Trends in preventive health risk factors

Queensland 2002 to 2013

About this report
This report is designed for a technical audience, and assumes knowledge of technical aspects of the measurement and monitoring of selected health behaviours. It assumes familiarity with survey methodologies and the self reported health status (SRHS) survey series. Detailed information about the series is publicly available from
http://www.health.qld.gov.au/epidemiology/publications/phs.asp

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Introduction

Health care costs are the largest component of the budget, with the Queensland Government spending $11,156 million[1] in 2011–12. When both state and Commonwealth funding are combined, recurrent health expenditures totalled $26,729 million in 2011–12.[2] In Australia, over 80% of the burden of disease is due to non-communicable health conditions[3], many of which are associated with modifiable behavioural risk factors. In 2010, the leading risk factors for such conditions in Australia were dietary risks (10.5%), high body mass (8.4%), and smoking (8.3%).[4] Because of the increasing proportion of health expenditure attributable to non-communicable disease, and because such conditions are associated with behavioural risk factors, understanding how risk factors are changing over time is valuable for current and future service and program planning. Systematic surveillance systems are an internationally recognised mechanism for obtaining such information.[5]

In Queensland, the self reported health status (SRHS) surveys were established in 2009 as a formal and ongoing surveillance system to be the primary source for routine monitoring of behavioural risk factors. Prior to 2009, these data were irregularly collected by the Queensland Government Department of Health as part of the Omnibus surveys. An important characteristic of the SRHS surveys that is not evident in other collections is the ability to reliably report at sub-state geography.

Aims

Surveillance systems are frequently used to determine whether behaviours or conditions are increasing, decreasing or remaining the same. Understanding how trends in risk factors are changing over time is required to efficiently allocate limited health resources. Developing programs to reduce risky health behaviours and increase healthy ones is one strategy to reduce overall health costs. Surveillance system data are important for both the design and evaluation of such programs.

The aim of the current report was to conduct trend analysis using 10 years of data from the Omnibus and SRHS surveys. Key health indicators collected consistently during that period were physical activity, smoking, body mass index (BMI), and alcohol consumption. Specific questions were:

- To determine whether the percentage of the adult population engaging in risky health behaviours was increasing, decreasing or not changing.
- To investigate trends by sociodemographic characteristics such as sex, age, socioeconomic status, and geographic region.

Secondary aims of this project were to thoroughly review historic data for consistency in terms of data collection and methodology used to derive key health indicators and to develop a robust analytical approach that would be the foundation of future investigations. This investment builds the capacity of the overall surveillance system. As successive years of data are collected and analysed, our understanding of population level behavioural change will increase.

It was not feasible to undertake all possible analyses using the combined dataset for this report. Therefore, some types of research questions were considered out of scope. Such questions include detailed multivariate analyses, primarily due to limitations of sample size in surveys prior to 2009, and time series analyses, as data were not collected in equally spaced intervals.

Methods summary

Methods are briefly summarised below. Detailed methods are included in Appendix 1: Detailed methods.

The SRHS surveys collect data by computer assisted telephone interviewing (CATI) using random digit dialling. One adult from each eligible household was invited to participate. When a household included multiple eligible adults, the invited participant was selected using the next birthday rule. Questionnaires were developed by the Department of Health with questions based on validated instruments, recommendations from expert working groups, or successful previous use by the Department of Health or other jurisdictions. Survey size varied from 1575–3081 participants (pre-2009 surveys) to between 6881–19,398 participants (2009 onwards). Not all health indicators were included annually.

Compiling the trend dataset

In the 10 years that data have been collected, accountability has resided in two Department of Health units with numerous analysts involved in data collection and analysis. Analysis has been undertaken using three different statistical packages and interviewers to collect data have been both designated Department of Health staff or contracted by external service providers. Verifying that data were consistent and comparable over time was therefore a critical step. First, questionnaires were reviewed to identify any changes to questions or response options. In some cases, new summary variables were developed to create a common variable across all survey years. Second, all statistical code was reviewed. For early surveys, key indicators were frequently recalculated to ensure compatibility with later methodology. Data were only included in the final dataset once these checks were performed and any required recalculations were undertaken. The final dataset contained 75,913 records over 13 years.

Based on this process, the health domains included in this report are:

- smoking
- physical activity
- body mass index
- alcohol consumption.

Additionally, each health indicator is analysed by:

- sex
- age
- socioeconomic indexes for areas (SEIFA)
- accessibility/remoteness index of Australia (ARIA).

Analytical approach

Primary considerations in developing the analytical approach were to facilitate interpretation across a range of stakeholders, to use a consistent methodology across all health indicators if possible, and to ensure that data adhered to the underlying assumptions of the selected methodology. This involved detailed exploratory analysis, visual and statistical tests of the distribution of responses and model fit, and confirmatory analysis. Based on these factors, Poisson regression on data aggregated by year is the primary analytical method. A detailed rationale for this approach is described in Appendix 1: Detailed methods.

Interpretation of results

Chapters are organised by health domains and typically several health indicators are presented for each domain (for example, BMI analysed as the percentage of adults who were obese and BMI analysed as a continuous score). In addition to year, each key health indicator is analysed for associations with sex, age, socioeconomic status and geographic region.

Graphs are included to simplify interpretation across years. Detailed results are also included in tables containing the annual percentage change (APC), the 95% confidence interval (95% CI), and p-values for both individual and overall tests of statistical significance. The APC will be positive when the behaviour is increasing and negative when the behaviour is decreasing. Because data are a sample of the population, a 95% CI is included to indicate the range of values that would contain the true population result 95% of the time if the population were repeatedly sampled. Wide CIs indicate less precise and less reliable results. A 95% CI is also included in the initial graph for each health outcome so that the precision of the data for each year can be assessed.

A p-value is the result of a test of whether a trend was significantly different to no change (with no change being a line that is statistically the same as a horizontal line in the corresponding figure/s). A p-value is included for each category of the sociodemographic characteristics examined. If the p-value is less than 0.05, it indicates the category experienced a significant change during the time period. An overall p-value tests whether there is a significant difference between the categories. For example, for 'sex', APCs, 95% CIs, and p-values are presented for both males and females. The p-values for each sex indicates wether an increase or decrease was observed for males or females, respectively. The overall p-value test indicates whether the trends for males and females was different from each other, for example whether males are increasing at a different rate than females.

Daily smoking summary

Summary

The percentage of adults smoking daily decreased significantly between 2002 and 2013 for persons (both males and females), for younger age groups (18–29 years and 30–44 years), across all socioeconomic groups, and in the northern coastal geographic region.

There was a difference in the rate of decrease between younger males (18–44 years) whose daily smoking is declining significantly compared to older males (45 years or older) among whom no change in smoking was observed.

The rate of decline in daily smoking did not differ by sex, socioeconomic status or geographic region.

About the indicator

The key health indicator for smoking status was daily smoking due to minor modifications in response options for non-daily smoking from 2009 onwards. Additional information is in Appendix 1: Detailed methods.

Available data (years)

2002, 2004, 2006, 2008, 2009, 2010, 2011, 2012, 2013 (2006–2013 for geographic analysis)

Details

From 2002 to 2013, the percentage of daily smokers decreased annually by an average of:

- 2.4% among persons (3.0% males and 1.6% females)
- 4.1% (persons) and 5.0% (males) among 18–29 year olds
- 2.3% (persons) and 2.9% (males) among 30–44 year olds
- 3.8% among 18–44 year old males
- 1.8% (most disadvantaged areas) and 2.5% (rest of Queensland)
- 5.8% among persons in the northern coastal region (2006 to 2013).

The rate of decreasing daily smoking varied by age group for males. Males aged 18–44 years decreased by an average of 3.8% per year compared to no significant change among males aged 45 years and older ($p=0.013$).

The rate of decreasing daily smoking did not vary by sex, age groups (persons or females) or socioeconomic or geographic regions.

Daily smoking results

Information on smoking status has been collected in all self reported health status surveys since 2002. Trends are analysed by sex, age groups, sex by age group, and socioeconomic and geographic regions. Based on these results, trends in sex by age were explored further. Additional results are included in the supplementary figures Figure 8 through Figure 12.

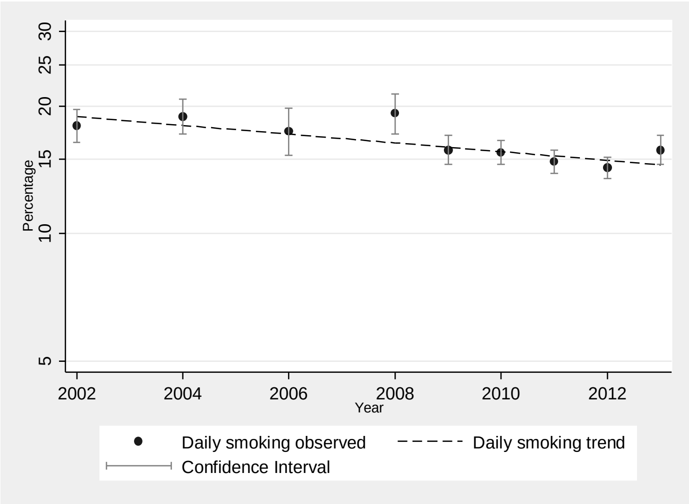


Figure 1: Daily smoking trend

From 2002 and 2013, the percentage of adults who smoked daily decreased by an average of 2.4% per year ($p<0.001$) or 23.3% for the entire period.

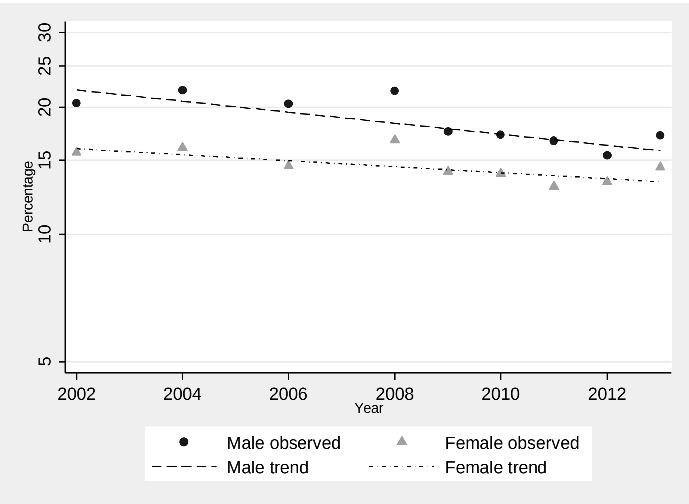


Figure 2: Daily smoking trend by sex

The percentage of adult daily smokers decreased annually by an average of:

- 3.0% for males ($p<0.001$)
- 1.6% for females ($p=0.015$).

No difference was observed in the rate of decline between males and females ($p=0.129$), however when adjusted by education, employment and marital status this did achieve statistical significance ($p=0.047$, refer Table 21). Additional analysis is presented in Figure 6.

On average, the prevalence of daily smoking was 19.5% (95%CI 14.8–24.0%) lower for females than for males ($p<0.001$).

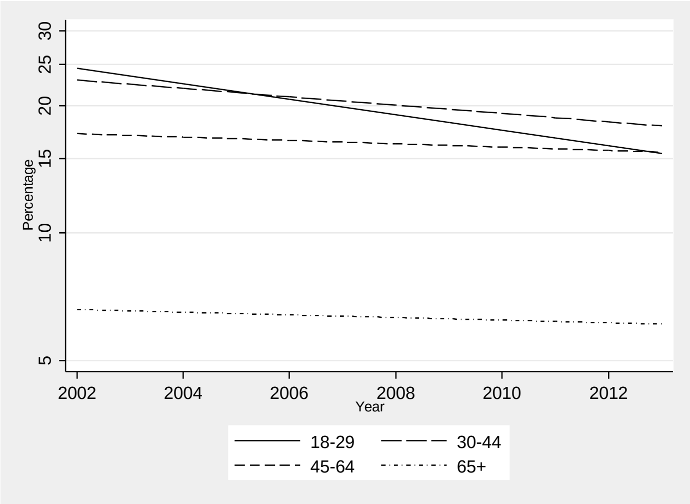


Figure 3: Daily smoking trend by age group

The percentage of adult daily smokers decreased annually by an average of:

- 4.1% (persons) and 5.0% (males) for 18–29 year olds
- 2.3% (persons) and 2.9% (males) for 30–44 year olds.

Compared to 18–29 year olds, the prevalence of daily smoking was, on average:

- 11.0% (95%CI 3.1–18.4%, p=0.008) lower for 45–64 year olds
- 65.2% (95%CI 61.3–68.6%, p<0.001) lower for those 65 years and older.

The rate of decrease by age group approached statistical significance (p=0.060), and was investigated further (see Figure 6).

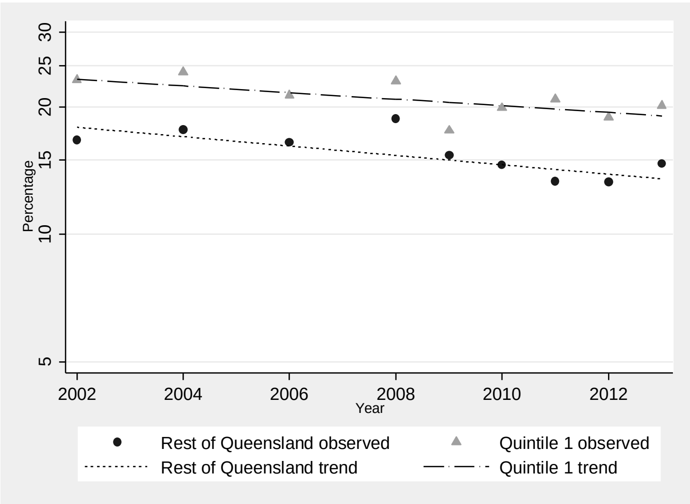


Figure 4: Daily smoking trend by socioeconomic status

The percentage of adult daily smokers decreased annually by an average of:

- 1.8% among persons in the most disadvantaged areas (quintile 1)
- 2.5% among persons in the rest of Queensland (quintiles 2–5).

No difference was observed in the rate of decrease between the most socioeconomically disadvantaged areas and the rest of Queensland (p=0.471).

Additional analyses were conducted comparing the most disadvantaged areas to the most advantaged (see Figure 7).

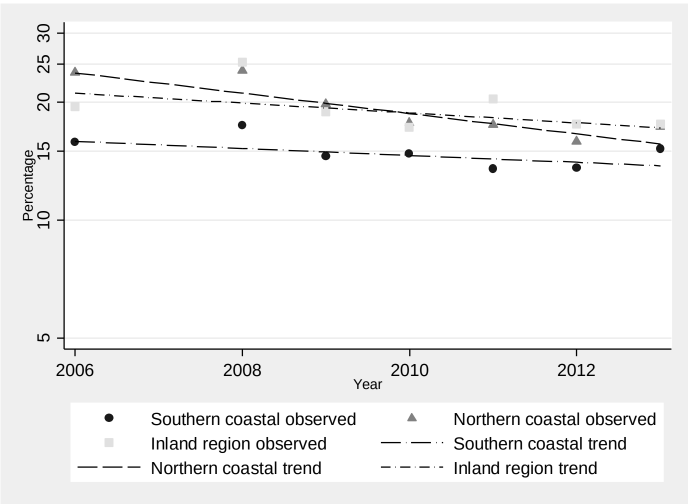


Figure 5: Daily smoking trend by geographic region

Among adults in the northern coastal region, the percentage of daily smokers decreased by an average of 5.8% per year (p=0.002).

No difference was observed in the rate of decrease between geographic regions (p=0.211).

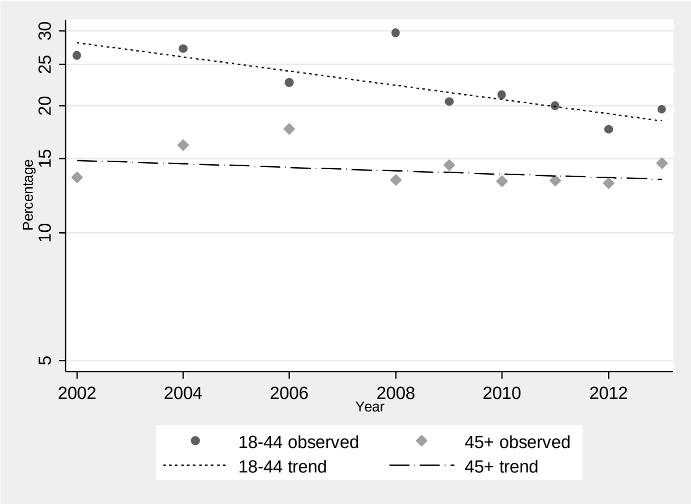


Figure 6: Age group difference for males

The rate of decline in daily smoking varied by age group among males (p=0.013). Males aged 18–44 years declined by an average of 3.8% per year while males aged 45 years and older had no significant change.

Additional results adjusted by education, employment and marital status are included in Table 21.

No difference was observed in the rate of decrease in these age groups for females (p=0.481).

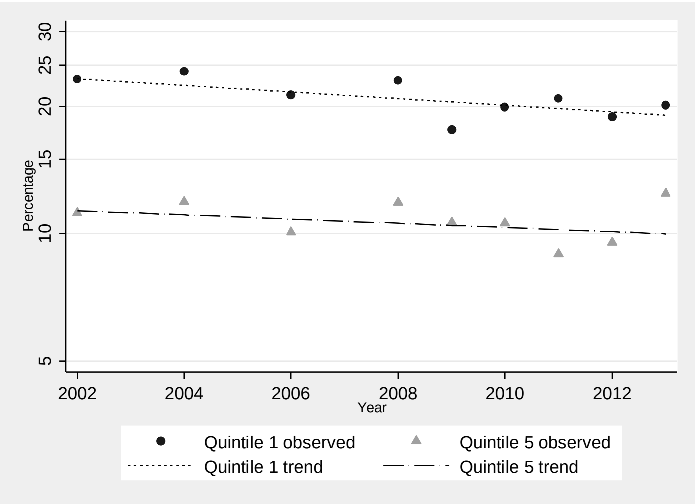


Figure 7: Daily smoking by socioeconomic status, most advantaged and most disadvantaged

No difference was observed in the rate of decrease in daily smoking between adults in the most disadvantaged areas (quintile 1) compared to those in the most advantaged (quintile 5, p=0.670).

Table 1 presents detailed results for the preceding figures. Supplementary figures (Figure 8 through Figure 12) contain results for age by: sex, socioeconomic status, and geographic region; and sex by: socioeconomic status and geographic region. No significant differences in the rate of decline were observed for these characteristics.

Table 1: Daily smoking trends 2002–2013

	Average annual[1] %	(95%CI)	Test for *p*-value[2]	Test for *p*-value[3]
Persons	-2.4	(-3.2, -1.5)	<0.001	
Sex				
Males	-3.0	(-4.1, -1.8)	<0.001	0.129
Females	-1.6	(-2.9, -0.3)	0.015	
Age category—persons				
18–29	-4.1	(-6.2, -2.0)	<0.001	0.060
30–44	-2.3	(-3.6, -0.9)	0.001	
45–64	-0.9	(-2.2, 0.4)	0.179	
65 years or older	-0.7	(-3.4, 2.0)	0.605	
Age category—males				
18–29	-5.0	(-7.6, -2.3)	<0.001	0.059
30–44	-2.9	(-4.8, -1.1)	0.002	
45–64	-0.8	(-2.6, 1.1)	0.395	
65 years or older	-0.8	(-4.4, 3.0)	0.687	
Age category—females				
18–29	-2.7	(-6.0, 0.7)	0.113	0.816
30–44	-1.3	(-3.3, 0.8)	0.221	
45–64	-1.0	(-2.8, 0.9)	0.315	
65 years or older	-0.6	(-4.4, 3.5)	0.785	
Age category—males				
18–44	-3.8	(-5.3, -2.2)	<0.001	0.013
45 years or older	-0.9	(-2.6, 0.7)	0.274	
Socioeconomic advantage/disadvantage				
Most disadvantaged—persons	-1.8	(-3.5, -0.1)	0.042	0.471
Rest of Queensland—persons	-2.5	(-3.5, -1.5)	<0.001	
Most disadvantaged—persons	-1.8	(-3.5, -0.1)	0.042	0.670
Most advantaged—persons	-1.1	(-3.6, 1.4)	0.374	
Most disadvantaged—males	-2.0	(-4.3, 0.4)	0.107	0.754
Most disadvantaged—females	-1.4	(-3.9, 1.1)	0.279	
Rest of Queensland—males	-3.3	(-4.6, -2.0)	<0.001	0.093
Rest of Queensland—females	-1.6	(-3.1, -0.1)	0.040	
Geographic regions[4]				
Southern coastal	-2.0	(-4.2, 0.1)	0.065	0.211
Northern coastal	-5.8	(-9.3, -2.2)	0.002	
Inland region	-2.9	(-7.1, 1.5)	0.199	

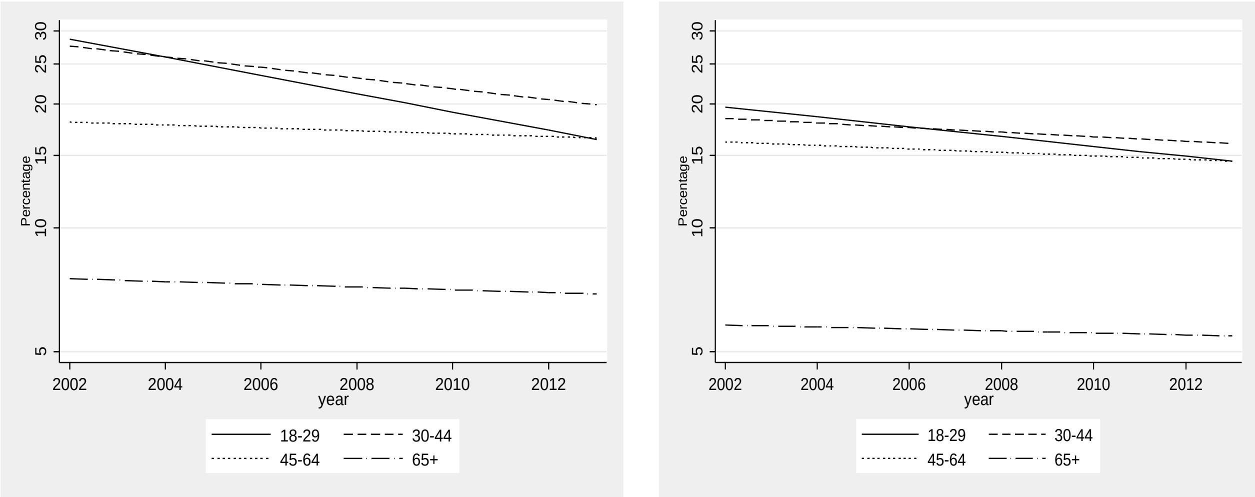
[1] Positive values represent annual percentage increases; negative values represent annual percentage decreases.
[2] Tests whether there is a statistically significant increase or decrease in trend over time.
[3] Tests whether there is significant difference in the trend over time between subgroups (for example, males vs. females).
[4] Trends by geographic region are for 2006—2013.

Table 2 presents results for differences in trends by combinations of sociodemographic characteristics. Each combination is analysed by year so represents three way interactions terms. No significant differences were observed.

Table 2: Daily smoking multivariate trend results

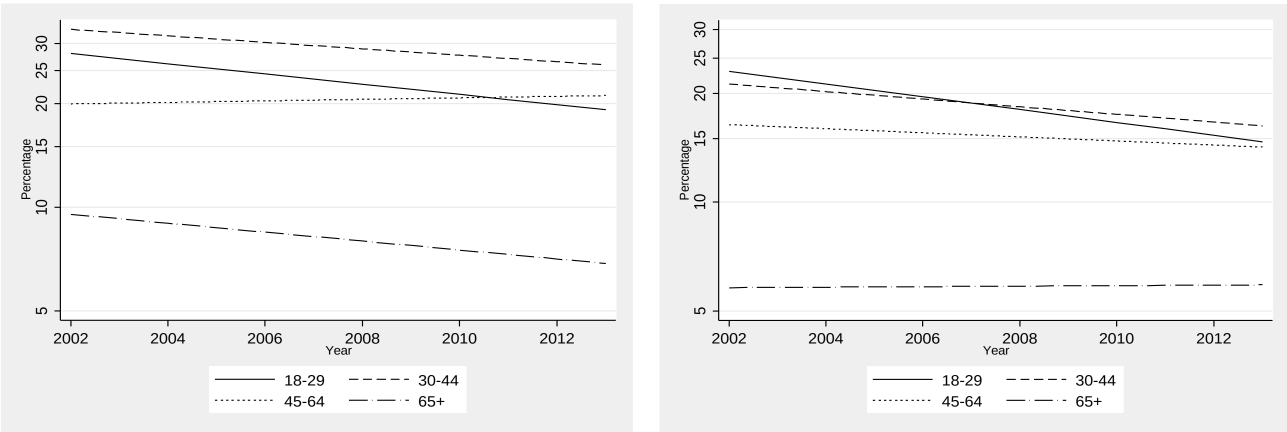
Sociodemographic characteristics	p-value	
Age by sex	0.191	Figure 8
Age by socioeconomic status	0.686	Figure 9
Sex by socioeconomic status	0.410	Figure 10
Geographic region by sex	0.184	Figure 11
Age by geographic region	0.428	Figure 12

Daily smoking supplementary figures



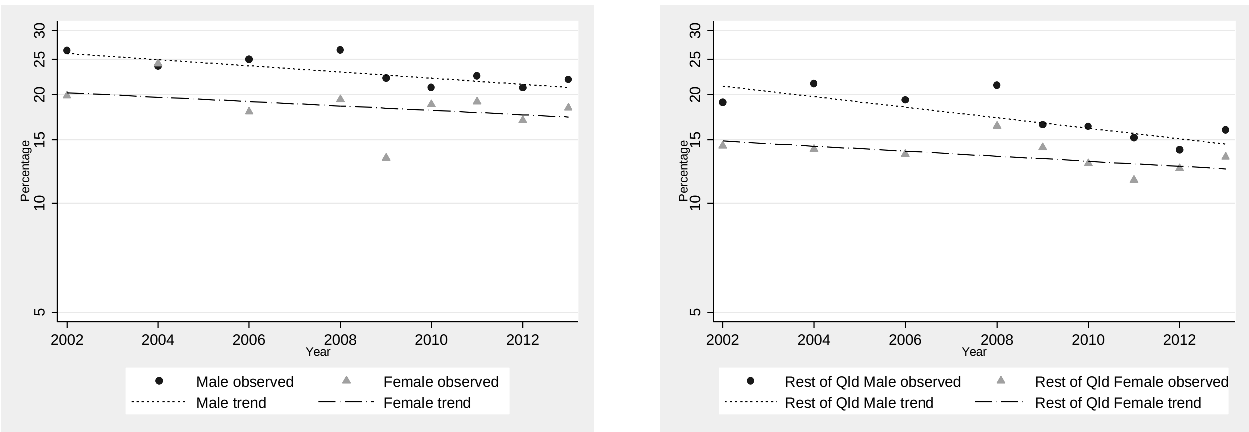
Males Females

Figure 8: Age by sex trends in daily smoking (p=0.191)



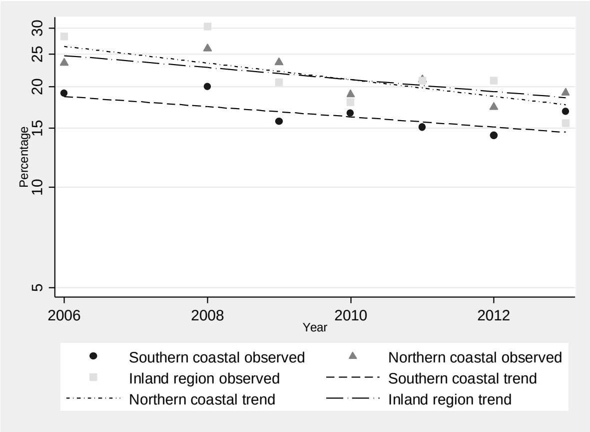
Most disadvantaged Rest of Queensland (quintiles 2–5)

Figure 9: Age by socioeconomic status trends in daily smoking (p=0.686)

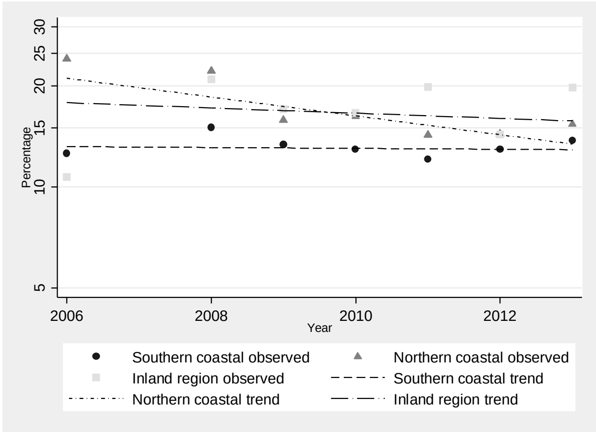


Most disadvantaged Rest of Queensland (quintiles 2–5)

Figure 10: Sex by socioeconomic status trends in daily smoking (p=0.410)

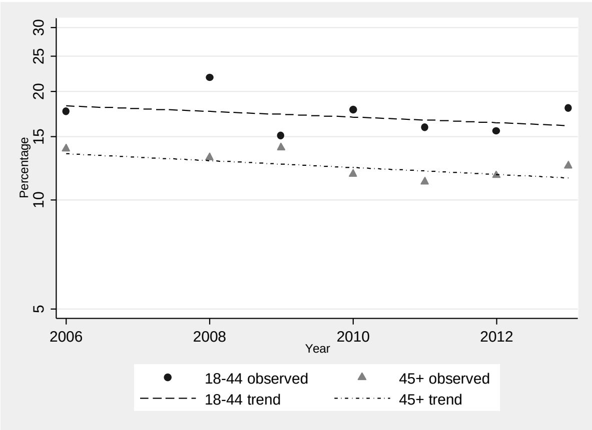


Males

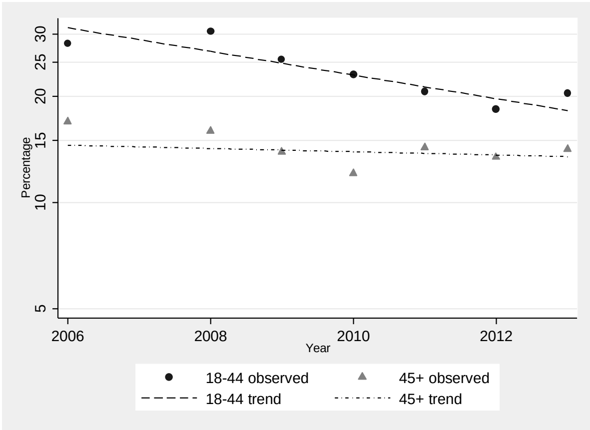


Females

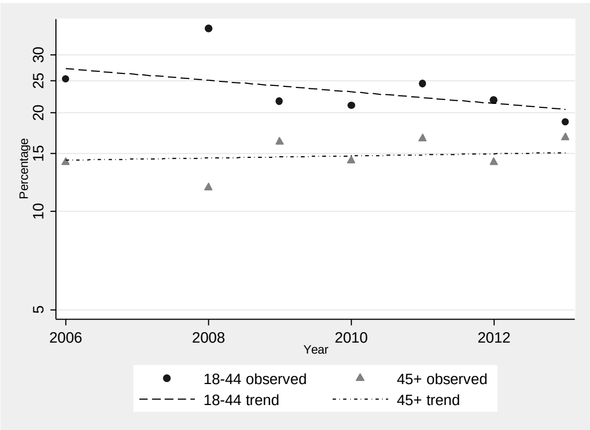
Figure 11: Geographic region by sex trends in daily smoking (p=0.184)



Southern coastal region



Northern coastal region



Inland region

Figure 12: Age by geographic region trends in daily smoking (p=0.428)

Physical activity summary

Summary

The percentage of adults achieving sufficient physical activity for health benefit increased significantly between 2004 and 2013 for persons (both males and females), for most age groups, and for most socioeconomic and geographical regions.

The percentage of adults achieving sufficient physical activity for health benefit increased substantially from 2004 to 2008 but has slowed considerably since 2009.

There were differences in the rate of increase by socioeconomic status for persons. Adults in the most disadvantaged quintile are now approaching sufficient physical activity levels observed in the rest of Queensland. This is principally due to a levelling off in the rate of increase among males from more advantaged areas.

The rate of increase did not differ by sex, age group, or geographic region.

Detailed analysis by age has shown that trends in the percentage of adults achieving sufficient physical activity vary little by age.

About the indicator

Sufficient physical activity data were collected using the Active Australia instrument and were analysed to enable reporting against the 1999 Department of Health and Ageing national physical activity guidelines for adults.[6]

Available data (years)

2004, 2006, 2008, 2009, 2010, 2011, 2012, 2013 (2006–2013 for geographic analysis)

Details

The trend for this indicator had a distinct pattern of a steep increase in early years of data collection which levelled off in later years. This curvilinear relationship complicated translation into annual percentage change. To better depict the trend, it was divided into two segments with an annual percentage change of approximately 7.3% from 2004–2008 and 1.5% from 2009–2013.

From 2004 to 2013, the percentage achieving sufficient physical activity increased annually among:

- persons, males and females
- persons aged 18–29 years, 30–44 years, 45–64 years, and also 18–44 years, 45–75 years
- males aged 18–29 years, 30–44 years, 45–64 years
- females aged 30–44 years, 45–64 years
- persons, males and females from most socioeconomic groups.

From 2006 to 2013, the percentage achieving sufficient physical activity increased annually in the southern coastal and inland regions.

The rate of increase varied by socioeconomic status for persons, primarily attributable to differences among males.

The rate of increasing physical activity was higher among:

- persons in the most disadvantaged areas compared to persons in the most advantaged areas ($p=0.025$)
- males in the most disadvantaged areas compared to males in the remaining socioeconomic areas ($p=0.038$)
- males in the most disadvantaged areas compared to males in the most advantaged areas ($p=0.015$).

The rate of increase did not vary by sex, age groups, or socioeconomic (females) or geographic regions.

Physical activity results

The percentage of adults achieving sufficient physical activity for health benefit increased significantly between 2004 and 2013 for persons, males, females, for most age groups, and for most socioeconomic and geographic regions.

Sufficient physical activity prevalence has been increasing since 2004 but has begun to level off since 2009. From 2004 to 2008 sufficient physical activity was increasing by an average of 7.3% per year but has slowed considerably to an average of 1.5% per year since 2009. While significant increases occurred between 2004 and 2008, there was no significant change in the percentage achieving sufficient physical activity since 2009 for most population groups.

Trends are analysed by sex, age groups, sex by age group, and socioeconomic and geographic regions. Based on these results, trends in sex by socioeconomic status were explored further. Additional results are included in the supplementary figures Figure 23 through Figure 27.

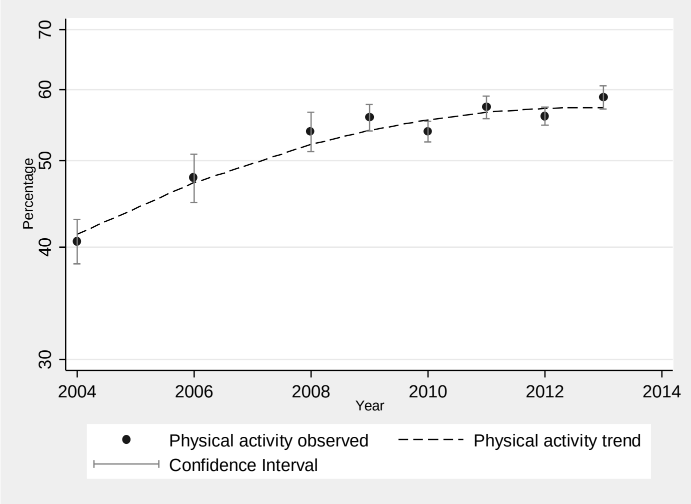


Figure 13: Sufficient physical activity trend

From 2004 to 2013, the percentage of adults achieving sufficient physical activity for health benefit has increased ($p<0.001$), however, the rate of increase has slowed since 2009.

Sufficient physical activity increased annually by an average of approximately:

- 7.3% per year from 2004 to 2008
- 1.5% per year since 2009.

Sufficient physical activity has increased by 38.6% over the entire period.

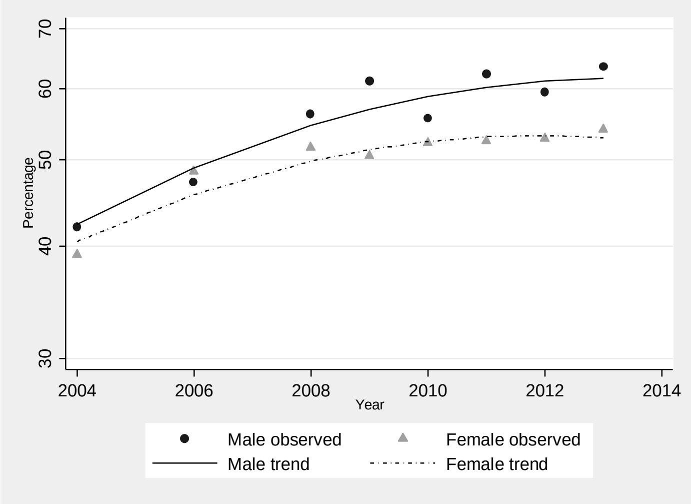


Figure 14: Sufficient physical activity trend by sex

The percentage of adults who were sufficiently physically active increased annually among:

- males ($p<0.001$)
- females ($p<0.001$).

