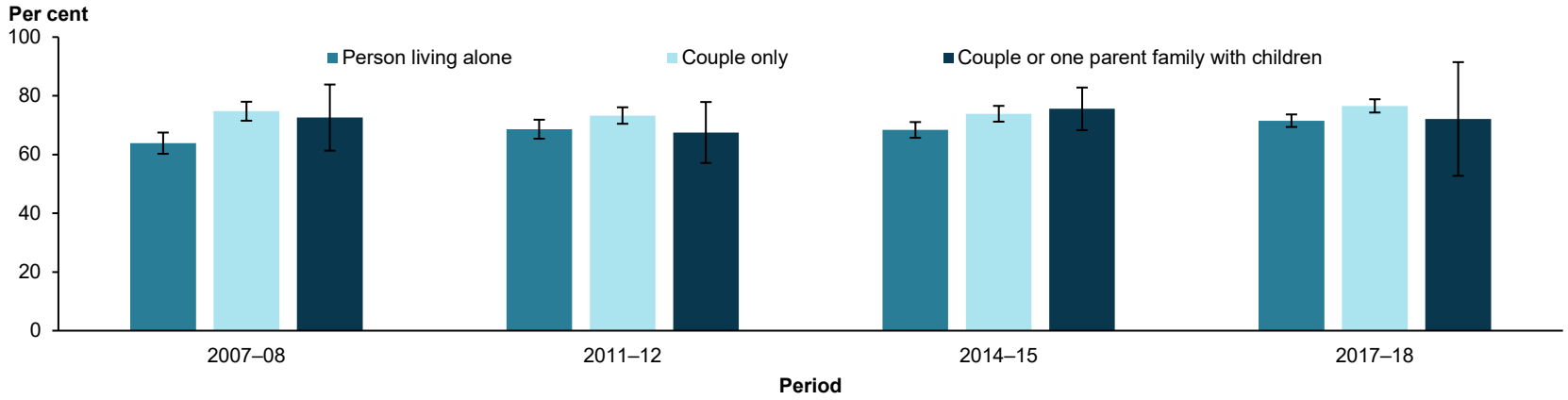
# Waist circumference risk

In the survey periods between 2007–08 and 2017–18, the age-standardised prevalence of increased risk of metabolic complications due to waist circumference consistently differed across:

- **educational attainment**—lowest for those who held a bachelor degree or higher qualification (ranging from 69–81%), compared with those who had not completed or attended secondary school (ranging from 82–83%) (Figure 4.3).

There were no consistent differences in the age-standardised prevalence of obesity for employment status, household type, household income, household tenure or remoteness area. See Table S11 for the prevalence for these determinants.

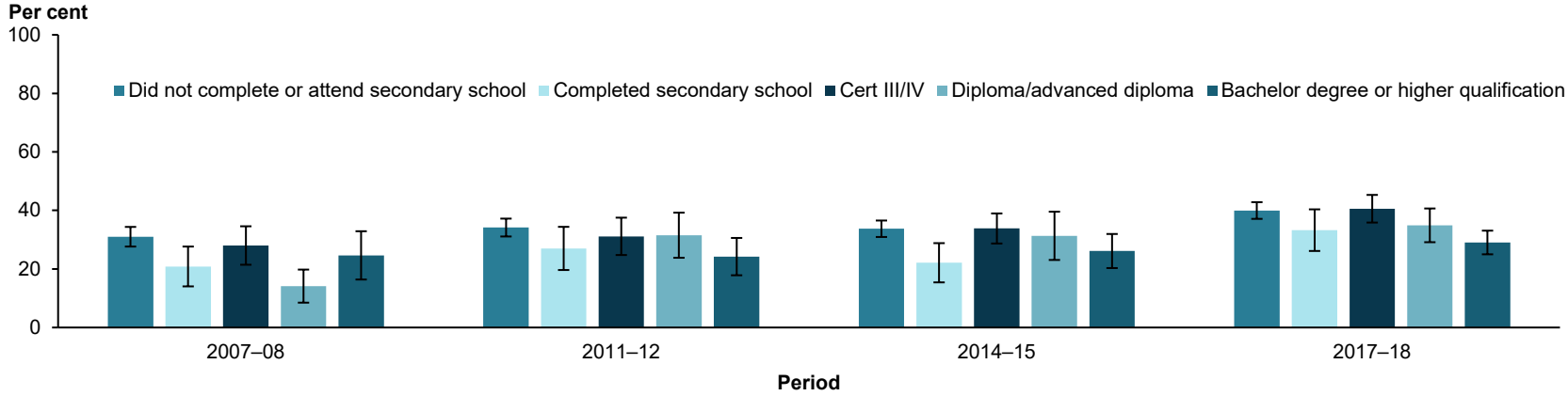
**Figure 4.1: Age-standardised prevalence and 95% CI of overweight and obesity, by household type, older Australians (aged 65 and over), 2007–08 to 2017–18**




*Note:* Data have been age standardised to the 2001 Australian Standard Population.

*Source*: AIHW analysis of ABS 2009a, 2013b, 2016, 2019a; Table S9 for data and footnotes.

