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Socioeconomic variation in absolute cardiovascular disease risk and treatment in the Australian population

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ABSTRACT

Cardiovascular disease (CVD), preventable through appropriate management of absolute CVD risk, disproportionately affects socioeconomically disadvantaged individuals. The aim of this study was to estimate absolute and relative socioeconomic inequalities in absolute CVD risk and treatment in the Australian population using cross-sectional representative data on 4751 people aged 45–74 from the 2011–12 Australian Health Survey. Poisson regression was used to calculate prevalence differences (PD) and ratios (PR) for prior CVD, high 5-year absolute risk of a primary CVD event and guideline-recommended medication use, in relation to socioeconomic position (SEP, measured by education). After adjusting for age and sex, the prevalence of high absolute risk of a primary CVD event among those of low, intermediate and high SEP was 12.6%, 10.9% and 7.7% (PD, low vs. high = 5.0 [95% CI: 2.3, 7.7], PR = 1.6 [1.2, 2.2]) and for prior CVD was 10.7%, 9.1% and 6.7% (PD = 4.0 [1.4, 6.6], PR = 1.6 [1.1, 2.2]). The proportions using preventive medication use among those with high primary risk were 21.3%, 19.5% and 29.4% for low, intermediate and high SEP and for prior CVD, were 37.8%, 35.7% and 17.7% (PD = 20.1 [9.7, 30.5], PR = 2.1 [1.3, 3.5]). Proportions at high primary risk and not using medications among those of low, intermediate and high SEP were 10.6%, 8.8% and 4.7% and with prior CVD and not using medications were 8.5%, 6.3% and 4.1%. Findings indicate substantial potential to prevent CVD and reduce inequalities through appropriate management of high absolute risk in the population.

1. Introduction

Cardiovascular disease (CVD) is the leading cause of death globally and a leading contributor to morbidity (GBD 2016 Causes of Death Collaborators, 2017). In Australia, CVD accounts for 12% of the total expenditure on health care, with estimated costs of $7.7 billion in 2008–09 (Australian Institute of Health and Welfare, 2014). Approximately 80% of CVD events can be prevented by modifying risk factors to reduce events (Chiuve et al., 2011; Chiuve et al., 2006). In high income countries like Australia the prevalence of modifiable risk factors is known to be disproportionately high in disadvantaged groups, and individuals of low socioeconomic position are more likely to have a CVD event than those of high socioeconomic position (Australian Institute of Health and Welfare, 2011; Backholer et al., 2016; Clark et al., 2009). This inverse association is likely the result of a complex interplay between risk factors, including behavioural and biological factors, across the life-course (Clark et al., 2009), and social determinants of health (Chow et al., 2009).

International guidelines (e.g. (National Institute for Health and Care Excellence, 2014; National Vascular Disease Prevention Alliance, 2012)) recommend an absolute risk approach for the assessment and management of primary CVD risk. Absolute risk is quantified using a validated CVD risk calculator, whereby quantitative data on multiple factors that influence risk, including smoking status, systolic blood pressure, blood lipid levels, and diabetes status, are applied to a person's age- and sex-specific background level of absolute risk to predict an individual's risk of having a CVD event in a given period of time (typically five or ten years) (D'Agostino Sr. et al., 2008). For people who have had a prior CVD event or who are at high absolute risk of primary CVD event (> 15% over 5 years in Australia) lifestyle modifications and treatment with blood pressure- and lipid-lowering therapies are generally recommended, unless contraindicated (National Vascular Disease Prevention Alliance, 2012).

Although the links between socioeconomic position and individual CVD risk factors, morbidity and mortality have been demonstrated by studies internationally (Bagheri et al., 2015a; Davis-Lameloise et al.,

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2013; Ford et al., 2004; Ramsay et al., 2011; Su et al., 2015), there are no studies that have quantified absolute CVD risk in relation to socioeconomic position. Population-level data on variations in absolute CVD risk assessment and management are needed to inform population-level interventions and policies to prevent CVD and address inequalities. This paper aims to estimate the absolute and relative socioeconomic inequalities in absolute CVD risk and treatment of risk in Australia.