No difference was observed in the rate of increase between males and females ($p=0.125$) over the entire time period. However this does become significant when adjusted by marital status, education and employment ($p=0.011$ Table 22) and is investigated further in Figure 18 to Figure 22

On average, the prevalence of sufficient physical activity was 11.0% (95% CI 8.0–14.0%) lower for females than for males.

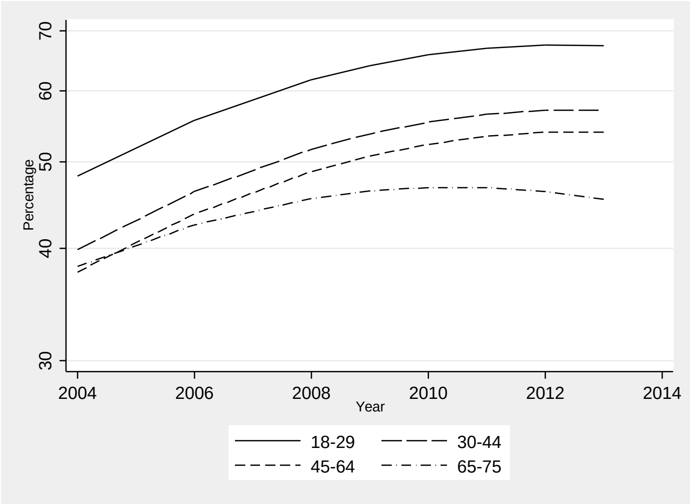


Figure 15: Sufficient physical activity trend by age group

The percentage of adults who were sufficiently physically active increased annually among:

- 18–29 year old persons and males
- 30–44 year old persons, males and females
- 45–64 year old persons, males and females.

No difference was observed in the rate of increase between age groups (p=0.280) over the entire time period.

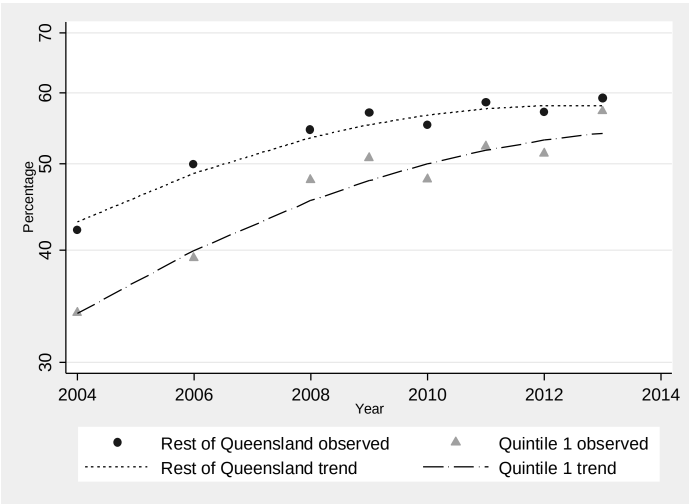


Figure 16: Sufficient physical activity trend by socioeconomic status

The percentage of adults who were sufficiently physically active increased annually among:

- persons in the most disadvantaged areas
- persons in the rest of Queensland (quintiles 2–5).

The difference in the rate of increase over the entire time period approached statistical significance (p=0.070) and achieved significance when adjusted by marital status, education and employment (p=0.015 Table 22). Further analysis of sex by socioeconomic status was undertaken and is presented in Figure 18 through Figure 22.

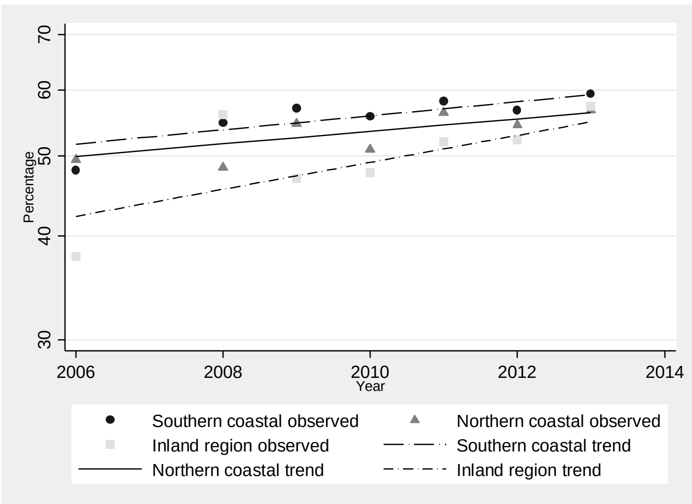


Figure 17: Sufficient physical activity trend by geographic region

From 2006 to 2008, the percentage of adults who were sufficiently physical activity increased annually among:

- persons in the southern coastal region
- persons in the inland region.

No difference was observed in the rate of increase between geographic regions (p=0.508).

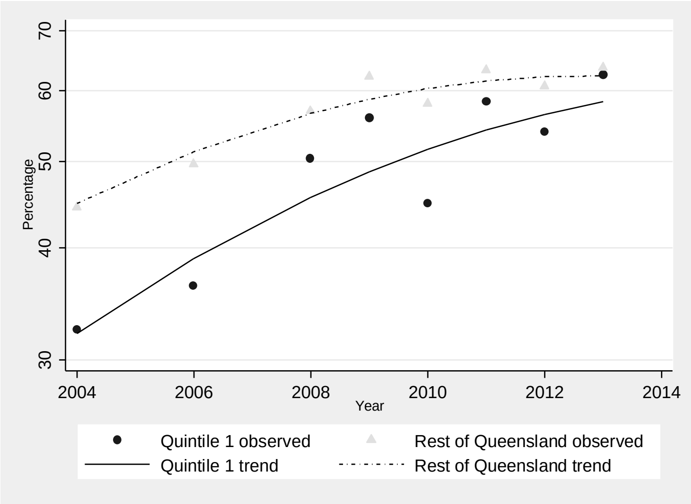


Figure 18: Sufficient physical activity trends by socioeconomic status for males

The percentage of adults who were sufficiently physically active increased annually among:

- males in the most disadvantaged areas
- males in the rest of Queensland (quintiles 2–5).

On average, the percentage of physically active males in the most disadvantaged areas was 13.1% (95%CI 7.6–18.3%) lower than in males in the rest of Queensland (p<0.001).

The rate of increase was significantly higher for males in the most disadvantaged areas compared to males in the rest of Queensland (p=0.038). This indicates that the difference in physical activity has narrowed over time.

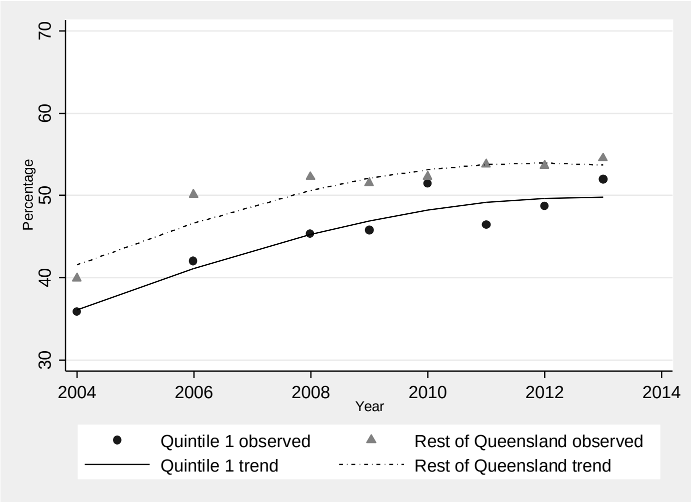


Figure 19: Sufficient physical activity trends by socioeconomic status for females

The percentage of adults who were sufficiently physically active increased annually among:

- females in the most disadvantaged areas
- females in the rest of Queensland (quintiles 2–5).

On average, the percentage of physically active females in the most disadvantaged areas was 8.9% (95%CI 3.0–14.5%) lower than in females in the rest of Queensland (p=0.004).

No difference was observed in the rate of increase between females in the most disadvantaged areas compared to females in the rest of Queensland (p=0.615).

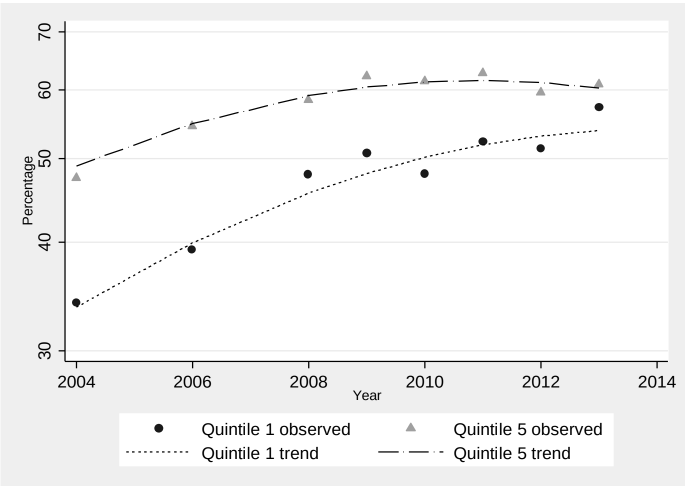


Figure 20: Sufficient physical activity trends in the most advantaged and most disadvantaged areas

The percentage of adults who were sufficiently physically active increased annually among:

- persons in the most disadvantaged areas
- persons in the most advantaged areas.

On average, the percentage of physically active persons in the most advantaged areas was 20.3% (95%CI 13.8-27.1%) higher than in persons in the most disadvantaged areas (p<0.001).

The rate of increase was significantly higher for persons in the most disadvantaged areas compared to persons in the most advantaged areas (p=0.025). Again, this indicates that the difference in physical activity is narrowing over time.

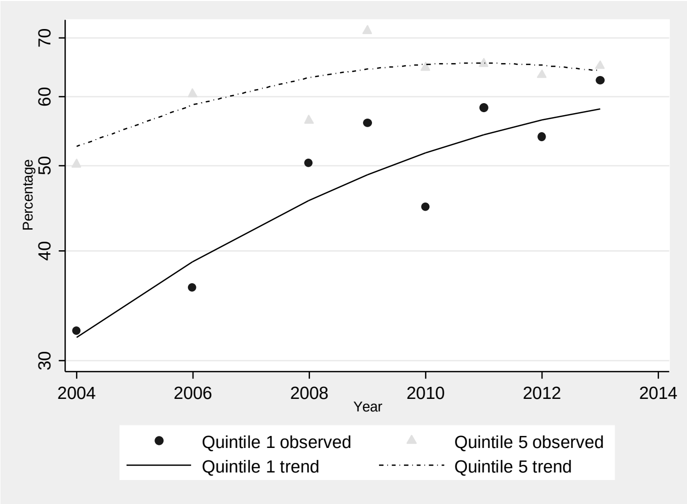


Figure 21: Sufficient physical activity trends in the most advantaged and most disadvantaged areas for males

The percentage of adults who were sufficiently physically active increased annually among males in the most disadvantaged areas.

The percentage of physically active males in the most advantaged areas was on average 23.4% (95%CI 14.3–33.3%) higher than in males in the most disadvantaged areas ($p<0.001$).

The rate of increase was significantly higher for males in the most disadvantaged areas compared to males in the most advantaged areas ($p=0.015$), indicating that the difference in physical activity is narrowing over time.

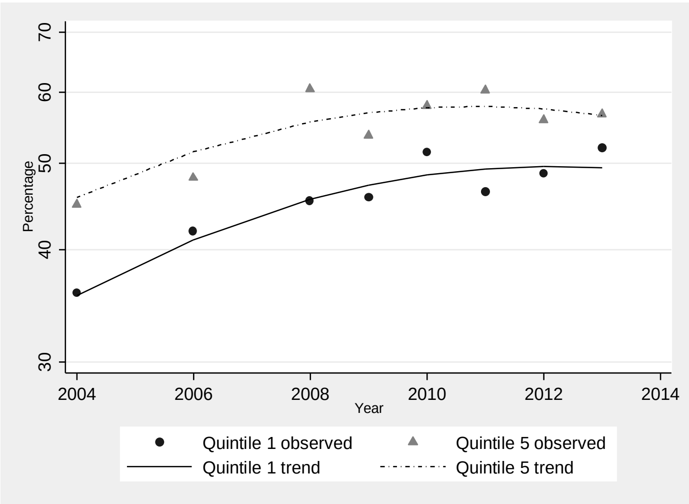


Figure 22: Sufficient physical activity trends in the most advantaged and most disadvantaged areas for females

The percentage of adults who were sufficiently physically active increased annually among females in the most disadvantaged areas.

The percentage of physically active females in the most advantaged areas was on average 18.1% (95%CI 9.1–27.8%) higher than in females in the most disadvantaged areas ($p<0.001$).

No difference was observed in the rate of increase between females in the most disadvantaged areas compared to females in the most advantaged areas ($p=0.481$). Therefore changes in physical activity between socioeconomic groups are largely attributable to males.

Table 3 presents detailed results for the preceding figures. Because of the curvilinear relationship between sociodemographic characteristics and physical activity, it is difficult to translate the results into a single average annual percentage change estimate. In order to provide this measure, the data were divided into two time periods (2004–2008 and 2009–2013) and analysed separately. This is provided in Table 3 for descriptive purposes only. All trends were analysed across the entire time period.

Table 3: Sufficient physical activity trends 2004–2013

	2004-2008 Average annual percentage change[1] %	(95%CI)	2009-2013 Average annual percentage change[1] %	(95%CI)	Test for trend for each subgroup[2] *p*-value	Test for trend differences between subgroups[3] *p*-value
Persons	7.3	(4.5, 10.2)	1.5	(0.1, 3.0)	<0.001	
Sex						
Males	7.5	(3.5, 11.6)	1.6	(-0.4, 3.6)	<0.001	0.125
Females	7.1	(3.2, 11.1)	1.4	(-0.8, 3.5)	<0.001	
Age category—persons						
18–29	5.3	(-1.1, 12.0)	2.9	(-1.1, 7.1)	0.001	0.280
30–44	8.0	(3.4, 12.9)	1.9	(-0.7, 4.5)	<0.001	
45–64	9.7	(5.3, 14.4)	0.7	(-1.2, 2.7)	<0.001	
65–75 years	2.1	(-4.9, 9.5)	0.1	(-2.9, 3.2)	0.279	
Age category—males						
18–29	8.1	(-0.7, 17.6)	2.5	(-2.5, 7.8)	0.009	0.322
30–44	7.0	(0.2, 14.3)	2.0	(-1.6, 5.8)	<0.001	
45–64	9.4	(2.8, 16.4)	0.7	(-2.0, 3.5)	<0.001	
65–75 years	0.3	(-8.7, 10.2)	0.8	(-3.3, 5.0)	0.550	
Age category—females						
18–29	2.5	(-6.6, 12.4)	3.2	(-2.9, 9.8)	0.120	0.654
30–44	8.6	(2.4, 15.1)	1.6	(-1.9, 5.4)	0.011	
45–64	10.1	(4.2, 16.4)	0.7	(-2.0, 3.5)	<0.001	
65–75 years	4.1	(-6.2, 15.6)	-0.7	(-5.1, 3.8)	0.481	
Age category—persons						
18–44	6.8	(2.9, 10.9)	2.2	(-0.1, 4.5)	<0.001	0.726
45–75 years	8.2	(4.3, 12.1)	0.4	(-1.2, 2.0)	<0.001	
Socioeconomic advantage/disadvantage						
Most disadvantaged—persons	8.7	(1.1, 16.9)	3.1	(-0.2, 6.6)	<0.001	0.070
Rest of Queensland—persons	6.7	(3.7, 9.7)	1.2	(-0.4, 2.8)	<0.001	
Most disadvantaged—males	11.5	(0.4, 23.8)	4.8	(0.1, 9.7)	<0.001	0.038
Rest of Queensland—males	6.4	(2.2, 10.8)	1.0	(-1.1, 3.2)	<0.001	
Most disadvantaged—females	5.9	(-4.2, 17.1)	1.5	(-3.2, 6.4)	0.028	0.615
Rest of Queensland—females	6.9	(2.7, 11.2)	1.3	(-1.0, 3.8)	<0.001	
Most disadvantaged—persons	8.7	(1.1, 16.9)	3.1	(-0.2, 6.6)	<0.001	0.025
Most advantaged—persons	5.2	(-1.0, 11.9)	-0.9	(-4.0, 2.4)	0.018	
Most disadvantaged—males	11.5	(0.4, 23.8)	4.8	(0.1, 9.7)	<0.001	0.015
Most advantaged—males	2.8	(-5.8, 12.1)	-1.8	(-6.0, 2.5)	0.111	
Most disadvantaged—females	5.9	(-4.2, 17.1)	1.5	(-3.2, 6.4)	0.028	0.481
Most advantaged—females	8.0	(-1.1, 17.9)	-0.1	(-4.7, 4.7)	0.140	
Geographic regions[4]						
Southern coastal			2.0	(0.8, 3.2)	0.001	0.508
Northern coastal			1.8	(-0.5, 4.1)	0.131	
Inland region			3.8	(0.8, 6.9)	0.012	

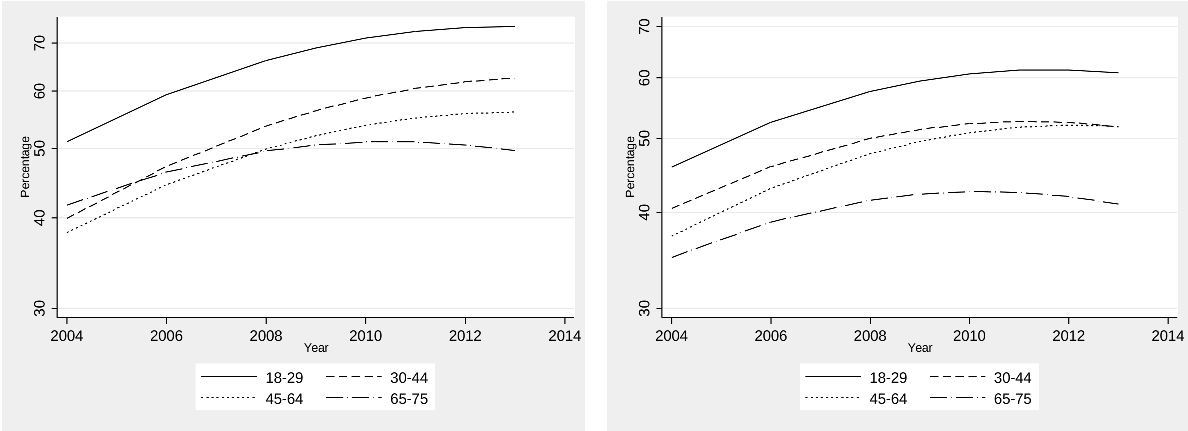
[1] Positive values represent annual percentage increases; negative values represent annual percentage decreases.
[2] Tests whether there is a statistically significant increase or decrease in trend over time.
[3] Tests whether there is significant difference in the trend over time between subgroups (for example, males vs. females).
[4] Trends by geographic region are for 2006—2013.

Table 4 presents results for differences in trends by combinations of sociodemographic characteristics. Each combination is analysed by year so represents three way interactions terms. No significant differences were observed.

Table 4: Physical activity multivariate trend results

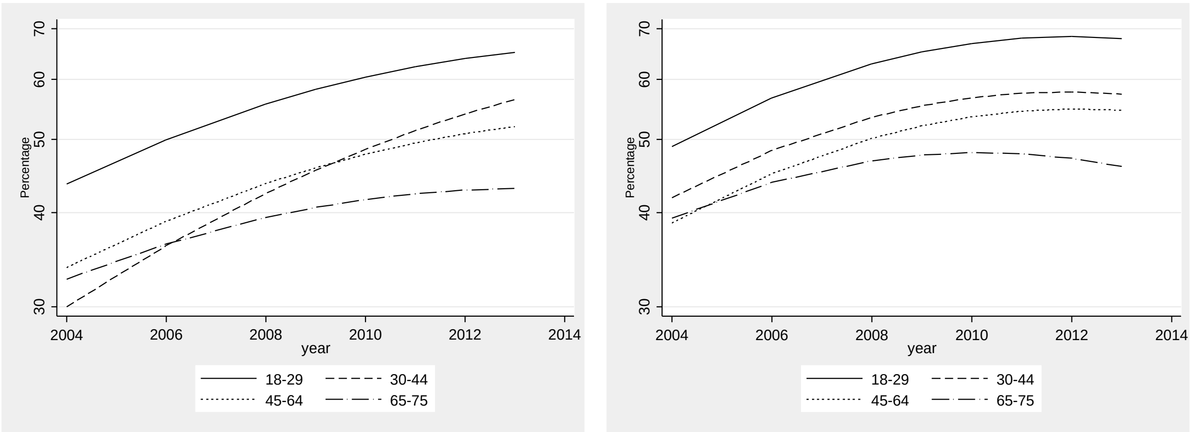
Sociodemographic characteristics	*p*-value	
Age by sex	0.264	Figure 23
Age by socioeconomic status	0.294	Figure 24
Sex by socioeconomic status	0.136	Figure 25
Geographic region by sex	0.448	Figure 26
Age by geographic region	0.713	Figure 27

Physical activity supplementary figures



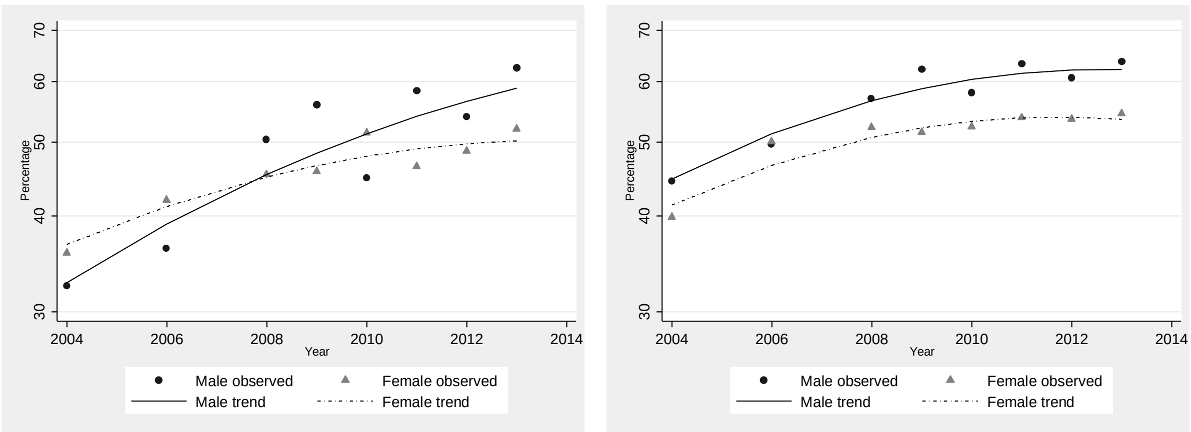
Males Females

Figure 23: Age by sex trends in sufficient physical activity (p=0.264)



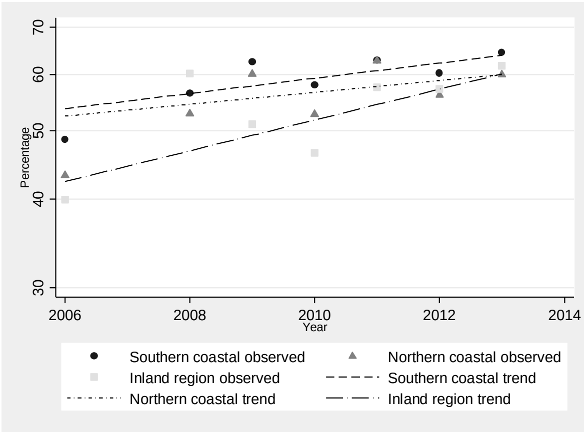
Most disadvantaged Rest of Queensland (quintiles 2–5)

Figure 24: Age by socioeconomic status trends in sufficient physical activity (p=0.294)

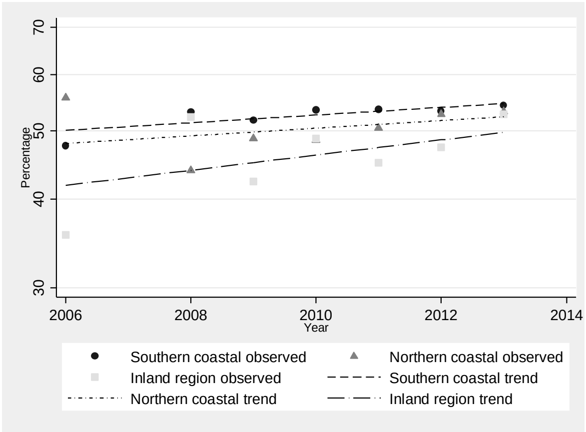


Most disadvantaged Rest of Queensland (quintiles 2–5)

Figure 25: Sex by socioeconomic status trends in sufficient physical activity (p=0.136)

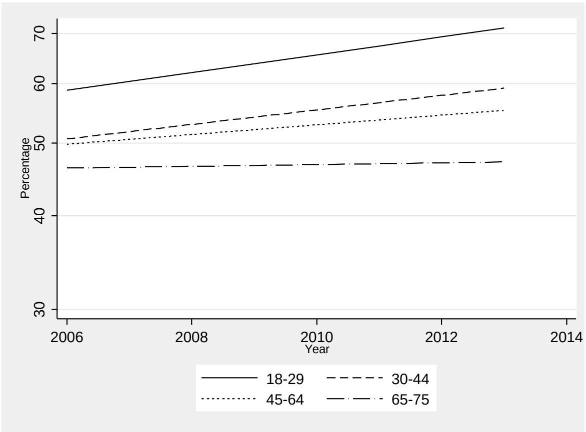


Males

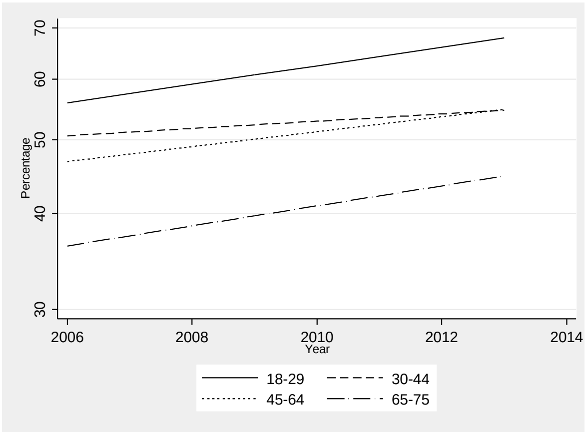


Females

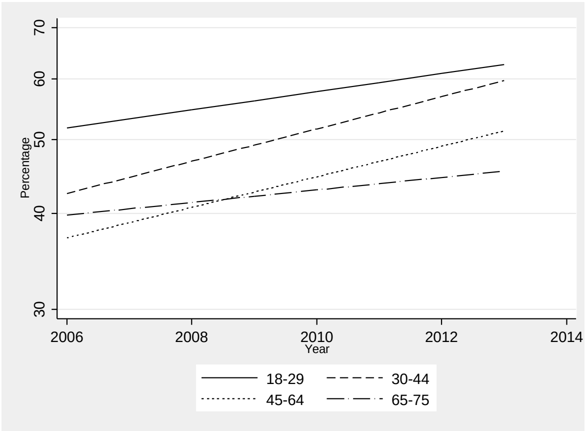
Figure 26: Geographic region by sex trends in sufficient physical activity (p=0.448)



Southern coastal region



Northern coastal region



Inland region

Figure 27: Age by geographic region trends in daily smoking (p=0.713)

Body mass index (BMI) summary

Summary

Obesity

The percentage of obese adults increased significantly between 2004 and 2013 for persons (both males and females), for most age groups and for most socioeconomic and geographic regions.

It is known that obesity increases with age and that the proportion of older Queenslanders is also increasing. Analysis shows that the observed increases are not due to the ageing population.

The rate of increase in obesity did not differ by sex, age groups, or socioeconomic or geographic regions.

Overweight and obesity

The percentage of overweight or obese adults increased significantly between 2004 and 2013 for persons (both males and females), most age groups and most socioeconomic and geographic regions.

As observed for obesity, analysis shows that the observed increases are not due to the ageing population.

There was a difference in the rate of increase by sex in the most disadvantaged socioeconomic quintile where the percentage of adults who were overweight or obese has increased for females where no change was observed for males.

The rate of increase in overweight and obesity did not differ by sex, age groups, or for persons by socioeconomic or geographic regions.

BMI

BMI increased significantly between 2004 and 2013 for persons, males, females, across all age groups and most socioeconomic and geographic categories. On average BMI increased by 107g/m^2 per year which equates to an average of about 3kg of weight gain by Queensland adults over the last decade.

There is a difference in the rate of increase for females in the most disadvantaged socioeconomic quintile where BMI is increasing significantly faster than males. A large but non-significant difference was also observed by geographic region for females where BMI for females in the northern coastal region increased faster than for those in the rest of Queensland even after accounting for differences in socioeconomic status between regions.

The rate of increase in BMI did not differ significantly by sex, age groups, or for persons by socioeconomic or geographic regions.

Age and increasing BMI

The proportion of adults at an unhealthy weight increases with age. This increase is rapid in a person's twenties, levels off by the late twenties, and then increases at a much reduced rate up until the mid-sixties. The rapid increase in the early twenties is similar in males and females although on average females have a lower proportion at an unhealthy weight. After the late twenties, however, females increase at a faster rate than males. By the mid-sixties, females have nearly caught up to the proportion of males at an unhealthy weight.

Assuming long term consistency in the rapid increase in the proportion of overweight and obesity in one's 20s, results suggest that by the age of 65, over 85% of overweight or obese males and over 65% of overweight or obese females will have been an unhealthy weight for 35–40 years.

About the indicator

Overweight and obesity were analysed using body mass index calculated by

$$BMI = \frac{wt(kg)}{ht(m)^2}$$

As recommended by the World Health Organisation[7] BMI score is then categorised as:

- Underweight: less than 18.5
- Healthy weight: 18.5 to 24.9
- Overweight: 25.0 to 29.9
- Obese: greater than or equal to 30.0.

When self reported weight is compared to measured weight, it is often underestimated. This tends to lower BMI scores and under represent the true prevalence of overweight and obesity. Even though prevalence estimates are conservative, trends are typically similar between the two types of measurement.

Changes over time in body mass index were investigated using a variety of measures.

This report presents trends in the BMI weight categories of obesity, and overweight and obese as a combined category. BMI score is also examined as a continuous variable.

Because weight tends to increase with age, age-standardised results were reported in some cases. Such instances are clearly indicated. Age standardisation is a technique that controls for the effects of an ageing population.

Available data (years)

2004, 2006, 2008, 2009, 2010, 2011, 2012, 2013 (2006–2013 for geographic analysis)

Details—Obesity

From 2004 to 2013, the percentage obese adults increased annually by an average of:

- 3.0% among persons (2.8% males and 3.2% females)
- 2.4% (persons) and 3.1% (females) among 30–44 year olds
- 2.5% (persons) and 3.1% (females) among 45–64 year olds
- 4.5% (persons), 4.4% (males) and 4.4% (females) among persons aged 65 and over
- 4.2% (most disadvantaged areas) and 2.6% (rest of Queensland)
- 5.1% among persons from northern coastal region and 2.1% in the southern coastal region (2006 to 2013).

The rate of increasing obesity did not vary by sex, age groups, or socioeconomic or geographic regions.

Details—Overweight and obesity

From 2004 to 2013, the percentage of overweight or obese adults increased annually by an average of:

- 1.6% among persons (1.0% males and 2.3% females)
- 1.4% (persons) and 2.6% (females) among 30–44 year olds
- 1.8% (persons) and 2.0% (males) among persons aged 65 and over
- 3.3% among females in the most disadvantaged areas.

The rate of increasing overweight and obesity varied among females in the most disadvantaged socioeconomic areas. Among those females, it increased by 3.3% per year compared to no significant change for males from the most disadvantaged areas (p=0.045).

The rate of increase did not vary by sex, age group or for persons by socioeconomic or geographic regions.

Details—BMI

From 2004 to 2013, BMI increased annually among:

- persons by 306g per year weight gain (based on increases of 107g/m^2)
- males by 267g per year (based on increases of 87g/m^2)
- females by 321g per year (based on increases of 125g/m^2)
- adults aged 18–29 years by 220g per year, 30–44 year olds by 421g per year, 45–64 year olds by 204g per year and 435g per year among those age 65 years and older (based on increases of 74g/m^2, 107 g/m^2, 99 g/m^2, and 124 g/m^2, respectively)
- males aged 30–44 years by 277g per year and 45–64 year old males by 225g per year (based on increases of 61g/m^2 and 99g/m^2, respectively)
- females aged 30–44 year olds by 485g per year, 45–64 year olds females by 290g per year and 390g per year among females age 65 years and older (based on increases of 147 g/m^2, 98 g/m^2, and 145 g/m^2, respectively)
- persons in the most disadvantaged areas by 281g per year (based on increases of 137g/m^2).

There were significant differences in the rate of BMI increase between males and females in the most disadvantaged areas (p=0.005, Table 9). Males in these areas increased by about 197g per year (based on increases of 60.1g/m^2) while females increased by about 544g per year (based on increases of 211g/m^2)

When results are adjusted by socioeconomic characteristics, there was a large differences in the rate of BMI increase between geographic regions for females. Females in the northern coastal region increased by 1.6kg per year (based on increases of 269g/m^2; p=0.002, Table 25) while no change was observed for females in the inland region and non-significant increases in the southern region.

The rate of increase did not vary by sex, age group or for persons by socioeconomic areas.

Details—Age and increasing BMI

Since 2004, rates of overweight and obesity increased as people age by an average of:

- 9.5% for males and 7.6% for females per year of age for those aged up to 28 years
- 0.5% for males and 1.1% for females per year of age for those aged over 28 years.

Since 2004, rates of overweight only increased as people age by an average of:

- 8.7% for males and 8.2% for females per year of age for those aged up to 28 years
- 0.1% for males and 0.9% for females per year of age for those aged over 28 years.

Since 2004, BMI increased as people age by an average of:

- 335g/m^2 for males and 255g/m^2 for females per year of age for those aged up to 28 years
- 36g/m^2 males and 68g/m^2 for females per year of age for those aged over 28 years.

Since 2004, rates of overweight or obesity increased for an age cohort of young people aged 18–24 in 2004 among those in:

- the overweight category by 6.0% per year of age for males and 5.4% per year of age for females
- the obesity category by 7.5% per year of age for males and 3.5% per year of age for females
- the healthy weight category declined by 5.9% per year of age for males and 1.6% per year for females.

The rate of increase is significantly different for males and females in the obesity category (p=0.023).

Measures of BMI

Information on height and weight has been collected since 2004. Several measures were used to examine changes in BMI. Results for obesity (BMI greater than or equal to 30) are presented first followed by overweight and obesity (BMI of 25 or greater). Next, BMI is analysed as a continuous measure. As BMI is known to increase with age, this is investigated further, using all years of data, to identify the ages associated with rapid weight gain. Lastly, a pseudo-cohort of 18–24 year olds is created and changes in weight status are examined as the cohort 'ages' across survey years.

Obesity results

Trends in obesity are analysed by sex, age groups, sex by age group, and socioeconomic and geographic regions. Based on these results, sex by age among young adults (Table 5) was investigated further. Additional results are included in the supplementary figures (Figure 33 through Figure 37).

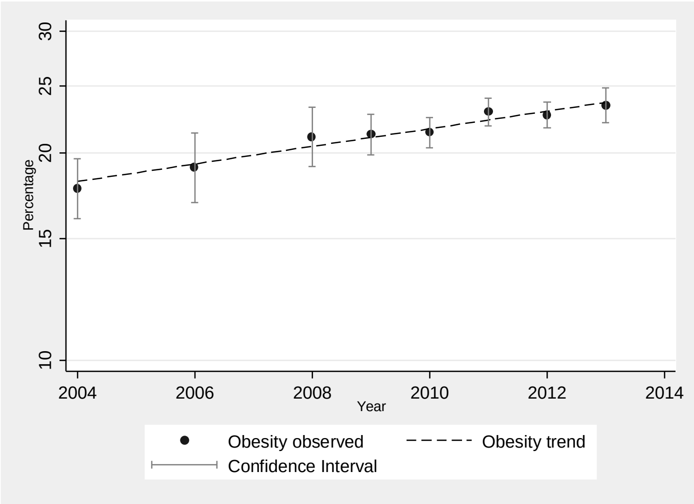


Figure 28: Obesity trend

From 2004 to 2013, the percentage of adults who were obese increased by an average of 3.0% per year (p<0.001) or an increase of 30.3% over the period.

When age effects are removed the average annual increase was 2.9% (age-standardised prevalence).

The similar finding for both analyses indicates that most of the increase is due to factors other than age.

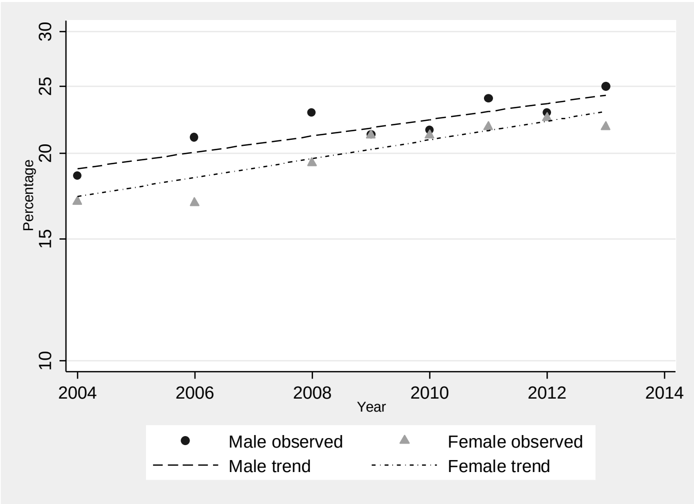


Figure 29: Obesity by sex

The percentage of obese adults increased annually by an average of:

- 2.8% for males (p=0.001)
- 3.2% for females (p<0.001).

