



Inequalities in premature mortality from comorbidity clusters:

Analysis of Census-linked multiple cause of death data in Australia

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Tim Adair, University of Melbourne

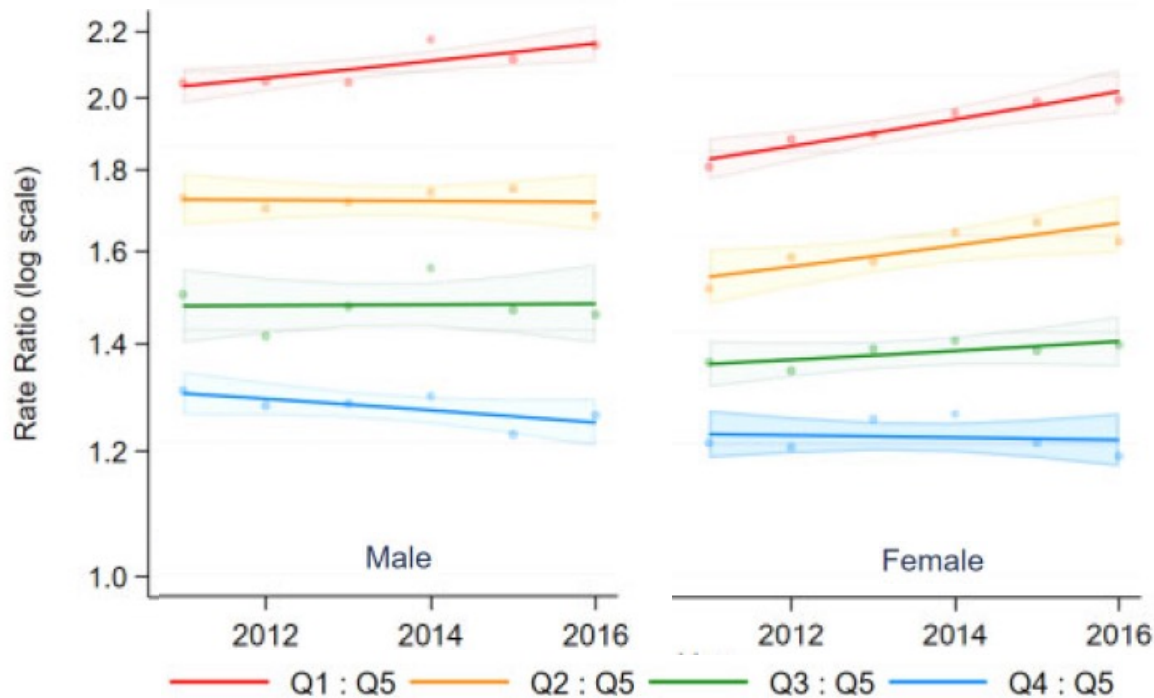
IUSSP Webinar Series

Social inequalities in multi-morbidity at death

28 September, 2023

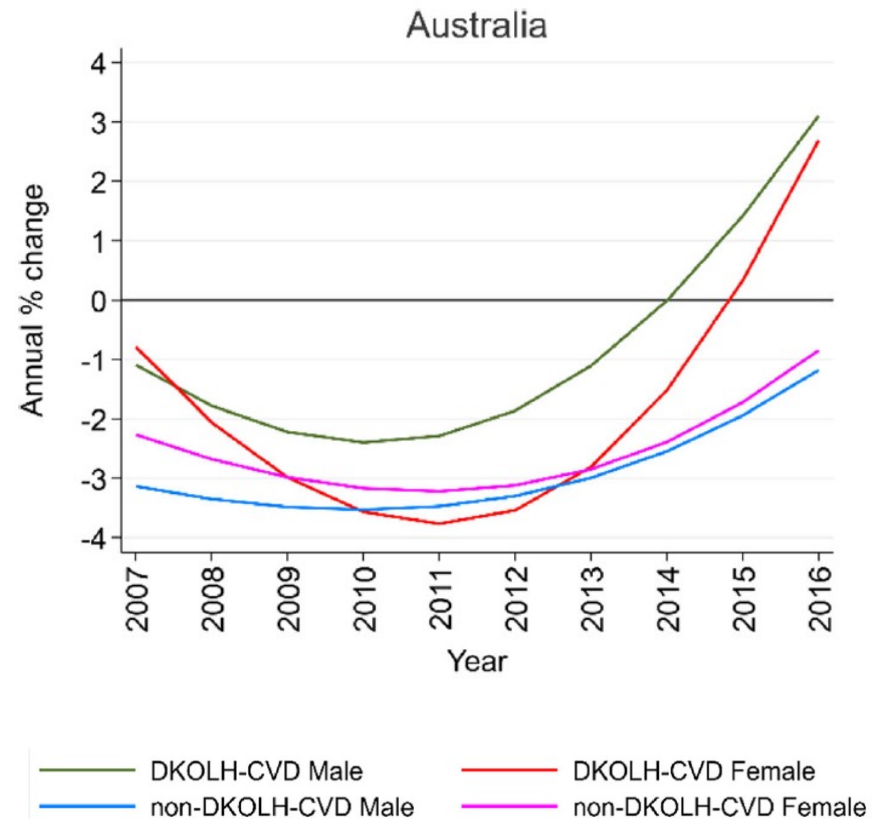
Recent mortality trends and patterns in Australia

- Slowdown in premature (35-74 years) mortality rate decline, accompanied by widening area-level socio-economic inequalities
- Stagnation in premature mortality rates in the lowest area-level socio-economic quintile from 2011-16



Recent mortality trends and patterns in Australia

- Adverse trends in premature cardiovascular disease (CVD) mortality from cardiometabolic conditions (**DKOLH-CVD**) – major risk factor is overweight and obesity
- **DKOLH-CVD**: any CVD reported in Part 1 or Part 2 the death certificate with one or more of:
 - diabetes,
 - chronic kidney disease,
 - obesity,
 - lipidemias, or
 - hypertensive heart disease



Annual change in age-standardized DKOLH-CVD and non-DKOLH-CVD MCOD death rates (%), 35–74 years²



Recent mortality trends and patterns in Australia

- Poor ranking among high-income countries in and alcohol- and drug-related mortality

Substance use disorder (alcohol and drug) mortality rates – ranking of Australia among 24 high-income countries (excluding USA), by age, 25-64 years, Global Burden of Disease 2019 ³

Sex	Age group								
	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male	14	16	19	22	20	18	15	12	12
Female	20	22	23	23	24	20	21	18	15