2. Methods

2.1. Study population

Details on the data sources have been published previously (Banks et al., 2016). Briefly, we used data from participants in the 2011–12 Australian Bureau of Statistics Australian Health Survey (Australian Bureau of Statistics, 2011-12) aged 45–74 years, and who provided data for the National Health Survey and biomedical data for the National Health Measures Survey, two components of the Australian Health Survey. All those that completed the National Health Measures Survey also completed the National Health Survey. The Australian Health Survey is a nationally representative survey of private households in Australia (~97% coverage). Of the 30,329 participants eligible to participate in the National Health Measures Survey, 11,246 (37%) took part (47% of those aged 45–74 years).

2.2. Outcomes: absolute CVD risk assessment and treatment

The outcomes were prior CVD, high absolute risk of a primary CVD event, and use of preventive medications according to recommendations in national Australian guidelines. Prior CVD was self-reported as having had one or more of: ischaemic heart disease, angina, heart failure, oedema, other heart disease (including atrial fibrillation/flutter), cerebrovascular disease, and diseases of arteries, arterioles and capillaries. People with prior CVD are considered to be at high risk of secondary CVD events. In participants without prior CVD, absolute risk of a primary CVD event over the next five years was estimated using the Australian National Vascular Disease Prevention Alliance risk assessment algorithm (National Vascular Disease Prevention Alliance, 2012). Using this algorithm, some people are considered to be at clinically-determined high risk based on existing risk factors (for example, people with diabetes who are over 60 years old). For all other people, the Framingham CVD risk equation (National Vascular Disease Prevention Alliance, 2012; D'Agostino Sr. et al., 2008) was applied, with five-year risk categorised as low (< 10%), moderate (10–15%) or high (> 15%) (National Vascular Disease Prevention Alliance, 2012). Recommended treatment (according to Australian clinical guidelines (National Vascular Disease Prevention Alliance, 2012)) for individuals at high absolute risk of a primary CVD event was defined as the use of blood pressure- and lipid-lowering medications, as reported in a medications review. For people with prior CVD, recommended treatment also included antithrombotic medication, as per Australian clinical guidelines (Chew et al., 2016; National Heart Foundation of Australia and the Cardiac Society of Australia and New Zealand, 2012; National Heart Foundation of Australia and the Cardiac Society of Australia and New Zealand (Chronic Heart Failure Guidelines Expert Writing Panel), 2011; National Stroke Foundation, 2010). Medications were coded using the World Health Organization Anatomical Therapeutic Chemical (ATC) Classification System (World Health Organization Collaborating Centre for Drug Statistics Methodology, 2015) and included ATC codes: C02, C03, C07, C08 and C09 for blood pressure-lowering medications, ATC code C10 for lipid-lowering medications, and ATC code B01 for antithrombotic medication.

2.3. Main exposure: socioeconomic position

Socioeconomic position was based on educational attainment ascertained from self-reported highest level of qualification and categorised as: high (university degree); intermediate (certificate, diploma or trade); or low (high school certificate or no qualifications).

2.4. Statistical analysis

The proportions with prior CVD and with low, moderate and high primary CVD risk were calculated, by socioeconomic position. We also summarised the distribution of individual CVD risk factors in those without a prior CVD event by socioeconomic position. We used Poisson regression with robust standard errors (Barros & Hirakata, 2003; Zou, 2004) to quantify absolute and relative inequalities in the prevalence of high absolute risk of primary CVD and of prior CVD, as well as in use of preventive treatments within each of these high risk groups. In the treatment analysis, we used data from the full National Health Survey dataset and included an additional 211 participants who reported having prior CVD and an additional 89 participants who had clinically determined high risk who were previously excluded due to missing biomedical data. Prevalence ratios (PR) were obtained directly from the Poisson regression coefficients, and post-estimation marginal effects were used to estimate the absolute prevalence differences, for each level of educational attainment in relation to the reference group (university degree). The models were adjusted sequentially, first for age and sex, and then additionally for region of residence (major cities, inner regional or other [outer regional and remote/very remote], measured using the Accessibility/Remoteness Index of Australia) and region of birth (Australia/New Zealand or other). We applied weights to the prevalence estimates to account for the sampling strategy and non-response (Australian Bureau of Statistics, 2013). 95% confidence intervals (95% CI) were calculated for all estimates. Analyses were performed using Stata version 13.1 (StataCorp, 2013).