No difference was observed in the rate of increase between males and females (p=0.709).

On average, the prevalence of obesity was 6.4% (95% CI 1.7–10.8%) lower for females than for males.

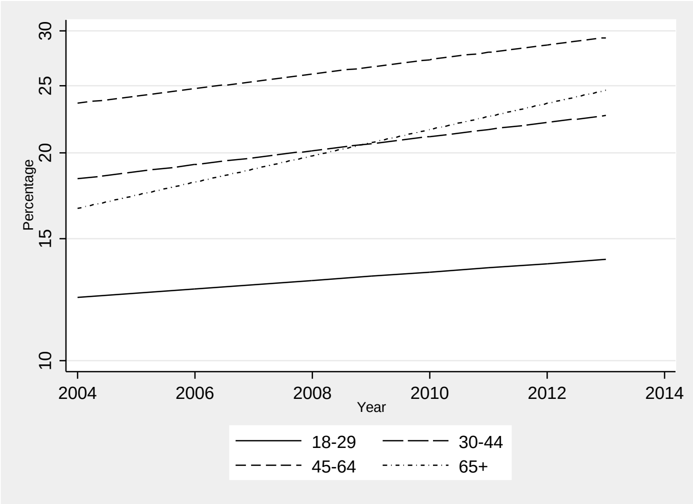


Figure 30: Obesity by age group

The percentage of obese adults increased annually by an average of:

- 2.4% (persons) and 3.1% (females) for 30–44 year olds
- 2.5% (persons) and 3.1% (females) for 45–64 year olds
- 4.5% (persons), 4.4% (males), and 4.4% (females) for those aged 65 years or older.

No difference was observed in the rate of increase by age group (p=0.407).

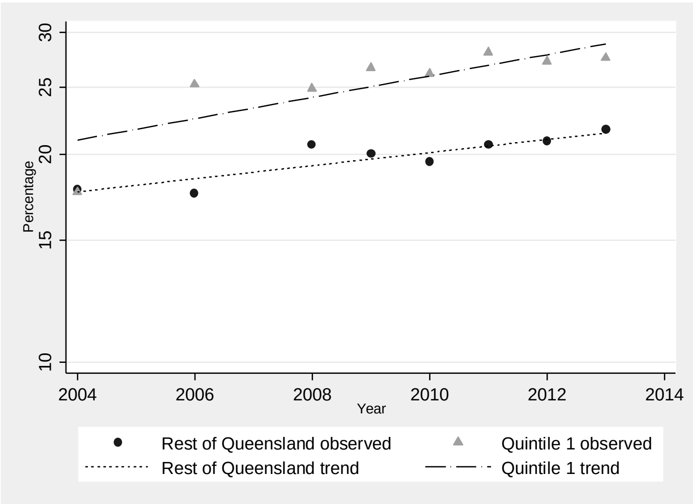


Figure 31: Obesity trend by socioeconomic status

The percentage of obese adults increased annually by an average of:

- 4.2% among persons in the most disadvantaged areas
- 2.6% among persons in the rest of Queensland (quintiles 2–5).

No difference was observed in the rate of increase between the most socioeconomically disadvantaged areas and the rest of Queensland (p=0.252).

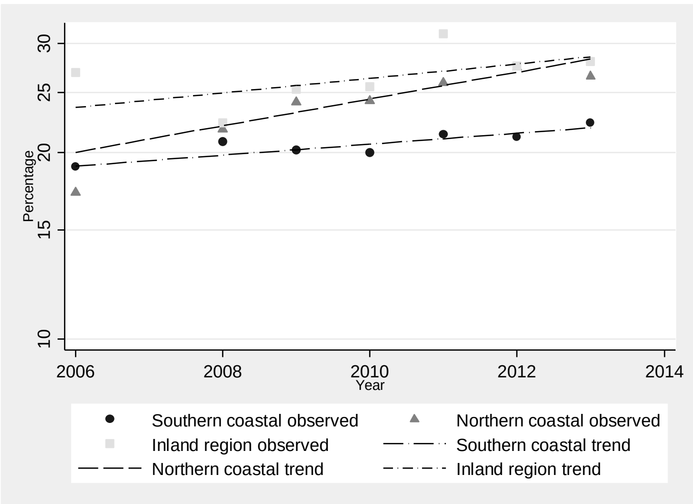


Figure 32: Obesity trends by geographic region

The percentage of obese persons increased annually by an average of:

- 2.1% in the southern coastal region
- 5.1% in the northern coastal region.

No difference was observed in the rate of increase between geographic regions (p=0.291).

Table 5 presents detailed results for the preceding figures. Supplementary figures (Figure 33 through Figure 37) contain results for age by: sex, socioeconomic status, and geographic region; and sex by: socioeconomic status and geographic region. No significant differences in the rate of increase were observed by these characteristics.

Table 5: Obesity trends 2004–2013

	Average annual percentage change[1]		Test for trend for each subgroup[2]	Test for trend differences between subgroups[3]
	%	**(95% CI)**	***p*-value**	***p*-value**
Persons	3.0	(1.8, 4.1)	<0.001	
Sex				
Males	2.8	(1.2, 4.4)	0.001	0.709
Females	3.2	(1.6, 4.8)	<0.001	
Age category—persons				
18–29	1.4	(-2.5, 5.5)	0.488	0.407
30–44	2.4	(0.3, 4.5)	0.025	
45–64	2.5	(0.1, 4.0)	0.001	
65 years or older	4.5	(2.2, 6.8)	0.000	
Age category—males				
18–29	3.1	(-2.4, 8.9)	0.272	0.579
30–44	1.7	(-1.2, 4.6)	0.266	
45–64	1.9	(-0.2, 4.1)	0.072	
65 years or older	4.4	(1.1, 7.8)	0.008	
Age category—females				
18–29	-0.1	(-5.7, 5.8)	0.977	0.614
30–44	3.1	(0.2, 6.1)	0.037	
45–64	3.1	(0.9, 5.3)	0.005	
65 years or older	4.4	(1.3, 7.6)	0.005	
Age category— 18–29 years				
Males	3.1	(-2.4, 8.9)	0.272	0.438
Females	-0.1	(-5.7, 5.8)	0.977	
Socioeconomic advantage/disadvantage				
Most disadvantaged	4.2	(1.9, 6.5)	<0.001	0.252
Rest of Queensland	2.6	(1.3, 3.9)	<0.001	
Geographic regions[4]				
Southern coastal	2.1	(0.2, 3.9)	0.028	0.291
Northern coastal	5.1	(1.8, 8.5)	0.002	
Inland region	2.7	(-1.0, 6.6)	0.152	

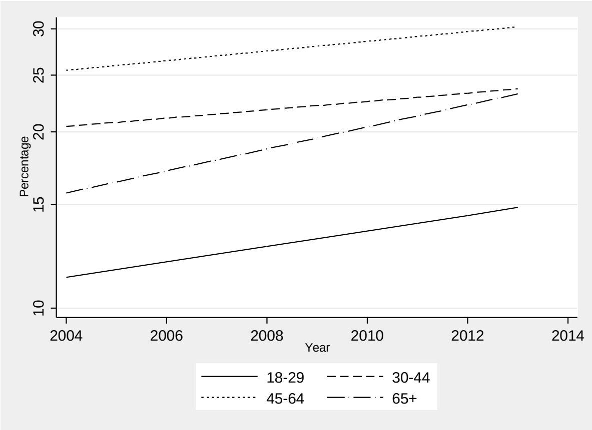
[1] Positive values represent annual percentage increases; negative values represent annual percentage decreases.
[2] Tests whether there is s statistically significant increase or decrease in trend over time.
[3] Tests whether there is significant difference in the trend over time between subgroups (e.g. males vs. females).
[4] Trends by geographic region are for 2006—2013.

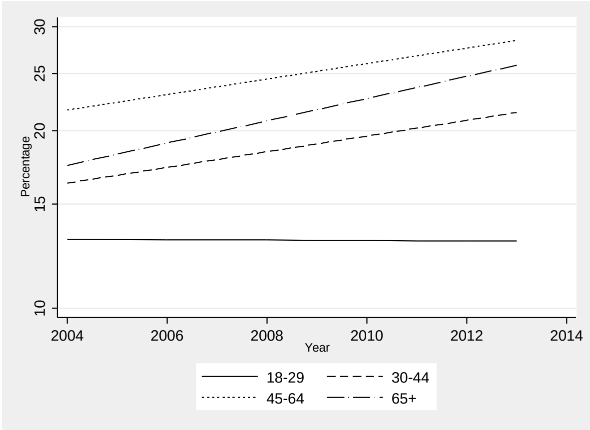
Table 6 presents results for differences in trends by combinations of sociodemographic characteristics. Each combination is analysed by year so represents three way interactions terms. No significant differences were observed.

Table 6: Obesity multivariate trend results

Sociodemographic characteristics	*p* value	
Age by sex	0.260	Figure 33
Age by socioeconomic status	0.525	Figure 34
Sex by socioeconomic status	0.615	Figure 35
Geographic region by sex	0.503	Figure 36
Age by geographic region	0.620	Figure 37

Obesity supplementary figures

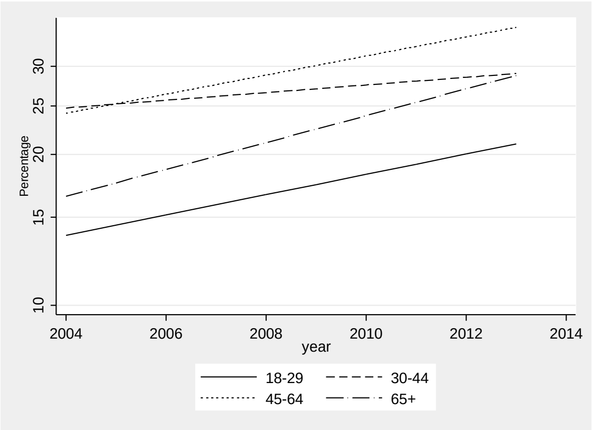


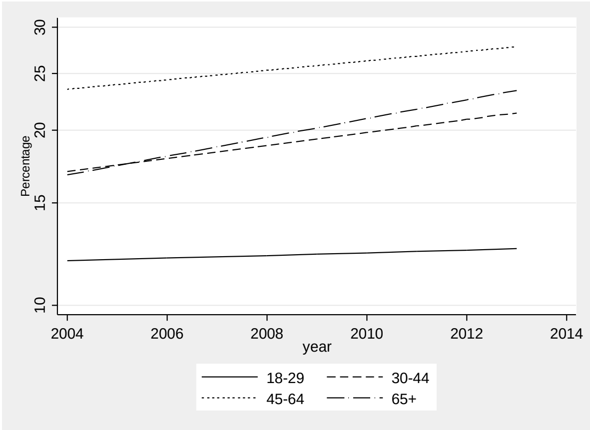


Males

Females

Figure 33: Age by sex trends in obesity (p=0.260)

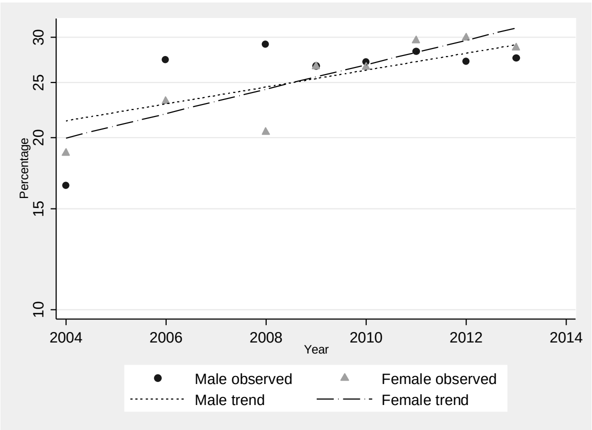


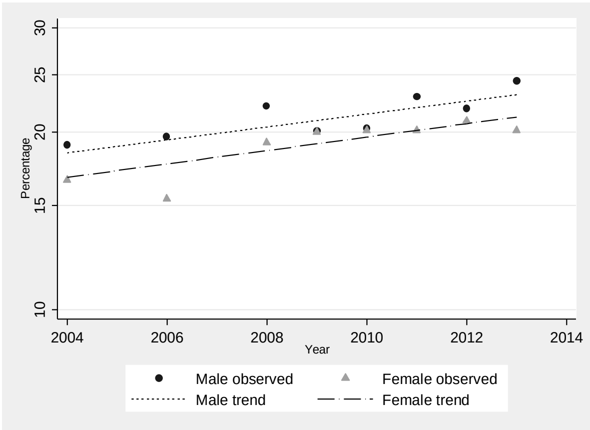


Most disadvantaged

Rest of Queensland (quintiles 2–5)

Figure 34: Age by socioeconomic status trends in obesity (p=0.525)

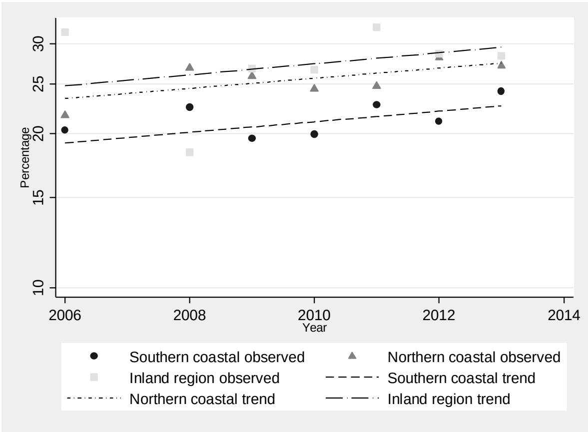




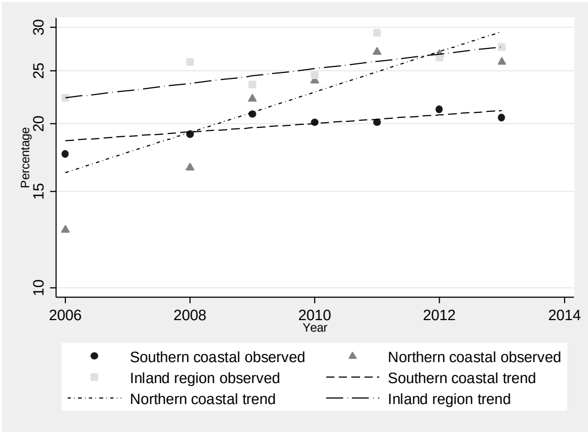
Most disadvantaged

Rest of Queensland (quintiles 2–5)

Figure 35: Sex by socioeconomic status trends in obesity (p=0.615)

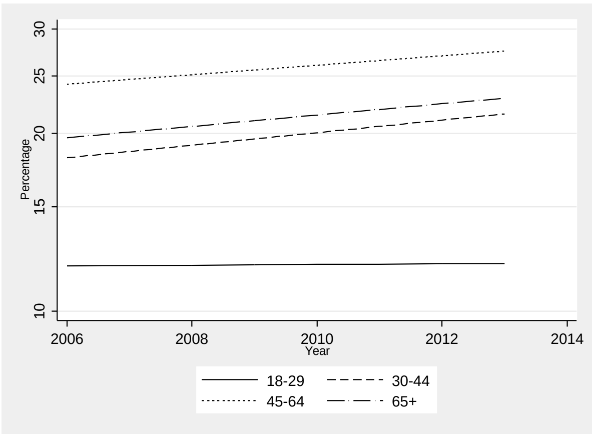


Males

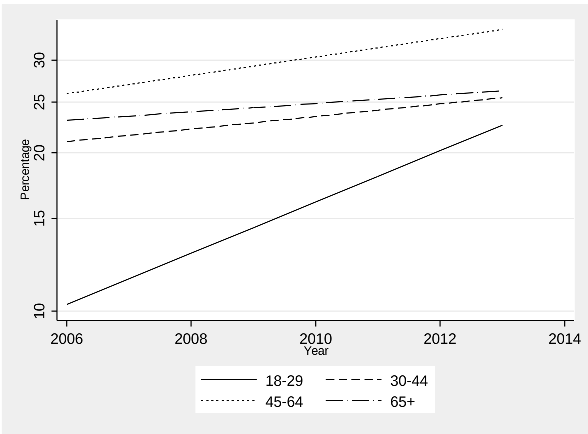


Females

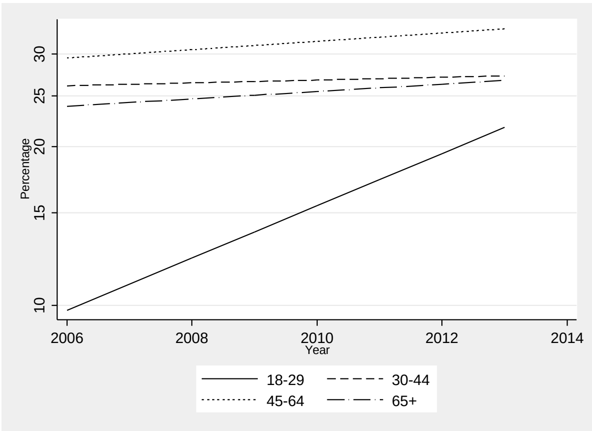
Figure 36: Geographic region by sex trends in obesity (p=0.503)



Southern coastal region



Northern coastal region



Inland geographic regions

Figure 37: Age by geographic region trends in obesity (p=0.620)

Overweight and obese results

The figures below present the trends for overweight and obesity by sociodemographic characteristics. Trends are analysed by sex, age groups, sex by age group, and socioeconomic and geographic regions. Based on these results, trends by sex among 30–44 year olds (Table 7) and by sex in the most disadvantaged areas (Figure 43) were explored further. Additional results are included in the supplementary figures (Figure 44 through Figure 48).

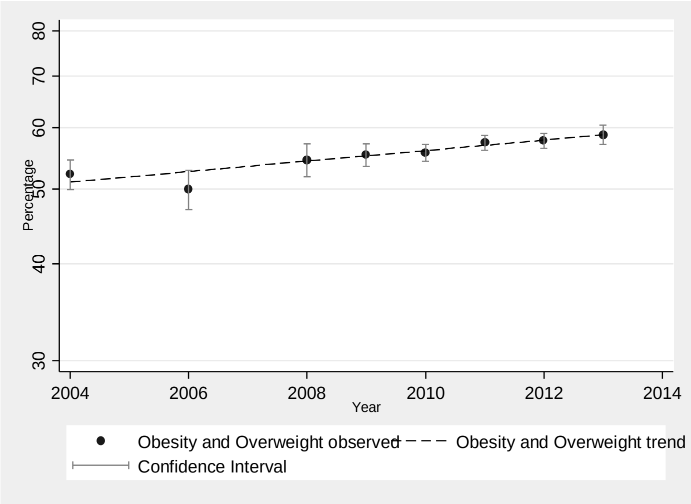


Figure 38: Overweight and obese trend

From 2004 to 2013, the percentage of adults who were overweight or obese increased by an average of 1.6% per year ($p<0.001$) or a 15.1% increase over the entire period.

When age effects are removed the average annual increase was 1.4% (age-standardised prevalence).

The similar finding for both analyses indicates that most of the increase is due to factors other than age.

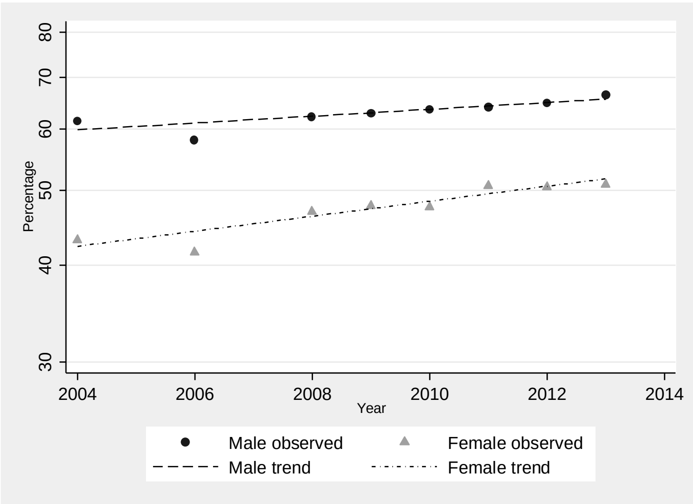


Figure 39: Overweight and obese trend by sex

The percentage of overweight or obese adults increased annually by an average of:

- 1.0% for males ($p=0.033$)
- 2.3% for females ($p<0.001$).

No difference was observed in the rate of increase between males and females ($p=0.089$), however, when adjusted by education, employment and marital status this did achieve statistical significance ($p=0.013$, refer Table 24). Additional analyses are presented in Figure 43.

On average, the prevalence of overweight and obesity was 23.6% (95% CI 21.2–26.1%) lower for females than for males.

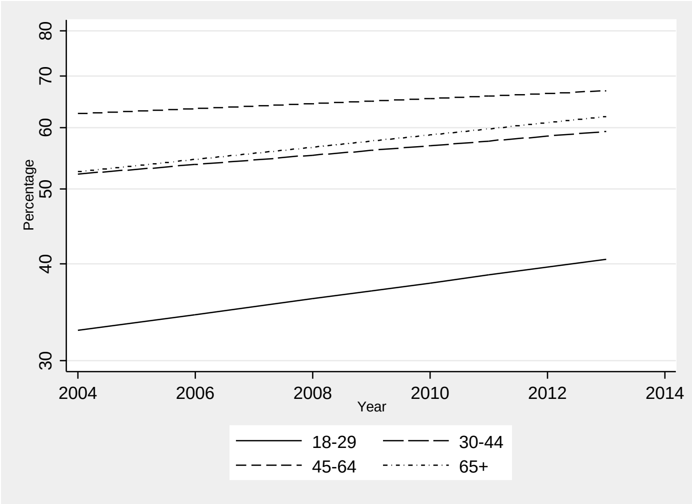


Figure 40: Overweight and obese trend by age group

The percentage of overweight or obese adults increased annually by an average of:

- 1.4% (persons) and 2.6% (females) for 30–44 year olds
- 1.8% (persons) and 2.0% (males) among those aged 65 years or older.

The rate of increase between age groups was not significantly different (p=0.428).

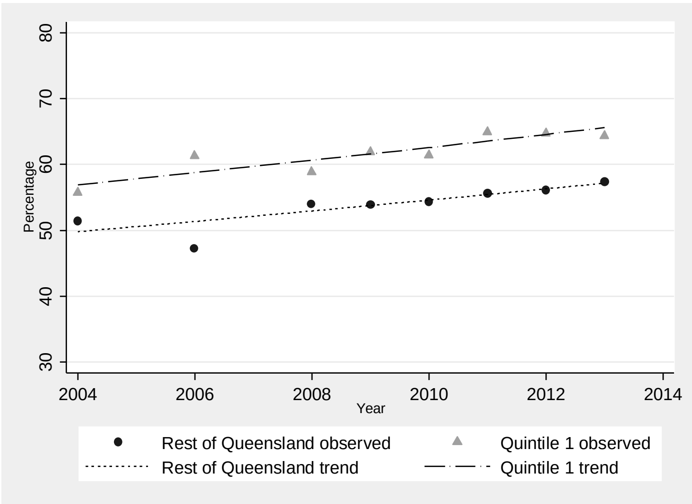


Figure 41: Overweight and obese trend by socioeconomic status

The percentage of overweight or obese adults increased annually by an average of 1.6% for both the most disadvantaged socioeconomic quintile and for the rest of Queensland (quintiles 2–5).

No difference was observed in the rate of increase between the most socioeconomically disadvantaged areas and the rest of Queensland (p=0.964).

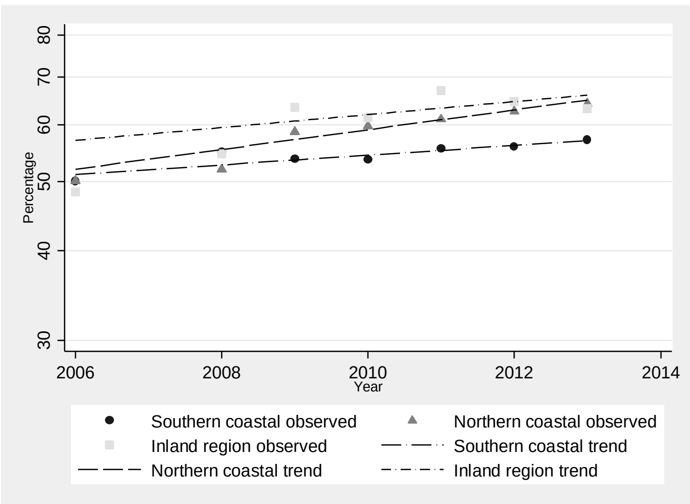


Figure 42: Overweight and obese trend by geographic area

The percentage of overweight or obese adults increased annually by an average of:

- 1.6% in the southern coastal region
- 3.2% in the northern coastal region.

Although the rate of increase between the regions was two fold higher in the northern coastal region compared to the southern coastal region, the difference was not statistically significant (p=0.426). However, when adjusted by education, employment and marital status results reached statistical significance (p=0.043, see Table 24). Additional analyses were conducted using BMI as a continuous measure in Figure 53, Figure 55 and Figure 56.

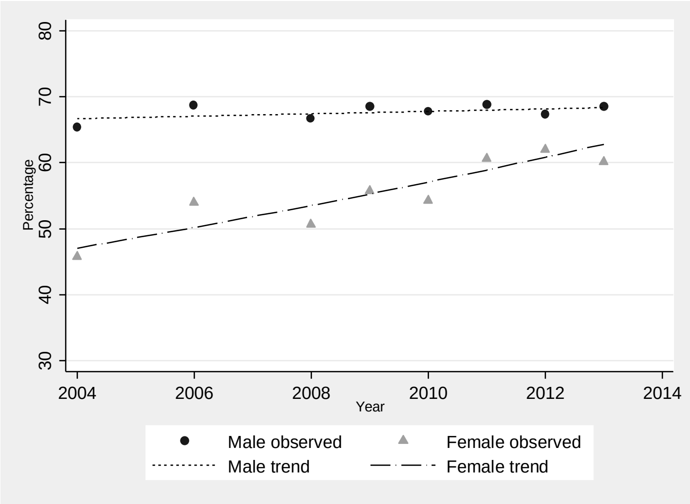


Figure 43: Overweight and obese by sex for the most disadvantaged areas

Among females in the most disadvantaged areas, the percentage of overweight or obese adults increased annually by an average of 3.3% (p=0.003).

The rate of increase was significantly different between males and females in the most disadvantaged areas (p=0.045). There was no difference in the rate of increase in overweight and obesity between males and females in more advantaged areas (quintiles 2–5; (p=0.324)

Table 7 presents detailed results for the preceding figures. Supplementary figures (Figure 44 through Figure 48) contain results for age by: sex, socioeconomic status, and geographic region; and sex by: socioeconomic status and geographic region. No significant differences in the rate of increase were observed by these characteristics.

Table 7: Overweight and obese trends 2004–2013

	Average annual percentage change[1] %	(95% CI)	Test for trend for each subgroup[2] *p*-value	Test for trend differences between subgroups[3] *p*-value
Persons	1.6	(0.9, 2.3)	<0.001	
Sex				
Males	1.0	(0.1, 2.0)	0.033	0.089
Females	2.3	(1.2, 3.3)	<0.001	
Age category—persons				
18–29	2.4	(0.0, 4.9)	0.053	0.428
30–44	1.4	(0.2, 2.7)	0.023	
45–64	0.8	(-0.2, 1.7)	0.110	
65 years or older	1.8	(0.5, 3.2)	0.006	
Age category—males				
18–29	1.7	(-1.4, 4.9)	0.283	0.463
30–44	0.6	(-1.0, 2.3)	0.474	
45–64	0.4	(-0.9, 1.6)	0.568	
65 years or older	2.0	(0.2, 3.8)	0.028	
Age category—females				
18–29	3.0	(-0.8, 7.0)	0.127	0.604
30–44	2.6	(0.7, 4.6)	0.006	
45–64	1.2	(-0.2, 2.6)	0.083	
65 years or older	1.5	(-0.4, 3.4)	0.120	
30–44 years				
Males	0.6	(-1.0, 2.3)	0.474	0.110
Females	2.6	(0.7, 4.6)	0.006	
Socioeconomic advantage/disadvantage				
Most disadvantaged—persons	1.6	(0.1, 3.1)	0.031	0.964
Rest of Queensland—persons	1.6	(0.8, 2.4)	<0.001	
Most disadvantaged—males	0.3	(-1.6, 2.2)	0.780	0.045
Most disadvantaged—females	3.3	(1.1, 5.5)	0.003	
Geographic regions[4]				
Southern coastal	1.6	(0.4, 2.8)	0.009	0.426
Northern coastal	3.2	(1.1, 5.5)	0.003	
Inland region	2.1	(-0.5, 4.7)	0.108	

[1] Positive values represent annual percentage increases; negative values represent annual percentage decreases.
[2] Tests whether there is s statistically significant increase or decrease in trend over time.
[3] Tests whether there is significant difference in the trend over time between subgroups (for example, males vs. females).
[4] Trends by geographic region are for 2006—2013.

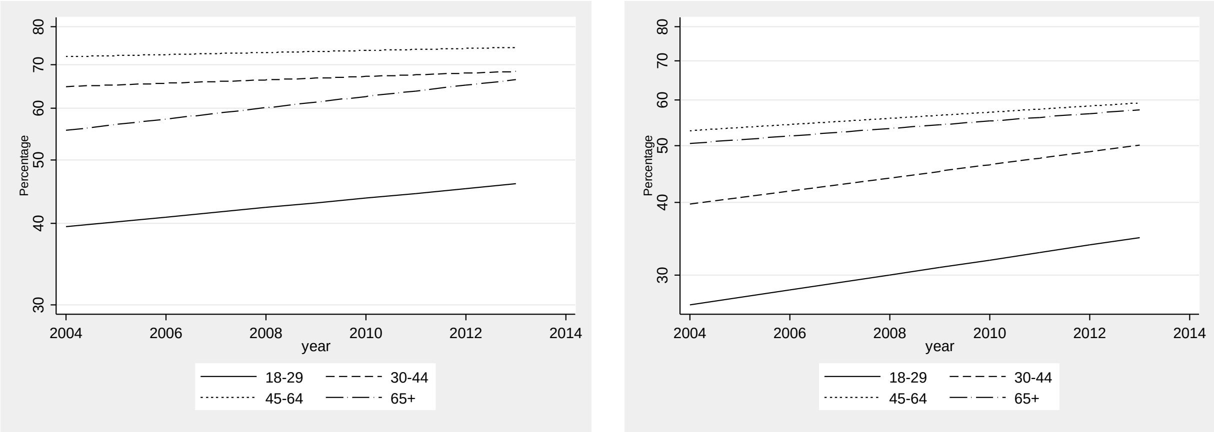
In Table 7 no difference was observed between males and females aged 30–44 years. However, when adjusted by education, employment and marital status results did achieve statistical significance (p=0.005, see Table 24). This should be investigated further as additional years of data become available.

Table 8 presents results for differences in trends by combinations of sociodemographic characteristics. Each combination is analysed by year so represents three way interactions terms. No significant differences were observed.

Table 8 Overweight and obese multivariate trend results

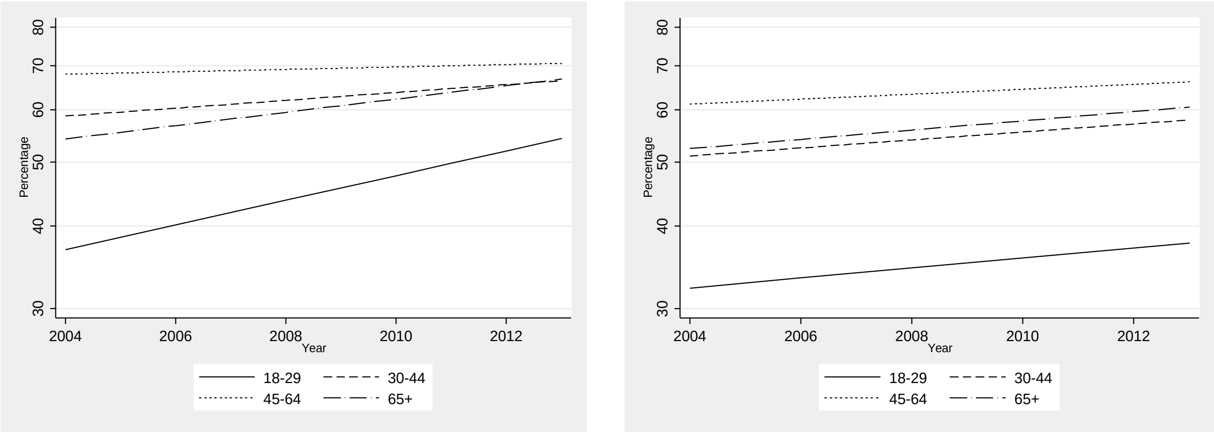
Sociodemographic characteristics	*p* value	
Age by sex	0.470	Figure 44
Age by socioeconomic status	0.961	Figure 45
Sex by socioeconomic status	0.840	Figure 46
Geographic region by sex	0.370	Figure 47
Age by geographic region	0.876	Figure 48

Overweight and obese supplementary figures



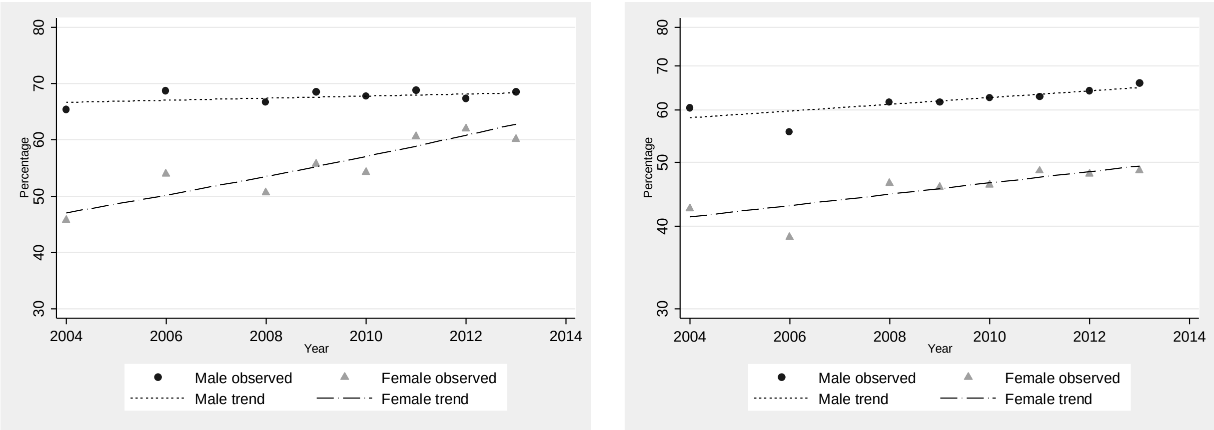
Males　　Females

Figure 44: Age by sex trends in overweight and obesity (p=0.470)



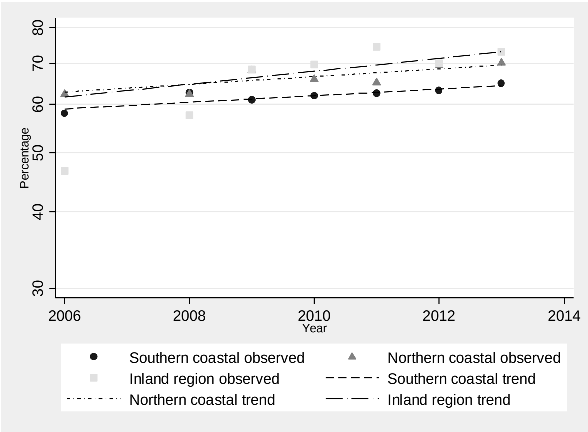
Most disadvantaged　　Rest of Queensland (quintiles 2–5)

Figure 45: Age by socioeconomic status trends in overweight and obesity (p=0.961)

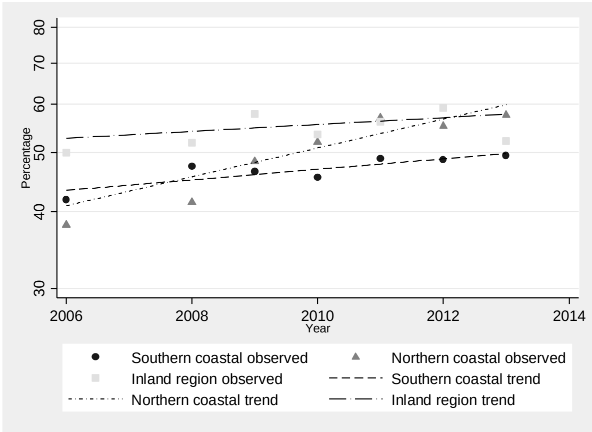


Most disadvantaged　　Rest of Queensland (quintiles 2–5)

Figure 46: Sex by socioeconomic status trends in overweight and obesity (p=0.840)

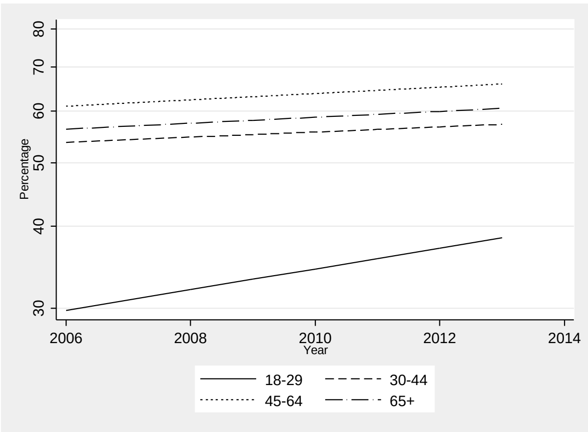


Males

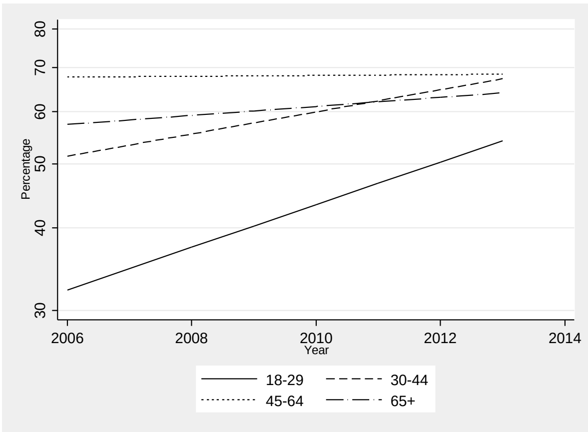


Females

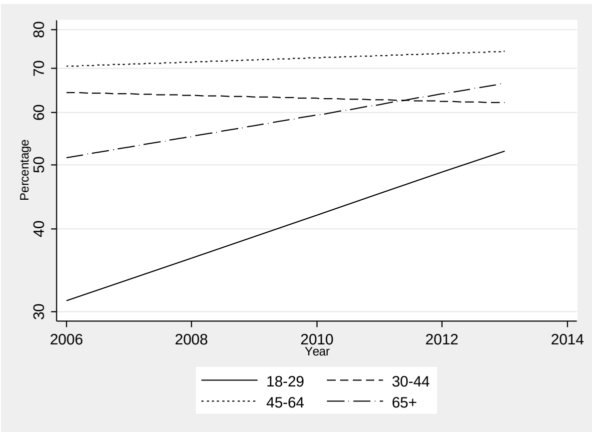
Figure 47: Geographic region by sex trends in overweight and obesity (p=0.370)



Southern coastal region



Northern coastal region



Inland region

Figure 48: Age by geographic region trends in overweight and obesity (p=0.876)

Body mass index results

The previous analyses were based on the clinically defined ranges in BMI that are categorised as obese (BMI score greater than or equal to 30) or overweight and obese (BMI score of 25 or higher). Results are interpreted as the percentage of the population with BMI scores in those ranges.