Improving understanding of mortality trends and patterns

- Australian death registration data and Census data can now be linked at the individual level, via the Australian Bureau of Statistics Multi-Agency Data Integration Project (MADIP).
- Death registration data contain all reported conditions on the death certificate (multiple causes of death)
- Census data contain detailed information on socio-economic characteristics of individuals, households and geographic areas
- **These data allow us to better understand recent trends and patterns in mortality in Australia**
 - Specifically, socio-economic inequalities in premature mortality from clusters of comorbidities in which Australia is not faring well among comparable countries:
 - CVD related to overweight and obesity
 - Alcohol- and drug-related mortality



Importance of inequalities in mortality from comorbidity clusters

- Previous research has used MADIP data to show inequalities between highest and lowest level of education in all-cause mortality (25-84 years: 2.20 males, 1.64 females) and life expectancy (at age 25 years: 9.1 years males, 5.5 females).⁴⁻⁵
- Literature has detailed higher risk of multi-morbidities among lower socio-economic groups.⁶
- Prevalence of overweight and obesity in Australia is higher among lower socio-economic groups and outside major cities.⁷⁻⁸
- Alcohol-related mortality and consumption is higher among lower socioeconomic groups, reflecting the generally greater alcohol consumption among these groups.⁹⁻¹⁰
- Drug-related mortality also exhibits significant socio-economic inequalities.¹¹



Aims

- This presentation aims to measure socioeconomic inequalities in premature mortality (25-74 years) in Australia from comorbidity clusters of:
 - Cardiovascular disease mortality
 - Alcohol- and drug-related mortality



Data

- The Australian Bureau of Statistics (ABS) Multi-Agency Data Integration Project (MADIP) comprises data sets from various Government agencies (statistics, health, taxation etc).
- Data sets can be linked using a Person Linkage Spine. The Spine aims to identify all individuals residing in Australia at any point in time based on Medicare, Centrelink and Income Tax data.
- Use of MADIP is only for approved projects, data can only be accessed in a secure environment and all data outputs must be approved by the ABS.
- This study uses death registration data (including multiple causes of death) from 2016-19 and 2016 Census data.



Data linkage

Personal linkage spine

**98.8%
match
spine**

**89.2%
match
spine**

**Death registration
(2016-19)**
Multiple causes of
death

2016 Census
Individual, household
and geographic socio-
economic information



Causes of death

- **Cardiovascular disease (CVD) mortality**
 - DKOLH-CVD: CVD (ICD-10 code I00-I45, I47-I99) reported anywhere on the death certificate (MCOD) and one or more of:
 - diabetes (E10-E14)
 - chronic kidney disease (N18)
 - obesity (E65-E66)
 - lipidemias (E78), or
 - hypertension (E10)
 - Cardiometabolic conditions, with common risk factor of overweight and obesity.
 - Other CVD: CVD MCODE excluding DKOLH causes.
 - Obesity MCODE (E65-E66) & CVD MCODE. Note that obesity is under-reported on death certificates



Causes of death

Alcohol-related

- Cirrhosis of the liver and other liver diseases (K70, K74, K76.0-.2, K76.4-.9)
- Alcohol-related disorders (F10): alcohol use, abuse, dependence
- Intentional self-poisoning (X65), accidental poisoning (X45) or undetermined intent (Y15) by and exposure to alcohol

Drug-related

- Drug-related disorders (F11-F16, F18-F19): drug use, abuse, dependence
- Intentional self-poisoning by (X60-X64), accidental poisoning (X40-X44) or undetermined intent (Y10-Y14) by and exposure to drugs

Alcohol- & drug-related

- Both an alcohol cause and a drug cause reported on the death certificate.
- 36% of drug-related deaths have an alcohol-related cause also reported



Socio-economic and geographic variables

- Household income (equivalised)
- Area-level Index of Relative Socio-economic Advantage and Disadvantage (IRSAD) at SA1 level (average population of 400)
- Highest educational attainment
- Labour force status (Employed, unemployed, not in labour force (NILF) but don't need assistance for core activity nor caring for child)
- Marital status
- Lone household



Methods

- Analysis of deaths from 10 August 2016 (after Census night) to 31 December 2019 of people aged 25-74 years who were living in Australia on Census night. Does not include COVID-19 pandemic years.
- Denominator: person-years lived during 10 August 2016 to 31 December 2019 by people included in the 2016 Census (excluding visitors)
- Cause-specific age-standardised death rates (per 100,000), standardised to 2016 Census population, 95% confidence intervals assume Poisson distribution of deaths.
- Ratios of age-standardised death rates between socio-economic groups & 95% confidence intervals.
- Cox regression of cause-specific deaths (by sex): covariates of age, household income, education, lone household, marital status, household tenure, English language spoken at home, Indigenous status, migrant status, state/territory & major city



Estimating deaths (by cause) for Census cases not linked to Spine

- 10.8% of Census cases not linked to the Spine.
- Unlinked cases are more likely to be from poorer socio-economic groups, so ignoring them would bias results.
- Negative binomial regression of cause-specific mortality of linked cases (offset by log of person-years) with socio-economic and geographic covariates. Coefficients used to predict cause-specific deaths for each combination of covariates of Census cases not linked to the Spine.
- Predicted deaths summed with actual deaths (for linked cases) used to calculate adjusted age-standardised cause-specific death rates and rate

Deaths & Census cases linked to the Spine:
Negative binomial regression of cause-specific deaths

Covariate coefficients

Predict cause-specific deaths for Census cases not linked to the Spine.
Sum with actual deaths (for linked cases)