2.5. Sensitivity analyses

We undertook three sensitivity analyses, re-running the main models using alternative measures of socioeconomic position: (1) educational attainment measured using highest year of school completed (year 11/12 or equivalent; year 9/10 or equivalent; year 8 or below); (2) equivalised household income in quartiles; and (3) area-level disadvantage measured using the Index of Relative Socioeconomic Disadvantage (Socio-Economic Indexes for Areas (Australian Bureau of Statistics, 2011)) in population-based quintiles. We also ran a post-hoc analysis to examine whether differences in medication use according to socioeconomic position varied by type of prior CVD.

Ethics approval for the National Health Measures Survey data collection was provided by the Australian Government Department of Health Human Research Ethics Committee (ref: 2/2011), with additional approval, for the current study, by the Australian National University Human Research Ethics Committee (ref: 2014/208).

3. Results

A total of 4751 people were included in the main analysis after excluding participants with missing data on education (n = 82, 1.5%) or on any variables needed for assessing absolute CVD risk (n = 520, 9.7%). Forty-nine percent of the participants were male and the median age was 59 years (interquartile range: 52–65 years). Overall, 24% of participants had a high socioeconomic position, 37% intermediate, and 38% had low socioeconomic position (Table 1). Compared to people with the highest socioeconomic position, those of the lowest socioeconomic position were more likely to be older, have been born in Australia or New Zealand, or be residing outside major cities (Table 1) and had a greater burden of CVD risk factors (Supplementary Table S1).

Table 1
Characteristics of the study population by socioeconomic position ($N = 4751$), data from the 2011–12 Australian Health Survey.

	Socioeconomic position			
	Low	Intermediate	High	Total
	$n = 1825$	$n = 1774$	$n = 1152$	$N = 4751$
Sex				
Male	43.2	57.6	45.1	49.3
Female	56.9	42.4	54.9	50.7
Age (years)				
45–49	14.8	23.9	26.6	21.1
50–54	18.0	20.4	25.2	20.6
55–59	17.4	19.1	18.1	18.2
60–64	18.8	16.4	14.6	16.9
65–69	17.5	11.2	10.5	13.4
70–74	13.6	9.1	5.1	9.8
Country of birth				
Australia or New Zealand	71.6	74.6	64.8	71.2
Other	28.4	25.5	35.2	28.8
Region of residence				
Major cities	62.4	66.9	75.1	67.2
Inner regional	25.9	23.0	19.1	23.2
Other	11.7	10.1	5.7	9.7

Notes: (1) Characteristics given as weighted percentages. (2) Socioeconomic position measured by level of educational attainment (low = high school certificate or no qualifications; intermediate = certificate, diploma or trade; and high = university degree). (3) Other region of residence includes outer regional and remote/very remote.

3.1. Socioeconomic variation in absolute risk of a primary CVD event and prior CVD

Overall, 11.0% (95% CI: 9.9, 12.2) of participants had a high absolute risk of a primary CVD event and 9.3% (8.3, 10.4) had prior CVD (Supplementary Table S2). The percentage of people with a high absolute CVD risk increased with decreasing socioeconomic position: of respondents with a high socioeconomic position 6.2% (4.7, 8.2) had a high absolute risk of a primary CVD event and 5.8% (4.3, 7.7) had prior CVD, compared with 11.2% (9.5, 13.2) and 9.0% (7.3, 11.0) of respondents with an intermediate socioeconomic position, and 13.8% (11.9, 16.0) and 11.7% (10.1, 13.7) of respondents with a low socioeconomic position (Supplementary Table S2). Age-sex adjusted prevalences are reported in Fig. 1.