However, the underlying BMI score can also be analysed as a continuous variable. BMI is calculated as a person's weight divided by their height squared, therefore the units of BMI are in the form kilograms/metre^2. As changes in average BMI are likely to be small over time we refer to these in the units of grams/metre^2 (g/m^2). Because the distribution of BMI was skewed, a geometric mean was analysed rather than an arithmetic mean. This is discussed further in Appendix 1: Detailed methods, Continuous BMI trends.

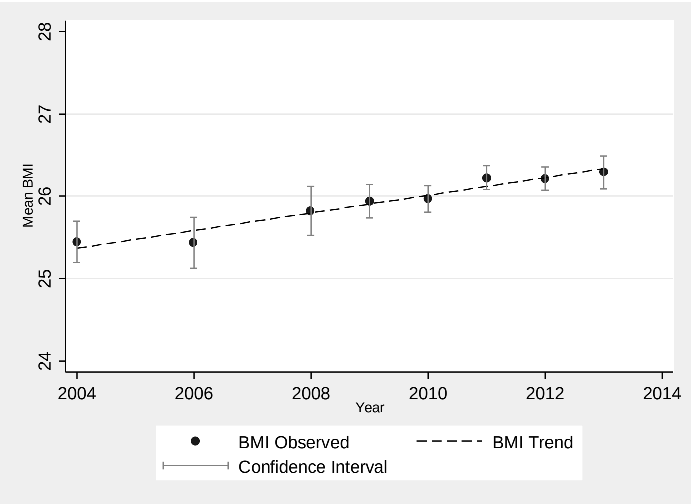


Figure 49: Geometric mean BMI trend

Overall BMI increased by an average of 107g/m^2 per year and was statistically significant ($p<0.001$).

After adjusting for height this BMI increase translates to an average of 306g of weight gain per year or 3.1kg over the last decade.

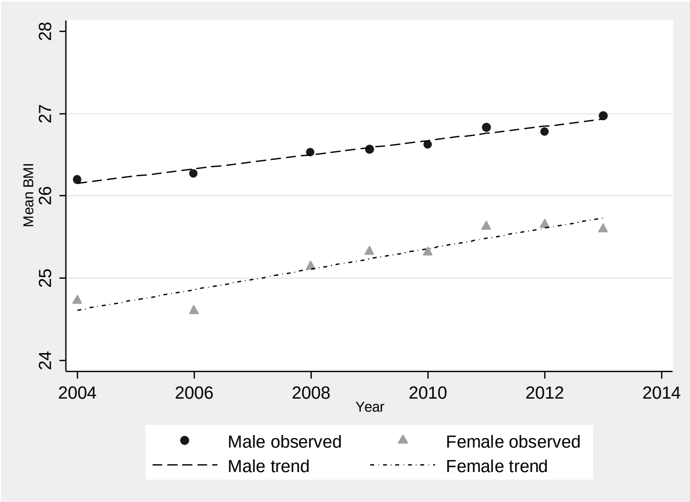


Figure 50: Geometric mean BMI trend by sex

Among males, BMI increased by an average of 87g/m^2 per year, which equates to an average weight gain of 267g per year or 2.7kg over the decade.

Among females BMI increased by an average of 125g/m^2 which is an average weight gain of 321g per year or more than 3.2kg over the decade.

No difference was observed in the rate of increase between males and females ($p=0.077$).

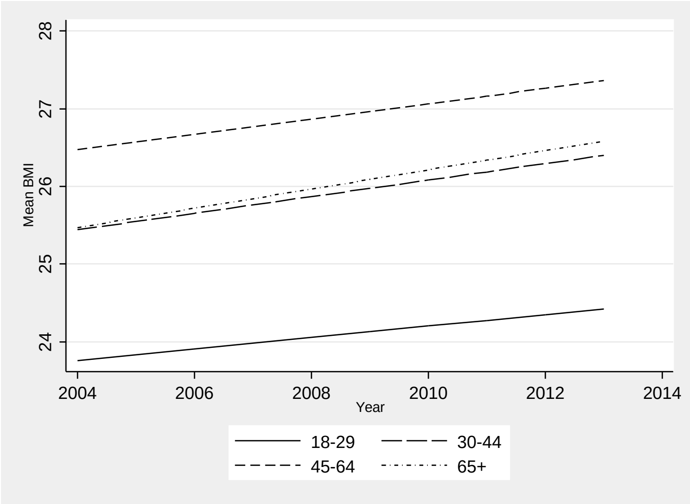


Figure 51: Geometric mean BMI trend by age group

BMI increased annually by an average of:

- 74g/m^2 for 18–29 year olds (on average 220g per year)
- 107g/m^2 (persons), 61g/m^2 (males) and 147g/m^2 (females) for 30–44 year olds (on average 421g, 277g, and 485g per year for persons, males and females, respectively)
- 99g/m^2 (persons) for 45–64 years olds with results similar for males and females
- 124g/m^2 (persons) and 145g/m^2 (females) for those 65 years and older (on average 435g and 390g per year for persons and females, respectively).

No difference was observed in the rate of increase by age groups (p=0.569).

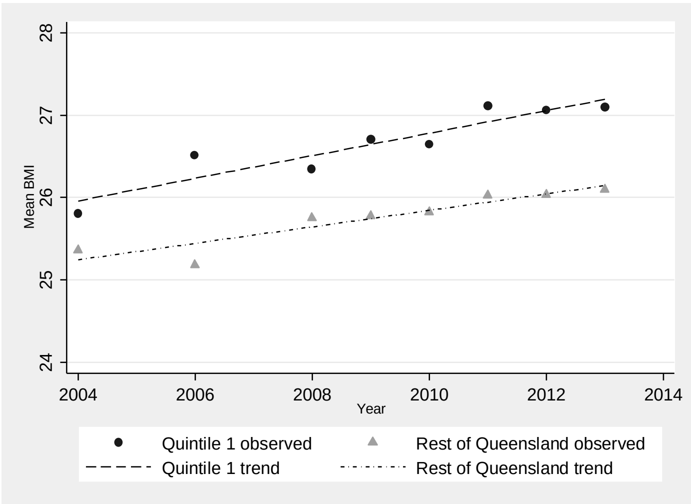


Figure 52: Geometric mean BMI trend by socioeconomic status

BMI increased annually by an average of:

- 137g/m^2 in the most disadvantaged areas (on average 281g per year)
- 100g/m^2 in the rest of Queensland (on average 363g per year; quintiles 2–5).

No difference was observed in the rate of increase between the most socioeconomically disadvantaged areas and the rest of Queensland (p=0.210).

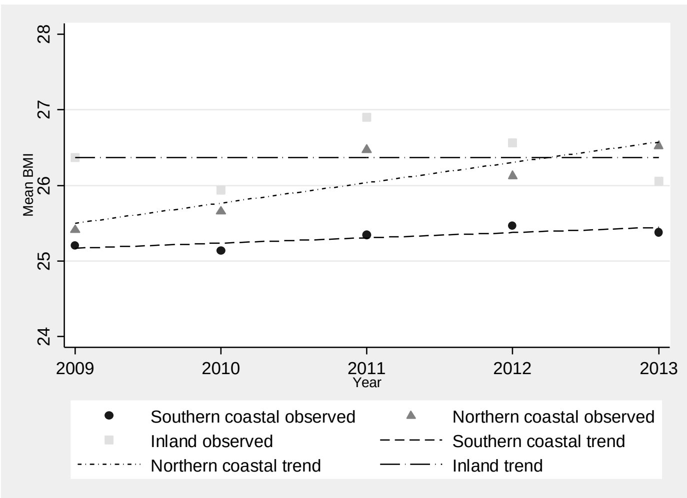


Figure 53: Geometric mean BMI trend by geographic area

BMI increased annually by an average of:

- 82g/m^2 (on average 343g per year) in the southern coastal region
- 203g/m^2 (on average 591g per year) in the northern coastal region.

No difference was observed in the rate of decrease between geographic regions (p=0.324). However, there was an over two-fold difference between southern and northern coastal regions that was explored further (see Figure 55 and Figure 56).

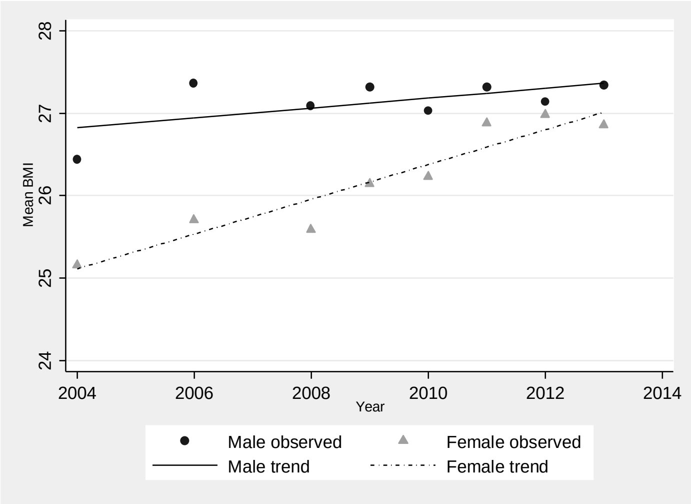


Figure 54: Geometric mean BMI trend by sex in the most disadvantaged socioeconomic quintile

The rate of increase varied by sex in the most disadvantaged areas (p=0.005).

BMI increased annually by an average of:

- 60g/m^2 (on average 197g per year) in the most disadvantaged areas for males
- 211g/m^2 (on average 544g per year) in the most disadvantaged areas for females.

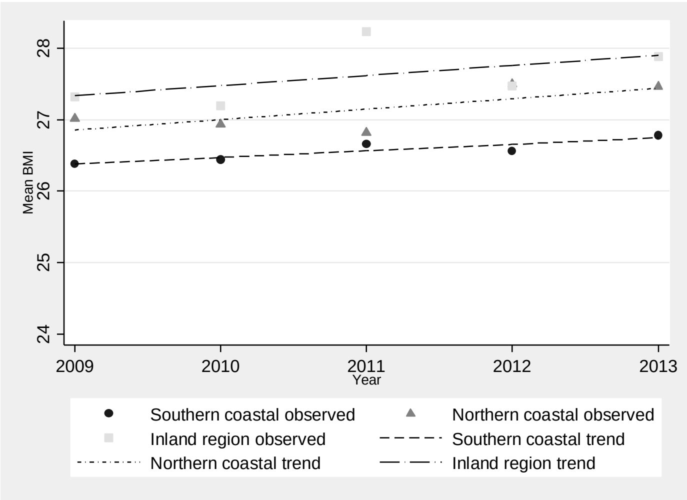


Figure 55: Geometric mean BMI trend by geographic region for males

Among males, average annual weight gain by geographic region varied by less than 150g (on average 284g, 304g, and 427g per year for the southern, northern and inland regions, respectively).

No difference was observed in the rate of increase between geographic regions for males (p=0.834).

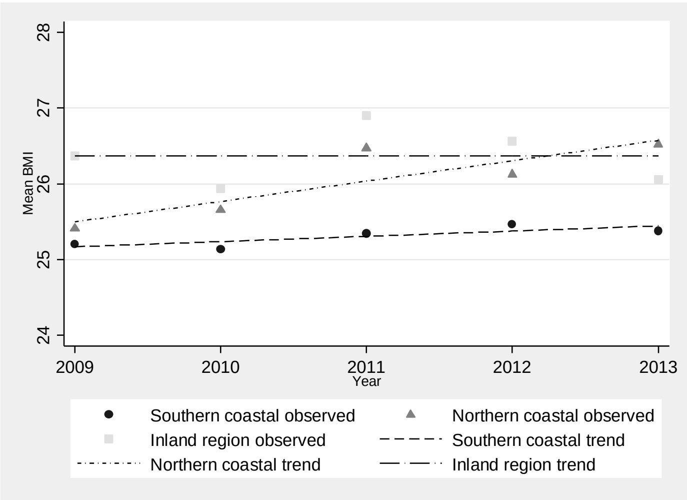


Figure 56: Geometric mean BMI trend by geographic region for females

While not achieving statistical significance (p=0.063), among females BMI increased annually by an average of:

- 69g/m^2 (on average a weight gain of 290g per year) in the southern coastal region
- 269g/m^2 (on average a weight gain of 1.6kg per year) in the northern coastal region.

Additional analyses adjusting by socioeconomic status did achieve significance (p=0.002 Table 25). This means that the increase in the north is not due to there being more disadvantaged areas in the northern region.

Table 9 presents detailed results for the preceding figures.

Table 9 BMI trends 2004–2013

	g/m[2]	Average annual BMI increase[1] (95% CI)	Test for trend for each subgroup[2] *p*-value	Test for trend differences between subgroups[3] *p*-value
Persons	107.2	(80.9, 133.5)	<0.001	
Sex				
Males	86.6	(68.9, 104.3)	<0.001	0.077
Females	124.7	(79.9, 169.6)	<0.001	
Age category—persons				
18–29	73.7	(-21.0, 168.4)	<0.001	0.569
30–44	106.6	(70.8, 142.4)	<0.001	
45–64	98.8	(46.0, 151.6)	0.040	
65 years or older	123.9	(40.2, 207.6)	0.011	
Age category—males				
18–29	66.9	(-29.6, 163.3)	0.141	0.773
30–44	60.8	(5.5, 116.1)	0.036	
45–64	99.3	(37.2, 161.3)	0.008	
65 years or older	95.2	(-30.8, 221.2)	0.114	
Age category—females				
18–29	77.4	(-36.7, 191.6)	0.148	0.290
30–44	146.7	(96.1, 197.2)	<0.001	
45–64	97.5	(17.2, 177.8)	0.025	
65 years or older	145.2	(61.3, 229.2)	0.005	
Socioeconomic advantage/disadvantage				
Most disadvantaged—persons	137.1	(82.1, 192.0)	0.001	0.210
Rest of Queensland—persons	100.3	(60.1, 140.4)	0.001	
Most disadvantaged—males	60.1	(-20.3, 140.6)	0.117	0.005
Most disadvantaged—females	211.2	(139.8, 282.7)	<0.000	
Geographic regions[4]				
Southern coastal	81.9	(28.0, 135.8)	0.017	0.324
Northern coastal	203.1	(164.8, 241.4)	<0.001	
Inland region	74.6	(-386.6, 535.8)	0.642	
Southern coastal—males	91.7	(7.3, 176.1)	0.041	0.834
Northern coastal—males	146.2	(-101.2, 393.5)	0.157	
Inland region—males	141.1	(-284.8, 567.0)	0.369	
Southern coastal—females	69.3	(-23.9, 162.5)	0.099	0.063
Northern coastal—females	269.4	(-18.6, 557.4)	0.059	
Inland region—females	0.3	(-451.8, 452.5)	0.998	

[1] Positive values represent annual BMI increases; negative values represent annual BMI decreases.
[2] Tests whether there is s statistically significant increase or decrease in trend over time.
[3] Tests whether there is significant difference in the trend over time between subgroups (for example, males vs. females).
[4] All analysis for geographic region is for 2009-2013

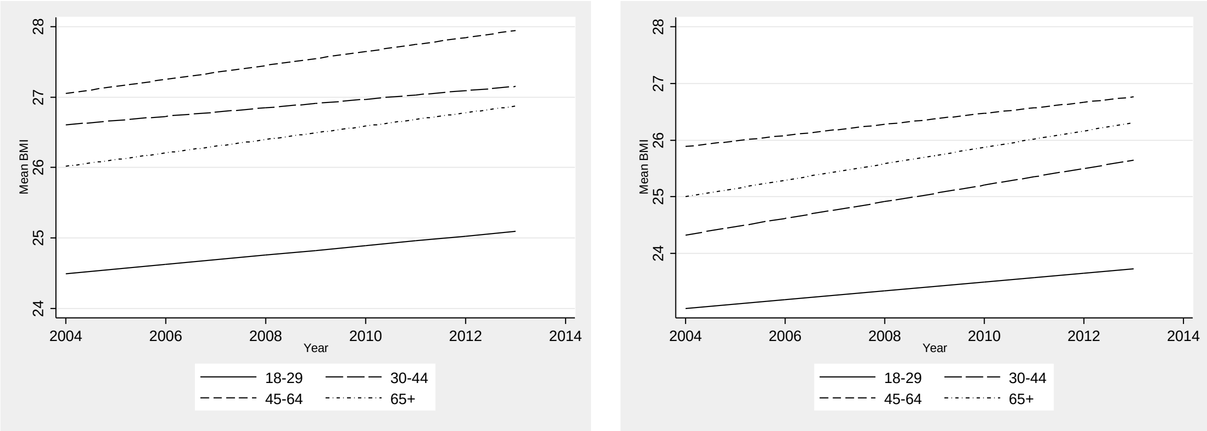
Supplementary figures (Figure 57 through Figure 61) contain results for age by: sex, socioeconomic status, and geographic region; and sex by: socioeconomic status and geographic region. No significant differences in the rate of increase were observed by these characteristics.

Table 10 presents results for differences in trends by combinations of sociodemographic characteristics. Each combination is analysed by year so represents three way interactions terms. No significant differences were observed.

Table 10: BMI multivariate trend results

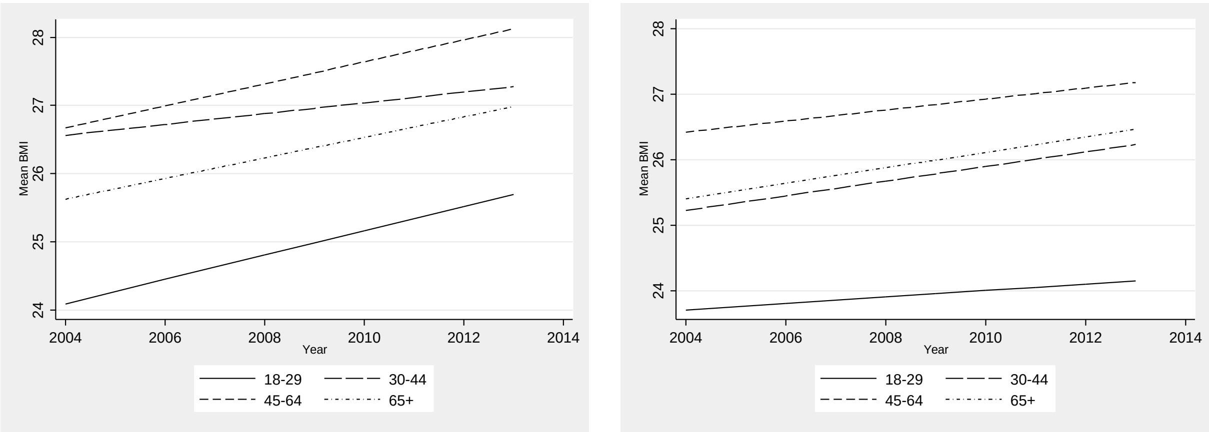
Sociodemographic characteristics	***p* value**	
Age by sex	0.685	Figure 57
Age by socioeconomic status	0.838	Figure 58
Sex by socioeconomic status	0.225	Figure 59
Geographic region by sex	0.164	Figure 60
Age by geographic region	0.268	Figure 61

BMI supplementary figures



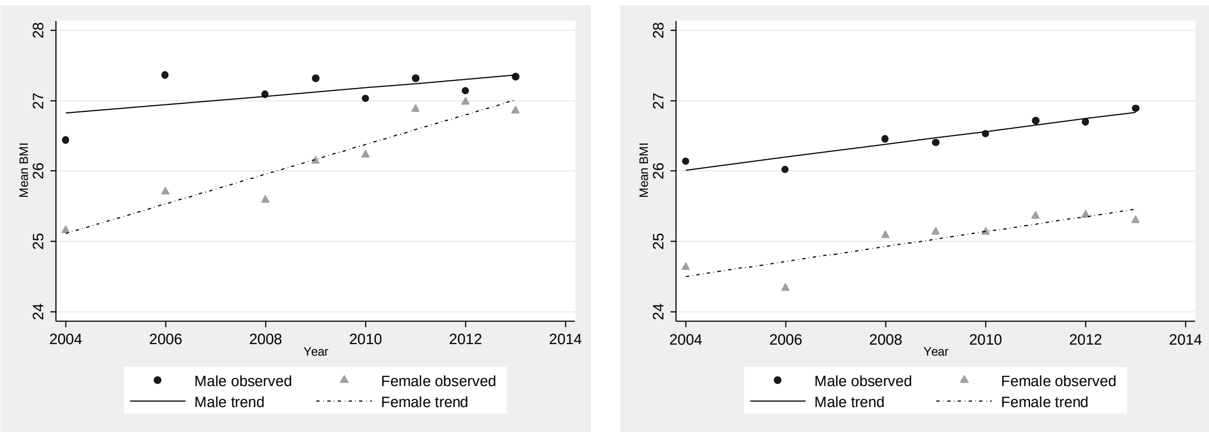
Males Females

Figure 57: Age by sex trends in BMI (p=0.685)



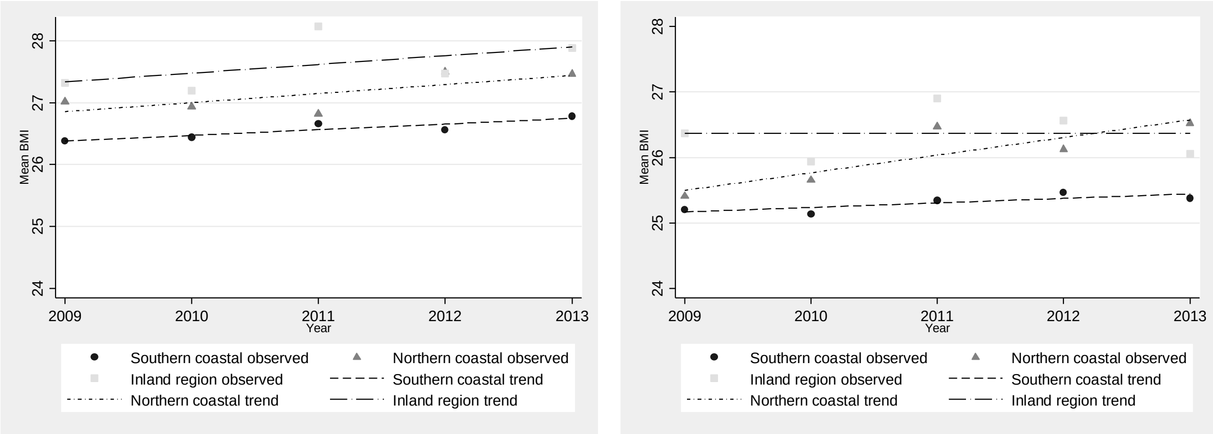
Most disadvantaged Rest of Queensland (quintiles 2–5)

Figure 58: Age by socioeconomic status trends in BMI (p=0.838)



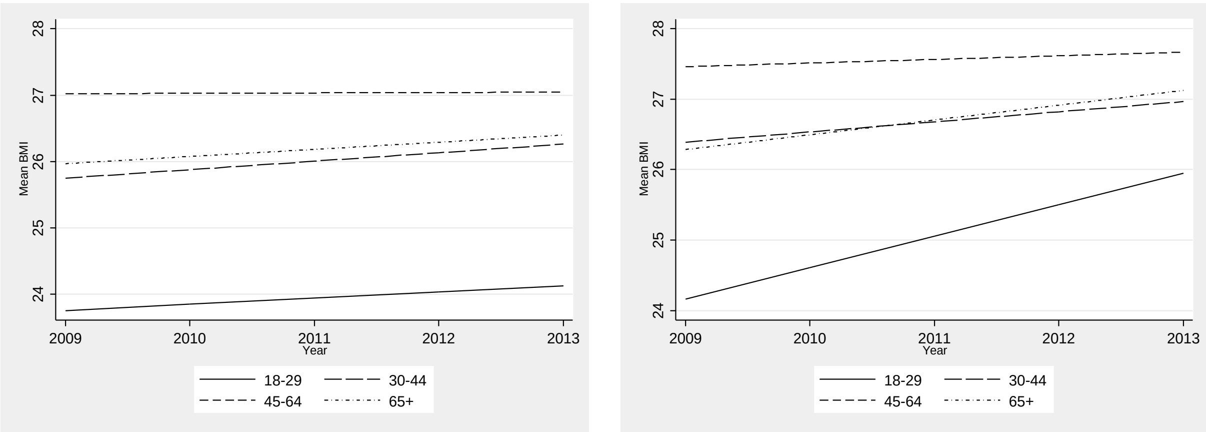
Most disadvantaged Rest of Queensland (quintiles 2–5)

Figure 59: Sex by socioeconomic status trends in BMI (p=0.225)

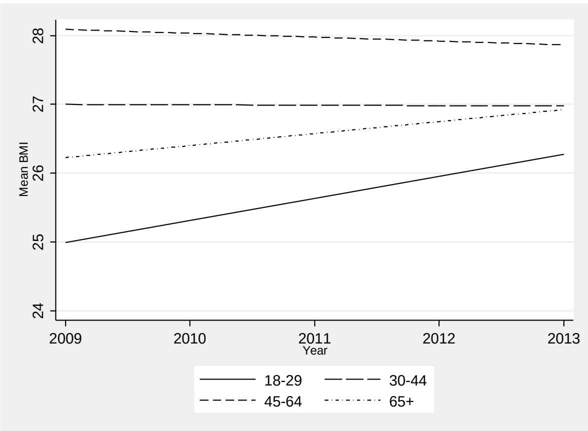


Males Females

Figure 60: Geographic region by sex trends in BMI (p=0.164)



Southern coastal region Northern coastal region



Inland region

Figure 61: Age by geographic region trends in BMI (p=0.268)

Age and increasing BMI results

Analysis by individual year of age was conducted to identify ages of rapid weight gain. Figure 62 through Figure 64 show that weight increases sharply up to the age of 28 and then plateaus for overweight and obese, overweight, and BMI. This pattern has been consistent since 2004 and is similar for both males and females.

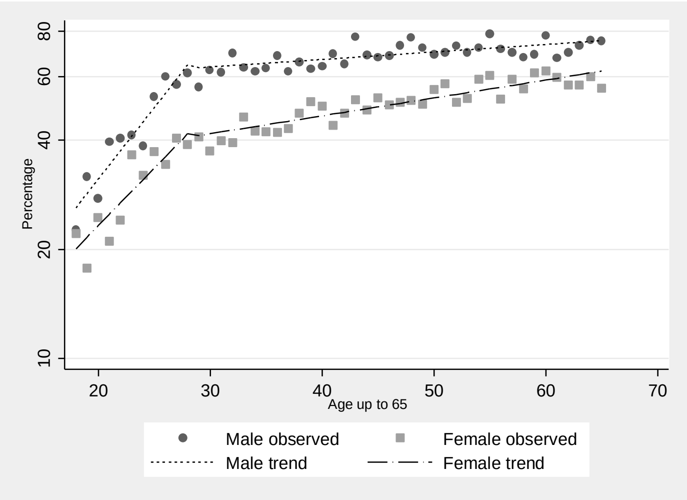


Figure 62: Percentage overweight and obese for 18–65 year olds

The percentage of overweight or obese adults increases per year by an average of:

- 9.5% (males) and 7.6% (females) per year of age up to the age of 28
- 0.5% (males) and 1.1% (females) per year of age after the age of 28.

Assuming this pattern has continued over the long term we could conclude that by the age of 65, 86% of overweight or obese males and 67% of overweight or obese females have been an unhealthy weight for 35-40 years.

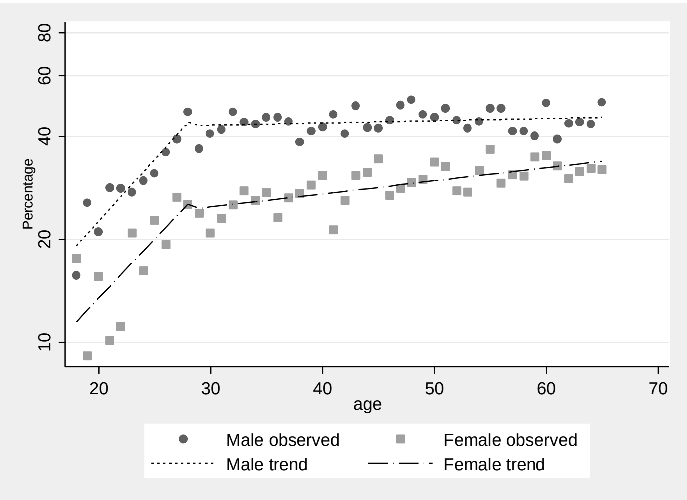


Figure 63: Percentage overweight for 18–65 year olds

The percentage of overweight only adults increases per year by an average of:

- 8.7% (males) and 8.2% (females) per year of age up to the age of 28
- 0.1% (males) and 0.9% (females) per year of age after the age of 28.

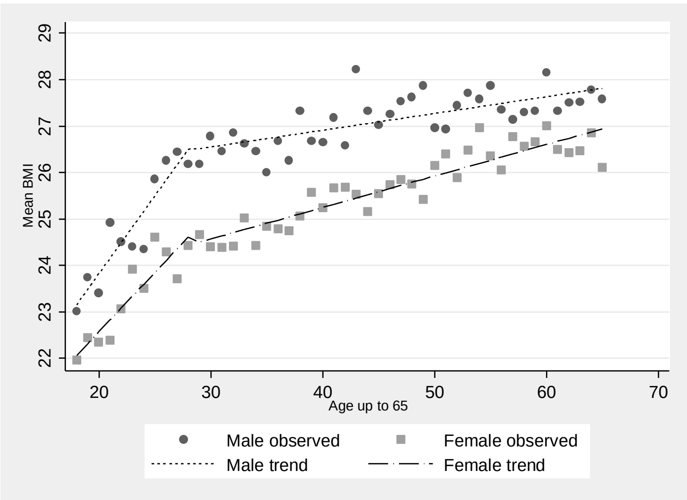


Figure 64: Mean BMI by age for 18–65 year olds

Mean BMI increases per year by an average of:

- 335g/m^2 (males) and 255g/m2 (females) per year of age up to the age of 28
- 36g/m^2 (males) and 68g/m^2 (females) per year of age after the age of 28.

In terms of average weight gain per year:

- 1.1 kilogram (males) and 707g (females) per year of age up to the age of 28
- 62g (males) and 150g (females) per year of age after the age of 28.

The previous analysis indicated that much of age-related weight gain occurs prior to 30 years of age, making 18–24 years of age important for targeting health interventions. To quantify the increase in unhealthy weight in this age group, a pseudo-cohort of 18–24 year olds was created by analysing those born in 1980 through 1986 in successive surveys.

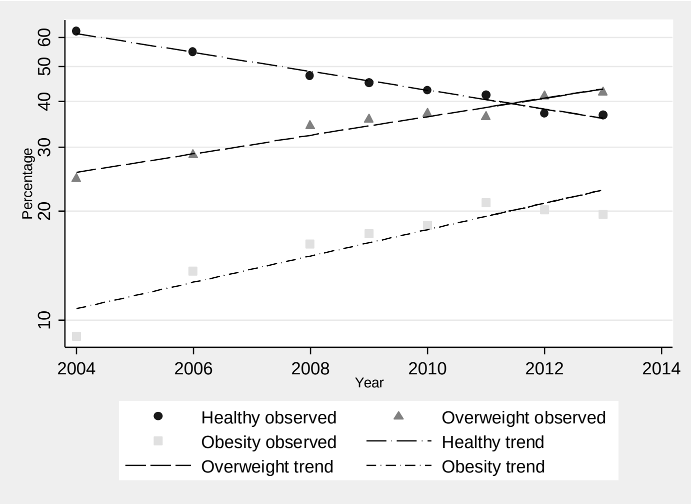


Figure 65: BMI category trends for males born 1980–86

For every year increase in age, the proportion of:

- healthy weight males decreased by 5.9%
- overweight males increased by 6.0%
- obese males increased by 7.5%.

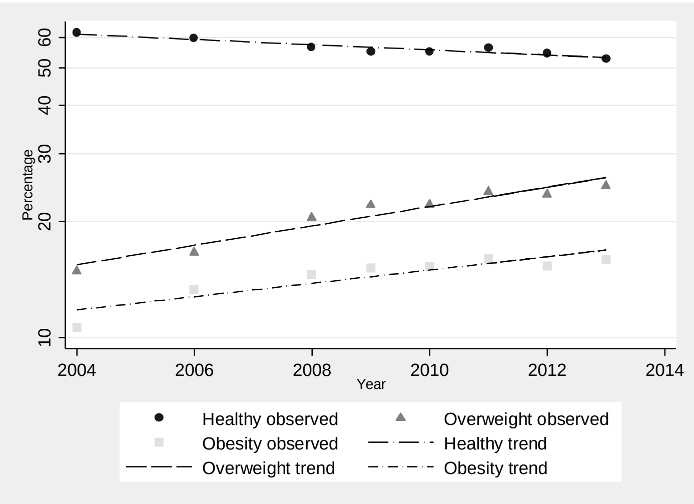


Figure 66: BMI category trends for females born 1980–86

For every year increase in age, the proportion of:

- healthy weight females decreased by 1.6%
- overweight females increased by 5.4%
- obese females increased by 3.5%.

The rate of increase in obesity varied by sex (p=0.023) with obesity increasing for males by 7.5% per year of age compared to 3.5% for females.

Table 11 presents detailed results for Figure 65 and Figure 66.

Table 11: **BMI category trends**

	Average annual percentage change[1] %	(95% CI)	Test for trend for each subgroup[2] *p*-value	Test for trend differences between subgroups[3] *p*-value
Males—healthy weight	-5.9	(-7.1, -4.7)	<0.001	<0.001
Males—overweight	6.0	(4.4, 7.7)	<0.001	
Males—obese	7.5	(5.0, 10.0)	<0.001	
Females—healthy weight	-1.6	(-2.7, -0.4)	0.008	<0.001
Females—overweight	5.4	(3.4, 7.5)	<0.001	
Females—obese	3.5	(1.1, 5.9)	0.004	
Obese—males	7.5	(5.0, 10.0)	<0.001	0.023
Obese—females	3.5	(1.1, 5.9)	0.004	

[1] Positive values represent annual percentage increases; negative values represent annual percentage decreases.
[2] Tests whether there is s statistically significant increase or decrease in trend over time.
[3] Tests whether there is significant difference in the trend over time between subgroups (for example, males vs. females).

Alcohol consumption summary

About the indicator

In 2009, the National Health and Medical Research Council (NHMRC) updated recommendations for low risk alcohol consumption. Two of the four guidelines apply to the adult general population, specifically:

- Guideline 1 recommends that no more than 2 standard drinks be consumed on any one day even if consumption is daily (reduced risk of alcohol related harm over a lifetime).
- Guideline 2 recommends that no more than 4 standard drinks be consumed on any one occasion (reduced risk of alcohol related harm on a single occasion).