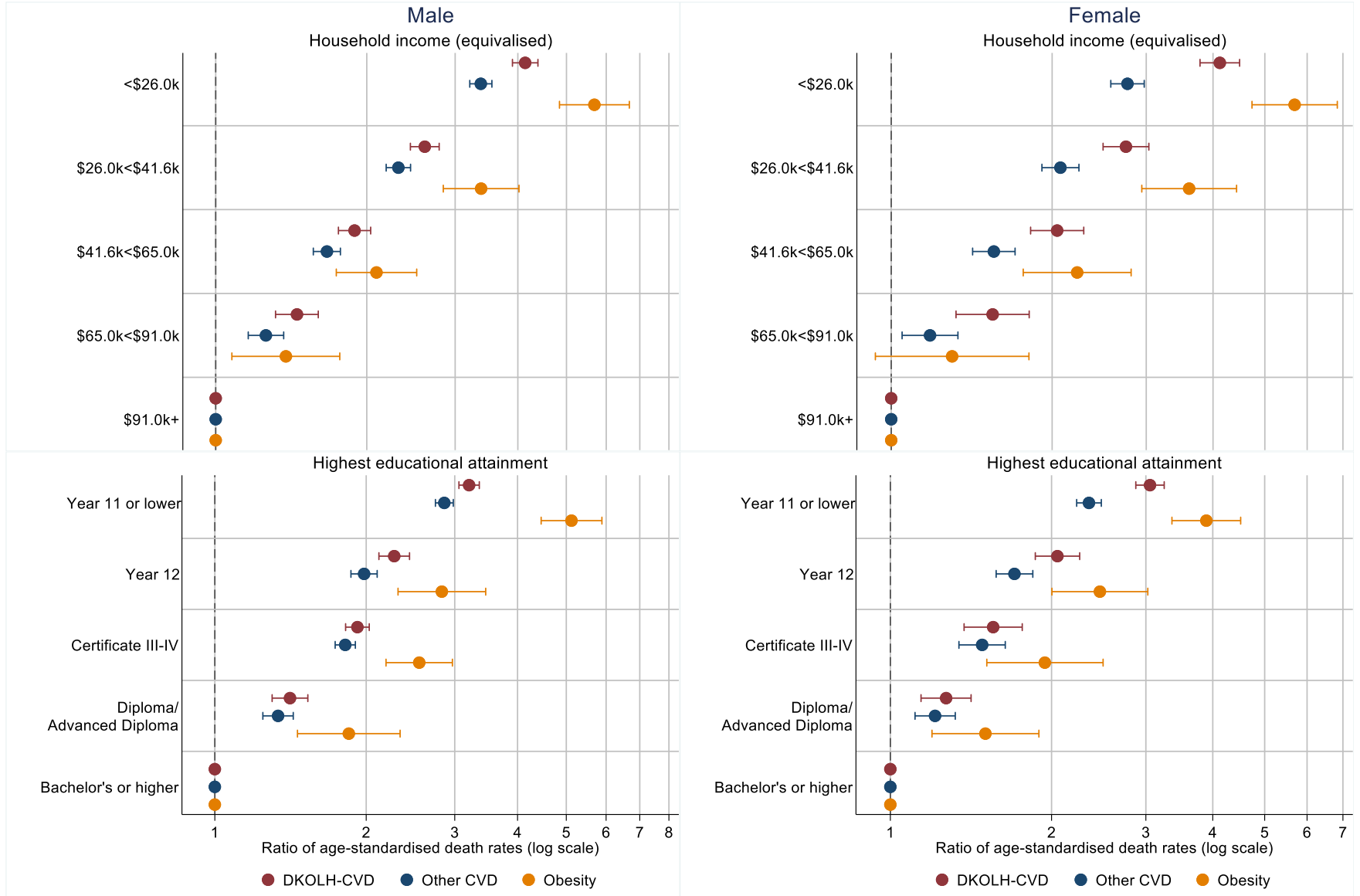
CVD comorbidities

% of condition where each other condition also reported (row %)

		Diabetes	Chronic kidney	Obesity	Lipidemias	Hypertension
Condition	Diabetes		19.8	9.9	12.3	42.1
	Chronic kidney	45.8		5.2	5.9	29.6
	Obesity	37.7	8.6		12.8	42.1
	Lipidemias	40.1	8.3	11.0		76.3
	Hypertension	35.0	10.6	9.2	19.4	
	DKOLH-CVD	47.6	20.6	12.5	14.5	57.2