After adjusting for age and sex, the prevalence of high absolute risk of a primary CVD event and prior CVD increased linearly with decreasing socioeconomic position (test for trend, $p = 0.001$ and $p = 0.005$, respectively). The prevalence of high absolute risk of a primary CVD event was 3.3 (0.6, 5.9) percentage points higher among people with intermediate socioeconomic position and 5.0 (2.3, 7.7) percentage points higher among those with low socioeconomic position, compared to those with a high socioeconomic position (Fig. 2). The corresponding prevalence ratios were 1.4 (1.1, 1.9) and 1.6 (1.2, 2.2) (Fig. 2). Further adjustment for country of birth and region of residence made little difference to the results (Supplementary Table S3). Patterns were similar for the outcome of prior CVD. After adjusting for age and sex, the prevalence of prior CVD was 2.4 (−0.3, 5.1) and 4.0 (1.4, 6.6) percentage points higher among those with an intermediate and low socioeconomic position, compared to those with a high socioeconomic position (Fig. 2). The corresponding PRs were 1.4 (1.0, 1.9) and 1.6 (1.1, 2.2) (Fig. 2).

3.2. Socioeconomic variation in treatment

Of those at high absolute risk of a primary CVD event, 21.8% (95%CI: 17.2, 27.2) were taking both blood pressure- and lipid-lowering medications, 27.7% (22.8, 33.3) were taking one of these medications, and half (50.5% [44.4, 56.5]) were taking neither (Supplementary Table S4). 28.5% (15.8, 45.7) of those with a high socioeconomic position, 19.2% (12.5, 28.2) with an intermediate socioeconomic position and 21.8% (15.6, 29.7) with a low socioeconomic position were taking both medications (Supplementary Table S4), and after adjusting for age and sex the differences were not statistically significant (Fig. 3). Among those with low, intermediate and high socioeconomic position respectively, the age-sex adjusted proportions of people at high primary risk and not using both medications were 10.6% (8.4, 12.8), 8.8% (6.8, 10.9) and 4.7% (2.9, 6.4).

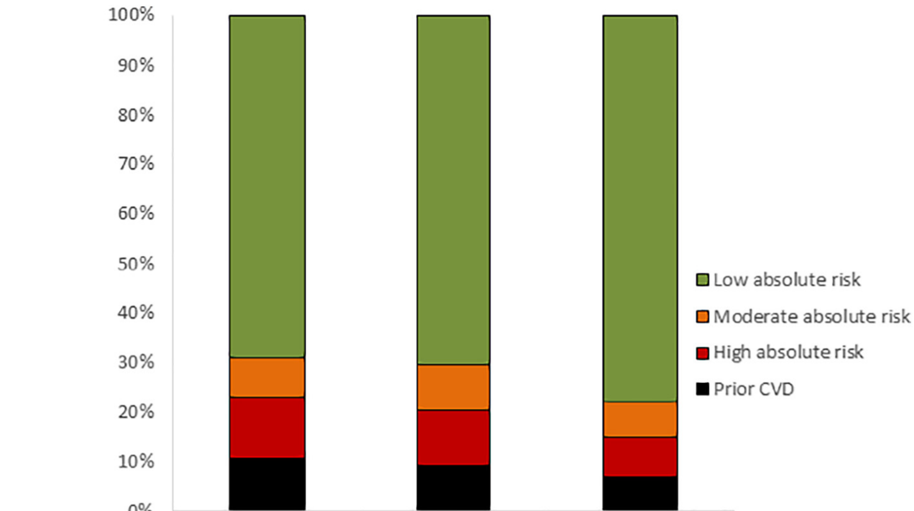
Among people with prior CVD, 34.3% (95%CI: 30.0–38.9) were taking the recommended medications, including 37.3% (31.3, 43.8) of those with a low and 36.5% (29.0, 44.7) of those with an intermediate socioeconomic position compared to 17.6% (10.6, 27.6) of those with a high socioeconomic position (Supplementary Table S4). After adjusting for age and sex, prevalence of recommended treatment was 18.0 (95%CI: 7.0, 29.0) and 20.1 (9.7, 30.5) percentage points higher among those with an intermediate and low socioeconomic position, compared to those with a high socioeconomic position (Fig. 3). The corresponding prevalence ratios were 2.0 (1.2, 3.4) and 2.1 (1.3, 3.5). Additional adjustment for country of birth and region of residence made no material difference to the results (Supplementary Table S5). We observed the same pattern of results when we restricted the analysis to people who reported having prior CVD and had biomedical data to calculate absolute risk (results not shown). Among those with low, intermediate and high socioeconomic position respectively, the age-sex adjusted proportions of people with CVD and not using both medications were 8.5% (6.5, 10.6), 6.3% (4.5, 8.1) and 4.1% (2.3, 5.9).