For population health monitoring, these guidelines are commonly reported independently. When trends were analysed independently, however, it was difficult to determine changes in drinking patterns. This was because a large percentage of the population engages in both behaviours.

To more fully characterise drinking patterns, mutually exclusive categories were created using both guidelines. These are described in Figure 67.

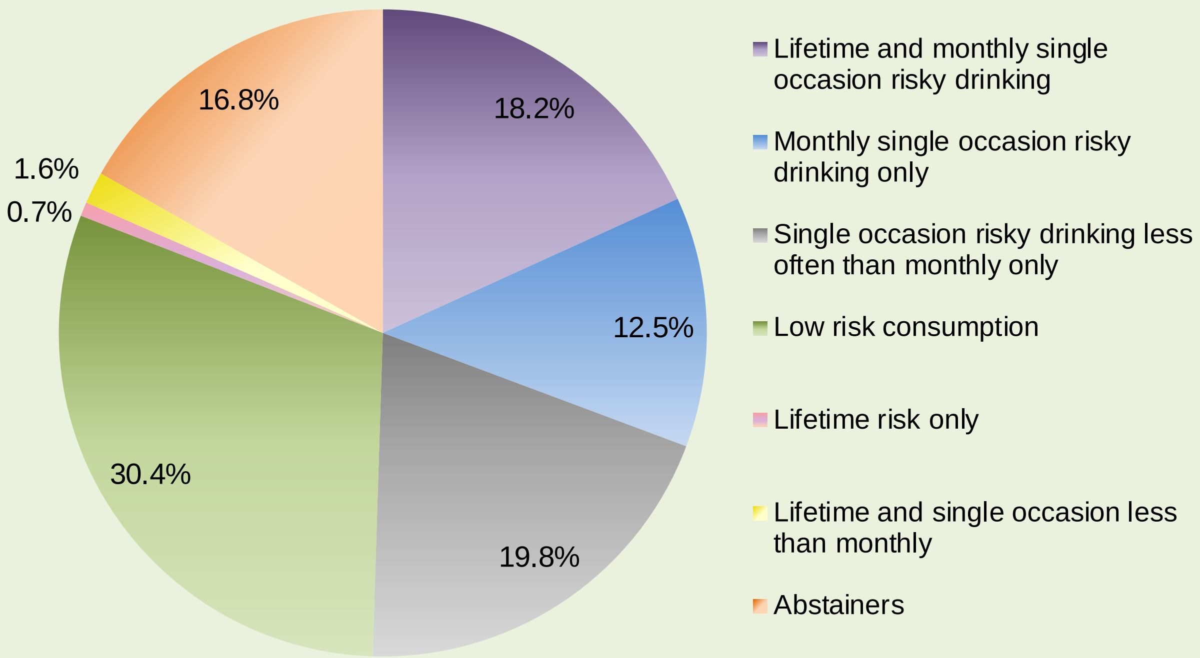


Figure 67: Prevalence (%) of drinking behaviour categories

This report explores the two most risky categories in depth: ‘lifetime and monthly single occasion risky drinking’ and ‘monthly single occasion risky drinking only’. The report also presents trend results for the five most prevalent categories and interprets these results in a description of changing drinking patterns.

Four years of alcohol consumption data were available for analysis. This shortened time frame meant that identifying statistically significant trends was more difficult, especially for more moderate changes.

Available data (years)

2010, 2011, 2012, 2013

Changing drinking patterns

Persons

Between 2010 and 2013, the percentage of persons consuming alcohol at both lifetime and monthly single occasion risky levels declined by 4.1% per year. This was almost entirely attributable to changes in drinking patterns among young people, especially males aged 18–29 years. Declines of 12% per year among those that consumed alcohol at both lifetime and monthly single occasion risky levels were observed in this age group.

Young males

Between 2010 and 2013, the percentage of 18–29 year old males consuming alcohol at both lifetime and monthly single occasion risky levels declined by 12% per year. At the same time, single occasion risky drinking less often than monthly without lifetime risky consumption increased by 15% per year. This may be an early indication that some young males are reducing their weekly average consumption and the frequency of single occasion risky consumption. Despite these gains, no change was observed in the percentage of males drinking at some form of risky level (for example, lifetime, monthly single occasion and less often than monthly single occasion combined) just a reduction in the most severe forms of risky drinking to a less severe form.

Young females

Young females aged 18–29 years experienced the same decline (12% per year) in monthly single occasion with lifetime risky consumption and a corresponding increase in abstaining from alcohol use (14% per year). While these failed to reach significance due to the much lower percentage of women engaging in the highest risk consumption pattern, it is encouraging that declines may be occurring among young people of both sexes.

Older persons

Among persons aged 30–64 years no change was evident in very high risk consumption (lifetime with monthly single occasion risk) or monthly single occasion risk. Single occasion risky consumption less than monthly decreased by 3.7% per year with a corresponding increase of 3.2% per year in low risk consumption. Monthly single occasion risk, with or without lifetime risk, continues to impact a large percentage of older, primarily male, adults with 45% of males drinking at these levels compared to only 17% of females.

Lifetime and monthly single occasion risky drinking

The percentage of adults drinking at both lifetime and monthly single occasion risky levels decreased between 2010 and 2013 for persons, males, and those aged 18–29 years (persons and males).

The rate of decline varied by age group among persons and males. Lifetime and monthly single occasion risky consumption declined among for persons and males aged 18–29 years with no change in other ages.

The rate of decline did not differ by sex, socioeconomic status or geographic region.

At least monthly single occasion risky drinking only

The percentage of adults consuming alcohol at monthly single occasion risky levels only did not change between 2010 and 2013 for any of the population groups.

The rate of decline did not differ by any of the population groups.

Details—lifetime and monthly single occasion risky drinking

From 2010 to 2013, the percentage of adults drinking at both lifetime and monthly single occasion risky levels decreased annually by an average of:

- 4.1% among persons (3.6% among males)
- 12.0% (persons) and 11.8% (males) among 18–29 year olds.

The rate of decline in the highest risky consumption pattern varied by age category:

- Among persons aged 18–29 years this pattern declined by an average of 12.0% per year compared to no significant change among those aged 30 years and older (p=0.013)
- Among males aged 18–29 years this pattern declined by an average of 11.8% per year compared to no significant change among those aged 30 years and older (p=0.021).

The rate of decline did not vary by sex or socioeconomic or geographic regions.

Details—at least monthly single occasion risky drinking only

From 2010 to 2013, there was no significant change in the percentage of adults with only at least monthly single occasion risky alcohol consumption for any of the population groups.

The rate of change in this pattern of alcohol consumption varied by sex among the most disadvantaged group. While neither sex experienced a significant change in consumption, trends were significantly different from each other with the prevalence of at least monthly risky consumption increasing among males but decreasing among females (p=0.046).

Details—transitions in the pattern of risky alcohol consumption

From 2010 to 2013, patterns of alcohol consumption changed annually for the following population groups:

Among 18–29 year old males, the percentage drinking at both lifetime and monthly single occasion risky levels declined significantly by 12% (p=0.007), where single occasion risky drinking less often than monthly without lifetime risky consumption increased by 15% (p=0.046). This may indicate a transition at a population level to lower average weekly consumption and reduced frequency of single occasion risky consumption.

Among 18–29 year old females, the percentage drinking at both lifetime and monthly single occasion risky levels declined by 12% (p=0.119), where abstaining from alcohol consumption increased by 14% (p=0.106). Even though the two trends did not achieve statistical significance due to the lower prevalence of this consumption among females, it is encouraging that declines in risky consumption among females may also be occurring.

Among persons aged 30–64 no change in drinking patterns were detected apart from a small decline of 3.7% (p=0.019) in single occasion risky drinking less often than monthly and an increase of 3.2% (p=0.024) in low risk drinking. This indicates that risky drinking is a continuing problem in this age group especially for males.

Measuring change over time

For routine health monitoring, guideline 1 ‘lifetime risky’ drinking (derived as consumption of more than 14 drinks weekly) and guideline 2 ‘single occasion’ risky drinking (derived as consuming more than four standard drinks on a single occasion) are typically calculated and reported independently.[8] However, when trends in guideline 1 and 2 were analysed independently changes in drinking patterns were difficult to interpret. This was because a large percentage of the population engaged in both behaviours. This is depicted in Figure 67, where 65% of lifetime risky consumers also drank at weekly single occasion risk levels and conversely 90% of single occasion risky drinkers also consumed alcohol at lifetime risky levels. In effect, results by either guideline independently were predominantly attributable to those that were risky drinkers by both guidelines.

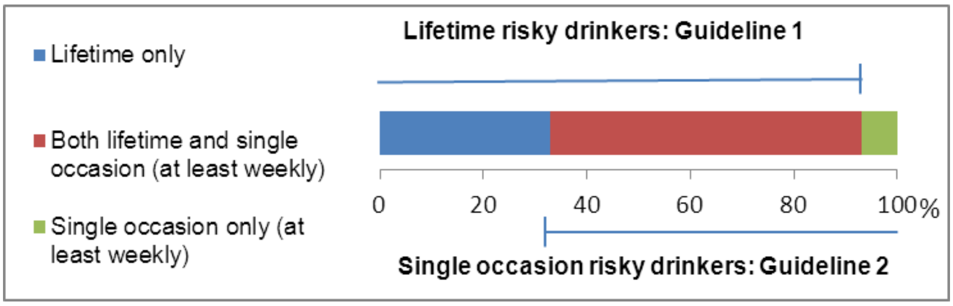


Figure 68: Overlap between NHMRC 2009 alcohol guidelines

To more accurately describe changes in the pattern of alcohol consumption, a single mutually exclusive variable was created from both guidelines. This categorised individuals as consuming alcohol at either lifetime risky levels, single occasion risky levels, or both. To further differentiate categories, single occasion risky consumption was based on monthly, rather than weekly episodes. The following table summarises the categories.

Table 12: Mutually exclusive alcohol consumption categories[1]

		Guideline 1, single occasion risk: greater than 4 drinks on any occasion		
		Never	**Less than monthly**	**At least monthly (includes weekly)**
Guideline 2, lifetime risk: no more than 2 drinks per day even if daily (less than 14 drinks per week)	**Less than or equal to 14 drinks per week**	Low risk for both “low risk”	Less than monthly single occasion only “single occasion less than monthly”	At least monthly single occasion only “monthly single occasion”
	Greater than 14 drinks per week	Lifetime only, low frequency (0.7%)	Less than monthly single occasion and lifetime, low frequency (1.6%)	At least monthly single occasion and lifetime “lifetime and single occasion”

[1] Those who abstain from alcohol consumption are omitted from this table but included in analyses.

Lifetime and monthly single occasion risky drinking results

The method used to collect alcohol consumption data was standardised to the methodology in the National Drug Strategy Household Survey (NDSHS). This method has been used consistently by Queensland Health since 2010.

Trends are analysed by sex, age groups, sex by age group, and socioeconomic and geographic regions. Additional findings are included in the supplementary figures Figure 74 through Figure 78.

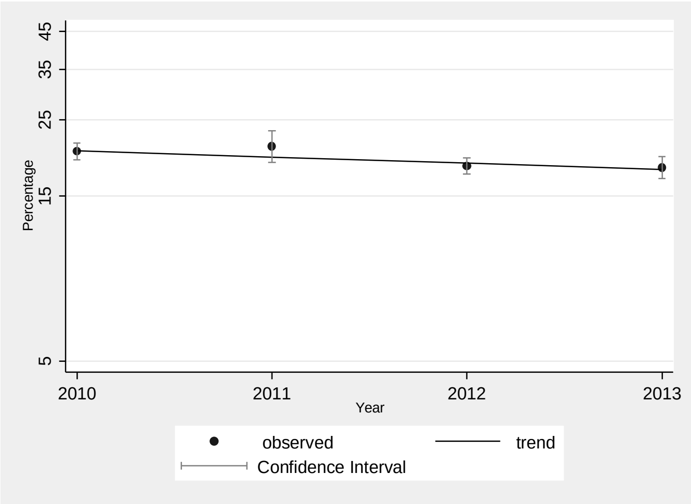


Figure 69: Lifetime and monthly single occasion risky drinking trend

From 2010 and 2013, the percentage of adults who consumed alcohol at lifetime and monthly single occasion risky levels decreased by an average of 4.1% per year or 11.8% over the entire period.

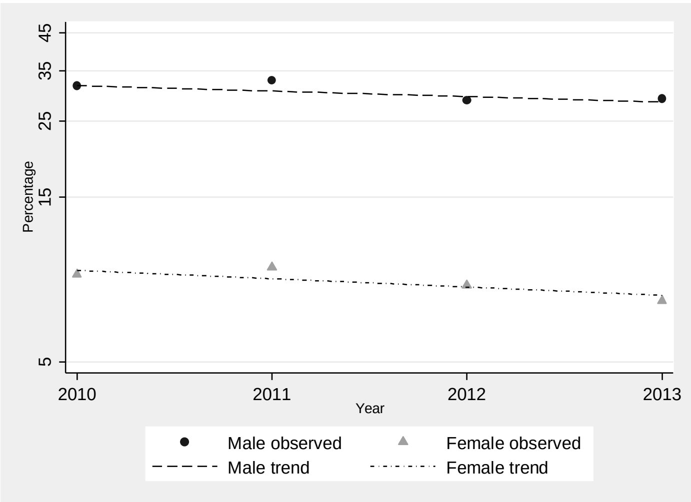


Figure 70: Lifetime and monthly single occasion risky drinking trend by sex

The percentage of males who consumed alcohol at lifetime and monthly single occasion risky levels decreased annually by an average of 3.6%. Females decreased at a similar rate but due to a lower prevalence the decline not achieve statistical significance.

No difference was observed in the rate of decline between males and females (p=0.634).

On average, the prevalence of lifetime and monthly single occasion risky drinking was 71.7% (95% CI 69.1–74.1%) lower for females than for males (p<0.001).

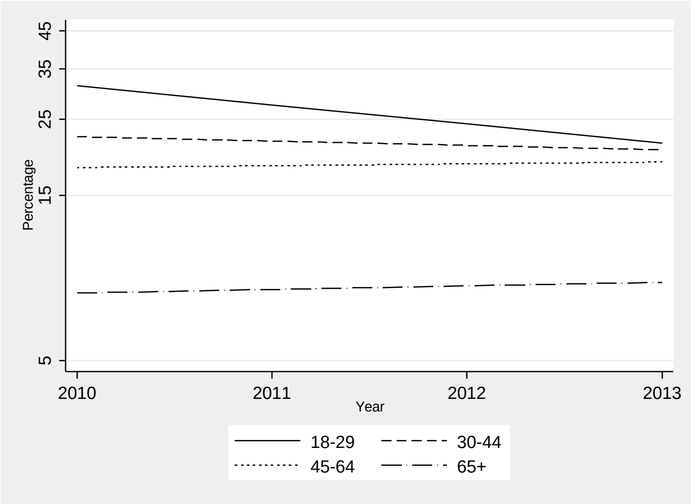


Figure 71: Lifetime and monthly single occasion risky drinking trend by age group

The percentage of adults aged 18–29 years who consumed alcohol at lifetime and monthly single occasion risky levels decreased annually by an average of:

- 12.0% (persons)
- 11.8% (males).

The rate of decline varied by age for persons (p=0.013) and males (p=0.021) with those aged 18–29 years decreasing significantly compared to no change in other age groups.

Females aged 18–29 years had a large decrease of 11.9% per year. This decline is similar to that observed among males although it was not statistically significant (p=0.119).

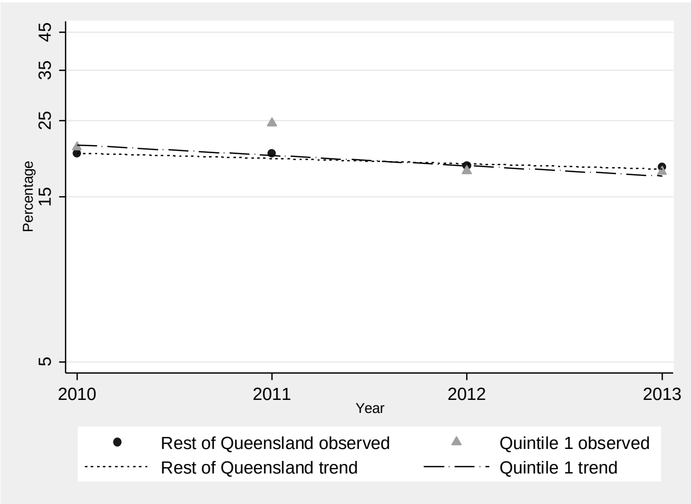


Figure 72: Lifetime and monthly single occasion risky drinking trend by socioeconomic status

No difference was observed in the rate of decrease between the most socioeconomically disadvantaged areas and the rest of Queensland (p=0.416).

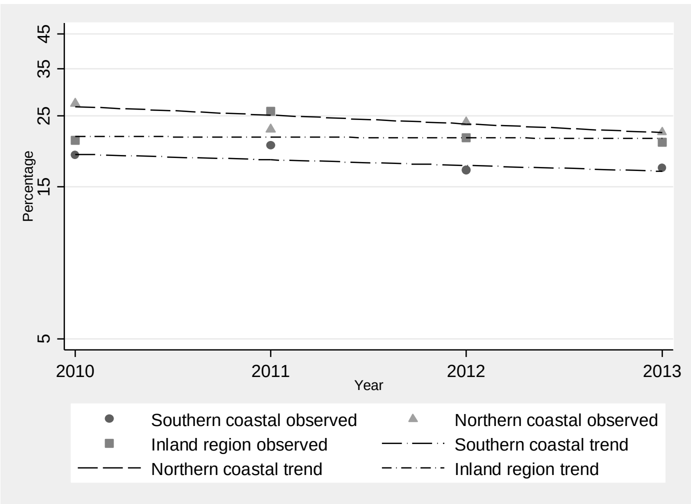


Figure 73: Lifetime and monthly single occasion risky drinking trend by region

The percentage of adults in the sourthern coastal region who consumed alcohol at lifetime and monthly single occasion risky levels decreased annually by an average of4.0%.

No differences was observed in the rate of decrease between geographic regions (p=0.528).

Table 13 presents detailed results for the preceding figures. Supplementary figures (Figure 74 through Figure 78) contain results for age by: sex, socioeconomic status, and geographic region; and sex by: socioeconomic status and geographic region. No significant differences in the rate of decline were observed by these characteristics.

Table 13: Lifetime and monthly single occasion risky drinking trends 2010–13

	Average annual percentage change[1]		Test for trend for each subgroup[2]	Test for trend differences between subgroups[3]
	%	(95% CI)	*p*-value	*p*-value
Persons	-4.1	(-7.1, -1.0)	0.010	
Sex				
Males	-3.6	(-7.0, -0.1)	0.043	0.634
Females	-5.4	(-11.7, 1.4)	0.115	
Age category—persons				
18–29	-12.0	(-18.8, -4.7)	0.002	0.013
30–44	-2.9	(-8.1, 2.6)	0.302	
45–64	1.2	(-2.9, 5.6)	0.566	
65 years or older	2.4	(-4.8, 10.2)	0.519	
Age category—males				
18–29	-11.8	(-19.5, -3.3)	0.007	0.021
30–44	-3.1	(-9.1, 3.4)	0.342	
45–64	1.4	(-3.3, 6.4)	0.558	
65 years or older	5.1	(-2.8, 13.7)	0.231	
Age category—females				
18–29	-11.9	(-24.9, 3.3)	0.119	0.455
30–44	-1.9	(-12.3, 9.6)	0.730	
45–64	-0.4	(-8.8, 8.7)	0.925	
65 years or older	-11.8	(-27.5, 7.4)	0.213	
Socioeconomic advantage/disadvantage				
Most disadvantaged	-6.7	(-13.2, 0.4)	0.062	0.416
Rest of Queensland	-3.5	(-6.8, 0.0)	0.049	
Geographic regions[4]				
Southern coastal	-4.0	(-7.7, -0.2)	0.042	0.528
Northern coastal	-6.1	(-12.6, 0.9)	0.086	
Inland region	-0.5	(-7.5, 7.0)	0.892	

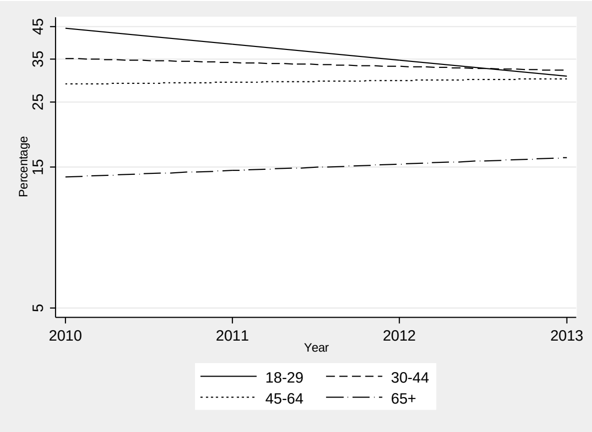
[1] Positive values represent annual percentage increases; negative values represent annual percentage decreases.
[2] Tests whether there is s statistically significant increase or decrease in trend over time.
[3] Tests whether there is significant difference in the trend over time between subgroups (e.g. males vs. females).
[4] Trends by geographic region are for 2006—2013.

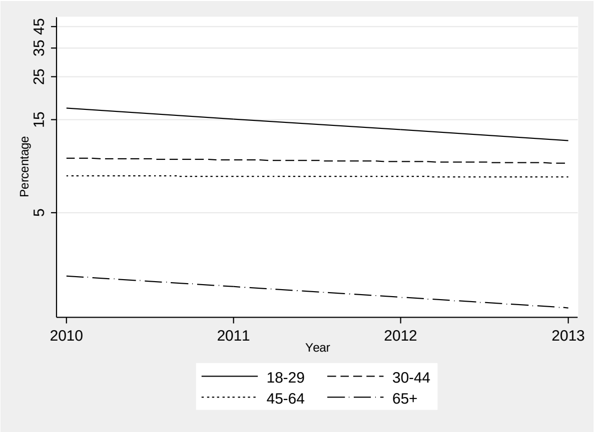
Table 14 presents results for differences in trends by combinations of sociodemographic characteristics. Each combination is analysed by year so represents three way interactions terms. No significant differences were observed.

Table 14: Lifetime and monthly single occasion risky drinking multivariate trend results

Sociodemographic characteristic	*p* value	
Age by sex	0.132	Figure 74
Age by socioeconomic status	0.196	Figure 75
Sex by socioeconomic status	0.516	Figure 76
Geographic region by sex	0.331	Figure 77
Age by geographic region	0.350	Figure 78

Lifetime and monthly single occasion risky drinking supplementary figures

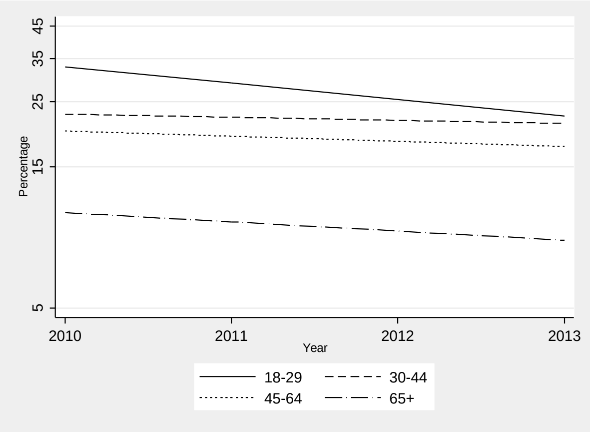


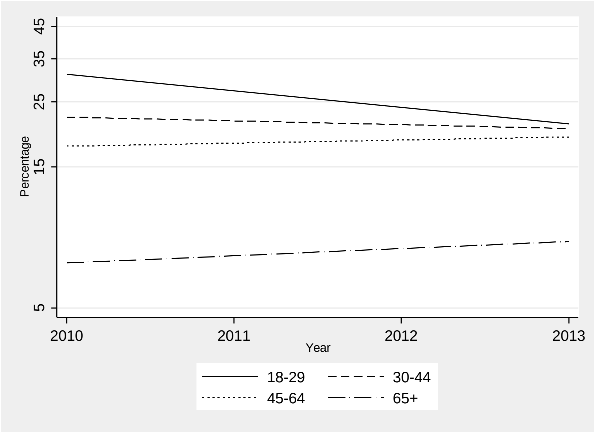


Males

Females

Figure 74: Age by sex trends in lifetime and monthly single occasion risky drinking (p=0.132)

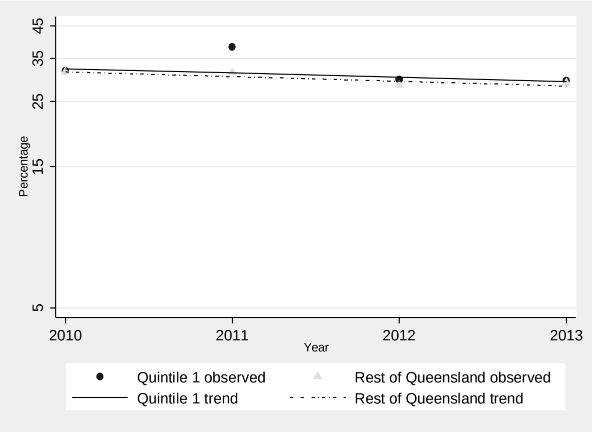


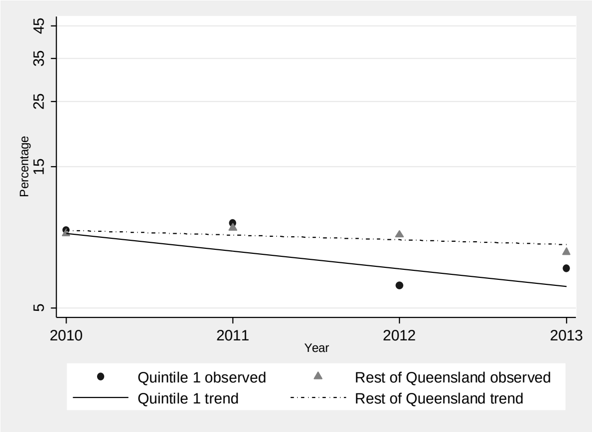


Most disadvantaged

Rest of Queensland (quintiles 2–5)

Figure 75: Age by socioeconomic status trends in lifetime and monthly single occasion risky drinking (p=0.196)

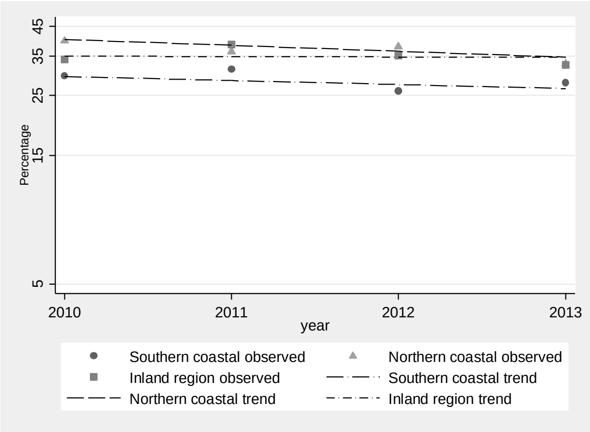




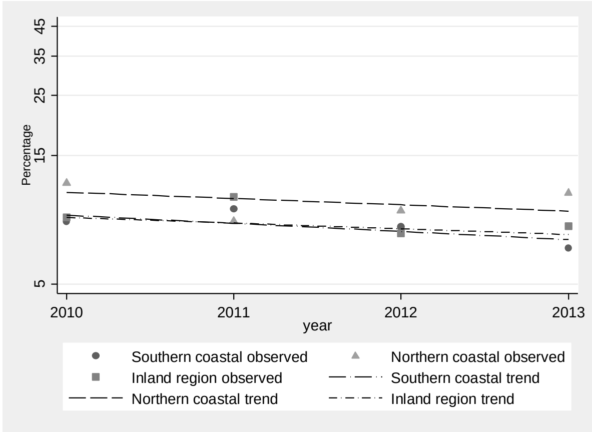
Males

Females

Figure 76: Sex by socioeconomic status trends in lifetime and monthly single occasion risky drinking (p=0.516)

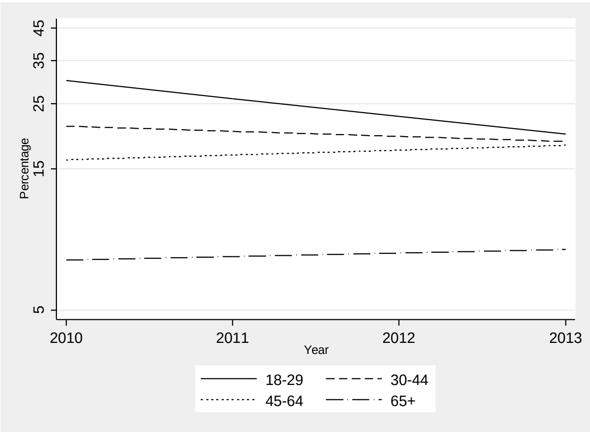


Males

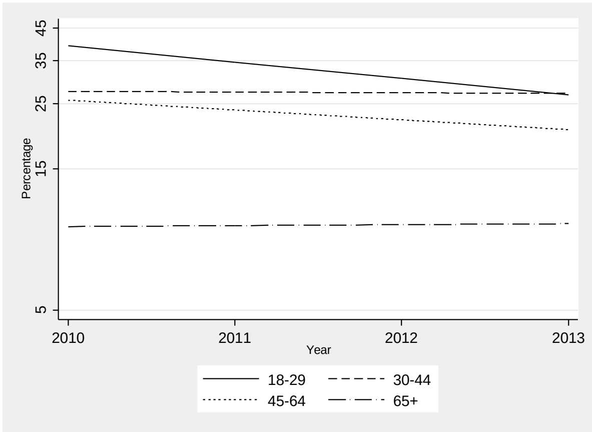


Females

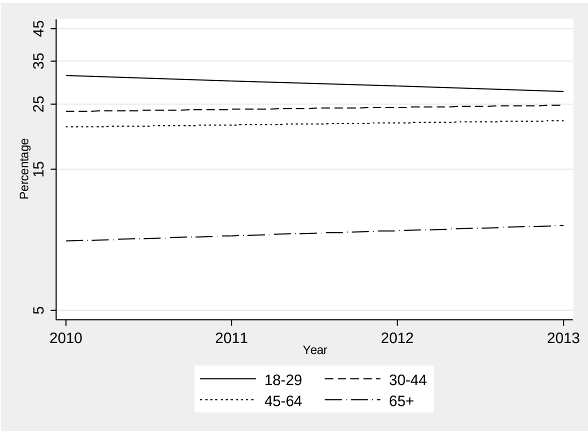
Figure 77: Geographic region by sex trends in lifetime and monthly single occasion risky drinking (p=0.331)



Southern coastal region



Northern coastal region



Inland region

Figure 78: Age by geographic region trends in lifetime and monthly single occasion risky drinking (p=0.350)

At least monthly single occasion risky drinking results

The second high risk alcohol consumption category analysed were adults who consumed alcohol at single occasion risky levels monthly but who did not meet criteria for lifetime risky consumption.

Trends are analysed by sex, age groups, sex by age group, and socioeconomic and geographic regions. Trends by sex in the most disadvantaged areas were explored further. Additional results are included in supplementary figures Figure 85 through Figure 89.

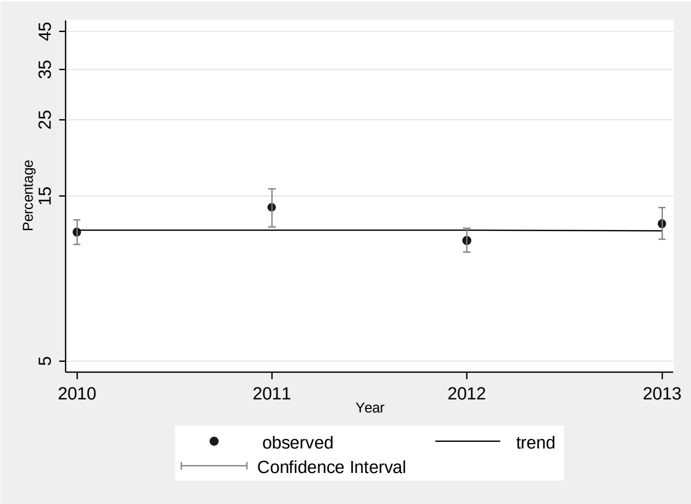


Figure 79: Monthly single occasion risky alcohol consumption trend

From 2010 and 2013, no significant change was observed in the percentage of adults who consumed alcohol at monthly single occasion risky levels without lifetime risk (p=0.955).

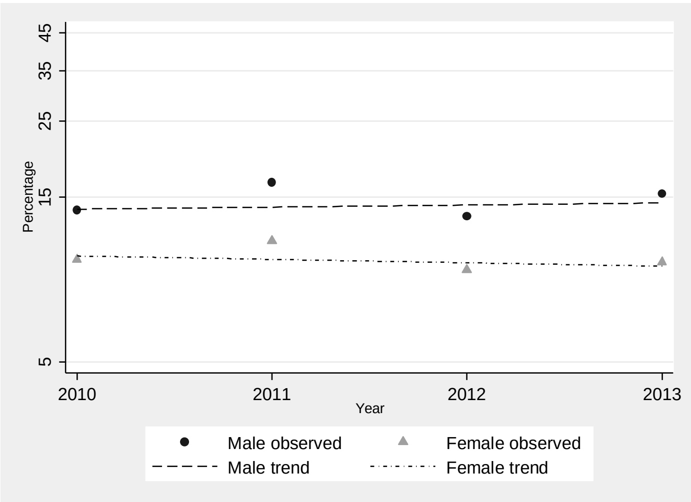


Figure 80: Monthly single occasion risky alcohol consumption trend by sex

No difference was observed in the rate of change between males and females (p=0.429), nor was there a change for males or females.

On average, the prevalence of monthly single occasion risky alcohol consumption without lifetime risk was 30.5% (95% CI 23.1-37.2%) lower for females than for males (p<0.001).

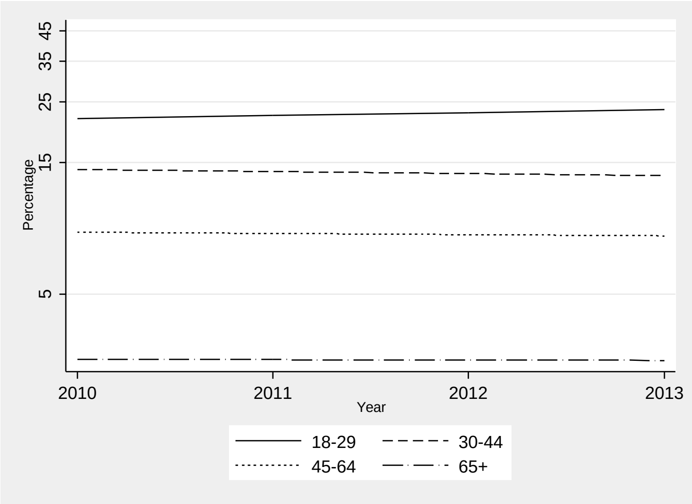


Figure 81: Monthly single occasion risky alcohol consumption trend by age

No difference was observed in the rate of change between age groups (p=0.904), nor was there a change for any age group.

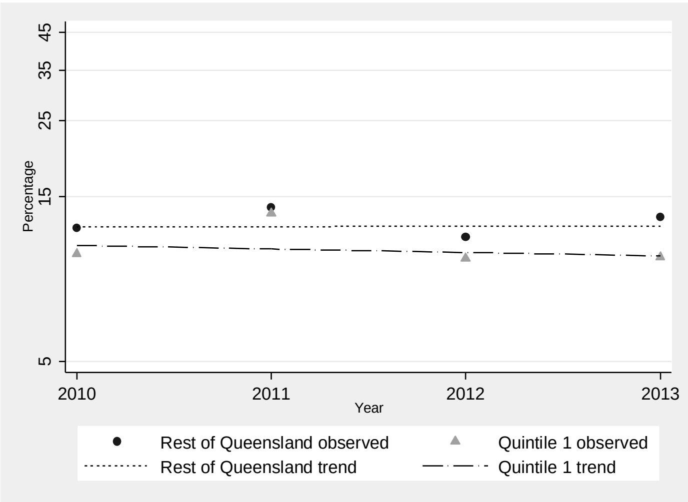


Figure 82: Monthly single occasion risky alcohol consumption trend by socioeconomic status

No difference was observed in the rate of change between socioeconomic groups (p=0.652), nor was there a change for persons in the most disadvantaged areas or the rest of Queensland (quintiles 2–5).

Trends by sex and socioeconomic status are explored further in Figure 84.

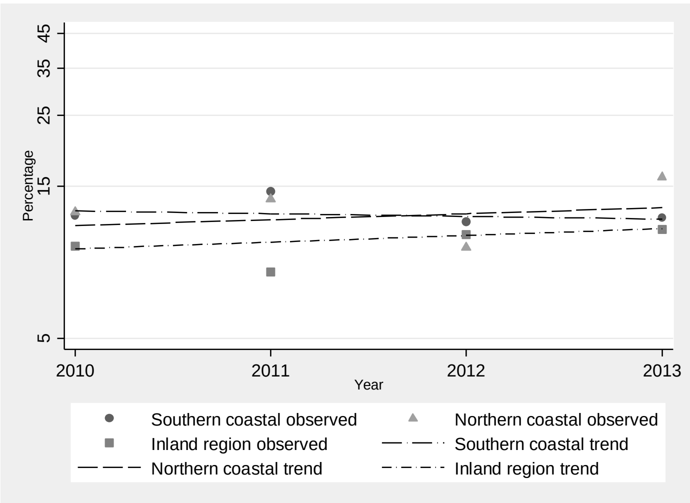


Figure 83: Monthly single occasion risky alcohol consumption trend by geographic region

No difference was observed in the rate of change between geographic regions (p=0.376), nor was there a change for any geographic region.