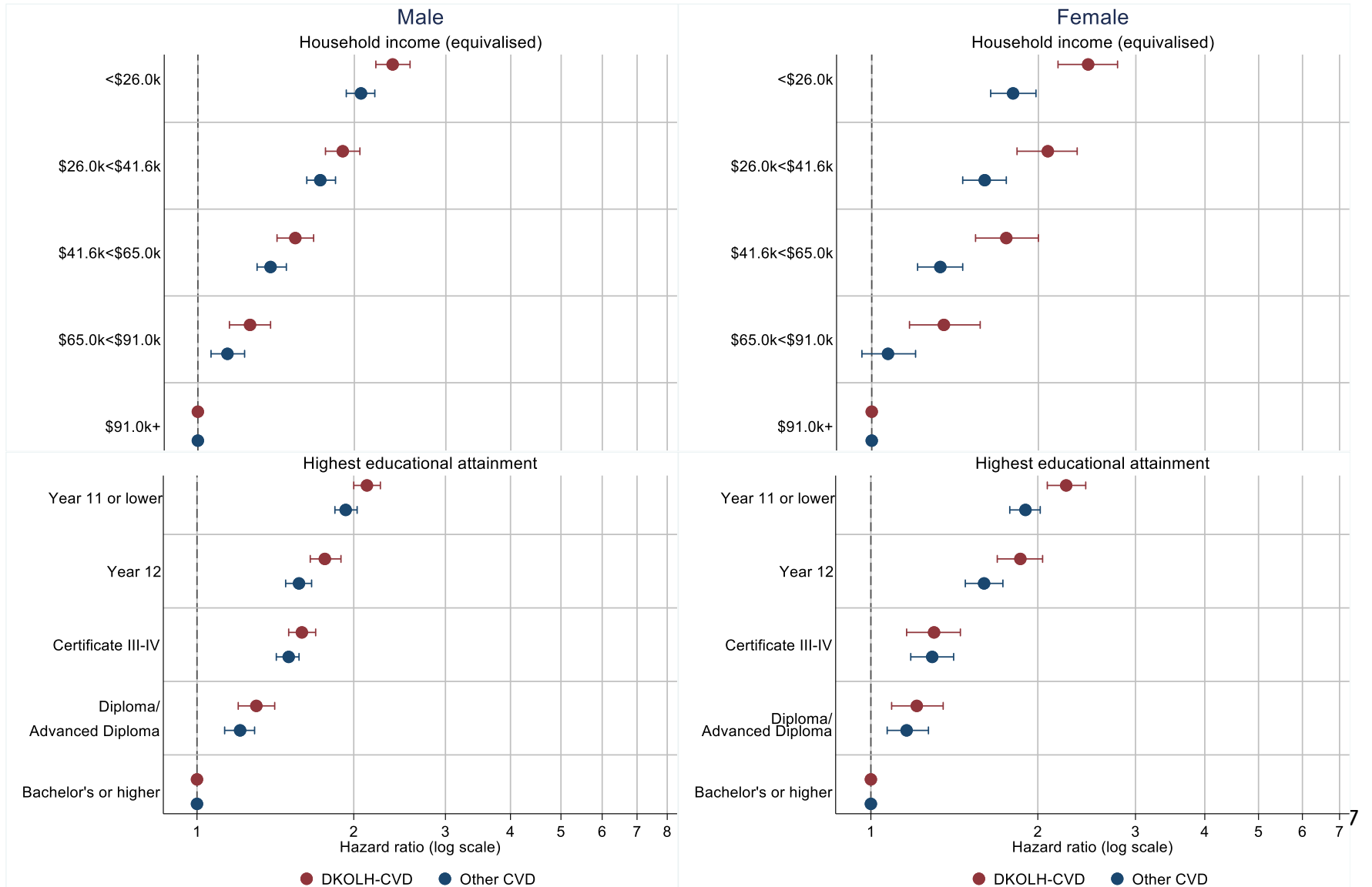


CVDs – mortality rate ratios – household income & education



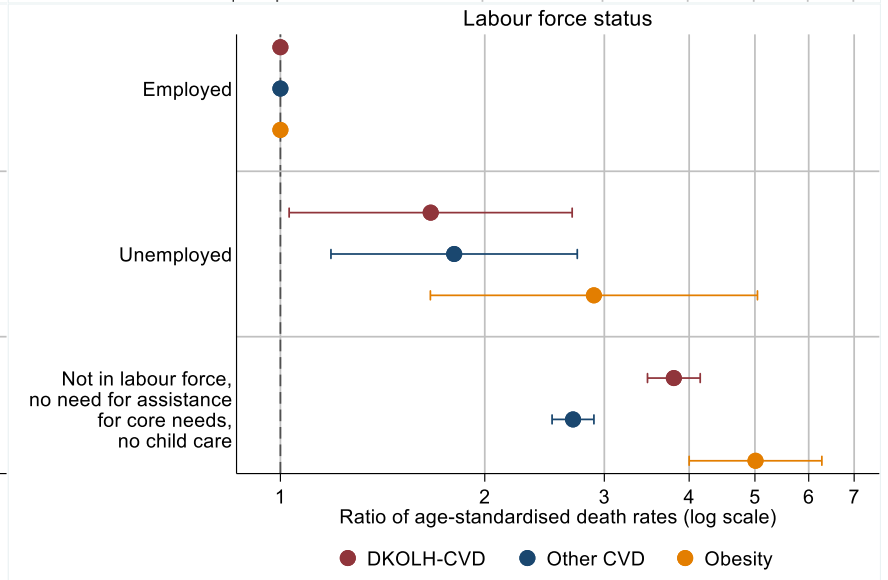
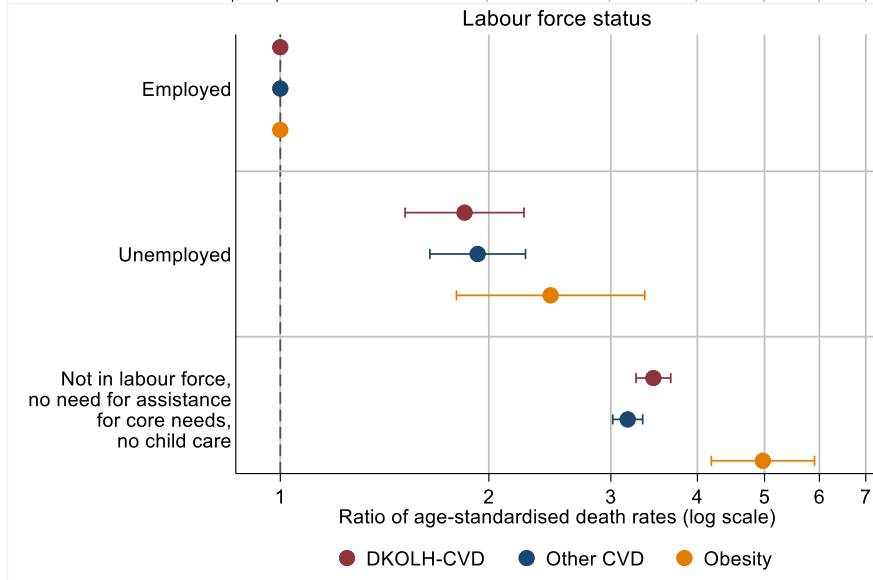
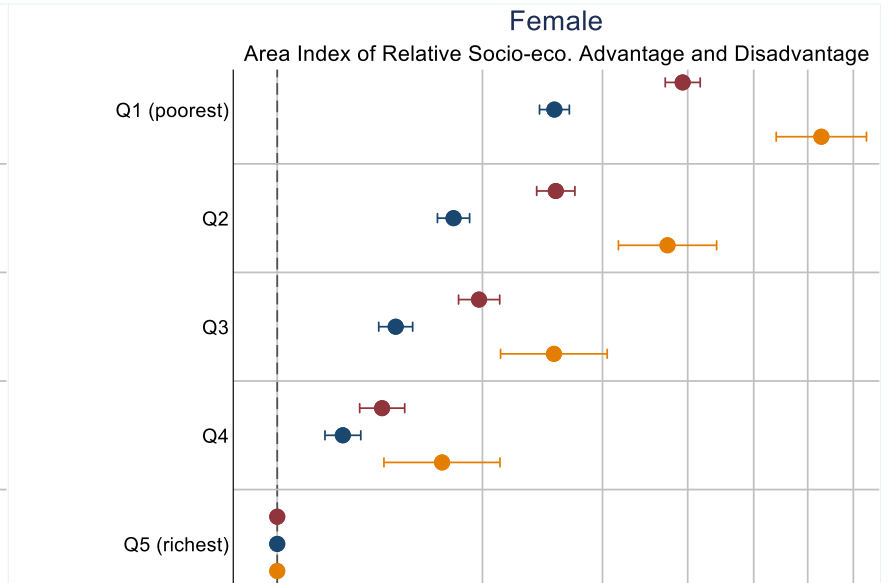
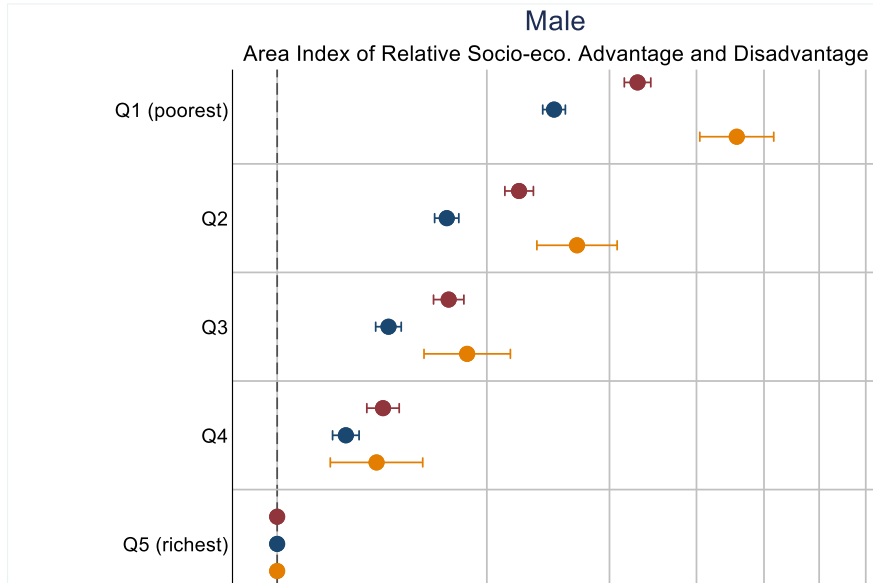