3.3. Sensitivity analyses

Results were broadly consistent when alternative measures of socioeconomic position (level of high school educational attainment, household income, and area level disadvantage) were used (Supplementary tables S6-S12). Prevalence of high absolute primary CVD risk and prior CVD increased with lower levels of socioeconomic position (Supplementary Tables S7 and S8). Using the alternative indicators of socioeconomic position, there were no clear patterns between treatment and socioeconomic position among those at high absolute risk of a primary CVD event (Supplementary Table S11), while in people with prior CVD, results were in the same direction as the main analysis but were not statistically significant (Supplementary Table S12). There was little difference in the types of prior CVD reported between those with low, intermediate and high socioeconomic position (Supplementary Table S13) and prevalence ratios were slightly attenuated but still in the same direction when type of CVD was adjusted for in the analysis of treatment in those with prior CVD (Supplementary Table S14).

4. Discussion

In this nationally representative population-based Australian study, the prevalence of both high absolute CVD risk and established CVD increased with increasing levels of disadvantage. In those with no school qualifications versus a university education, the prevalence of established CVD and of high absolute risk of a primary CVD event were both 1.6 times higher, and in absolute terms, 4 and 5 percentage points higher, respectively. Treatment levels were low overall and varied by socioeconomic position. Overall, around one in five people with a high primary risk and one in three people with established CVD reported using both lipid- and blood pressure-lowering medications. However, among people with established CVD the use of recommended preventive medications was twice as high in those with low versus high socioeconomic position. Despite this, around two times as many people of low compared to high socioeconomic position were at high absolute risk of a primary CVD event or had existing CVD and were not using



	Low socioeconomic position	Intermediate socioeconomic position	High socioeconomic position
Low absolute risk	69.4	69.9	76.2
Moderate absolute risk	7.9	9.5	7.1
High absolute risk	12.6	10.9	7.7
Prior CVD	10.7	9.1	6.7

Fig. 1. Age and sex adjusted prevalence of prior CVD and low, moderate and high absolute 5-year risk of primary CVD event by socioeconomic position among individuals in the Australian population aged 45–74, data from the 2011–12 Australian Health Survey.
CVD = cardiovascular disease. Notes: (1) Socioeconomic position measured by level of educational attainment (low = high school certificate or no qualifications; intermediate = certificate, diploma or trade; and high = university degree). (2) Absolute risk categorised according to five-year predicted CVD risk estimated using the Australian National Vascular Disease Prevention Alliance risk assessment algorithm, low risk ≤10%, moderate risk = 10–15%, high risk = > 15%. (3) Percentages were weighted to account for the sampling strategy and non-response.

lipid- and blood pressure-lowering medications.

This is the first study, to our knowledge, to investigate how absolute CVD risk and treatment varies according to socioeconomic position. Our findings are consistent with previous findings that incidence and prevalence of CVD is higher in people of low compared to high socioeconomic position (Bagheri et al., 2015b; Daviglus et al., 2012; Clark et al., 2007; Woodward et al., 2015). The observed inverse association between socioeconomic position and treatment in people with prior CVD were contrary to our expectation that, consistent with findings of inequalities in care (Schroder et al., 2016), people with a low socioeconomic position would be less likely to receive treatment than those with a high socioeconomic position. However, this finding is not without precedent. Two previous Australian studies found age-adjusted rates of statin prescribing were highest in the most socioeconomically disadvantaged people (Stocks et al., 2009; Stocks et al., 2004).