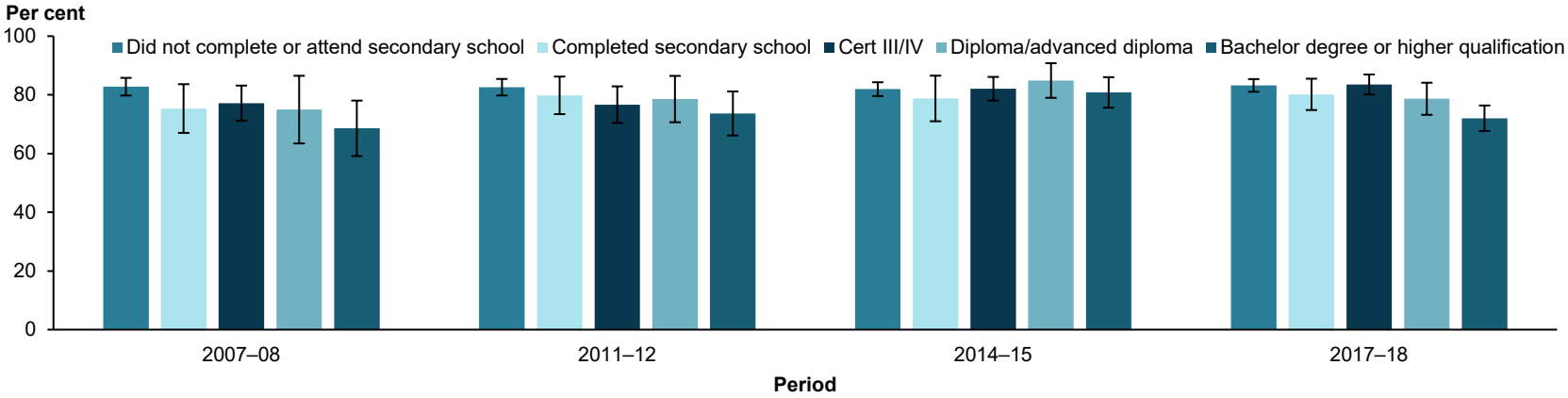
**Figure 4.2: Age-standardised prevalence and 95% CI of obesity, by highest level of education, older Australians (aged 65 and over), 2007–08 to 2017–18**




*Note:* Data have been age standardised to the 2001 Australian Standard Population.

*Source*: AIHW analysis of ABS 2009a, 2013b, 2016, 2019a; Table S10 for data and footnotes.

**Figure 4.3: Age-standardised prevalence and 95% CI of waist circumference risk, by highest level of education, older Australians (aged 65 and over), 2007–08 to 2017–18**




*Note:* Data have been age standardised to the 2001 Australian Standard Population.

*Source*: AIHW analysis of ABS 2009a, 2013b, 2016, 2019a; Table S11 for data and footnotes.

# 5 Discussion

A wide range of factors may be associated with overweight and obesity, many of which include social and cultural components that can interact within a complex system. For example, levels of educational attainment (both at an individual and family level) are associated with engagement in healthy behaviours, health, employment or occupational outcomes and subsequent income levels. The conditions in which people live, learn and work (for example, in homes and communities) have also been proposed to affect access to education, employment and health care, which may influence risk factors associated with overweight and obesity (Friel & Goldman 2019).

Interpretations of the associations between social determinants of health and overweight and obesity should be considered with caution, as two-way relationships may exist between them. For example, while stress (financially and psychologically) from unemployment or underemployment may increase the risk of developing overweight and obesity in adults, stigmatisation of, or discrimination against, overweight and obese individuals may have an impact on employment opportunities, and therefore on income and housing, and so on (Pearl 2018; Puhl & Heuer 2009; Siahpush et al. 2014).

Furthermore, the social determinants available for reporting depend on developed data sources. The analyses presented in chapters 2–4 of this report examined the prevalence of overweight and obesity in Australia across selected social determinants of health that were collected at a national level and over time.

This chapter summarises the key findings of the report and places them within the wider context of what is known in the area.

## Overweight and obesity is associated with lower levels of educational attainment

From the analyses presented for Australians of working age, the age-standardised prevalence of overweight and obesity, obesity, and waist circumference risk was consistently higher for those who did not complete or attend secondary school than for those who held a bachelor degree or higher qualification from 2007–08 to 2017–18. After controlling for the effects of other social determinants and selected demographic factors, education was associated with increased odds of overweight and obesity, obesity, and waist circumference risk. That is, the odds of weight-related outcomes were higher for those who did not complete or attend secondary school than for those who held a bachelor degree or higher qualification.

When examining overweight and obesity by education-related measures, birth cohorts may need to be considered (Galobardes et al. 2006). Changes in opportunities for educational attainment may mean that older people are over-represented in groups classified as less educated if the same classification is used for all birth cohorts. Based on the analyses presented for older Australians, the age-standardised prevalence of obesity, and waist circumference risk—but not overweight and obesity—was consistently higher for those who had not completed or attended secondary school than for those who held a bachelor degree or higher qualification from 2007–08 to 2017–18.

For children and adolescents, the prevalence of overweight and obesity was higher for those whose parent had not completed or attended secondary school than for those whose parent held a bachelor degree or higher qualification in 2007–08, 2011–12 and 2017–18. While our analyses were restricted to the educational status of 1 parent in the household, an analysis

of the Longitudinal Study of Australian Children reported a similar finding for the educational status of both parents, with around 1 in 3 (32%) children aged 9–11 being classified as overweight or obese if neither parent had a degree, compared with around 1 in 5 (25%) children who had 1 or both parents with a degree (Gasser et al. 2019).