CVDs – Cox regression results – household income & education





CVDs – mortality rate ratios – area SES & labour force status



Ratio of age-standardised death rates (log scale)

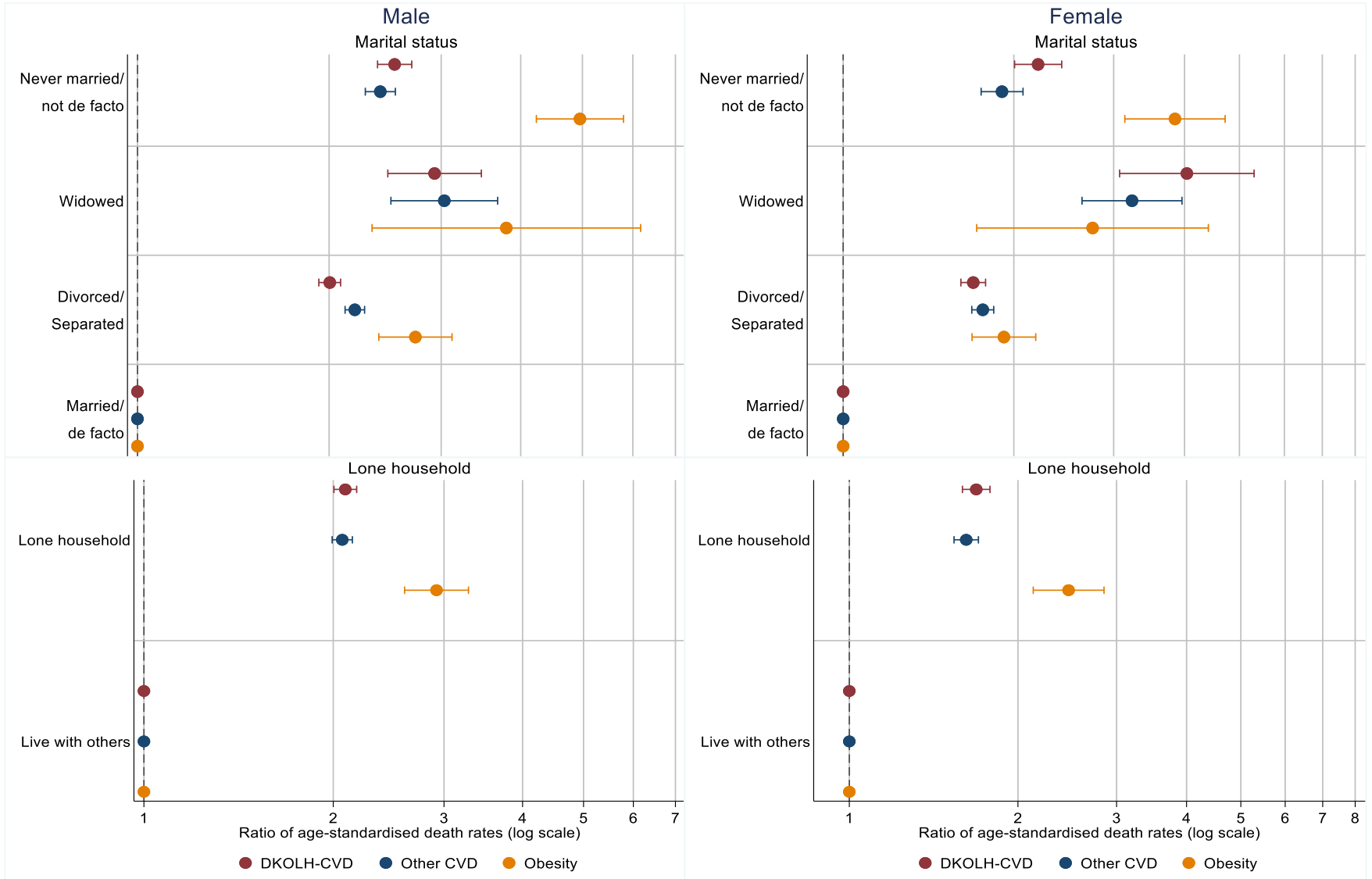
● DKOLH-CVD ● Other CVD ● Obesity

Ratio of age-standardised death rates (log scale)