There is limited evidence of socioeconomic variations in preventive treatment use in people with prior CVD from previous international studies. Findings from an international systematic review and meta-analysis found socioeconomic-related differences in treatment following hospitalisation for acute coronary syndrome varied by medication type (Hyun et al., 2017). Overall they found no inequalities in prescribing of aspirin, a 20% lower prevalence of lipid-lowering prescriptions and a 16% lower prevalence of beta-blocker prescriptions but a 13% higher prevalence of ACE inhibitor prescriptions, in the people with the lowest compared to the highest socioeconomic position (Hyun et al., 2017). Studies of secondary prevention prescribing in people with prior CVD in Denmark, England and Scotland found no overall evidence of differences in prescribing by socioeconomic status (Reid et al., 2002; Simpson et al., 2005; Thomsen et al., 2005). The study in Denmark observed an increased prevalence of statin prescribing in men (but not women) with higher compared to lower socioeconomic position measured by occupation in 1995 but this finding was attenuated and no longer statistically significant using data from 1999 (Thomsen et al., 2005).

	Age-sex adjusted prevalence (95%CI)	Prevalence difference (95%CI)	Prevalence ratio (95%CI)
High Absolute Risk Primary CVD			
Socioeconomic position			
High	7.7 (5.7, 9.7)	0.0	1.0
Intermediate	10.9 (9.3, 12.6)	3.3 (0.6, 5.9)	1.4 (1.1, 1.9)
Low	12.6 (10.9, 14.4)	5.0 (2.3, 7.7)	1.6 (1.2, 2.2)
Prior CVD			
Socioeconomic position			
High	6.7 (4.8, 8.6)	0.0	1.0
Intermediate	9.1 (7.3, 10.9)	2.4 (-0.3, 5.1)	1.4 (1.0, 1.9)
Low	10.7 (9.0, 12.4)	4.0 (1.4, 6.6)	1.6 (1.1, 2.2)

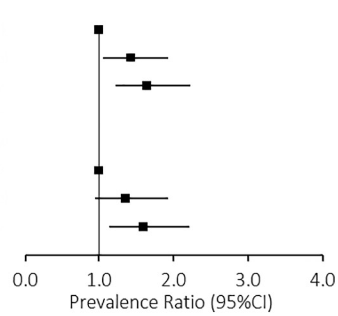


Fig. 2. Relative and absolute differences in prevalence of individual aged 45–74 years at high absolute risk of primary CVD and prior CVD by level of education, data from the 2011–12 Australian Health Survey
Notes: (1) Socioeconomic position measured by level of educational attainment (low = high school certificate or no qualifications; intermediate = certificate, diploma or trade; and high = university degree). (2) Numbers are based on 4751 respondents. (3) Models are adjusted for age and sex. (4) Prevalence ratios are plotted. (5) Prevalences were weighted to account for the sampling strategy and non-response. (6) Absolute risk categorised according to five-year predicted CVD risk estimated using the Australian National Vascular Disease Prevention Alliance risk assessment algorithm, low risk ≤10%, moderate risk = 10–15%, high risk = > 15%.

	Age-sex adjusted prevalence (95%CI)	Prevalence difference (95%CI)	Prevalence ratio (95%CI)
High Primary Risk			
Socioeconomic position			
High	29.4 (13.8, 45.0)	0.0	1.0
Intermediate	19.5 (11.6, 27.4)	-9.9 (-27.5, 7.7)	0.6 (0.3, 1.3)
Low	21.3 (14.7, 28.0)	-8.1 (-24.9, 8.8)	0.7 (0.4, 1.3)
Prior CVD			
Socioeconomic position			
High	17.7 (9.5, 26.0)	0.0	1.0
Intermediate	35.7 (28.4, 43.0)	18.0 (7.0, 29.0)	2.0 (1.2, 3.4)
Low	37.8 (31.5, 44.1)	20.1 (9.7, 30.5)	2.1 (1.3, 3.5)

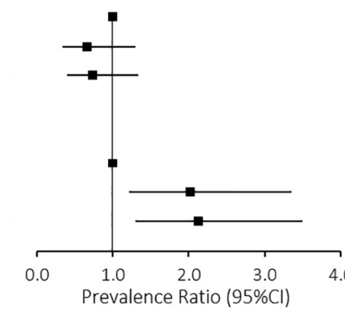


Fig. 3. Relative and absolute differences in prevalence and total number of individuals aged 45–74 years at high absolute risk of primary CVD or with prior CVD using recommended medication by level of education, data from the 2011–12 Australian Health Survey.