Education may protect against overweight and obesity through increased health literacy. Health literacy relates to how people access, understand and use health information in ways that benefit their health; people with low health literacy are at a higher risk of worse health outcomes and poorer health behaviours (AIHW 2020d). As there is a strong association between lower levels of education and low health literacy, this might, in part, influence overweight and obesity (AIHW 2020d).

As well as the highest level of education achieved, the level of education relative to peers could also be important, as this may influence social positions and associated stress and coping mechanisms (Devaux et al. 2011). Education may also have an impact on overweight and obesity through income and employment outcomes (discussed later in this report). Parental education could potentially affect childhood overweight and obesity through these same mechanisms.

As educational attainment may correlate highly with other social determinants that were not controlled for in the current report, care should be taken when interpreting its association with overweight and obesity. However, the present findings do add support to a previous suggestion that policy initiatives and interventions to prevent overweight and obesity may benefit from targeting actions towards people with lower levels of education (VicHealth 2020).

# Rates of overweight and obesity differ for some occupations but the strength of the association is unclear

From the analyses presented for Australians of working age, the age-standardised prevalence of overweight and obesity, obesity, and waist circumference risk was consistently higher for those working as labourers, machinery operators and drivers and managers than for professionals from 2007–08 to 2017–18. However, after controlling for the effects of other social determinants and for selected demographic factors, the association between occupation and weight-related outcomes was unclear.

One potential explanation for the reduced association between occupation and overweight and obesity might have been the association between occupation with education and selected demographic factors included in the models. Previous Australian research has found that, after controlling for age, men who worked as associate professionals or in production and transport were more likely to be overweight or obese than those who were unemployed or not in the labour force (Allman-Farinelli et al. 2010). However, after including socioeconomic variables (including education and household income), this difference was no longer apparent, suggesting that other potential mechanisms (for example, through education and income) might account for part of the relationship between occupation and overweight and obesity.

As well as income, employment has been suggested to protect against or contribute to overweight and obesity through the impacts of stress at work or the psychological effects of unemployment (WHO 2003). The coping mechanisms used to deal with this stress, such as comfort eating or drinking alcohol, may, in turn, contribute to overweight and obesity (Marmot & Bell 2019). Furthermore, research from the Unites States suggests that many occupations

have become increasingly sedentary, with daily energy expenditure at work having decreased by more than 420 kilojoules between 1960–2008, which could account for resultant weight gain over time (Church et al. 2011). Employment also has the potential to contribute to overweight and obesity by affecting the amount of time available for activities such as food shopping or preparation, or physical activity (Friel et al. 2015).

## Rates of obesity differ between households with the highest and lowest incomes but the strength of the association is unclear

Sufficient ongoing financial resources enable people to engage in healthy behaviours, such as physical activity, or purchasing healthy food (Friel 2009). While income relates to employment (discussed earlier), social protection may also provide basic income security and entitlements to health care and education for those who are unemployed or aged (Friel 2009).

When comparing levels of overweight and obesity by income-related measures, it may be important to consider the effects of gender. For example, low-paid jobs typically undertaken by men may be more physically demanding than those undertaken by women (Devaux & Sassi 2013), so different relationships may be observed. It is also important to note that measures of income typically do not consider other assets ('wealth'), which are also likely to influence people's ability to choose to undertake healthy behaviours. Other considerations when using income-related measures may include:

- variation in income levels over the life course
- variations in the cost of living by location
- the use of personal or household income
- equivalisation (adjustment for household size and composition)
- the use of gross or disposable income.

This report used quintiles of equivalised household income (that is, earnings for the entire household) that accounted for the number of individuals within the household.

From the analyses presented for Australians of working age, the age-standardised prevalence of obesity risk was consistently higher for those living in households with the lowest 20% of income compared with those living in households with the highest 20% of income. A similar result was found for obesity prevalence in children. Furthermore, waist circumference risk was consistently higher for Australians of working age living in households with either the second lowest or middle income compared with households with the highest 20% of income.

For Australians of working age, the association between household income and obesity was no longer observed, after controlling for the effects of other social determinants (for example, education and household tenure) and selected demographic factors.

## Overweight and obesity may be associated with household tenure and remoteness area

Housing has the potential to indirectly contribute to overweight and obesity by influencing health behaviours, including food choice and physical activity as well as the amount of household income available. The availability of adequate food preparation and storage

spaces may shape cooking and eating behaviours (Friel et al. 2015). Mortgage, rental and/or utility payments as well as the area in which people live in can affect the proportion of income available for purchasing healthy food, where value for money (quantity, weight or number of serves) can influence purchasing choices (Drewnowski & Darmon 2005).

For people living in lower socioeconomic areas and in more remote areas, diet quality generally decreases and overweight and obesity increases, as differences in diet quality might, in part, be driven by issues of affordability (AIHW 2018). Healthy diets consistent with the Australian Dietary Guidelines are less expensive than unhealthy diets (Lee et al. 2016), but it has been estimated that a family of 2 adults and 2 children from low-income households would need to spend proportionally more of their income (about 28%) to afford a healthy diet compared with those from high-income households (about 8.9%) (Ward et al. 2013).

From the analyses presented for Australians of working age, the age-standardised prevalence of overweight and obesity was consistently higher for those living in homes owned with a mortgage than for those living in homes owned outright. Furthermore, the age-standardised prevalence of overweight and obesity, obesity and waist circumference risk was consistently higher for those living in *Inner regional* and *Outer regional* and *Remote* areas of Australia than for those living in *Major cities*.