● DKOLH-CVD ● Other CVD ● Obesity

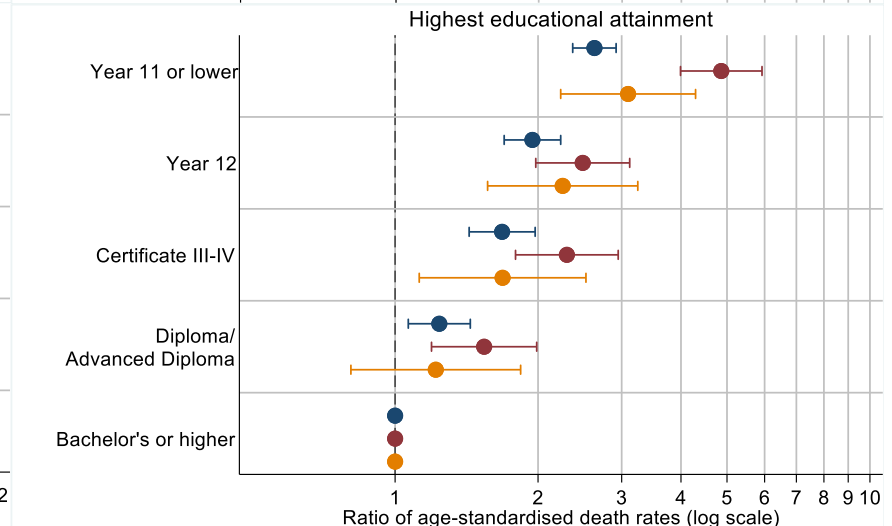
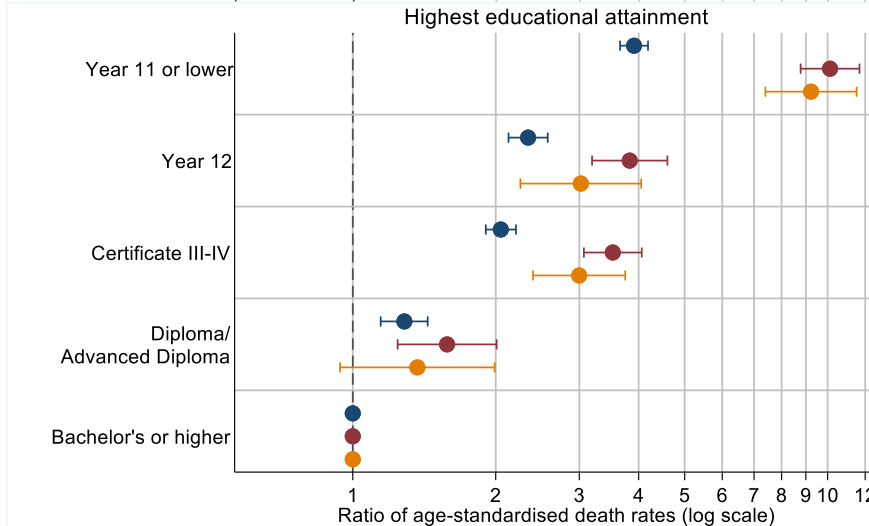
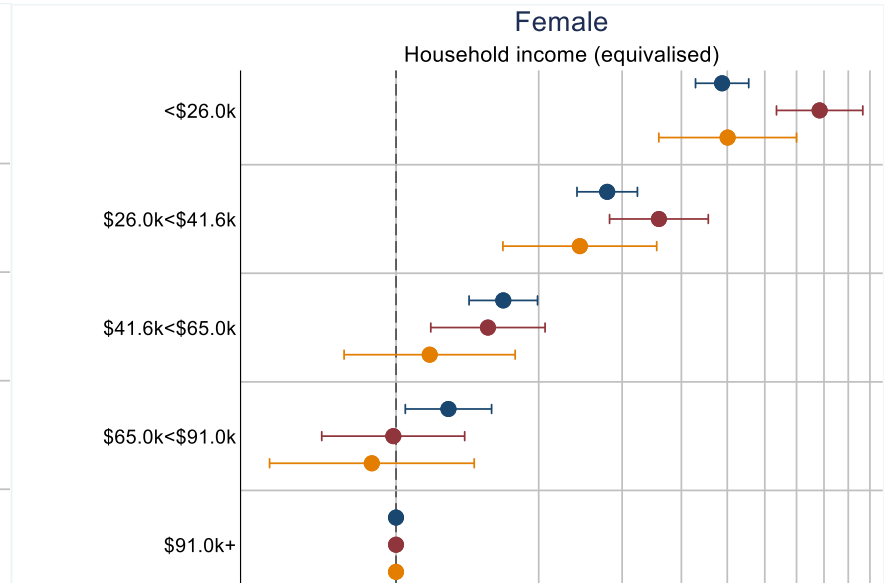
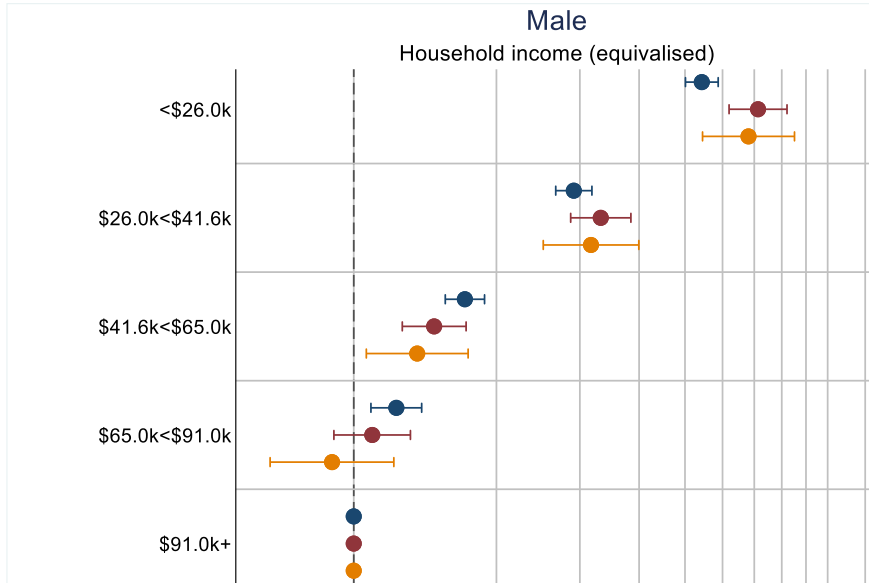