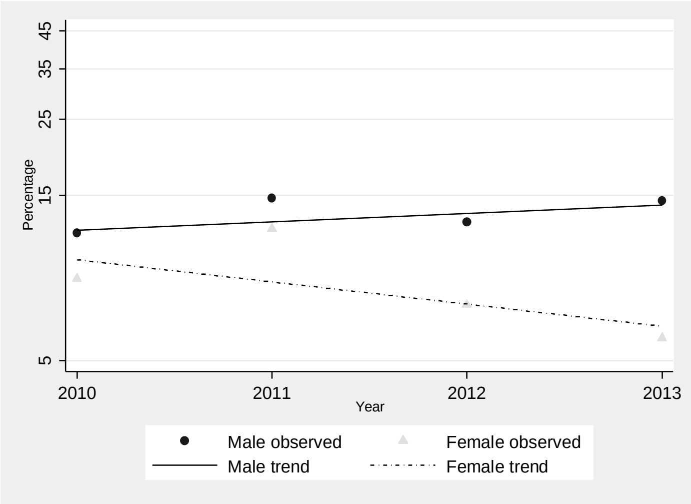


Figure 84: Monthly single occasion risky alcohol consumption trend in the most disadvantaged areas by sex

In the most disadvantaged areas, the rate of change in monthly single occasion risky alcohol consumption without lifetime risk varied by sex (p=0.046). The percentage of females consuming alcohol at these levels decreased by an average of 13.8% per year while males increased by an average of 5.7% per year.

No difference was observed in the rate of change between males and females in the rest of Queensland (quintiles 2–5, p= 0.945), nor was there a change for males or females in these areas.

Table 15 presents detailed results for the preceding figures. Supplementary figures (Figure 85 through Figure 89) contain results for age by: sex, socioeconomic status, and geographic region; and sex by: socioeconomic status and geographic region. A significant difference in changing monthly risky drinking without lifetime risk was observed between males and females in the most disadvantaged areas (Figure 84 and Figure 87). No other significant differences in the rate of change for this risky alcohol consumption category were observed

Table 15: Monthly single occasion risky alcohol consumption without lifetime risk trends 2010–13

	Average annual percentage change[1]		Test for trend for each subgroup[2]	Test for trend differences between subgroups[3]
	%	**(95% CI)**	***p*-value**	***p*-value**
Persons	-0.1	(-4.4, 4.4)	0.955	
Sex				
Males	1.4	(-4.2, 7.3)	0.634	0.429
Females	-2.2	(-8.9, 4.9)	0.527	
Age category—persons				
18–29	2.5	(-6.2, 12.0)	0.588	0.904
30–44	-1.7	(-8.2, 5.3)	0.629	
45–64	-1.0	(-7.0, 5.5)	0.760	
65 years or older	-0.3	(-11.8, 12.7)	0.960	
Age category—males				
18–29	5.8	(-6.0, 19.1)	0.348	0.739
30–44	-1.7	(-10.5, 8.1)	0.727	
45–64	-0.4	(-7.9, 7.8)	0.925	
65 years or older	4.5	(-9.1, 20.1)	0.533	
Age category—females				
18–29	-1.0	(-13.4, 13.1)	0.883	0.967
30–44	-1.5	(-10.9, 8.8)	0.762	
45–64	-1.7	(-11.6, 9.3)	0.756	
65 years or older	-7.8	(-28.2, 18.4)	0.523	
Socioeconomic advantage/disadvantage				
Most disadvantaged—persons	-2.3	(-11.6, 7.9)	0.647	0.652
Rest of Queensland—persons	0.2	(-4.6, 5.3)	0.926	
Most disadvantaged—males	5.7	(-7.1, 20.3)	0.398	0.046
Most disadvantaged—females	-13.8	(-26, 0.4)	0.057	
Rest of Queensland—males	0.5	(-5.6, 7.1)	0.877	0.945
Rest of Queensland—females	0.1	(-7.3, 8.2)	0.970	
Geographic regions[4]				
Southern coastal	-1.9	(-7.0, 3.4)	0.476	0.376
Northern coastal	4.4	(-6.1, 16.0)	0.425	
Inland region	5.0	(-5.5, 16.6)	0.367	

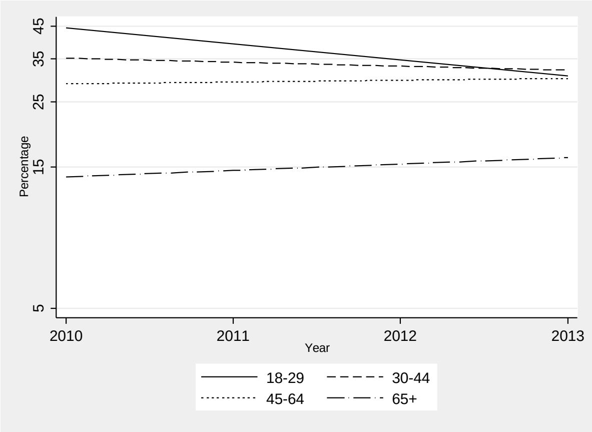
[1] Positive values represent annual percentage increases; negative values represent annual percentage decreases.
[2] Tests whether there is s statistically significant increase or decrease in trend over time.
[3] Tests whether there is significant difference in the trend over time between subgroups (e.g. males vs. females).
[4] Trends by geographic region are for 2006—2013.

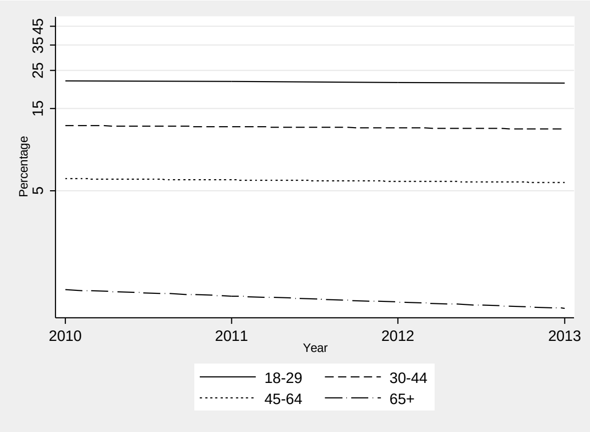
Table 16 presents results for differences in trends by combinations of sociodemographic characteristics. Each combination is analysed by year so represents three way interactions terms. No significant differences were observed.

Table 16: Monthly single occasion risky alcohol consumption multivariate trend results

Sociodemographic characteristic	*p* value	
Age by sex	0.143	Figure 85
Age by socioeconomic status	0.908	Figure 86
Sex by socioeconomic status	0.314	Figure 87
Geographic region by sex	0.576	Figure 88
Age by geographic region	0.145	Figure 89

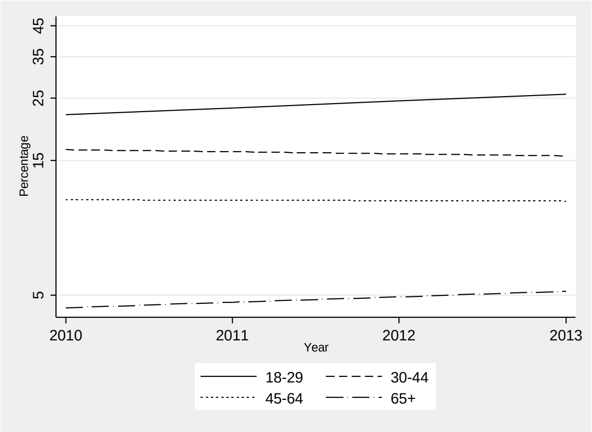
Monthly single occasion risky drinking supplementary figures

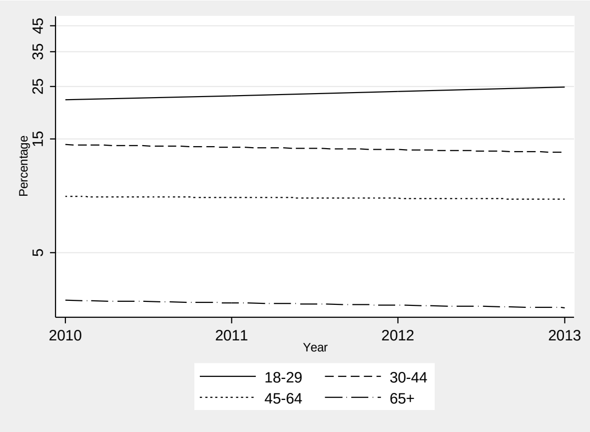




Males Females

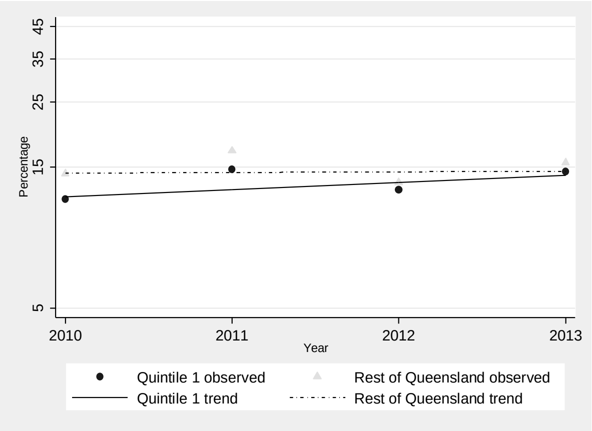
Figure 85: Age by sex trends in monthly single occasion risky drinking only (p=0.143)

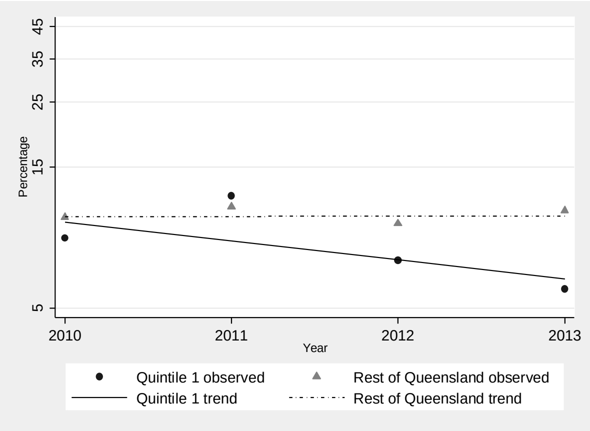




Most disadvantaged Rest of Queensland (quintiles 2–5)

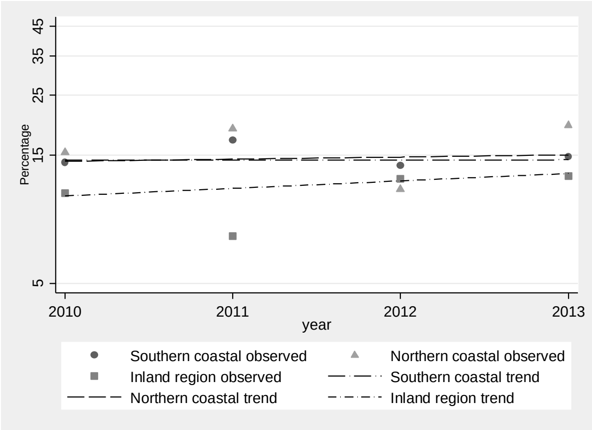
Figure 86: Age by socioeconomic status trends in monthly single occasion risky drinking (p=0.908)



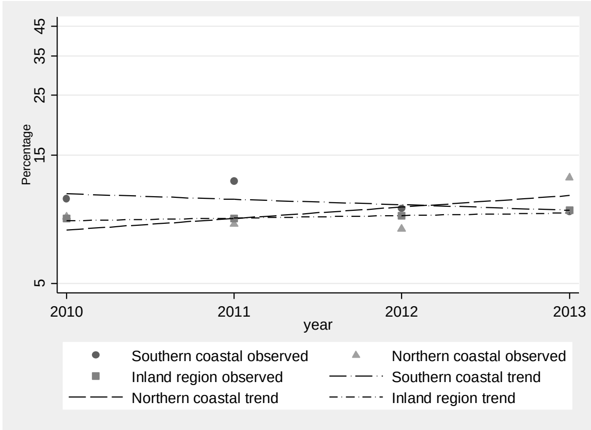


Males Females

Figure 87: Sex by socioeconomic status trends in monthly single occasion risky drinking (p=0.314)

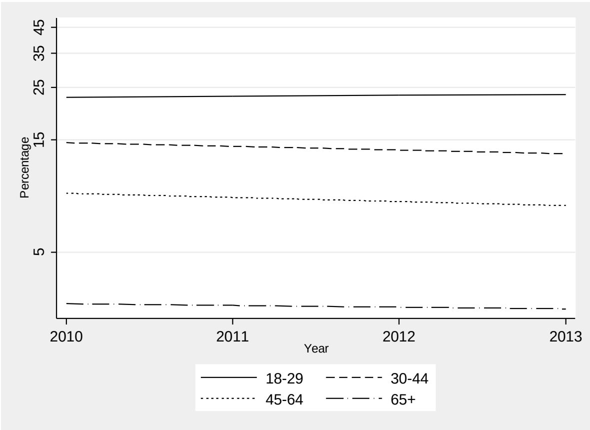


Males

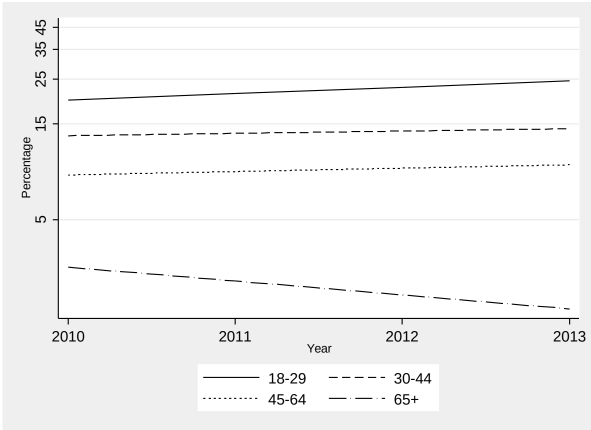


Females

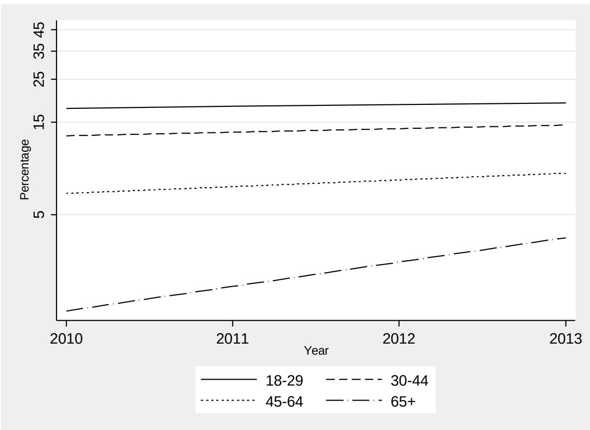
Figure 88: Geographic region by sex trends in monthly single occasion risky drinking (p=0.576)



Southern coastal region



Northern coastal region



Inland region

Figure 89: Age by geographic region trends in monthly single occasion risky drinking (p=0.145)

Interpreting varying alcohol consumption trends by risk category

To more fully understand changing alcohol consumption trends, risk categories need to be examined simultaneously. For example, if a decrease is observed in one category there should be a corresponding increase another category for a subpopulation. These shifts between categories are evidence of population level net transitions from one drinking behaviour to another.

Analysis of lifetime and monthly risky drinking showed that the majority of the decrease in risky alcohol consumption was attributable to young people. While this is encouraging, we need to simultaneously examine the other categories to quantify the change in overall risk across the entire alcohol consumption spectrum.

Trends are analysed by sex and age with age defined as 18–29 years and 30–64 years. First, flow charts are used to depict the transitions between consumption categories at the population level. These are followed by figures and tables with more detailed results.

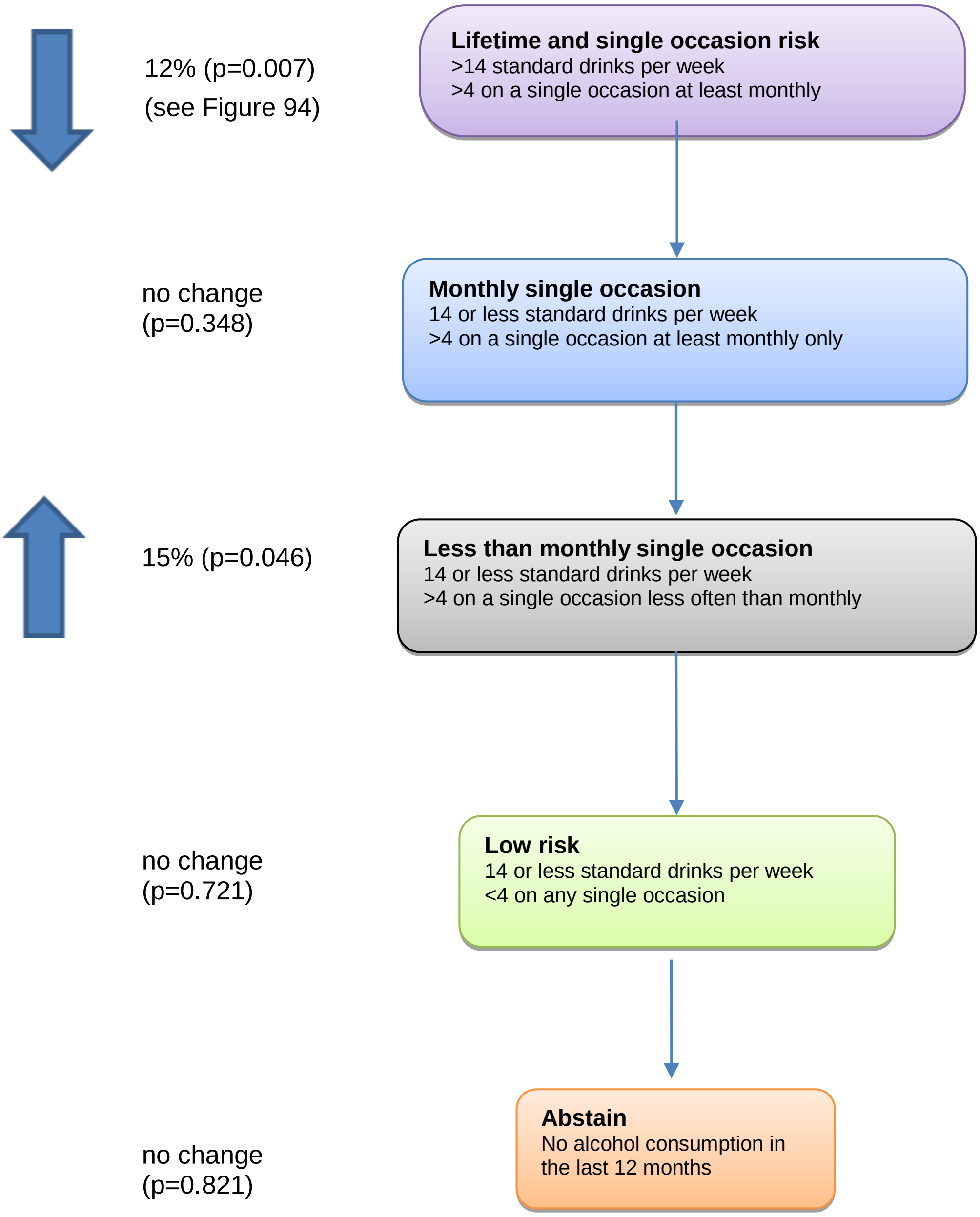


Figure 90: Alcohol consumption patterns, males 18–29 years

The percentage of young males consuming alcohol at lifetime and single occasion monthly risky levels is decreasing by an annual average of 12% per year. This indicates that, at a population level, average weekly consumption and frequency of monthly single occasion risky drinking are both declining in this group. At a population level, the transition appears to be to single occasion risky drinking less often than monthly, which has increased by an annual average of 15% per year, with no change in other drinking categories. While this gain is admirable, it is overshadowed by the fact that over 80% of young males are engaging in some form of risky alcohol consumption.

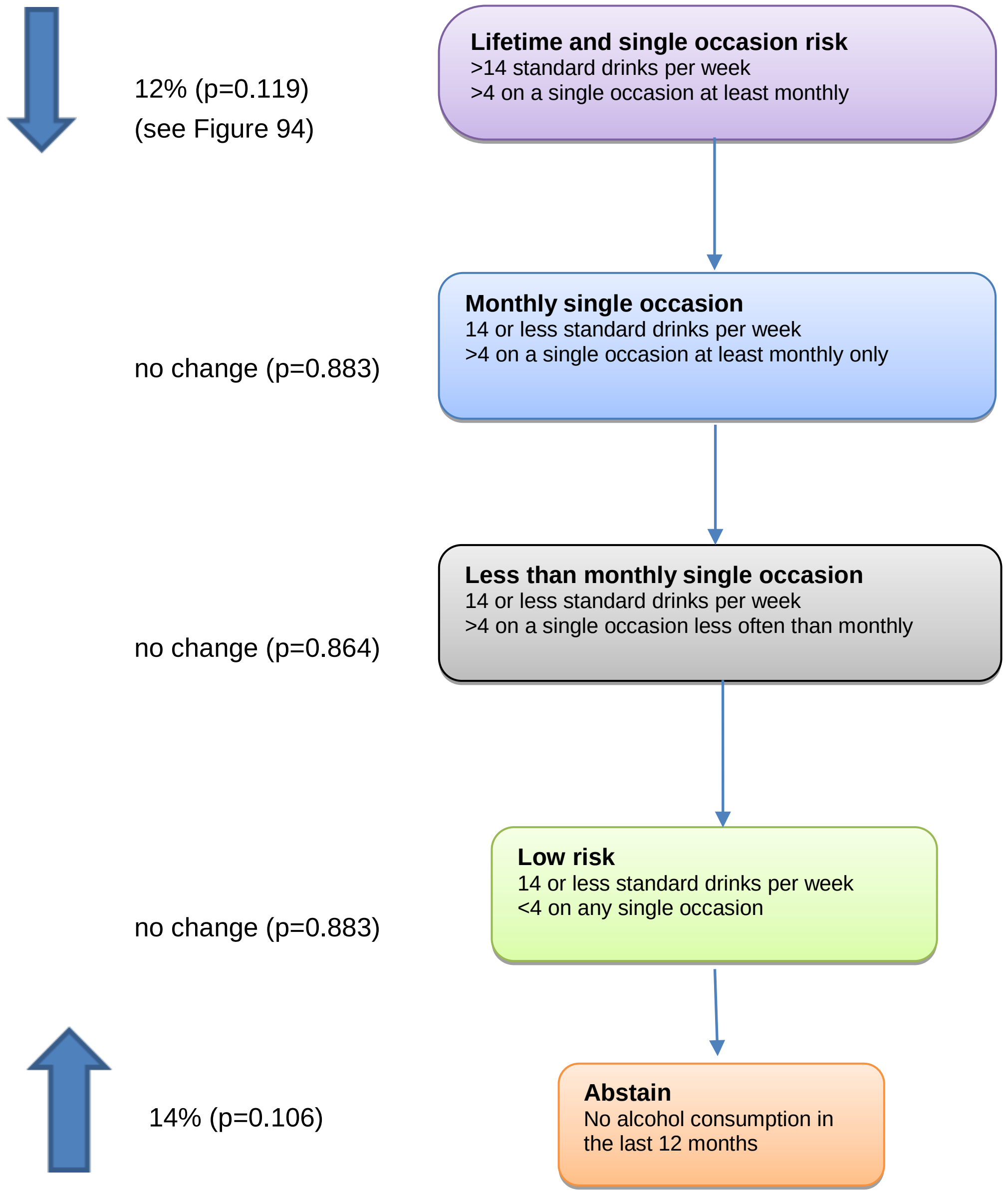


Figure 91: Alcohol consumption patterns, females 18–29 years

Young females have experienced a similar, although not statistically significant, decrease in lifetime and single occasion monthly risky drinking. However, the transition appears to be to abstaining from alcohol consumption (increased annually by an average of 14% per year).

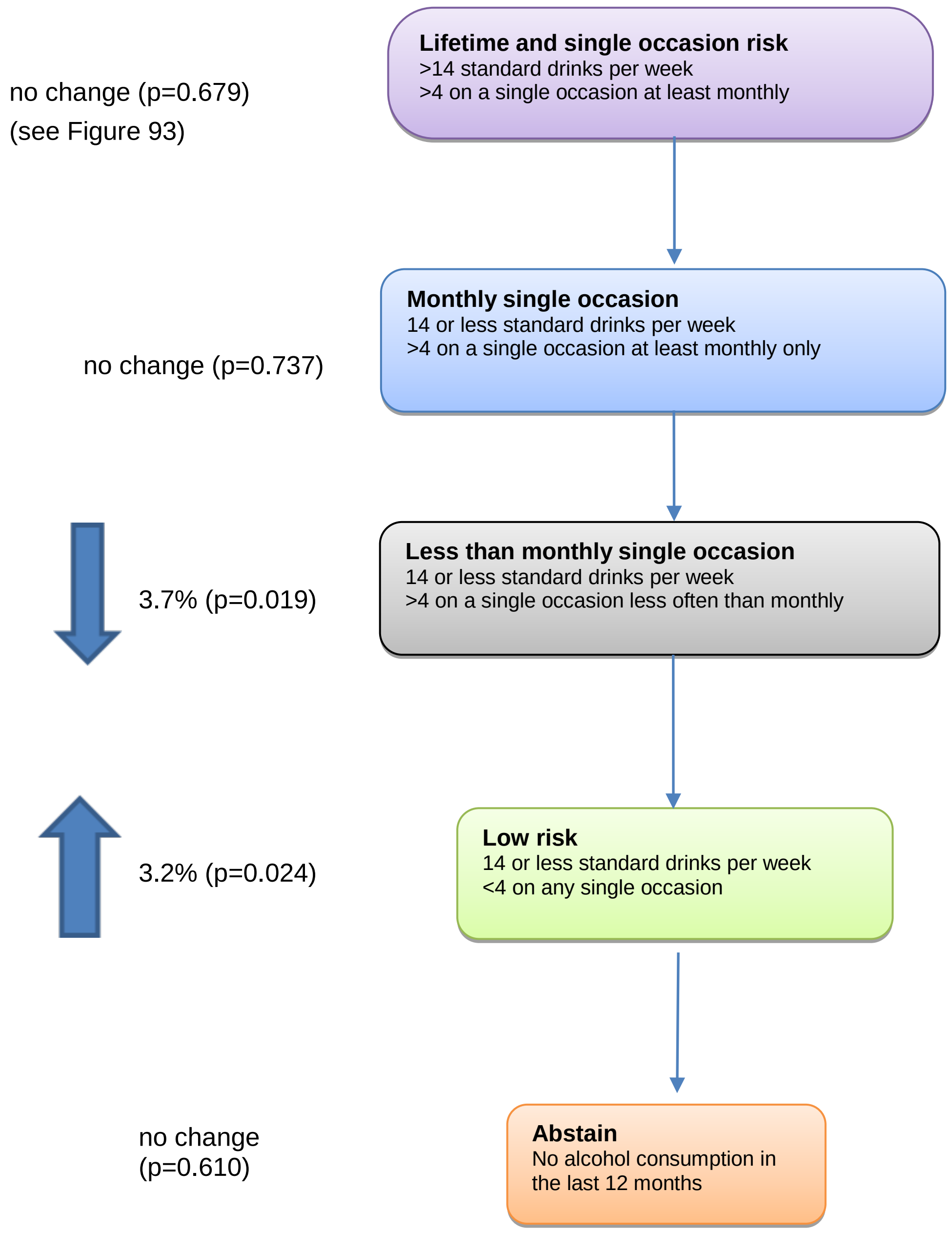
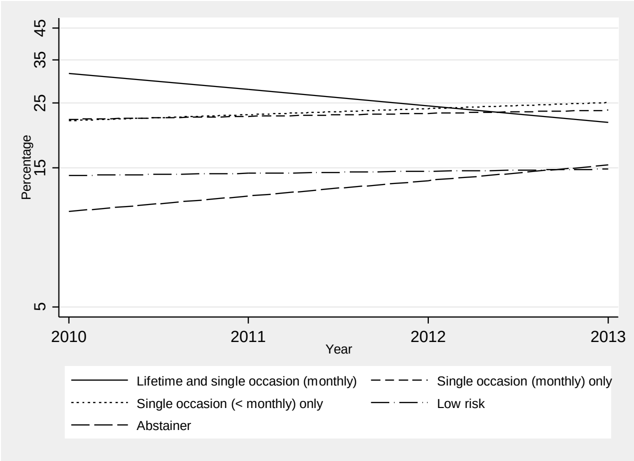


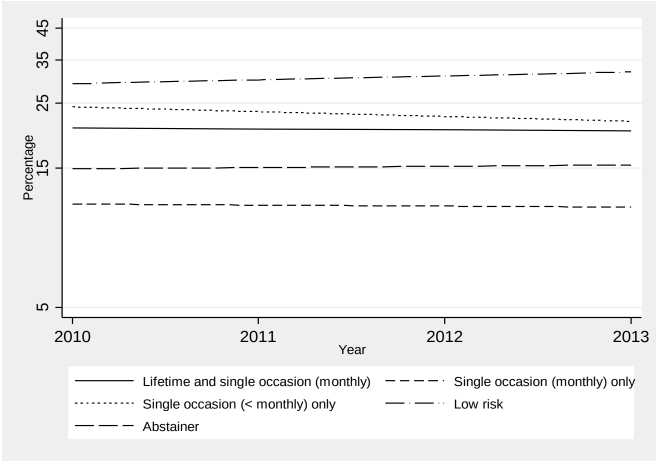
Figure 92: Alcohol consumption patterns, persons 30–64 years

There is little change in drinking patterns for persons aged 30–64 years apart from a small decrease in single occasion less than monthly risky drinking and a corresponding increase in low risk drinking. Trends in this age group do not differ by sex, however, the prevalence in the top two most risky categories was 45% for males while only 17% for females in 2013.

Alcohol consumption categories supplementary figures

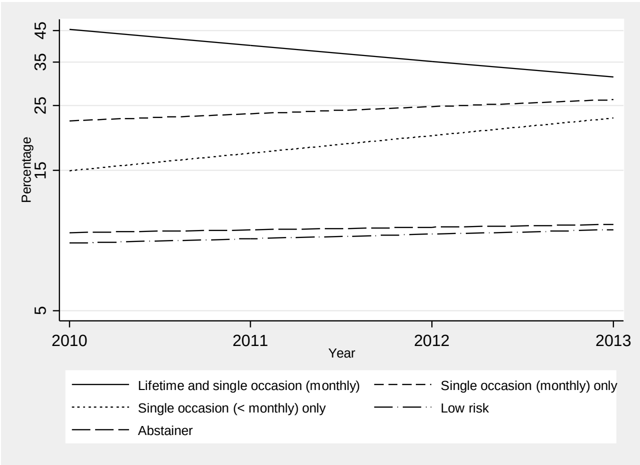


18–29 years

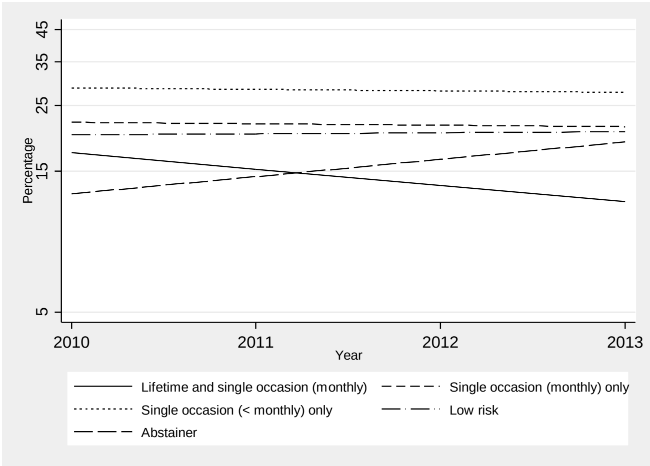


30–64 years

Figure 93: Trends in alcohol consumption categories for persons by age

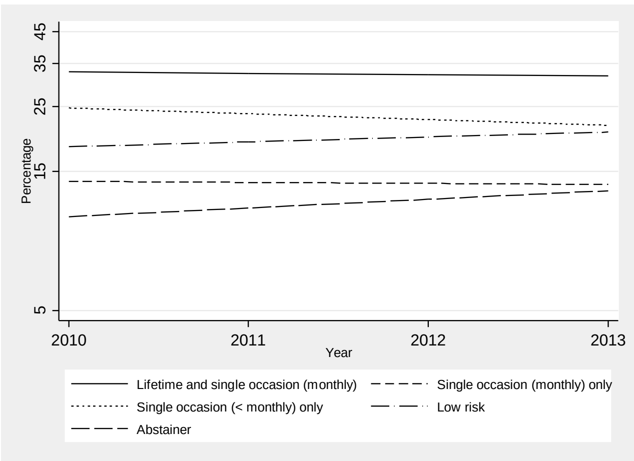


Males

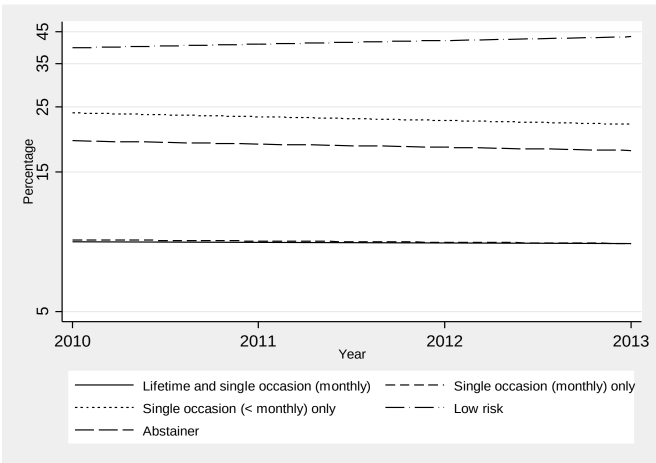


Females

Figure 94: Trends in alcohol consumption categories for 18–29 year olds by sex



Males



Females

Figure 95: Trends in alcohol consumption categories for 30–64 year olds by sex

Table 17 presents the results summarised previously in flowcharts and figures in detail across the alcohol consumption categories by age and sex. For example, among males aged 18–29 years, consuming alcohol at lifetime and monthly single occasion risky levels decreased by 11.8% between 2010–13 and the prevalence of this behaviour was 29.3% in 2013. The prevalence of single occasion risky consumption without lifetime risk did not change between 2010–13 (29.6% prevalence in 2013) in this subgroup.

Table 17: Prevalence (2013) and trends in alcohol consumption categories 2010–13

	Lifetime and single occasion risky drinking at least monthly			Single occasion risky drinking at least monthly without lifetime risk			Single occasion risky drinking less often than monthly without lifetime risk			Low risk drinking			Abstainers		
	%[1] (2013)	Annual % change[2]	p-value[3]	%[1] (2013)	Annual % change[2]	p-value[3]	%[1] (2013)	Annual % change[2]	p-value[3]	%[1] (2013)	Annual % change[2]	p-value[3]	%[1] (2013)	Annual % change[2]	p-value[3]
Persons	18.2	-4.1 (-7.1, -1.0)	0.010	12.5	-0.1 (-4.4, 4.4)	0.955	19.8	-2.5 (-5.4, 0.6)	0.108	30.4	2.7 (0.3, 5.1)	0.024	16.8	3.2 (0.1, 6.5)	0.044
Males															
18–29	29.3	-11.8 (-19.5, -3.3)	0.007	29.6	5.8 (-6.0, 19.1)	0.348	24	14.8 (0.3, 31.5)	0.046	8.7	3.5 (-14.4, 25.3)	0.721	6.8	2.1 (-14.9, 22.6)	0.821
30–44	32.9	-3.1 (-9.1, 3.4)	0.342	15.8	-1.7 (-10.5, 8.1)	0.727	23	-3.2 (-10.1, 4.3)	0.398	14.2	6.5 (-4.1, 18.2)	0.237	12.5	13.3 (0.1, 28.2)	0.049
45–64	31.3	1.4 (-3.3, 6.4)	0.558	10.4	-0.4 (-7.9, 7.8)	0.925	19.1	-5.5 (-10.7, -0.1)	0.047	24.7	3.9 (-1.5, 9.7)	0.162	11.2	2.8 (-4.3, 10.5)	0.448
65+ years	16.8	5.1 (-2.8, 13.7)	0.213	5.5	4.5 (-9.1, 20.1)	0.533	11.3	-6.0 (-14.1, 2.9)	0.180	39	-1.0 (-5.6, 3.8)	0.681	21.4	0.7 (-5.5, 7.3)	0.835
Females															
18–29	9.4	-11.9 (-24.9, 3.3)	0.119	21.4	-1.0 (-13.4, 13.1)	0.883	28.1	-1.0 (-11.6, 10.9)	0.864	20.3	1.0 (-11.5, 15.2)	0.883	20.8	14.4 (-2.8, 34.7)	0.106
30–44	9.7	-1.9 (-12.3, 9.6)	0.730	11.1	-1.5 (-10.9, 8.8)	0.762	28.2	-2.6 (-8.4, 3.7)	0.413	36.6	5.2 (-0.7, 11.5)	0.086	13.5	-4.0 (-11.6, 4.4)	0.341
45–64	7.6	-0.4 (-8.8, 8.7)	0.925	6	-1.7 (-11.6, 9.3)	0.756	16.1	-5.2 (-10.8, 0.6)	0.080	49.6	1.8 (-1.8, 5.5)	0.337	17.4	-1.7 (-7, 4)	0.556
65+ years	1.8	-11.8 (-27.5, 7.4)	0.213	1.4	-7.8 (-28.2, 18.4)	0.523	2.8	-27.1 (-36.1, -16.9)	<0.001	50	1.5 (-2.6, 5.8)	0.476	41.7	2.0 (-2.5, 6.8)	0.388
30–64 years															
Persons	20.2	-0.7 (-4.1, 2.8)	0.679	10.7	-0.8 (-5.5, 4.1)	0.737	21.4	-3.7 (-6.8, -0.6)	0.019	31.7	3.2 (0.4, 6.0)	0.024	13.7	1.0 (-2.9, 5.1)	0.610
Males	32.1	-0.7 (-4.6, 3.3)	0.719	13.0	-0.5 (-6.6, 5.9)	0.867	20.9	-4.2 (-8.6, 0.4)	0.071	19.8	4.1 (-1.0, 9.5)	0.119	11.8	7.4 (0.4, 14.8)	0.037
Females	8.6	-0.8 (-7.6, 6.6)	0.832	8.4	-1.3 (-8.3, 6.3)	0.735	21.8	-3.2 (-7.4, 1.1)	0.139	43.4	2.6 (-0.6, 5.9)	0.108	15.6	-2.7 (-7.3, 2)	0.252

[1] Prevalence in current year
[2] Positive values represent annual percentage increases; negative values represent annual percentage decreases.
[3] Tests whether there is s statistically significant increase or decrease in trend over time.