For Australians of working age, household tenure was associated with increased odds of overweight and obesity, after controlling for the effects of other social determinants and selected demographic factors. That is, the odds of overweight and obesity were higher for those who lived in a home owned with a mortgage or rented than for those who lived in a home owned outright. This aligns with previous research based on data from the 2011 Australian Survey of Social Attitudes, which found that public renters and home owners with a mortgage were more likely to be obese than home owners without a mortgage (Tranter & Donoghue 2017).

Similarly, remoteness area was associated with increased odds of overweight and obesity, after controlling for the effects of other social determinants and selected demographic factors. That is, the odds of overweight and obesity, obesity and waist circumference risk were generally higher for those who lived in an *Inner regional* or *Outer regional* and *Remote* areas of Australia than for those who lived in *Major cities*.

Overall, there is some evidence that policy initiatives and interventions to do with overweight and obesity should consider the nature of household tenure and the remoteness area in which people live in order to reduce inequalities in outcomes.

# What are the limitations of the data?

Social determinants of health act through complex and multidirectional pathways and occur over the life course, making their impact difficult to measure over long periods of time (Braveman & Gottlieb 2014). Exposure to, and experience of, different social determinants of health is individual and specific to personal and environmental conditions. Therefore, it is difficult to determine whether individual social determinants of health are direct or independent risk factors for overweight and obesity, or if they act as disadvantage measures. Future research might consider the use of linked data assets (for example, the Multi-Agency Data Integration Project) to follow individuals over time to see how social determinants at one point in time affect overweight and obesity.

This report focuses on a selection of social determinants of health where data are available. However, other social determinants of health also influence overweight and obesity outcomes. For example, research has shown that early life experiences and exposures

(such as mother's smoking habits, pre-pregnancy BMI as well as weight gain or development of gestational diabetes) have been associated with a higher risk of children becoming overweight or obese (Larqué et al. 2019; Moore et al. 2017; Woo Baidal et al. 2016). Other early life experiences within the home environment, such as physical activity, eating patterns and parental modelling, can also influence the risk of overweight and obesity (AIHW 2021). Furthermore, research highlights that the built environment (including transport systems) can affect not only opportunities for physical activity but also access to nutritious foods or the density of available fast food outlets which may, in turn, contribute towards overweight and obesity (AIHW 2020c).

Data availability and analytical constraints limit the monitoring of social determinants and the evidence needed for policy development. Monitoring trends across time requires consistency in how social determinants are measured. The selected social determinants examined in this report are broadly comparable from 2007–08 to 2017–18 and thus inferences can be drawn. However, comparisons further back in time, for example with the 1995 National Nutrition Survey, are limited due to differences in the definitions used for the social determinants. Furthermore, small sample sizes for certain population groups (for example, children and adolescents or older Australians) can result in considerable statistical variability, making it difficult to see differences in the prevalence of overweight and obesity across some of the social determinants.

Differences in body composition among certain population groups (for example, Aboriginal and Torres Strait Islander or Asian and South Pacific people) were not considered in this report. While different BMI cut-off points might need to be used for these populations, the data available and scope of the present report have limited reporting to Australians at a national level only and not further disaggregated by population groups. Care should be considered when generalising the key findings to specific population groups.

While extending reporting to include variables such as ethnicity, culture, social support and the residential environment (for example, physical activity facilities and opportunities for public transport) would provide a more robust picture of socioeconomic position (AIHW 2016), these concepts are difficult to define and data are difficult to collect.

# Appendix A: Detailed methods

## Data sources

The analyses presented in this report are based on data collected in the following 4 national cross-sectional surveys conducted by the Australian Bureau of Statistics (ABS)—the 2007–08 National Health Survey, the 2011–12 National Health Survey component of the 2011–13 Australian Health Survey, the 2014–15 National Health Survey and the 2017–18 National Health Survey. These surveys were based on nationally representative samples that included only residents of private dwellings, and excluded residents of non-private dwellings such as hospitals, nursing homes, hotels, motels, boarding schools, and prisons.

The sample size in each survey varied, with about:

- 20,800 people surveyed in the 2007–08 National Health Survey (NHS)
- 32,000 people surveyed in the 2011–13 Australian Health Survey (AHS)
- 19,300 people surveyed in the 2014–15 NHS
- 21,300 people surveyed in the 2017–18 NHS.

The 2011–12 AHS, the 2014–15 NHS and the 2017–18 NHS included physical measurements for people aged 2 and over, while the 2007–08 NHS included these for people aged 5 and over.

Each survey included collection of measured height, weight, and waist circumference by trained interviewers. All 4 surveys used scales that could weigh a maximum weight of 150 kg. In all survey periods, women who identified that they were pregnant did not have their height, weight or waist circumference recorded.

The response rates for physical measures varied between surveys and between adults and children. The non-response rates for physical measurements for adults and children were higher for the 2017–18 NHS (43.9% and 33.8%, respectively) and the 2014–15 NHS (37.7% and 26.8%, respectively) than for the 2011–12 NHS (20.1% and 16.5%, respectively).