Notes: (1) Socioeconomic position measured by level of educational attainment (low = high school certificate or no qualifications; intermediate = certificate, diploma or trade; and high = university degree). (2) Numbers are based on 426 respondents at high absolute risk of primary CVD and 716 respondents with prior CVD. (3) Prevalence ratios are plotted. (4) Proportions refer to those at high primary risk using both blood pressure- and lipid-lowering medications and those using blood pressure- and lipid-lowering, and antithrombotic medications among those with prior CVD. (5) Models are adjusted for age and sex. (6) Prevalences were weighted to account for the sampling strategy and non-response. (7) Absolute risk categorised according to five-year predicted CVD risk estimated using the Australian National Vascular Disease Prevention Alliance risk assessment algorithm, low risk ≤10%, moderate risk = 10–15%, high risk = > 15%.

It is not clear why there might be an inverse association between socioeconomic position and use of preventive medications in people with established CVD in Australia, although this does not appear to be driven by differences in type of CVD. Our findings may reflect, at least in part, differential subsidisation of medications under Australian's universal healthcare system, Medicare. Generally, people with a Medicare card (Australian and New Zealand citizens and permanent residents/visa holders) pay a co-payment for prescription medicines under the Pharmaceutical Benefits Scheme, but this co-payment is substantially lower for people who are eligible for a concession, including people with low incomes and pensioners. However, this does not explain why we did not observe socioeconomic variation in use of preventative medications for those at high primary risk.

Our study has three crucial strengths compared to previous studies examining CVD treatment. First, we were able to examine socioeconomic variation in treatment separately for people with prior CVD and those at high absolute risk of a primary CVD event. Second, we examined medication use according to recommendations in Australian national guidelines which recommend the concurrent use of multiple medications to lower risk. Third, we had information on a range of indicators of socioeconomic position allowing us to test the robustness of the results to different SEP measures.

Although we observed socioeconomic variation in the prevalence of prior CVD and high absolute CVD risk, we did not explicitly quantify which CVD risk factors were the main contributing factors to these inequalities. In our sample, those of the lowest compared with the highest socioeconomic position had a higher prevalence of many CVD risk factors, including smoking, diabetes and systolic blood pressure, suggesting these factors are key contributors to the observed socioeconomic variation. This is consistent with evidence that individual CVD risk factors are elevated in people with lower socioeconomic position (Albert et al., 2006; Winkleby et al., 1998), and that most of the socioeconomic position-CVD relationship is accounted for by traditional CVD risk factors (Albert et al., 2006; Lynch et al., 1996).

This is the first study, to our knowledge, to use nationally representative data from Australia to estimate socioeconomic inequalities in the prevalence of absolute CVD risk and recommended treatment use according to national guidelines. This is important as understanding variations in the prevalence of high absolute CVD risk provides insights about the potential to target population-based interventions and policies to improve primary prevention of CVD events. Access to biomedical data allowed for the calculation of absolute risk according to the National Vascular Disease Prevention Alliance algorithm (National Vascular Disease Prevention Alliance, 2012) and we tested the robustness of our findings using a range of individual-level socioeconomic indicators.

In addition to these strengths, our study has some limitations. First, the study is cross-sectional and since treatment may have lowered absolute risk, the results cannot be used to draw conclusions of overtreatment in low risk groups. Second, for some analyses, sample sizes were small resulting in low power to observe statistically significant associations. Third, a small proportion of individuals may not be prescribed some medications due to contraindications. However, given we examined broad classes of medications this is likely to only be an issue for a very small subset of participants and is unlikely to impact interpretation of the results. Finally, some of the key variables, including socioeconomic position and prior CVD, were self-reported. This may have resulted in some misclassification, however the direction and extent to which this would bias the results is unknown.

Our findings of increasing levels of high absolute CVD risk with increasing levels of disadvantage and low levels of treatment among high risk individuals suggest there is huge potential to prevent CVD events in the population through appropriate management of absolute risk. Further, given the higher prevalence of untreated individuals at high absolute risk among those of lower socioeconomic position, treating according to absolute risk should result in reductions in absolute inequalities in CVD.

Contributors

EP drafted the manuscript. JW conducted the analyses. EB and RK conceived the study. All authors interpreted the data, and critically revised and approved the final manuscript.

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Competing interests

None declared.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2018.07.011.

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