Appendix 1: Detailed methods

Data source

The SRHS/Omnibus surveys collect data by computer assisted telephone interviewing (CATI) using random digit dialling. The sampling frame was the electronic white pages prior to 2009 and from 2009 onwards the sampling frame has been provided by an external provider. Similarly, interviews were conducted by designated Department of Health CATI interviewers prior to 2009 and by an external service provider specialising in the collection of sensitive health data from 2009 onwards.

The surveys adhere to all relevant legislation and standards in effect at the time of collection such as the Privacy Act (1988), the Public Health Act (2009), and the Telemarketing and Research Calls Industry Standard (2007). Surveys have been approved by the Department of Health Human Research Ethics Committee since 2010.

One adult from each eligible household was invited to participate. When a household included multiple eligible adults, the invited participant was selected using the next birthday rule or a similar methodology. The following individuals were excluded from selection: those unable to speak English sufficiently well for an interview to be conducted, those with a mental or physical disability which prevented them from being able to take part in a telephone interview, usual residents of the selected household who were absent from the household during the interviewing hours during the interview period, visitors to the selected household who did not usually live in that household. Average sample size was 6178 (range 1521 to 19,398) and average response rate was 63% (range 44% to 81%).

Questionnaires for each survey were developed by the Department of Health with questions based on validated instruments, recommendations from expert working groups, or successful previous use by the Department of Health or other jurisdictions. Questionnaires were developed to meet Queensland Government business needs, including reporting against state and national health targets. Therefore, questionnaire content varied each year with some health topics included annually while others were included semi-regularly.

Methods are summarised in Table 18 and technical reports are available from http://www.health.qld.gov.au/epidemiology/publications/phs.asp or by request.

Because the SRHS is a survey, data are weighted to population benchmarks using Australian Bureau of Statistics estimated resident population data to adjust for any differences between the survey sample and the population. Survey weighting also adjusts for oversampling, which is a component of SRHS survey design that enables reporting at multiple intrastate geographies. Due to this design, it is important that survey weights are included in any analyses.

All analyses were conducted in Stata v13[9] using a dataset specifically developed for trend analysis. Compiling the dataset involved extensive verification of data questions, coding, and derivation of final outcome variables. First, questionnaires were reviewed to identify any changes to questions or response options. In some cases, new summary variables were developed to create a common variable across all survey years. Second, all statistical code was reviewed. For early surveys, key indicators were frequently recalculated to ensure compatibility with later methodology. Data were only included in the final dataset once these checks were performed and any required recalculations were undertaken. The final dataset contained 75,913 records over 13 years.

Based on this process, the health domains included in this report are:

- smoking
- physical activity
- body mass index
- alcohol consumption.

Each of these health behaviours are described in the following section.

Table 18: Methodological summary for Omnibus 2004 to SRHS 2013

Survey Name	Data collection periods[1]	Sample size (18+ years)	Response rate (%)	SEIFA details[2]	ARIA details[2, 3]
SRHS 2013	14 February–22 May 2013	7,791	77%	Census 2011 SEIFA quintiles, index of advantage/disadvantaged	Census 2011 ARIA+
SRHS 2012	3 October 2011–28 March 2012	19,398	81%	Census 2011 SEIFA quintiles, index of advantage/disadvantaged	Census 2011 ARIA+
SRHS 2011	11 March–June 2011	12,164	44%	Census 2011 SEIFA quintiles, index of advantage/disadvantaged	Census 2011 ARIA+
SRHS 2010	29 October 2009–22 February 2010	8,959	65%	Census 2011 SEIFA quintiles, index of advantage/disadvantaged	Census 2011 ARIA+
SRHS 2009	27 January – 25 March 2009	7,571	56%	Census 2011 SEIFA quintiles, index of advantage/disadvantaged	Census 2011 ARIA+
Omnibus Survey 2008	10 June–4 July 2008	2,002	47%	Census 2006 SEIFA quintiles, index of advantage/disadvantage	Census 2006 ARIA+
Omnibus Survey 2007	22 May–16 June 2007	2,004	47%	Census 2001 SEIFA quintiles, index of disadvantage	Census 2001 ARIA+
Omnibus Survey 2006	13 October–26 November 2006	1,521	66%	Census 2001 SEIFA quintiles, index of disadvantage	Census 2001 ARIA+
Omnibus Survey 2004	27 April–28 June 2004	2,231	71%	Census 2001 SEIFA quintiles, index of disadvantage	Census 2001 ARIA+
Omnibus Survey 2002	8 April–13 June 2002	2,481	75%	Census 1996 SEIFA quintile, index of disadvantage	Census 2001 ARIA

1 Data not collected during school term breaks.
2 Applied to 2011 SLAs (2009–13), to 2006 SLAs (2008), to 2001 delivery area postcode (2007), to 2004 SLAs (2002–04), and to 1999 SLAs (2002).
3 Census 2001 ARIA+ ABS release based on 2001 population and 1996 service centres.

Key health indicators (outcome variables)

Key health indicators are derived from numerous individual survey questions that translate complex behaviours into a single summary outcome. The final outcome is typically aligned to health guidelines that may be clinically based or developed by panels of experts. The underlying survey questions are either extensively validated or in common use across jurisdictions and have been assessed as providing valid measures of behaviour.

Key health indicators are often coded as a binary variable (for example, 0=non-smoker and 1=smoker). The annual reports from each survey present results as the prevalence of the population that engages in behaviour, typically reported as percentages. However, binary outcomes can also be used to generate counts of the population engaging in a behaviour which enables the use of other analytic methods.

Information for the following key health indicators was collected regularly and could be analysed for trends. In all cases, respondents that refused to answer or didn't know were coded to missing.

Daily smoking

Daily smoking was collected by asking respondents whether they smoke cigarettes, cigars, pipes or other tobacco products daily, at least weekly (not daily), less often than weekly, or not at all. Data were collected in this format from 2009 onwards. Prior to 2009, response options were: I smoke daily, I smoke occasionally, I don't smoke now but I used to, I've tried a few times but never smoked regularly and I've never smoked. Due to this code frame shift, daily smoking was the key health indicator used for trend analysis across the entire period.

Physical activity

Sufficient physical activity data were collected using the Active Australia instrument with summary indicators derived as detailed in the data user manual.[10] Final physical activity indicators align to the 1999 Department of Health and Ageing (DoHA) National physical activity guidelines for adults.[6] Specifically, recommendation for adults aged 18 years and older are 30 minutes or more of moderate physical activity on most (preferably all) days. 'Most' days was defined as five or more. New national physical activity guidelines were released in early 2014.[11,12] The recommended weekly sessions were unchanged and the recommended duration of moderate physical activity was increased from 2.5 hours to 2.5–5.0 hours. Sufficient physical activity can therefore be interpreted as achieving minimum recommended amounts.

Body mass index

Height is collected as respondents' height without shoes; weight is collected as respondents' weight without shoes or clothes. BMI is then calculated as:

$$BMI = \frac{wt(kg)}{ht(m)^2}$$

As recommended by the World Health Organisation[7] this score is then categorised as:

- Underweight: less than 18.5
- Healthy weight: 18.5 to 24.9
- Overweight: 25.0 to 29.9
- Obese: greater than or equal to 30.0.

Alcohol consumption

In this report, alcohol consumption is categorised based on the 2009 National Health and Medical Research Council (NHMRC) Australian guidelines to reduce health risks from drinking alcohol (Table 19).[13] Additional recommendations for pregnant women and youth were not applied. Statistical code from the Australian Institute of Health and Welfare (AIHW)[8] was adapted to calculate risky consumption.

Table 19: Australian guidelines to reduce health risks from drinking alcohol

GUIDELINE 1	GUIDELINE 2
Reducing the risk of alcohol-related harm over a lifetime	**Reducing the risk of injury on a single occasion of drinking**
The lifetime risk of harm from drinking alcohol increases with the amount consumed	On a single occasion of drinking, the risk of alcohol-related injury increases with the amount consumed
Healthy men and women ***2 or less standard drinks on any one day***	Healthy men and women ***4 or less standard drinks on any one occasion***

Details regarding a single mutually exclusive risky alcohol consumption variable are described in the alcohol chapter of this report.

Covariates (predictor variables)

Age

Age was categorised into four broad age groups, specifically 18–29, 30–44, 45–64, and 65 years and older. Smaller age ranges were investigated, especially for younger adults, but were not feasible due to the small sample sizes prior to 2008. The final age groups were chosen to be the most relevant for policy purposes given this constraint.

Socioeconomic status and remoteness

Socioeconomic status and remoteness are added to the data based on survey participants' area of residence, typically statistical local area (SLA)[14] or more recently by statistical areas (SA2s).[15] Both of these indexes require accurate population estimates or other census data so are produced for years when Census data are collected. They are typically released approximately 12–18 months after each Census.

The socio-economic indexes for areas (SEIFA[16]) is comprised of several indexes with the primary ones used for analysis of health data being the index of relative socio-economic disadvantage (IRAD) and the index of relative socio-economic advantage and disadvantage (IRSAD). The IRAD was included for the initial 1996 SEIFA[17] while the IRSAD became available as from the 2001 SEIFA[18-20] onwards. The accessibility and remoteness index of Australia (ARIA and ARIA+) categorises areas into major cities, inner regional, outer regional, remote and very remote areas using distances of road networks to service centres and population size.[21]

As the indexes are geographically derived, changes in boundaries or geographic boundary systems[14,15] will impact the comparability of SEIFA and ARIA assignment over time. Queensland has undergone numerous geographic boundaries changes during the period that data are available. Changes most relevant to the current report were a large de-amalgamation in 2006 followed by an amalgamation in 2008 with SLA boundaries predominantly stable since that time.

For ARIA+, changing geography has less impact because the underlying measures (population and roads networks) are unlikely to change dramatically over time or based on revised boundaries for most areas. SEIFA is more heterogeneous and therefore more likely to be impacted. Two strategies to minimise the impact of geographic changes were 1) to limit both SEIFA and ARIA+ analyses to 2006 data onwards, and 2) for SEIFA, to initially compare the most disadvantaged quintile with rest of Queensland. If there was a difference, it was explored further by comparing the most disadvantaged quintile with the most advantaged quintile.

Geographical area classification

One aim of the analyses was to compare northern and southern urban areas as well rural areas. An issue using ARIA classifications is that northern urban areas such as Cairns and Townsville are classified as outer regional while southern urban areas are classified as major city or inner regional. In order to have relatively similar urban areas in both the north and south of Queensland, ARIA was reclassified into three levels—southern coastal region, northern coastal region and inland region. Latitude 24.5 degrees south was used as the demarcation between north and south because it bisects the urban areas of Gladstone and Bundaberg. Gladstone is in the catchment of the Rockhampton Health Service which has the characteristics of a northern city, whereas Bundaberg is in the Hervey Bay catchment and has southern characteristics. The northern coastal region is defined as statistical local areas (SLA) with centroids north of 24.5 degrees latitude which have an ARIA+ classification of outer regional. Southern coastal region is defined as SLAs with centroids south of 24.5 degrees latitude which have an ARIA+ classification of inner regional or major city. All other areas in Queensland were defined as inland region.

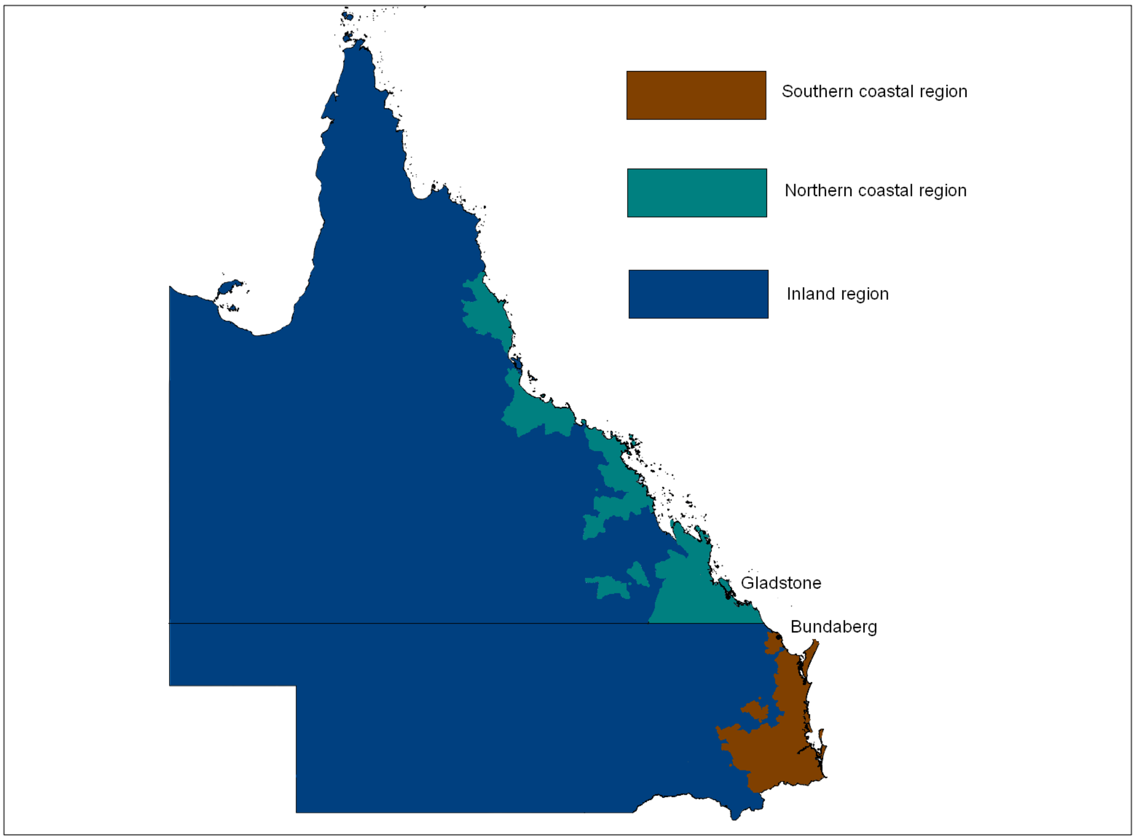


Figure 96: Queensland by geographical region

A consequence of this geographic classification is that the majority of the population resides in the southern coastal region. Often when a significant trend is observed for whole of Queensland, corresponding significant trends will be evident in the southern region but may not achieve significance in other areas. Rather than indicating true geographic differences, this is often due to larger sample sizes and statistical power in the southern coastal region. Therefore, geographic differences should be assessed by a formal statistical test as presented in the annual percent change tables throughout this report.

Developing the trend analysis approach

The aim of this analysis was to determine whether health status was changing over time and, if so, by how much. It also examined whether prevalence within subpopulations was changing at different rates. Various methods are available to answer these types of questions. These are summarised below, including the strengths and limitations of each method. This provides the rationale for the analytical approach utilised in this report.

Ordinary least squares (OLS) linear regression

OLS regression is a technique used with continuous outcome data and was used to model BMI. Data may be individual responses or aggregated by year. Where aggregate annual data are used, the sample size becomes the number of years included in analysis. This leads to a limitation in calculating confidence intervals (CIs), which are the range of values that would contain the true population result 95% of the time (for 95% CI)if different samples were surveyed. CIs are a measure of precision. When using aggregate data, information on the sample size that resulted in the prevalence for any given year cannot be included in the model.[22] This means that 10 years of data are analysed as 10 data points with no additional statistical power if the underlying population was 1000 or 10,000.

With the exception of BMI score, data in this report were in the form of counts or binary outcomes. When OLS is used to model binary outcomes it can result in any predicted value when projected into the future. This is inappropriate because a rate or proportion cannot be less than 0 or greater than 1.

Count data violate two assumptions of OLS regression. First, because count data are often skewed with no counts below zero, many counts in low ranges, and few counts in the higher ranges, the assumption of normality of error terms is violated.[23] Second, because the variability of count data tends to increase as the value of the predictor variable increases, the assumption of constant variance is violated. These violations, and the fact that sample size cannot be included in the model, affect the ability to accurately calculate CIs across the time period.

OLS regression was, however, appropriate to model BMI as this is a continuous measure. Detailed analysis has shown that the distribution of this measure is skewed and therefore violates the assumption of a normally distributed outcome. This was addressed however by log transforming the data and is discussed in more detail in Continuous BMI trends.

Poisson regression

Poisson regression was the primary analytical method and was used to model prevalence data as counts. As with OLS regression, Poisson regression can be conducted on individual-level or aggregated data. Data are, however, modelled as counts rather than as a continuous outcome. For aggregate analysis, annual prevalence was translated into annual counts with a numerator and denominator. These counts are statistically equivalent to having individual level data rather than aggregated annual data.[23] Counts were weighted due to the design factors discussed earlier. Because Poisson regression on aggregate data includes parameters for both the numerator and denominator, it adjusts for both variability across years as well as variability within years. Poisson regression using individual level data models data as counts. When the outcome is binary and the outcome is rare, this has little or no effect. Many of the indicators in this report are fairly common so this requirement is not met, therefore, Poisson regression was only used on aggregated data that meets stringent criteria discussed below.

There are three main limitations to Poisson regression. Two concern difficulties in modelling data with zero counts and the third concerns a violation of the shape of the distribution, namely the assumptions that conditional mean and variance are equal. Two variants to Poisson regression were developed to address difficulty in modelling zero counts, namely zero inflation and zero truncation.[23,24] Zero inflated analysis is required where zeros in the data can result from multiple sources and will consequently be in excess of other values. For example, in analysing the number of standard alcoholic drinks weekly, a response of ‘0’ can come from those who drink but didn’t have a drink in the last week and from those who don’t drink at all. Because the SRHS data are coded to binary outcomes and because there are no values greater than 1, the proportion of zeros cannot be in excess of other integer values. Zero truncation occurs where a zero cannot occur, for example if a survey counted the number of bus trips per week where the survey was conducted on a bus, all respondents would be bus riders and therefore a zero could not occur. Because the SRHS survey was representative of the general Queensland population, zeros are possible for all indicators.

Overdispersion is where the variance exceeds the conditional mean which is a violation of one of the assumptions for Poisson regression. All models need to be tested for overdispersion and this was done by fitting a negative binomial model which tested the significance of the overdispersion. Throughout this report negative binomial models are conducted on all models that have aggregated count outcomes to determine overdispersion before conducting a final analysis using Poisson regression.

Generalised linear models (GLMs)

GLMs were used to include additional sociodemographic covariates and to confirm the Poisson model results. GLMs are generalised extensions to OLS that incorporated two important modifications. First, GLMs can be used on data that are not normally distributed by using a ‘link’ transformation function to relate the metric of the predicted scores to that of the observed outcome scores. Second, it is more flexible in terms of error structure by including a specific random (error) component. Individual level data are analysed which maximises statistical power and GLMs enable more complex covariates to be included in the models.

The GLM used in this report is the binomial GLM. When analysis is conducted on individual level data, the outcome is in a binary form. Since the events are reasonably common, there were a similar number of ones to zeros and the binomial distribution becomes the most appropriate to use for the link function.

An advantage of analysing these data in this way is that it is easier to include additional covariates to adjust models by characteristics such as education level, marital status and employment status while incorporating the survey weights through the use of Stata’s survey design commands. A disadvantage is that the inclusion of additional covariates also increases the likelihood that models will fail to converge. This makes it difficult to produce a consistent set of adjustment variables across analyses. Assessing the suitability of the model can also be more difficult than for aggregate level data Poisson modelling. This is discussed further in Model diagnostics.

For these reasons, binomial GLMs in this report were used for confirmation of Poisson regression results and to determine the effects of confounding variables. These results are included in Table 21 to Table 27

Comparability of results

Generally, the results of OLS regression of the natural log of the prevalence, Poisson regression, and the binomial GLM will be quite similar. The difference will be greatest when data are based on small numbers and/or when the variability in annual prevalence is high. This is because Poisson regression bases CIs on both year to year variability and population size for each year (with the most emphasis on population size) whereas OLS regression CIs are only based on year to year variability.

Model rationale

Exploratory analysis examined outcomes by year using a variety of regression methods and residual plots and statistics to assess whether data met fundamental assumptions for the relevant technique. Visually assessing data is an important component for both model development and communication of results. For indicators with a binary outcome Poisson regression on aggregated count data demonstrated the most robust residual plots and treatment of survey weights across years. For indicators with a continuous outcome, a log transformed OLS regression was used. Throughout the modelling process goodness of fit tests were used to ensure the model chosen was appropriate.

Because the same source data are used for all outcomes and to aid interpretation across outcomes, it was preferable to present similar analyses for each key health indicator. Poisson regression has a number of advantages. First is the fact that predicted values are limited to positive values and when combined with a denominator, make it ideal for modelling rates, proportions and percentages. Second is the ability of Poisson regression to take into account the precision of any given years' estimate. This is especially important for the current analyses because in early years, surveys were smaller with wider confidence intervals. OLS regressions can have an issue with leverage where data points at extreme ends of the data series can exude more influence on the overall trend compared to other data points. Poisson regression will weight the influence on each data point by its precision by specifying a denominator in the model.

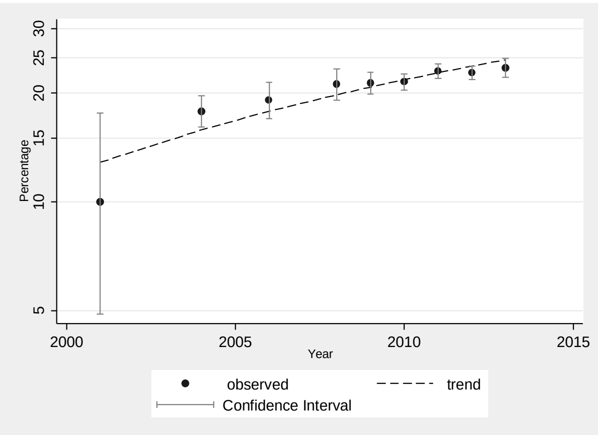


Figure 97: OLS regression

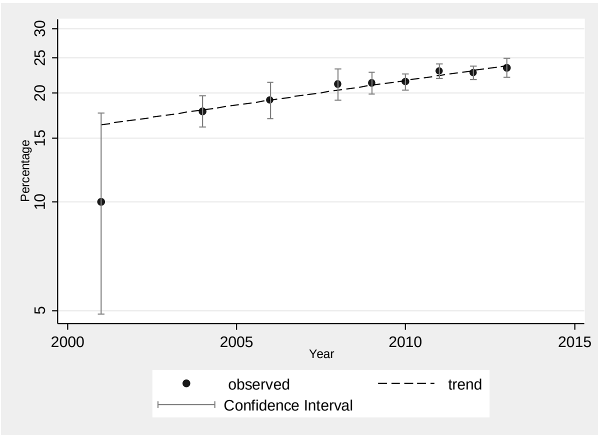


Figure 98: Poisson regression

Figure 97 and Figure 98 demonstrate the effects of a hypothetical 2001 data point. Using OLS regression, the trend line is leveraged by the 2001 data point which exaggerates the trend rate of increase. Using Poisson regression, however, the imprecise 2001 data point has little impact on the overall trend. Results from the two types of regression are quite different with OLS regression resulting in an annual percentage change of 6.2% (95%CI 3.3%–9.1%) whereas the Poisson regression result was 3.2% (95%CI 2.1%–4.3%). Using OLS regression the influence of the 2001 data point has altered the annual percentage change by nearly a factor of two and made the estimate of the annual percentage change much more imprecise with a standard error of 0.0117 as compared with Poisson regression with a more precise standard error of 0.0057.

Based on these advantages, Poisson regression was selected as the preferred method. However, binomial GLM was used to confirm results from the Poisson modelling and resolve any differences in results between the two methods. It was also used to adjust for additional factors such as marital status, education level and employment. These adjusted models were compared to Poisson results to identify any variation in findings and to determine whether there were any policy implications. There were two occasions where adjustment by the additional covariates altered conclusions and these are discussed in the body of the report. Full results of binomial GLM are included in Table 21 to Table 27. Table 20 summarises the analyses undertaken for each health indicator.

Table 20: Analysis methods for each indicator

	Poisson regression on aggregated data	**Binomial GLM on individual level data**	**Log transformed linear regression on aggregated data**	**Log transformed linear regression on individual level data**
	Used in main analysis	**Used to test adjustment variables**	**Used in main analysis**	**Used to test adjustment variables**
Smoking	✓	✓		
Obesity	✓	✓		
Overweight and obesity	✓	✓		
Physical activity	✓	✓		
Lifetime alcohol	✓	✓		
Single occasion alcohol	✓	✓		
BMI continuous			✓	✓
Overweight and obesity by age	✓			

Poisson regression methodology

Compiling the aggregate dataset

Survey prevalence estimates were first converted to counts. Survey weights were used to adjust for survey sampling design. Weighted standard errors were used to include information on the precision of each annual survey estimate.

The formula for the denominator comes from the formula to calculate a standard error from a proportion. This formula for standard error is only appropriate if Np>5 and N(1-p)>5.[25]

$$SE = \sqrt{\frac{p(1-p)}{N}}$$

This is rearranged to:

$$N = \frac{p(1-p)}{SE^2}$$

And

$$n = N \quad p$$

Where N is the converted denominator, n is the converted numerator, p is the weighted prevalence of the condition of interest and SE is the standard error. These aggregate counts were generated for each year and compiled into the dataset for analysis. This process can also be used to create a dataset stratified by other variables, resulting in an aggregate file with two records for each year (for example one for males and one for females). The final dataset is reviewed for small cell sizes and the distribution of the compiled dataset to ensure that Poisson regression was appropriate.

Analysing trends

Poisson regression was used to answer the following hypotheses:

- To determine whether there was an increasing or decreasing trend in the prevalence of key health indicators

- Where trends are evident, to determine whether it was linear or better described by another shaped function
- To include covariates to determine whether trends varied by sociodemographic characteristics.

When year of data collection is included as a covariate, the results of the model are in terms of annual percentage change. If annual percentage change is a negative value, the trend is declining. If it is positive, there is an increasing trend. Standard statistical tests (p value<0.05) were used to determine whether trends were significantly different from the 'no change' assumption.

To determine the linearity of the trend, year was fitted as a factor in the model and, through a likelihood ratio test, it was compared to a model where it was fit as a covariate. If the likelihood ratio test was significant it meant that the trend was nonlinear and that a different function should be used to fit the curvature in the trend (for example, a quadratic function). Generally it was found that trends over time were in fact linear, with the exception being physical activity where a quadratic function was best due to steep increases in early years and levelling off in later years.

Interaction terms were used to determine differences in trend between sociodemographic characteristics. For example, a statistically significant interaction term between sex and year would mean that the trend for males was changing at a different rate than for females. The annual percentage change for each sex can then be calculated by modelling within each group. It is important to note that it is common to have highly significant individual results (for example, trends for males and females are both increasing) but a nonsignificant results for the characteristic as a whole (for example, males and females are increasing at the same rate, reflected as parallel lines when graphed by year).

Model diagnostics

An important component of regression analysis is ensuring that models meet the underlying assumptions of the chosen method. This is frequently undertaken visually, by plotting residuals from final models by year and covariate. Residuals are the difference between the predicted outcomes from a model and the actual outcomes reported by participants. Any patterns in these plots can indicate violations to randomness and equality of variance.

Below are residual plots from Poisson models of obesity prevalence with the covariates of age, sex and year (Figure 99, Figure 100 and Figure 101). Residuals should be reasonably distributed around zero for each category and results for each category should have similar ranges of values. Patterns, such as residuals that are all above zero for one year and below zero for another year or when the amount of spread around zero for each of the covariate categories varies, indicate problems with the underlying model assumptions.

In Figure 99 and Figure 100 residuals appear random around zero and have similar ranges. However, in Figure 101, the range of residual values is smaller in age group 1 compared to age group 4, indicating an issue with equal variances that should be assessed further. As a rule of thumb, if the spread is twice as great for one category compared to another then the validity of the model may be compromised and additional covariates should be explored to improve model fit. In this example, the differences in residual variability for the four age groups is within those guidelines.

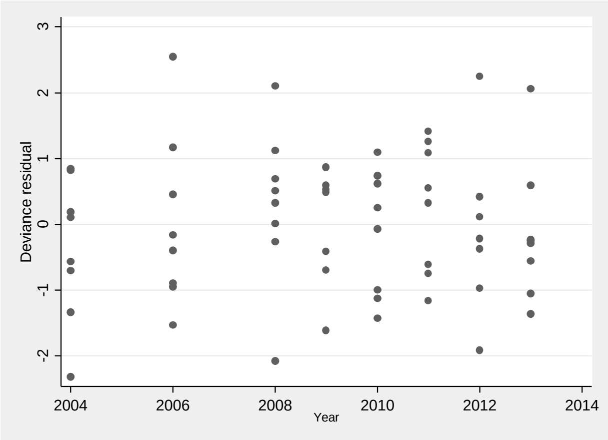


Figure 99: Residuals by year

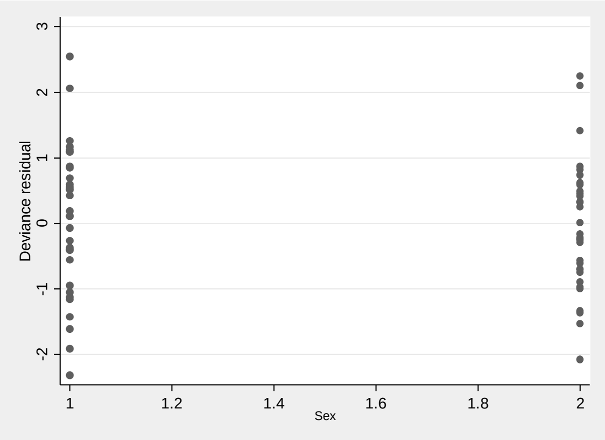


Figure 100: Residuals by sex

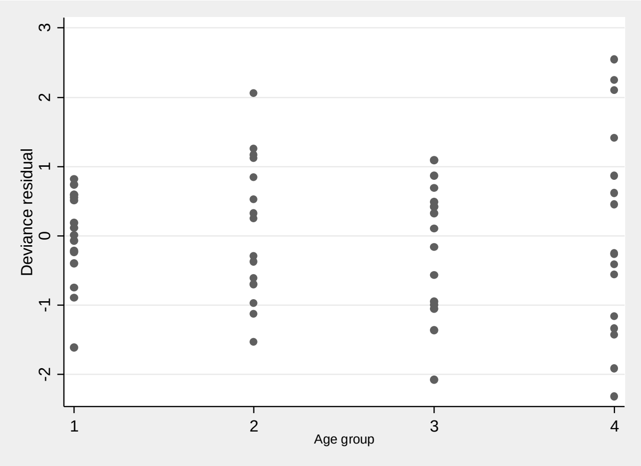


Figure 101: Residuals by age group

Interpreting the residuals of binomial GLM regression is not as straight forward. Figure 102 indicates that some model assumptions may be violated. For example, the obesity residuals are not evenly distributed around zero and there is decreasing trend in residuals for higher predicted values. This indicates that there is a violation in the assumption of randomness in the error term.

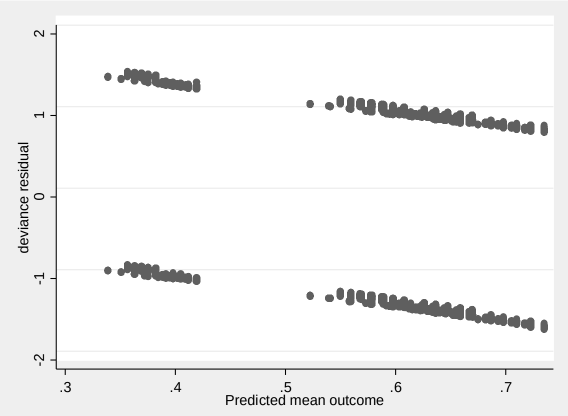


Figure 102: Residuals by predicted values

These examples demonstrate that Poisson regression produced very robust residual plots that showed an even variance and random scatter around mean predicted values, meeting two of the assumptions discussed earlier. The binomial GLM produced residual plots that exhibited nonrandom patterns. Although this is somewhat expected as the outcome variable is binary, using this regression technique has the disadvantage of limiting the effectiveness of the residual plot as a model diagnostic tool.

Interpretation

Tables

When survey year is included as a covariate in these models it returns a coefficient representing an annual percentage increase or decrease. Because Poisson and binomial regression are both from the exponential family, the coefficient must be exponentialised to convert it to an annual percentage change on an absolute scale. Annual percentage change is a multiplicative rate of change and is used throughout this report.

In this report tables of trends include various sociodemographic factors. Each factor contains several categories (for example, male versus female). For each category, trends are presented as an annual percentage change point estimate with a 95%CI. A p-value is included that indicates whether the trend was significantly different to no change (with no change being a line that is not significantly different from a flat horizontal line). This indicates whether each category has a statistically significant increasing or decreasing trend. For each factor, an overall p-value is also included which indicates whether there is a statistically significant difference in the trends between the categories for that factor. For example, within the factor ‘sex’, annual percentage changes, 95%CIs, and p-values are presented for both males and females. The p-values for males tests whether males are increasing or decreasing and the p-value for female tests whether females are increasing or decreasing. The overall factor p-value indicates whether the trends for males and females are different to each other, for example whether males are increasing at a different rate than females.

Comparisons of trends are also reported for interactions between factors. For example an age by sex comparison is presented which tests whether age group trend patterns are the same for males as for females. Comparisons of interactions between factors includes age by sex, age by socioeconomic status, age by geographic region, sex by socioeconomic status and sex by geographic region.

Figures

Graphs are plotted using a logarithmic scale for the y-axis which has several advantages. First, a constant rate of change will be represented by a straight line. Second, the slope of the line represents the rate of change per unit of time. Lastly, parallel lines indicate a similar rate of change between groups and the vertical distance between the lines indicates a constant relative risk.[26] When trends are plotted using an arithmetic y-axis, assessing differences in rates of change between groups is challenging. An example of two graphs using the same sample data with one plotted on a log scale and the other plotted on a linear scale is presented to illustrate this point.

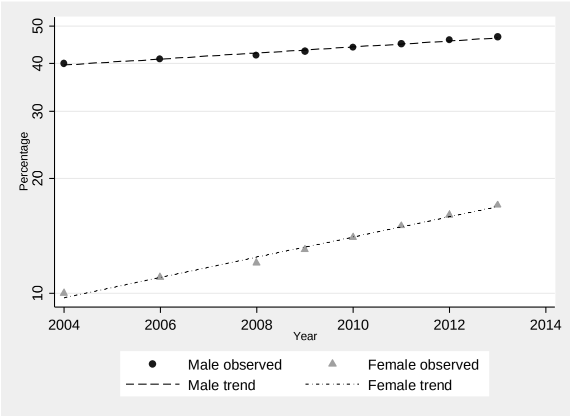


Figure 103: Logarithmic scale example

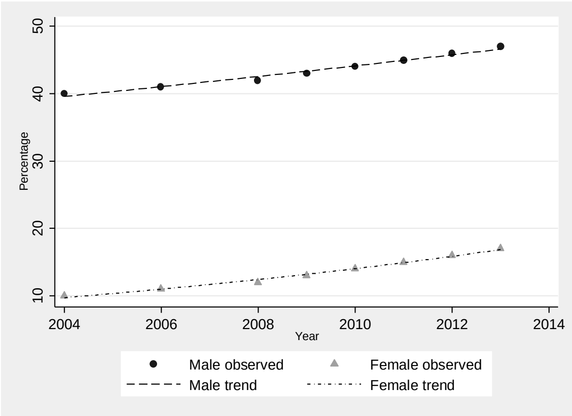


Figure 104: Arithmetic scale example

Regression results for these data show that females are increasing by 6.3% per year (95%CI 4.0%–8.7%) while males are only increasing by 1.8% per year (95%CI 1.0%–2.6%). The difference between the trends is statistically significant ($p<0.001$), which is easily observable in Figure 103. Using an arithmetic y-axis, however, the two lines appear parallel which could be misinterpreted as no difference between the sexes (Figure 104).