In response, the ABS imputed body mass index (BMI) for those people for whom BMI was not measured in the 2014–15 NHS and the 2017–18 NHS. In this method, participants with a missing response were given the response of similar participants who were matched on age group, sex, part of state, self-perceived body mass, level of exercise, and whether or not a participant had high cholesterol as a long-term health condition (ABS 2017). There was no imputation of BMI in the 2007–08 NHS or the 2011–12 AHS.

For each survey, the ABS allocated a person weight to each participant. Estimates based on the person weights can be used to infer results for the in-scope population.

## Data quality

Data quality statements for the primary data sources used are available on the ABS website:

- **2017–18 National Health Survey:** https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/4363.0~2017-18~Main%20Features~Data%20quality~9
- **2014–15 National Health Survey:** https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/4363.0~2014-15~Main%20Features~Data%20quality~61

- **2011–13 Australian Health Survey:** https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/5209F2553DE3B084CA257BBB0014D160?opendocument
- **2007–08 National Health Survey:** https://www.abs.gov.au/AUSSTATS/abs@.nsf/Previousproducts/4363.0.55.001Main%20Features82007-08?opendocument&tabname=Summary&prodno=4363.0.55.001&issue=2007-08&num=&view=

# Measures

While there are numerous social determinants of health, the measures used in the present analyses were restricted to those available across the NHS between 2007–08 and 2017–18. Furthermore, as the impact of determinants on overweight and obesity differs for children and adults, different categories for the outcome and predictor variables for children and adults are presented here.

In the sections that follow, the terms outcomes and predictors are used.

- An outcome refers to the result of what is being examined. For this report, measures of whether or not an individual is at risk of ill health due to a high BMI or large waist circumference are considered to be the outcome.
- Predictors refer to variables that are linked to, and explain changes in, the outcome. For example, if men are more likely to be overweight and obese than women, sex can be considered a predictor of the outcome of overweight and obesity.

## Comparability of demographic measures

Age, sex and social marital status were considered to be directly comparable between the 2007–08 NHS, 2011–13 AHS, 2014–15 NHS and 2017–18 NHS (ABS 2009b, 2013a, 2017, 2019b). Social marital status was collected only for those aged 15 and over across the survey periods and, in this report, are presented only for those aged 18 and over. For children and adolescents (aged 5–17), the social marital status of their parent was reported (see Box 2.1 for more information on how parent was classified).

Main language spoken at home was classified according to the Australian Standard Classification of Languages (ASCL) 2005–06 for the 2007–08 NHS and the 2011–13 AHS, the ASCL 2011 for the 2014–15 NHS and the ASCL 2016 for the 2017–18 NHS (ABS 2009b, 2013a, 2017, 2019b). While broadly comparable at aggregated levels used in the report (that is, ‘English’ compared with ‘language other than English’), potential differences in overweight and obesity across survey periods due to differences in measuring main language spoken at home at lower levels should be considered. As well, main language spoken at home was collected only for those aged 15 and over in the 2007–08 NHS. We are therefore unable to report how the prevalence of overweight and obesity for children and adolescents (aged 5–17) might differ by main language spoken at home for this period.

Country of birth was classified according to the Standard Australian Classification of Countries (SACC), 2nd Edition, Revision 2.03 for the 2007–08 NHS and the 2011–13 AHS, and the SACC 2011 for the 2014–15 NHS and the 2017–18 NHS (ABS 2009b, 2013a, 2017, 2019b). While broadly comparable at aggregated levels used in the report (that is, ‘Australia’ compared with ‘elsewhere’), potential differences in overweight and obesity across survey periods due to differences in measuring country of birth at lower levels should be considered.

## Comparability of household measures

### Equivalised household income

Equivalised household income was considered broadly comparable between the 2007–08 NHS, 2011–13 AHS, 2014–15 NHS and the 2017–18 NHS and was reported using quintiles throughout this report (see Table A1 for dollar amounts in each quintile and for each survey period) (ABS 2009b, 2013a, 2017, 2019b).

Equivalised income is derived by calculating an equivalence factor and then dividing income by that factor. The equivalence factor is built up by allocating points to each person in the household unit and summing those points. One point is allocated to the first adult in the unit, 0.5 points for each other person aged 15 and over, and 0.3 points for each person aged under 15. For example:

- A single person household has a factor of 1.0. Equivalised income is therefore the same as reported income.
- A household comprising 2 adults and a child aged under 15 would have a factor of 1.8. Equivalised income for this household is therefore the household income divided by 1.8.

**Table A1: Equivalised household income (quintile) by period ($)**

| | Period | | | |
|---|---|---|---|---|
| **Quintile** | **2007–08** | **2011–12** | **2014–15** | **2017–18** |
| 1 (lowest) | Less than $319 | Less than $398 | Less than $435 | Less than $449 |
| 2 | $320–$564 | $399–$638 | $436–$675 | $450–$712 |
| 3 | $565–$841 | $639–$958 | $676–$1,018 | $713–$1,100 |
| 4 | $842–$1,246 | $959–$1,437 | $1,019–$1,550 | $1,101–$1,663 |
| 5 (highest) | $1,247 or more | $1,438 or more | $1,551 or more | $1,664 or more |

*Sources:* ABS 2009b, 2013a, 2017, 2019b.

### House tenure

House tenure data are considered broadly comparable between the 2007–08 NHS, 2011–13 AHS, 2014–15 NHS and the 2017–18 NHS (ABS 2009b, 2013a, 2017, 2019b).

Respondents aged 18 and over were asked whether the house they lived in was either owned or partly owned, being paid off (mortgage or secure loan), rented, purchased under a share equity scheme, occupied under a life tenure scheme or occupied rent free.