CVDs – mortality rate ratios – marital status & lone household





Drug & alcohol – mortality rate ratios – household income & education

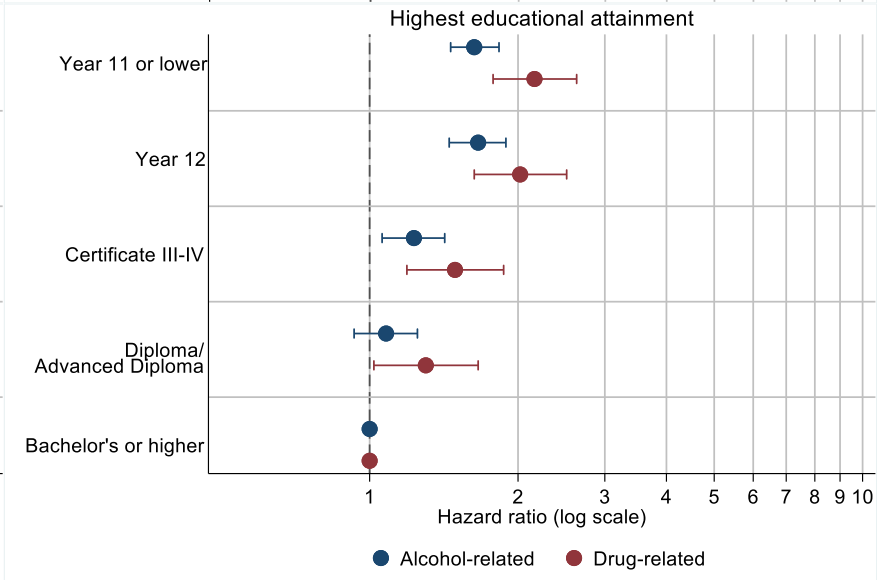
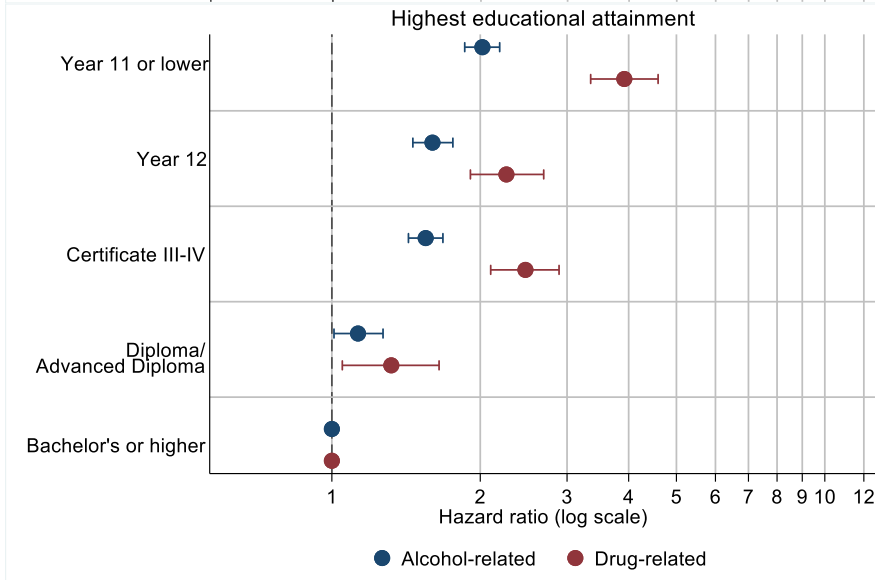
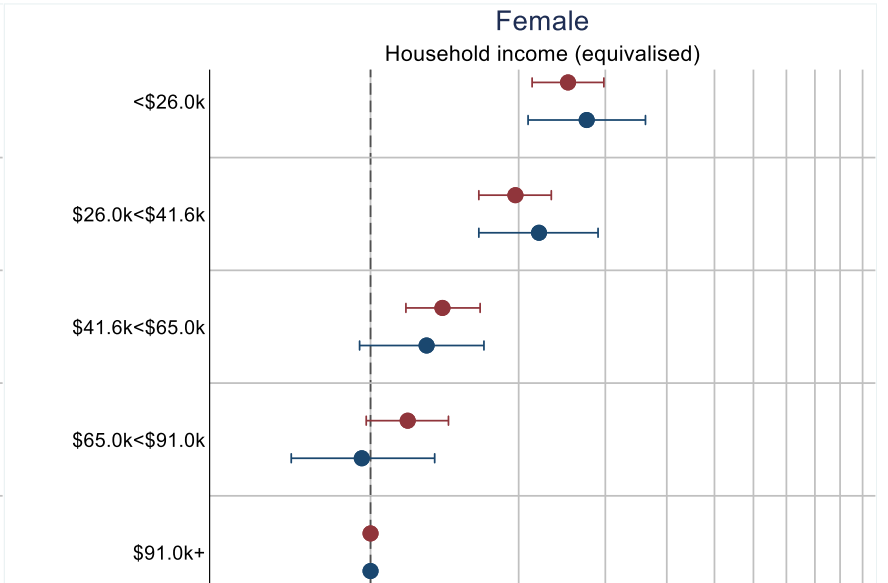


● Alcohol-related ● Drug-related ● Alcohol- & drug-related

● Alcohol-related ● Drug-related ● Alcohol- & drug-related



Drug & alcohol – Cox regression results – household income & education

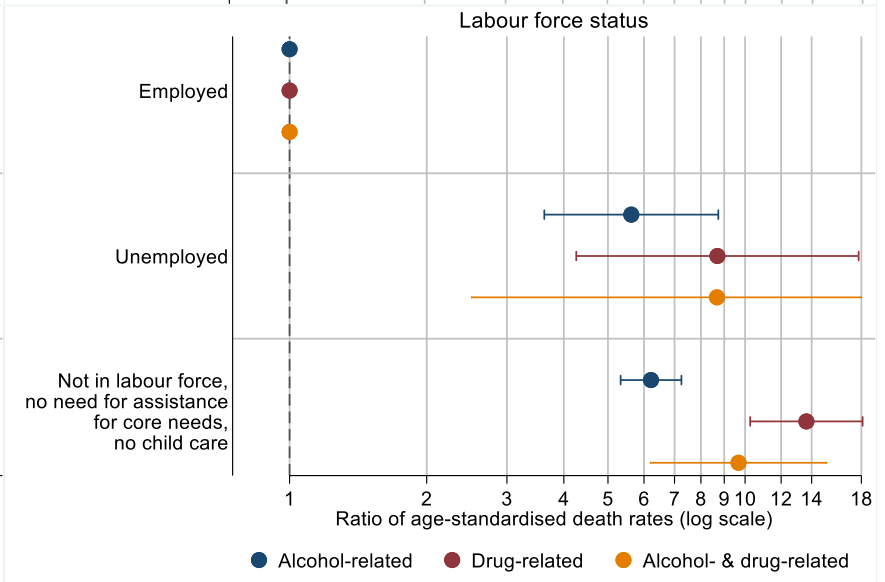
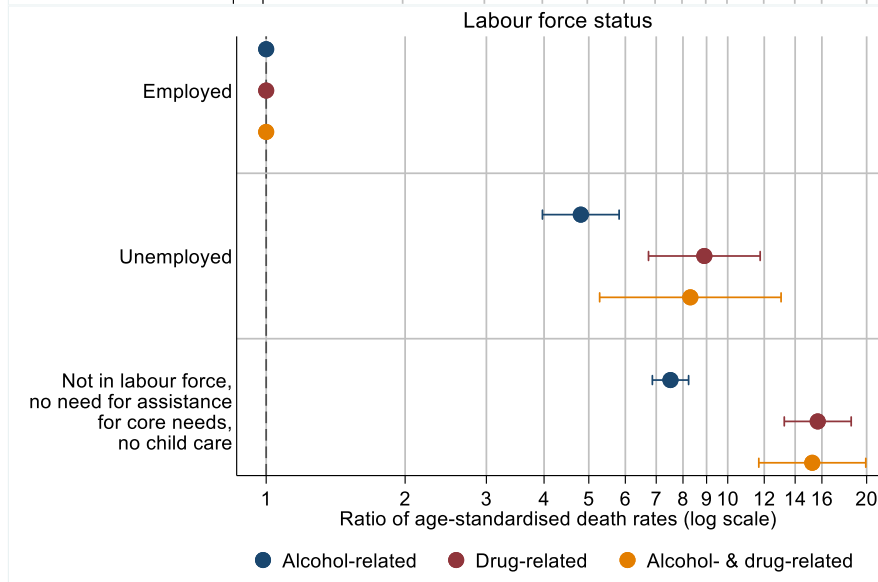
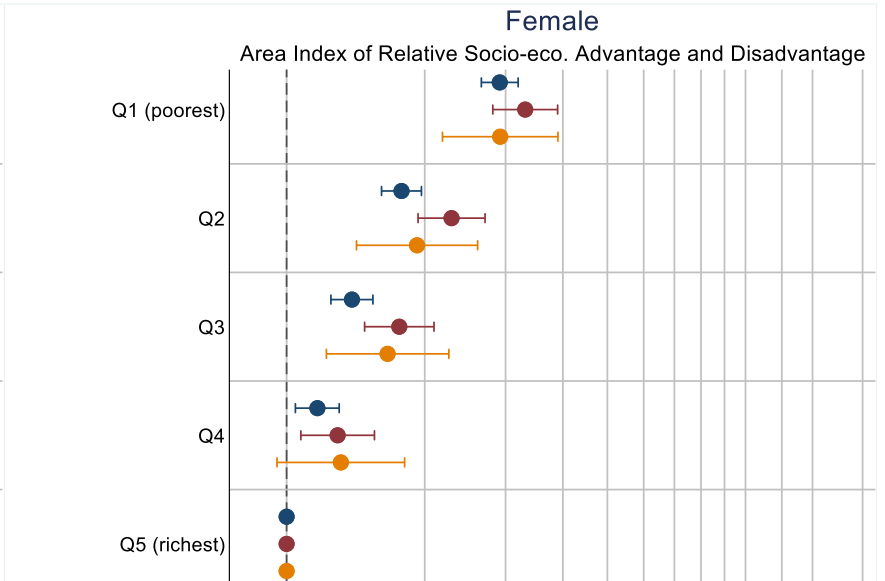
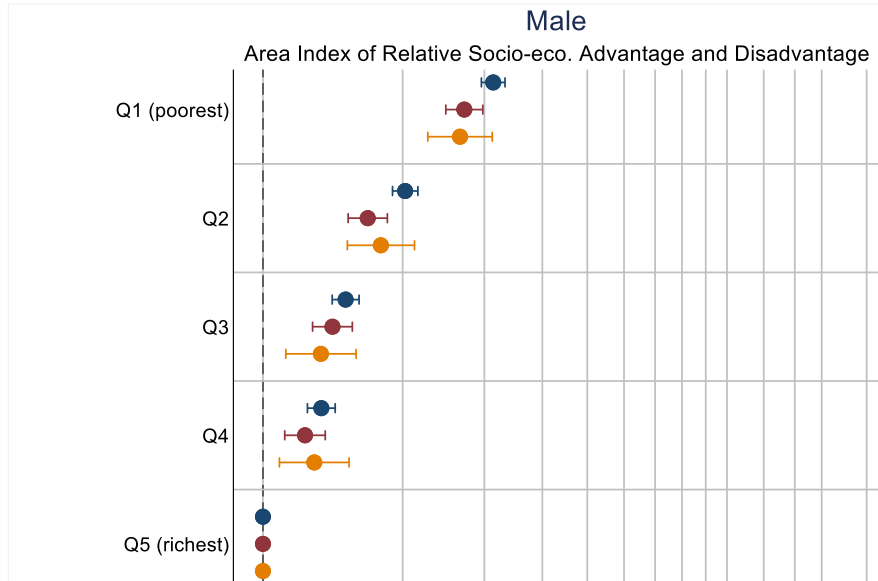