Data were analysed as rates, for example counts of events per population subgroups. As the outcomes are relatively frequent, reporting these as rates can be cumbersome (for example, obesity rates of 300 per 1,000 persons). For the purposes of graphing and general interpretation, rates are expressed as a population prevalence and discussed in text as the percentage of the population that is obese (30% obesity prevalence).

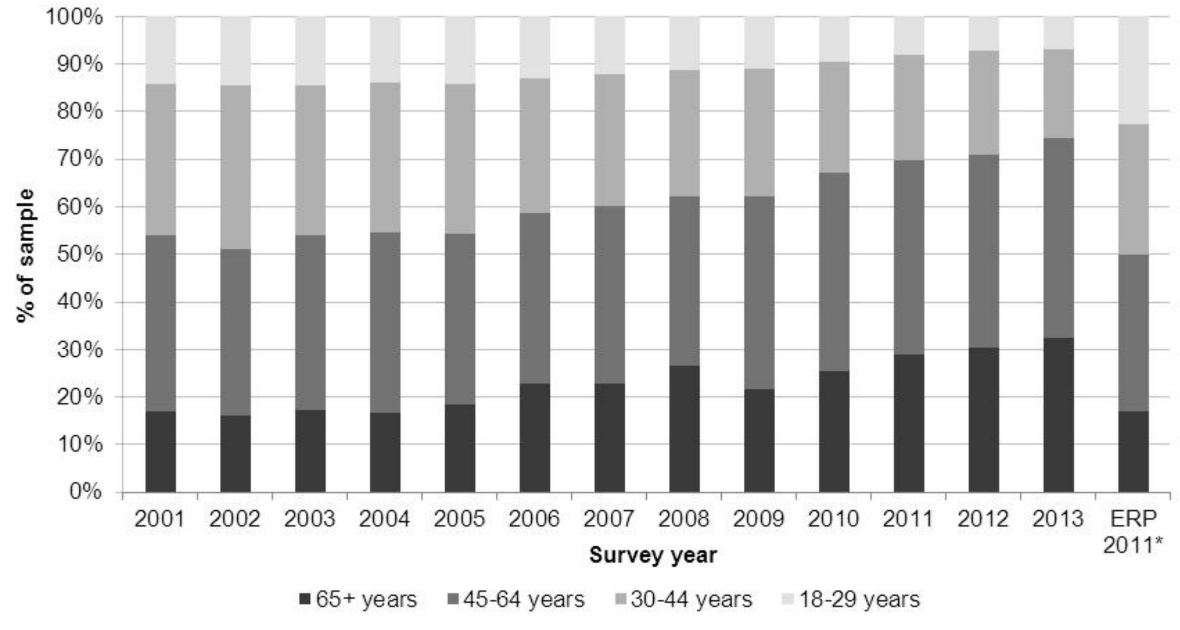
Response bias

Several methods were used to ensure that the demographic profile of sample was representative of Queensland. First, randomly generated telephone numbers were used to include unlisted and silent numbers; households without a fixed line were not eligible. Second, during data collection, multiple call backs, flexible interview scheduling and combinations of daytime and evening interviewing sessions increased the opportunity for people to participate, particularly shift workers, young adults and the elderly. Third, surveys are weighted to population benchmarks to compensate for lower response rates in some subpopulations, such as youth.

Generalisability of survey results is in part dependent upon achieving a representative sample and significant emphasis is placed on the measures described above to achieve this aim. Mobile phone uptake has had an acknowledged effect on the demographic composition of samples recruited by landlines compared to mobile phones. Landline only frames typically resulting in a higher number of older, female or married participants[27] and survey weighting is the recognised method to adjust for the under-representation of some demographic groups. Whether under-representation is biasing weighted prevalence estimates is an active areas of research and debate. For example, a study in South

Australia[28] showed no significant effects on prevalence of health behaviours between fixed and mobile telephone respondents while a second study showed increased odds of cannabis and tobacco smoking but no difference in risky alcohol consumption prevalence between mobile-only and landline recruited participants.[29]

The trend of under-representation among younger age groups is observed in the SRHS survey series as depicted in Figure 105.



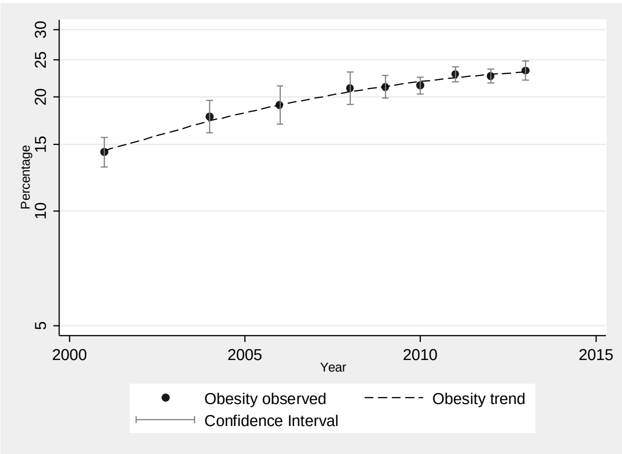
* Estimated resident population 2011

Figure 105: Sample size for SRHS surveys by year

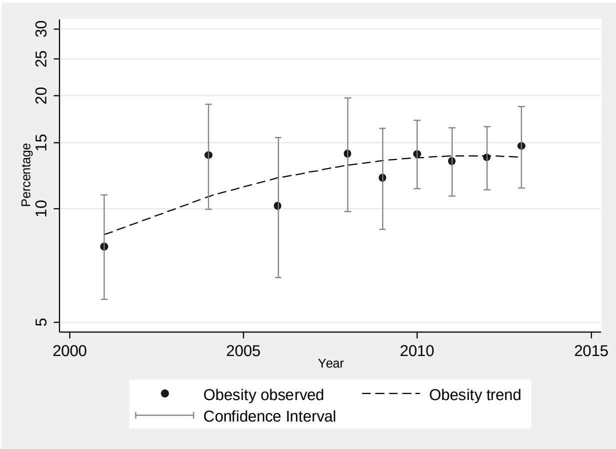
Additional methods for specific health indicators

Assessing BMI information from older surveys

Exploratory analysis revealed a high degree of variability in BMI results in surveys from the early 2000s. Issues with leverage were discussed in Model rationale and this appears to be a significant risk with BMI data despite using Poisson regression. This was examined by removing the 2001 data and is presented in Figure 106 and Figure 107.



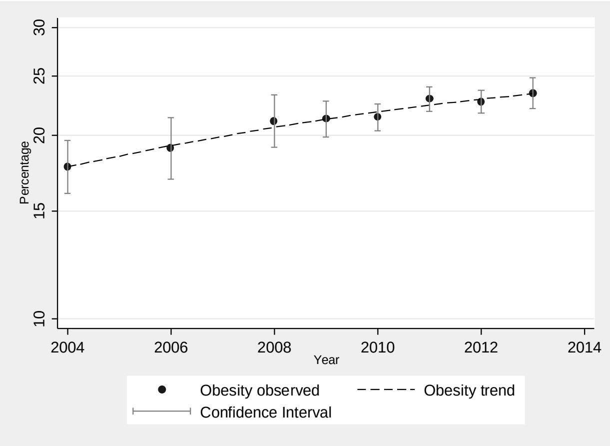
18 years and older



18–29 years

Figure 106: Obesity trend including 2001 data

When data from 2001–13 are analysed, the curvature observed in the trend is statistically significant ($p=0.037$) and could be interpreted as a plateau in the trend. When 2001 data are omitted, the curvature is no longer significant (p=0.481, Figure 107) and the trend is an annual average increase of 3% per year.



18 years and older

Figure 107: Obesity trend excluding 2001 data

Limiting analysis to 2004–13 data is supported for several important reasons. First, it is more robust analytically to put more emphasis on recent data rather than to permit a single year of data to overly influence a decade of results. Second, the 2001 survey had a much smaller sample size with less precise estimates and a higher likelihood of sampling bias. For these reasons, the trend from 2004–13 is considered the most reliable.

Overweight and obesity trends by geography

In the analysis of overweight and obesity trends, large differences in the annual percent change estimates by geographic area were found, with the southern coastal region increasing by 1.6% per year while the northern coastal region is increasing by 3.2% per year. However, some unusually low observations in the earlier years appear to be overly influencing this result. When 2006 is excluded from the analysis, the northern coastal region trend is 2.9% compared to 1.3%per year in the southern coastal region. When 2008 data are excluded, the difference is further reduced to 2.3% per year compared to 1.8% per year for northern and southern coastal regions, respectively. These trends are not statistically significant using Poisson regression.

The issue above complicates the interpretation of the geographic trends by sex analysis. Using Poisson regression, results were not statistically significant (p=0.370, see Table 7). Overweight and obesity among northern coastal region females appears to be increasing at a faster rate but this may be due to the influence of the 2006 data point.

When binomial regression is applied to the unit record data for overweight and obesity, results begin to approach statistical significance when analysing data from 2006–2013 (p=0.062 unadjusted and p=0.043 adjusted, see Table 24). However results may still be largely due to the influence of data prior to 2009. It is challenging to resolve this discrepancy given the number of years of data available and using a categorical outcome. A more robust analysis is of BMI as a continuous outcome, which enables a higher level of scrutiny using residual plot model diagnostics. Due to uncertainty around data points for 2006 and 2008 these years were excluded from the analysis of geographic region by sex when using BMI as a continuous measure.

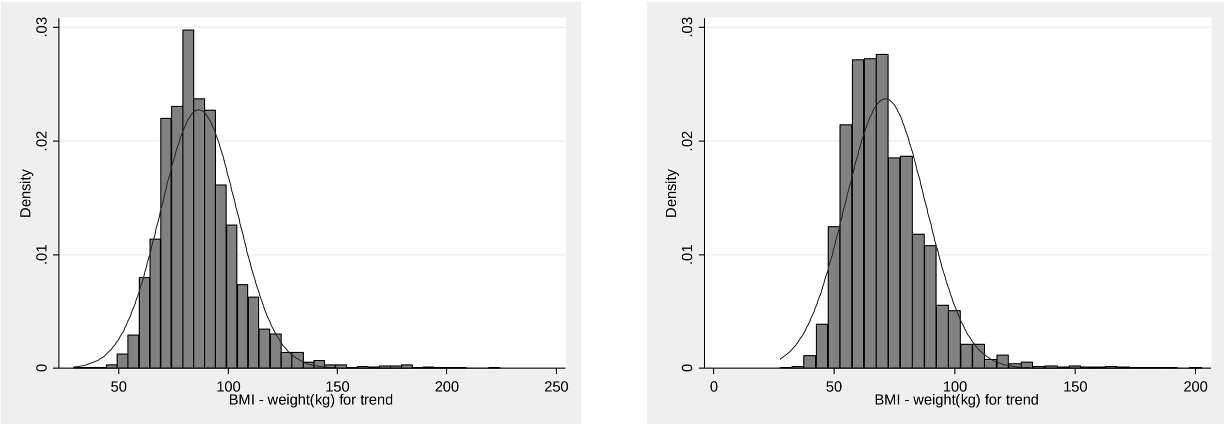
Increase in the percentage overweight and obese with age

The results included in this section were not trend analyses so differ from results in all other sections. The aim was to identify the age range where the percentage overweight or obese participants increased rapidly compared to ages where the increase has plateaued. This is found by using an iterative linear regression technique and sequentially dropping the data for older ages (for example, first drop 75 years and older, then 74 years, etc.) As data points are dropped, the slope of the line increases. The plateau point is where the slope of the line is maximised. This technique repeated for each year of data and it was consistently observed for both males and females there is a steep increase in overweight or obesity up to the age of 28, followed by a much more gradual increase until age 65 years.

Continuous BMI trends

Trends in BMI can also be modelled as a continuous outcome rather than measuring the changes in proportions of those who are obese or overweight. BMI is calculated as a person's weight divided by their height squared, therefore, the units are in the form kilograms/metre^2. As changes in average BMI are likely to be small over time we shall refer to these in the units of grams/metre^2 (g/m^2).

Both BMI and the combination of height and weight could be analysed as continuous variables using OLS regression, however, BMI and weight are both skewed which violates the assumption of a normally distributed outcome. An arithmetic mean estimated from a skewed distribution will produce a higher value as extreme values to the right of the distribution will pull the mean higher in comparison to values on the left of the distribution. This can be corrected by conducting analysis on the log of BMI.



Males

Females

Figure 108: Distribution of weight

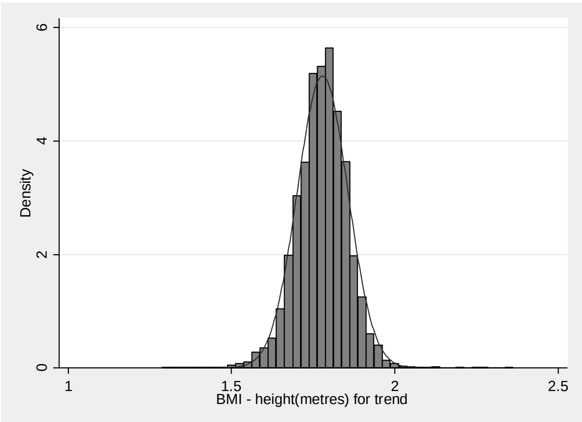
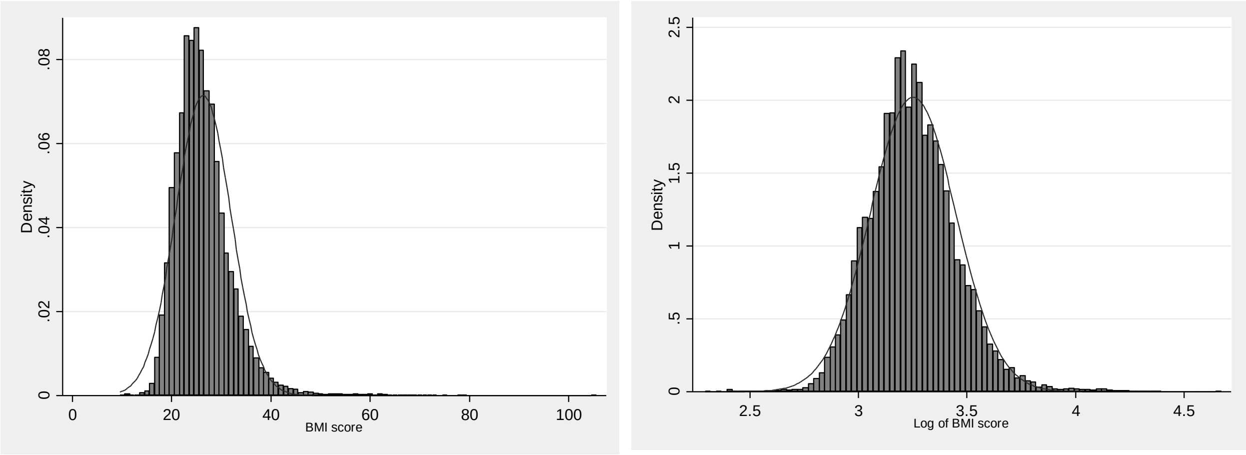


Figure 109: Distribution of height



BMI score

Log BMI score

Figure 110: Distribution of BMI scores

In the current report, the mean of the log of BMI was calculated for each year and then re-exponentialised to obtain the geometric mean. Aggregate annual data were then analysed using OLS regression to obtain trends in terms of g/m^2. This method was also used to analyse the weight variable to obtain a geometric mean for weight. Weight was then modelled including an adjustment for height. The results are interpreted as a trend in terms of weight gain per year (after adjusting for a person's height), which can be used in conjunction with BMI units to put these units into context. Results were extensively verified to ensure that using the geometric mean of height and weight in the BMI formula (weight/metre^2) is equivalent to the geometric mean of BMI.

Analysis using unit record data (without summarising year by year) would increase statistical power. However since the BMI outcome has been log transformed it makes the interpretation of the resulting regression coefficients difficult. Analysis of the unit record data was used in exploratory analysis to gain an understanding of the overall patterns, however, summarised data was used in the final analysis to obtain meaningful measures for trends.

Resolving differences between Poisson and binomial GLM results

Smoking trends for males 18–44 compared to 45 years or older

Unadjusted Poisson regression resulted in a significance difference (p=0.013) in declining smoking rates comparing 18–44 year old males to those 45 years and older. When binomial regression was used to adjust by employment status, marital status and education, results ceased to be significant (p=0.259). On further investigation, males who do not provide marital status also exhibit the greatest declines in smoking prevalence (12.2% per year, p=0.009). Proportionally, there are more male who refuse to provide marital status in younger age groups. When adjusting by marital status this group is excluded, which reduces the decline in daily smoking among young males to levels that are not significantly different from males 45 years and older. Because the difference in results is due to excluded cases and because marital status information would not alter the public health approach, Poisson regression results are considered the most valid.

Overweight and obesity trends by geography

The second instance where Poisson and binomial regression results varied was results for overweight or obese by geography. This was discussed in Assessing BMI information from older surveys.

Appendix 2: GLM detailed results

Table 21: Smoking trends 2002–2013 by binomial GLM analysis method

	Unadjusted binomial GLM			Adjusted[5] binomial GLM		
	Average annual percentage change[1]	Test for trend for each sub-group[2]	Test for trend differences between subgroups[3]	Average annual percentage change[1]	Test for trend for each sub-group[2]	Test for trend differences between sub-groups[3]
	% (95% CI)	*p*-value	*p*-value	% (95% CI)	*p*-value	*p*-value
Persons	-2.2 (-3.0, -1.4)	<0.001		-1.8 (-3.0, -0.7)	0.002	
Sex						
Males	-2.7 (-3.8, -1.7)	<0.001	0.125	-3.0 (-4.5, -1.5)	<0.001	0.047
Females	-1.5 (-2.7, -0.3)	0.015		-0.6 (-2.3, 1.1)	0.492	
Age category—persons						
18–29	-3.8 (-5.7, -1.9)	<0.001	0.067	-4.5 (-7.2, -1.8)	0.001	0.092
30–44	-2.0 (-3.2, -0.8)	0.001		-1.3 (-3.0, 0.5)	0.158	
45–64	-0.9 (-2.1, 0.3)	0.154		-1.8 (-3.4, -0.1)	0.033	
65 years or older	-0.8 (-3.6, 2.1)	0.579		1.3 (-2.7, 5.4)	0.534	
Age category—males						
18–29	-4.4 (-6.7, -2.0)	<0.001	0.115	-4.9 (-8.2, -1.5)	0.005	0.423
30–44	-2.8 (-4.4, -1.1)	0.001		-3.1 (-5.3, -0.9)	0.006	
45–64	-1.0 (-2.7, 0.7)	0.234		-2.4 (-4.7, -0.1)	0.042	
65 years or older	-1.0 (-4.8, 2.9)	0.599		-0.3 (-5.5, 5.2)	0.912	
Age category—females						
18–29	-3.1 (-6.2, 0.0)	0.052	0.608	-3.5 (-8.1, 1.4)	0.160	0.191
30–44	-1.1 (-2.9, 0.8)	0.260		0.6 (-2.1, 3.3)	0.681	
45–64	-0.7 (-2.4, 1.0)	0.427		-1.2 (-3.4, 1.1)	0.301	
65 years or older	-0.7 (-4.9, 3.7)	0.758		1.7 (-4.2, 8.1)	0.579	
Age category—males						
18–44	-3.4 (-4.8, -2.1)	<0.001	0.031	-3.3 (-5.3, -1.3)	0.001	0.259
45 years or older	-1.2 (-2.7, 0.4)	0.153		-2.2 (-4.3, 0.0)	0.045	
Socioeconomic advantage/disadvantage						
Most disadvantaged	-1.8 (-3.4, -0.3)	0.023	0.637	-1.8 (-4.0, 0.4)	0.104	0.418
Rest of Queensland	-2.3 (-3.2, -1.4)	<0.001		-2.1 (-3.4, -0.7)	0.002	
Geographic regions[4]						
Southern coastal	-2.1 (-4.2, 0.1)	0.056	0.199	-1.1 (-3.2, 1.0)	0.302	0.184
Northern coastal	-5.9 (-9.5, -2.2)	0.002		-6.0 (-9.4, -2.5)	0.001	
Inland region	-3.5 (-8.3, 1.5)	0.165		-3.6 (-8.3, 1.5)	0.164	

[1] Positive values represent annual percentage increases; negative values represent annual percentage decreases.
[2] Tests whether there is a statistically significant increase or decrease in trend over time.
[3] Tests whether there is significant difference in the trend over time between subgroups (for example, males vs. females).
[4] Trends by geographic region are for 2006—2013.
[5] Adjusted by education level, employment and marital status.

Table 22: Physical activity trends 2004–2013 by analysis method

	Unadjusted binomial GLM		Adjusted[4] binomial GLM	
	Test for trend for each subgroup[1]	Test for trend differences between subgroups[2]	Test for trend for each subgroup[1]	Test for trend differences between subgroups[2]
	p-value	*p*-value	*p*-value	*p*-value
Persons	<0.001		<0.001	
Sex				
Male	<0.001	0.009	<0.001	0.011
Female	<0.001		<0.001	
Age category—persons				
18–29	<0.001	0.054	<0.001	0.039
30–44	<0.001		<0.001	
45–64	<0.001		<0.001	
65–75 years	0.155		0.261	
Socioeconomic advantage/disadvantage				
Most disadvantaged	<0.001	0.011	<0.001	0.015
Rest of Queensland	<0.001		<0.001	
Geographic regions[3]				
Southern coastal	<0.001	0.761	<0.001	0.730
Northern coastal	0.040		0.053	
Inland region	0.037		0.028	

[1] Tests whether there is a statistically significant increase or decrease in trend over time.
[2] Tests whether there is significant difference in the trend over time between subgroups (for example, males vs. females).
[3] Trends by geographic region are for 2006—2013.
[4] Adjusted by education level, employment and marital status.

Table 23: Obesity trends 2004–2013 by analysis method

	Unadjusted binomial GLM			Adjusted[5] binomial GLM		
	Average annual percentage change[1]	Test for trend for each subgroup[2]	Test for trend differences between subgroups[3]	Average annual percentage change[1]	Test for trend for each subgroup[2]	Test for trend differences between subgroups[3]
	% (95% CI)	*p*-value	*p*-value	% (95% CI)	*p*-value	*p*-value
Persons	2.6 (1.5, 3.6)	<0.001		3.3 (2.3, 4.4)	<0.001	
Sex						
Males	2.2 (0.7, 3.7)	0.003	0.473	2.7 (1.2, 4.2)	<0.001	0.315
Females	3 (1.5, 4.5)	<0.001		3.7 (2.2, 5.3)	<0.001	
Age category—persons						
18–29	1.7 (-2.2, 5.7)	0.396	0.576	1.5 (-2.3, 5.5)	0.448	0.491
30–44	2.6 (0.6, 4.6)	0.001		3.6 (1.6, 5.6)	<0.001	
45–64	2.9 (1.5, 4.3)	<0.001		3.2 (1.8, 4.6)	<0.001	
65 years or older	4.3 (2.1, 6.5)	<0.001		4.4 (2.2, 6.7)	<0.001	
Age category—males						
18–29	3.2 (-2.2, 8.9)	0.256	0.912	3.1 (-2.2, 8.7)	0.253	0.964
30–44	1.7 (-1.1, 4.5)	0.233		2.4 (-0.4, 5.2)	0.091	
45–64	2.7 (0.7, 4.6)	0.007		2.8 (0.9, 4.8)	0.005	
65 years or older	3.1 (-0.1, 6.4)	0.055		2.8 (-0.4, 6.2)	0.088	
Age category—females						
18–29	0.2 (-5.2, 5.8)	0.955	0.393	0.1 (-5.3, 5.9)	0.960	0.243
30–44	3.7 (0.9, 6.5)	0.009		4.8 (2.0, 7.7)	0.001	
45–64	3.2 (1.2, 5.2)	0.002		3.3 (1.3, 5.4)	0.001	
65 years or older	5.4 (2.4, 8.5)	<0.001		5.7 (2.6, 8.9)	<0.001	
Age category—18–29 years						
Males	3.2 (-2.2, 8.9)	0.256	0.453	3.1 (-2.2, 8.7)	0.253	0.648
Females	0.2 (-5.2, 5.8)	0.955		0.1 (-5.3, 5.9)	0.960	
Socioeconomic advantage/disadvantage						
Most disadvantaged	3.6 (1.5, 5.7)	0.001	0.267	3.8 (1.7, 5.9)	<0.001	0.336
Rest of Queensland	2.2 (1.0, 3.4)	<0.001		3.1 (1.9, 4.3)	<0.001	
Geographic regions[4]						
Southern coastal	1.5 (-0.3, 3.2)	0.105	0.151	2.1 (0.4, 3.9)	0.018	0.101
Northern coastal	5.2 (1.9, 8.6)	0.002		6.1 (2.8, 9.6)	<0.001	
Inland region	2.3 (-2.0, 6.8)	0.294		3.9 (-0.6, 8.6)	0.086	

[1] Positive values represent annual percentage increases; negative values represent annual percentage decreases.
[2] Tests whether there is s statistically significant increase or decrease in trend over time.
[3] Tests whether there is significant difference in the trend over time between subgroups (e.g. males vs. females).
[4] Trends by geographic region are for 2006—2013.
[5] Adjusted by education level, employment and marital status.

Table 24: Overweight and obesity trends 2004–2013 by binomial GLM analysis method

	Unadjusted binomial GLM			Adjusted[5] binomial GLM		
	Average annual percentage change[1]	Test for trend for each subgroup[2]	Test for trend differences between subgroups[3]	Average annual percentage change[1]	Test for trend for each subgroup[2]	Test for trend differences between subgroups[3]
	% (95% CI)	*p*-value	*p*-value	% (95% CI)	*p*-value	*p*-value
Persons	1.3 (0.8, 1.8)	<0.001		2.0 (1.5, 2.5)	<0.001	
Sex						
Males	0.8 (0.2, 1.4)	0.012	0.012	1.3 (0.7, 1.9)	<0.001	0.013
Females	1.9 (1.1, 2.7)	<0.001		2.6 (1.8, 3.4)	<0.001	
Age category—persons						
18–29	2.6 (0.5, 4.8)	0.014	0.201	3.1 (1.0, 5.2)	0.004	0.217
30–44	1.6 (0.7, 2.4)	<0.001		2.0 (1.1, 2.8)	<0.001	
45–64	0.9 (0.3, 1.5)	0.002		1.3 (0.7, 1.9)	<0.001	
65 years or older	1.9 (0.9, 2.8)	<0.001		2.2 (1.2, 3.1)	<0.001	
Age category—males						
18–29	2.3 (-0.4, 5.0)	0.091	0.294	2.3 (-0.2, 4.9)	0.075	0.315
30–44	0.6 (-0.4, 1.7)	0.207		0.7 (-0.2, 1.7)	0.141	
45–64	0.6 (-0.1, 1.4)	0.085		0.9 (0.1, 1.6)	0.020	
65 years or older	1.8 (0.5, 3.0)	0.005		1.8 (0.6, 3.1)	0.005	
Age category—females						
18–29	3.1 (-0.3, 6.6)	0.077	0.339	3.1 (-0.3, 6.6)	0.078	0.355
30–44	2.9 (1.4, 4.4)	<0.001		3.5 (2.0, 5.0)	<0.001	
45–64	1.3 (0.4, 2.3)	0.007		1.8 (0.8, 2.8)	<0.001	
65 years or older	1.9 (0.5, 3.4)	0.008		2.4 (0.9, 3.9)	0.001	
Age category—30–44 years						
Male	0.6 (-0.4, 1.7)	0.207	0.015	0.7 (-0.2, 1.7)	0.141	0.005
Female	2.9 (1.4, 4.4)	<0.001		3.5 (2.0, 5.0)	<0.001	
Socioeconomic advantage/disadvantage						
Most disadvantaged	1.0 (0.1, 2.0)	0.037	0.551	1.5 (0.5, 2.4)	0.002	0.668
Rest of Queensland	1.4 (0.8, 1.9)	<0.001		2.0 (1.5, 2.5)	<0.001	
Most disadvantaged						
Males	-0.1 (-1.2, 1.1)	0.877	0.013	0.5 (-0.6, 1.6)	0.341	0.011
Females	2.4 (0.8, 4.0)	0.003		3.2 (1.6, 4.7)	<0.001	
Geographic Regions[4]						
Southern coastal	1.2 (0.3, 2.0)	0.008	0.062	1.8 (1.0, 2.6)	<0.001	0.043
Northern coastal	3.1 (1.4, 4.8)	<0.001		3.6 (2.0, 5.2)	<0.001	
Inland region	2.9 (0.9, 5.0)	0.005		3.2 (1.3, 5.2)	0.001	

[1] Positive values represent annual percentage increases; negative values represent annual percentage decreases.
[2] Tests whether there is s statistically significant increase or decrease in trend over time.
[3] Tests whether there is significant difference in the trend over time between subgroups (e.g. males vs. females).
[4] Trends by geographic region are for 2006—2013.
[5] Adjusted by education level, employment and marital status.

Table 25: BMI continuous trends 2004–2013 by analysis method

	Unadjusted log transformed linear		Adjusted log transformed linear[3]	
	Test for trend for each subgroup[1]	Test for trend differences between subgroups[2]	Test for trend for each subgroup[1]	Test for trend differences between subgroups[2]
	p-value	*p*-value	*p*-value	*p*-value
Persons	<0.001		<0.001	
Sex				
Males	<0.001	0.116	<0.001	0.079
Females	<0.001		<0.001	
Age category—persons				
18–29	0.030	0.819	0.027	0.715
30–44	<0.001		<0.001	
45–64	<0.001		<0.001	
65 years or older	<0.001		<0.001	
Socioeconomic advantage/disadvantage				
Most disadvantaged	<0.001	0.384	<0.001	0.240
Rest of Queensland	<0.001		<0.001	
Geographic regions[4]				
Southern coastal	0.021	0.243	<0.001	0.203
Northern coastal	0.001		<0.001	
Inland region	0.146		0.057	
Southern coastal—males	0.042	0.750	0.002	0.657
Northern coastal—males	0.061		0.013	
Inland region—males	0.090		0.030	
Southern coastal—females	0.191	0.150	0.053	0.132
Northern coastal—females	0.004		0.002	
Inland region—females	0.722		0.700	

[1] Tests whether there is s statistically significant increase or decrease in trend over time.
[2] Tests whether there is significant difference in the trend over time between subgroups (for example, males vs. females).
[3]Adusted by education level, employment and marital status, also adjusted by socioeconomic status for geography.
[4] All analysis for geographic region is for 2009-2013

Table 26: Lifetime and monthly single occasion risky drinking trends 2010–13 by binomial GLM analysis method

	Unadjusted binomial GLM			Adjusted[5] binomial GLM		
	Average annual percentage change	Test for trend for each sub-group[2]	Test for trend difference between sub-groups[3]	Average annual percentage change	Test for trend for each sub-group[2]	Test for trend difference between sub-groups[3]
	% (95% CI)	*p*-value	*p*-value	% (95% CI)	*p*-value	*p*-value
Persons	-4.4 (-7.2, -1.5)	0.003		-3.9 (-6.7, -1.0)	0.008	
Sex						
Males	-3.8 (-6.7, -0.8)	0.014	0.501	-3.7 (-6.6, -0.6)	0.019	0.511
Females	-6.2 (-12.2, 0.2)	0.059		-6.5 (-12.6, -0.1)	0.047	
Age category—persons						
18–29	-13.3 (-18.8, -7.5)	<0.001	<0.001	-12.3 (-17.8, -6.4)	<0.001	0.001
30–44	-2.7 (-7.7, 2.6)	0.313		-1.7 (-6.6, 3.6)	0.525	
45–64	2.2 (-1.8, 6.4)	0.292		2.1 (-1.9, 6.1)	0.311	
65 years or older	1.6 (-5.3, 9.0)	0.651		3.1 (-4.1, 10.8)	0.411	
Age category—males						
18–29	-12.8 (-18.5, -6.7)	<0.001	<0.001	-11.8 (-17.5, -5.6)	<0.001	0.002
30–44	-3.1 (-8.4, 2.5)	0.272		-2.4 (-7.7, 3.1)	0.386	
45–64	2.9 (-1.5, 7.5)	0.196		2.7 (-1.6, 7.2)	0.218	
65 years or older	3.9 (-3.4, 11.7)	0.305		3.8 (-3.6, 11.8)	0.322	
Age category—females						
18–29	-14.0 (-25.2, -1.1)	0.034	0.246	-13.5 (-24.9, -0.4)	0.044	0.230
30–44	-0.9 (-11.6, 11.1)	0.880		0.2 (-10.5, 12.1)	0.979	
45–64	-0.4 (-8.6, 8.6)	0.931		0.1 (-8.2, 9.1)	0.986	
65 years or older	-11.9 (-27.3, 6.8)	0.198		-11.6 (-27.3, 7.5)	0.217	
Socioeconomic advantage/disadvantage						
Most disadvantaged	-7.8 (-13.7, -1.4)	0.017	0.240	-7.6 (-13.5, -1.4)	0.017	0.295
Rest of Queensland	-3.6 (-6.7, -0.3)	0.030		-3.2 (-6.3, 0.0)	0.052	
Geographic regions[4]						
Southern coastal	-4.5 (-8.0, -0.9)	0.014	0.527	-4.0 (-7.4, -0.4)	0.030	0.356
Northern coastal	-5.4 (-11.5, 1.2)	0.105		-5.5 (-11.4, 0.8)	0.084	
Inland region	-0.8 (-6.9, 5.7)	0.805		0.3 (-5.9, 6.8)	0.937	

[1] Positive values represent annual percentage increases; negative values represent annual percentage decreases.
[2] Tests whether there is a statistically significant increase or decrease in trend over time.
[3] Tests whether there is significant difference in the trend over time between subgroups (for example, males vs. females).
[4] Trends by geographic region are for 2006—2013.
[5] Adjusted by education level, employment and marital status.

Table 27: Monthly single occasion risky drinking trends 2010–13 by binomial GLM analysis method

	Unadjusted binomial GLM			Adjusted[5] binomial GLM		
	Average annual percentage change[1]	Test for trend for each sub-group[2]	Test for trend differences between subgroups[3]	Average annual percentage change[1]	Test for trend for each sub-group[2]	Test for trend differences between sub-groups[3]
	% (95% CI)	*p*-value	*p*-value	% (95% CI)	*p*-value	*p*-value
Persons	-0.6 (-4.7, 3.8)	0.799		-0.4 (-4.6, 4.0)	0.860	
Sex						
Males	0.8 (-4.6, 6.6)	0.764	0.450	1.4 (-4.2, 7.2)	0.638	0.430
Females	-2.5 (-9.0, 4.4)	0.466		-3.4 (-9.7, 3.4)	0.318	
Age category—persons						
18–29	3.5 (-4.8, 12.5)	0.417	0.594	3.3 (-5.1, 12.3)	0.455	0.632
30–44	-2.7 (-9.0, 4.0)	0.419		-2.2 (-8.6, 4.5)	0.510	
45–64	-3.1 (-8.7, 2.8)	0.291		-1.4 (-7.1, 4.6)	0.636	
65 years or older	0.5 (-11.2, 13.7)	0.941		0.9 (-10.7, 14.1)	0.885	
Age category—males						
18–29	8.4 (-3.5, 21.7)	0.173	0.335	7.4 (-4.4, 20.6)	0.230	0.455
30–44	-2.9 (-11.3, 6.3)	0.525		-2.2 (-10.8, 7.3)	0.640	
45–64	-3.6 (-10.2, 3.6)	0.320		-1.1 (-8.1, 6.6)	0.779	
65 years or older	3.4 (-10.1, 18.8)	0.641		1.9 (-11.2, 16.9)	0.787	
Age category—females						
18–29	-1.7 (-12.9, 10.9)	0.775	0.961	-2.1 (-13.4, 10.6)	0.731	0.886
30–44	-2.4 (-11.4, 7.5)	0.622		-2.2 (-11.1, 7.5)	0.643	
45–64	-2.3 (-11.8, 8.3)	0.661		-1.9 (-11.2, 8.4)	0.705	
65 years or older	-9.1 (-29.8, 17.8)	0.472		-8.5 (-29.0, 17.9)	0.492	
Socioeconomic advantage/disadvantage						
Most disadvantaged	-3.9 (-12.7, 5.7)	0.411	0.442	-2.2 (-11.1, 7.6)	0.647	0.423
Rest of Queensland	0.2 (-4.5, 5.1)	0.938		0.2 (-4.5, 5.2)	0.924	
Geographic regions[4]						
Southern coastal	-3.0 (-7.8, 2.2)	0.251	0.205	-3.0 (-7.9, 2.1)	0.247	0.154
Northern coastal	5.7 (-4.8, 17.4)	0.302		7.2 (-3.7, 19.3)	0.203	
Inland region	5.0 (-5.6, 16.8)	0.366		5.8 (-5.1, 17.8)	0.310	

[1] Positive values represent annual percentage increases; negative values represent annual percentage decreases.
[2] Tests whether there is s statistically significant increase or decrease in trend over time.
[3] Tests whether there is significant difference in the trend over time between subgroups (e.g. males vs. females).
[4] Trends by geographic region are for 2006—2013.
[5] Adjusted by education level, employment and marital status.

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