In this report, house tenure was categorised as:

- owner without a mortgage
- owner with a mortgage
- renter
- other.

### Household type (composition)

Household type data are considered to be comparable between the 2007–08 NHS, 2011–13 AHS, 2014–15 NHS and the 2017–18 NHS (ABS 2009b, 2013a, 2017, 2019b). The composition of a household was based on information about the residents living in the

household, such as familial relationships and whether unrelated family members also reside in the same household. In this report, family composition in households was categorised as:

- person living alone
- couple only
- couple family with children
- one parent family with children
- other.

### Remoteness area

Remoteness area was classified according to the Australian Standard Geographical Classification (ASGC) 2006 for the 2007–08 NHS, the Australian Statistical Geography Standard (ASGS) 2011 for the 2011–13 AHS and the 2014–15 NHS, and the ASGS 2016 for the 2017–18 NHS (ABS 2009b, 2013a, 2017, 2019b). These data are considered broadly comparable across the survey periods.

In this report, remoteness area was categorised as:

- *Major cities*
- *Inner regional*
- *Outer regional* and *Remote*.

## Comparability of education and labour force characteristics

### Education

Educational attainment data are considered to be comparable between the 2007–08 NHS, 2011–13 AHS, 2014–15 NHS and the 2017–18 NHS (ABS 2009b, 2013a, 2017, 2019b). Educational attainment was collected only for those aged 15 and over across the survey periods and, in this report, are presented only for those aged 18 and over. For children and adolescents (aged 5–17), the educational attainment of their parent was reported (see Box 2.1 for more information on how parent was classified).

Educational attainment refers to the highest level of schooling completed as well as completion of non-school qualifications.

In this report, educational attainment was categorised as:

- did not complete or attend secondary school (includes Year 11, Year 10, non-school qualification of certificate I/II as highest qualification, Year 9 or below, certificate not further defined as highest qualification and no educational attainment)
- completed secondary school (Year 12 or equivalent)
- certificate III/IV as highest non-school qualification
- diploma/advanced diploma as highest non-school qualification
- bachelor degree or higher qualification as highest non-school qualification (includes bachelor degree, graduate diploma/graduate certificate or postgraduate degree as highest non-school qualification).

## Employment

Employment status data are considered to be directly comparable between the 2007–08 NHS, 2011–13 AHS, 2014–15 NHS and the 2017–18 NHS (ABS 2009b, 2013a, 2017, 2019b). Employment status was collected only for those aged 15 and over across the survey periods and, in this report, are presented only for those aged 18 and over. For children and adolescents (aged 5–17), the employment status of their parent was reported (see Box 2.1 for more information on how parent was classified).

In this report, employment status was categorised as:

- employed working full time (35 or more hours/week) or part time (fewer than 35 hours/week)
- unemployed looking for full-time work, part-time work or full- or part-time work (within the last 4 weeks)
- not in the labour force (such as people who are retired or voluntarily inactive, caring for children or an ill or disabled person, or studying as well as those experiencing long- or short-term illness or injury).

## Occupation

Occupation refers to the respondent's main job. For respondents who had more than 1 job at the time of the interview, main job was defined as the paid job in which they usually worked the most hours (ABS 2009b, 2013a, 2017, 2019b).

Occupation was classified according to the Australian and New Zealand Standard Classification of Occupations (ANZSCO), First Edition, Revision 1, 2006 for the 2007–08 NHS, the ANZSCO, First Edition, Revision 1, 2009 for the 2011–13 AHS, and the ANZSCO, Version 1.2, 2013 for both the 2014–15 NHS and the 2017–18 NHS (ABS 2009b, 2013a, 2017, 2019b).

While broadly comparable at aggregated levels used in the report (that is, 'Managers' and 'Professionals'), potential differences in overweight and obesity across survey periods due to differences in measuring occupation at lower levels should be considered. Furthermore, occupation was collected only for those aged 15 and over across the survey periods and, in this report, are presented only for those aged 18 and over. For children and adolescents (aged 5–17), the occupation of their parent was reported (see Box 2.1 for more information on how parent was classified).

In this report, occupation was combined with employment status and the following categories were used:

- employed as a manger
- employed as a professional
- employed as a technician or trade worker
- employed as a community or personal service worker
- employed as a clerical or administrative worker
- employed as a sales worker
- employed as a machinery operator or driver
- unemployed
- not in the labour force.

# Statistical analyses

## Crude prevalence estimates

Crude prevalence estimates are presented as percentages in this report. Crude prevalence, as a percentage, is defined as the number of people with a particular characteristic, divided by the number of people in the population of interest, multiplied by 100.

In calculating crude prevalence estimates, those people for which the information of interest (for example, BMI or waist circumference) was not available were excluded from the denominator.

All crude prevalence estimates in this report are weighted estimates that use person weights allocated to each survey participant by the ABS.

## Standard error, relative standard error, and confidence intervals

For all survey data, the jack-knife weight replication method was used to derive the standard errors for each number estimate, using replicate weights provided by the ABS.

Once the standard error for the number estimates was produced, the standard error for the proportion was derived as follows:

$$SE\ (x/y) = RSE\ (x/y) \times (x/y)$$

where *RSE (x/y)* is calculated as shown below.

The relative standard error of an estimate is a measure of the percentage errors likely to have occurred due to sampling. The relative standard error of an estimate is calculated as:

$$RSE\%(x) = SE/x \times 100$$

Estimates with a relative standard error greater than 50% are considered unreliable. No estimates in this report have a relative standard error greater than 50%. Caution should be used when a relative standard error is between 25% and 50%. These cases have been highlighted in the text as relevant and marked with a # in this report.

The relative standard error for the proportion was derived from the standard error of both the estimate for the numerator ($x$) and the denominator ($y$):

$$RSE\ (x/y) = \sqrt{RSE(x)^2 - RSE(y)^2}$$

where $x$ is a subset of $y$ and $y$ is a survey estimate of the number of people in a group.

The 95% confidence interval around the proportion estimates ($P$) was derived as follows:

$$LCL = P - (1.96 \times SE(x/y))$$

$$UCL = P + (1.96 \times SE(x/y))$$

where:

LCL = lower confidence limit

UCL = upper confidence limit.

## Logistic regression

Logistic regression is used to obtain odds ratios for binary outcomes (for example, obese versus not obese) in the presence of more than 1 predictor variable. In our analyses, we were interested in the odds of weight-related outcomes (that is, obese, overweight and

obese, or at an increased risk of chronic conditions due to waist circumference) in the presence of demographic measures (that is, sex, age and social marital status) and select social determinants.

### Model selection

Firstly, univariate logistic regression models were fitted for each outcome and predictor variable, without adjusting for other variables. The Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) (also known as the Schwarz Information Criterion) were used to determine which predictor variable to include in the base model for each outcome. The predictor variables that produced the models with the lowest AIC and BIC were selected as the first variable to be included in the base model.

To ensure that the AIC and BIC across different models could be compared, we created subsets of data where there were no missing data for any outcome or predictor variable. In excluding respondents with missing data, we verified that we still retained a high percentage of respondents in the subsets used in building the models for comparison.

Once the first variable was selected for inclusion in the base model of the multivariate model, we used a forward selection approach to add 1 variable at a time. The explanatory variables that produced the model with the lowest AIC and BIC were selected to be the next variable included in the multivariate model. A backward elimination approach was then applied to the final multivariate model, where only variables with a *p*-value of less than 0.10 were retained.

Using the outcome variable overweight or obese for the period 2007–08 as an example, the following steps outline our modelling procedure:

- Step 1: We built univariate models of overweight or obese and each predictor variable, resulting in 10 univariate models.
- Step 2: We compared the AIC and BIC of each univariate model and selected the predictor variable that produced the model with the lowest AIC and BIC values as the first variable to add into the model.
- Step 3: We built models with first predictor (identified in Step 2) and each of the remaining predictor variables, resulting in 9 new models.
- Step 4: We compared the AIC and BIC of these 9 new models and selected the predictor variable that produced the model with the lowest AIC and BIC values as the second variable to add into the model.
- Step 5: We built models with the first variable (identified in Step 2), the second variable (identified in Step 4), and each of the remaining 8 explanatory variables, resulting in 8 new models.
- Step 6: We continued with this forward selection method of adding variables until either:
  - the AIC and/or BIC values increased, in which case no more variables were then added
  - all predictor variables had been added into the model (without increasing the AIC and/or BIC).
- Step 7: Once Step 6 was completed, we applied a backward elimination method, where only the variables with *p*-values of less than 0.10 were retained in the model. For the outcome overweight or obese, for the period 2007–08, this resulted in the retention of age, country of birth, highest level of educational attainment, main language spoken at home, remoteness and sex.

The final multivariate model from Step 7 was then fitted using the full cohort of people (excluding those with a missing value for the predictors in the final model). All models were performed using the survey weights and replicate weights in the SURVEYLOGISTIC procedure in SAS 9.4.

Two statistics for how well the logistic regression models fit are provided in the supplementary tables. These are the adjusted *R*-squared and *c*-statistic. The adjusted *R*-squared is a measure of the variation in the outcome variable that is explained by the explanatory variables. The *c*-statistic is a measure of the predictive accuracy of a logistic regression model.

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# Abbreviations

| | |
|---|---|
| ABS | Australian Bureau of Statistics |
| AHS | Australian Health Survey |
| AIC | Akaike Information Criterion |
| AIHW | Australian Institute of Health and Welfare |
| ANZSCO | Australian and New Zealand Standard Classification of Occupations |
| ASCL | Australian Standard Classification of Languages |
| ASGC | Australian Standard Geographical Classification |
| ASGS | Australian Statistical Geography Standard |
| BIC | Bayesian Information Criterion |
| BMI | body mass index |
| CI | confidence interval |
| NHS | National Health Survey |
| OR | odds ratio |
| RSE | relative standard error |
| SACC | Standard Australian Classification of Countries |
| SE | standard error |

# Symbols

| | |
|---|---|
| % | per cent |
| cm | centimetres |
| kg | kilograms |
| $kg/m^2$ | kilograms per metre squared |
| n.a. | This determinant is not applicable for this period; that is, it did not reach statistical significance and was not retained in the final model. |

# Glossary

**Australians of working age:** Australian adults between the ages of 18 and 64.

**body mass index (BMI):** The most commonly used method of assessing whether a person is normal weight, underweight, overweight or obese (see **obesity**). It is calculated by dividing the person's weight (in kilograms) by their height (in metres) squared—that is, kg ÷ $m^2$. For both men and women, underweight is a BMI below 18.5, normal weight is from 18.5 to less than 25, overweight but not obese is from 25 to less than 30, and obese is 30 and over. Sometimes overweight and obese are combined—defined as a BMI of 25 and over (see **overweight**).

**children and adolescents:** In this report, children and adolescents refer to those between the ages of 5 and 17.

**comorbidities:** Any additional disease/s experienced by a person with a disease of interest.

**educational attainment:** Highest level of educational qualification for a respondent over the age of 18.

**employment status:** People were classified as being either employed, unemployed, or not in the labour force based on criteria relating to whether the person had a job in the week before interview, whether those who did not have a job were actively seeking work, and whether those actively seeking work were available to start work.

In this report:

- employed persons were those aged 18 and over who reported that, in the preceding week, they had worked in a job, business or farm, or had a job but were absent during that week. People who usually worked less than 1 hour, who had unpaid volunteer work arrangements, or were away from work due to workers compensation and were not (or did not know if they were) returning to work for their employer were excluded
- unemployed persons were those aged 18 and over who were not employed in the reference week (or who fall into an exclusion category for employed) and actively looked for work some time during the previous 4 weeks and were available to start, or waiting to start within the following 4 weeks
- persons not in the labour force were those aged 18 and over who were not employed or unemployed, as defined.

**equivalised household income:** Differences in household types and compositions, and their requirements relative to income, can be taken into account by applying equivalence scales. These scales are a set of ratios which, when applied to the income of different household or income unit types, produce standardised estimates of income that reflect the households' relative wellbeing.

Equivalised income is derived by calculating an equivalence factor and then dividing income by that factor. The equivalence factor is built up by allocating points to each person in the unit (household or income unit) and summing those points. One (1) point is allocated to the first adult in the unit, 0.5 points for each other person aged 15 and over, and 0.3 points for each person aged under 15. For example: a single person household has a factor of 1. Equivalised income is therefore the same as reported income. A household comprising 2 adults and a child aged under 15 would have a factor of 1.8 (1.0 + 0.5 + 0.3). Equivalised income for this household is therefore the household income divided by 1.8.

Equivalised income in this report is presented in quintiles (that is, in 20% brackets from the lowest income households to the highest income households).

**household tenure:** The financial arrangements under which someone has the right to live in a house/apartment. These are broadly divided into tenancy (rent is paid to a landlord), owner-occupancy in which occupants own the house/apartment, or mixed forms (for example, shared equity scheme).

**household type:** The composition of the household based on information about its residents. Output categories used in this report are:

- person living alone
- couple only (that is, no children)
- couple family with children (includes households with 1 other relative)
- one parent family with children (includes households with 1 other relative)
- other.

**obesity:** Marked degree of overweight, defined for population studies as a **body mass index** of 30 or over. See also **overweight**.

**occupation:** A collection of jobs that are sufficiently similar in their title and tasks, skill level and skill specialisation that are grouped together for the purposes of classification. In this report, an occupation code was assigned, based on the description of the type of work performed by the respondent in their main job. Occupations were classified according to the Australian and New Zealand Standard Classification of Occupations (ANZSCO), with the major groups of occupations being:

- managers
- professionals
- technicians and trades workers
- community and personal service workers
- clerical and administrative workers
- sales workers
- machinery operators and drivers
- labourers.

**older Australians:** Australian adults aged 65 or older.

**overweight:** Defined for the purpose of population studies as a **body mass index** of 25 or over. See also **obesity**.

**parent**: In this report, a parent is defined as a husband, wife, partner or lone parent in a household with a child aged under 15 or a dependent student. As well, in this report, parent was applied only to one-family households in which no non-family members were present.

**social marital status:** Respondents over the age of 18 were considered married if living with another person in a couple relationship, which was reported as either a registered marriage or a de facto relationship. This includes people living with a person of the same sex in a couple relationship. Not married includes respondents over the age of 18 who were not living with another person in a couple relationship. This includes persons living alone, with other family members, or in shared accommodation, and those in a registered or de facto marriage whose partners are not usually resident in the household.

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# Related publications

The following AIHW publications relating to overweight and obesity might also be of interest:

- AIHW 2020. A framework for monitoring overweight and obesity in Australia. Cat. no. PHE 272. Canberra: AIHW.
- AIHW 2020. Australia's health 2020: data insights. Cat. no. AUS 231. Canberra: AIHW.
- AIHW 2020. Overweight and obesity among Australian children and adolescents. Cat. no. PHE 274. Canberra: AIHW.
- AIHW 2020. Overweight and obesity in Australia: an updated birth cohort analysis. Cat. no. PHE 268. Canberra: AIHW.
- AIHW 2020. Overweight and obesity: an interactive insight. Cat. no. PHE 251. Canberra: AIHW.
- AIHW 2019. Data sources for monitoring overweight and obesity in Australia. Cat. no. PHE 244. Canberra: AIHW.
- AIHW 2017. A picture of overweight and obesity in Australia 2017. Cat. no. PHE 216. Canberra: AIHW.

Everyday life such as family circumstances, housing, working conditions, livelihood and education can influence our health and subsequently our chances of developing overweight and obesity. This report explores how the social determinants of health are associated with overweight and obesity in children and adolescents, adults of working age and older Australians. Data presented are based on national health survey data over a 10-year period to explore the associations between social determinants of health and inequalities in overweight and obesity.

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