● Alcohol-related ● Drug-related

● Alcohol-related ● Drug-related



Drug & alcohol – mortality rate ratios – area SES & labour force status

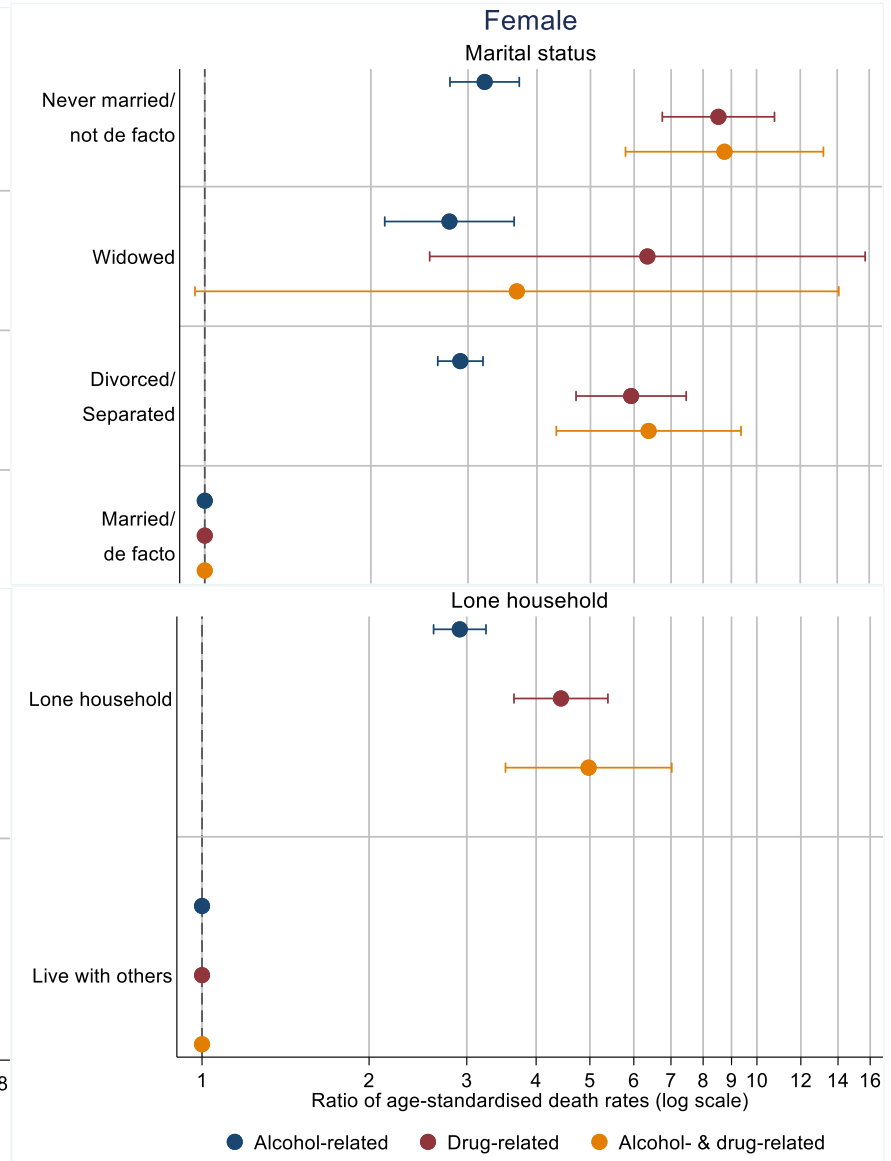
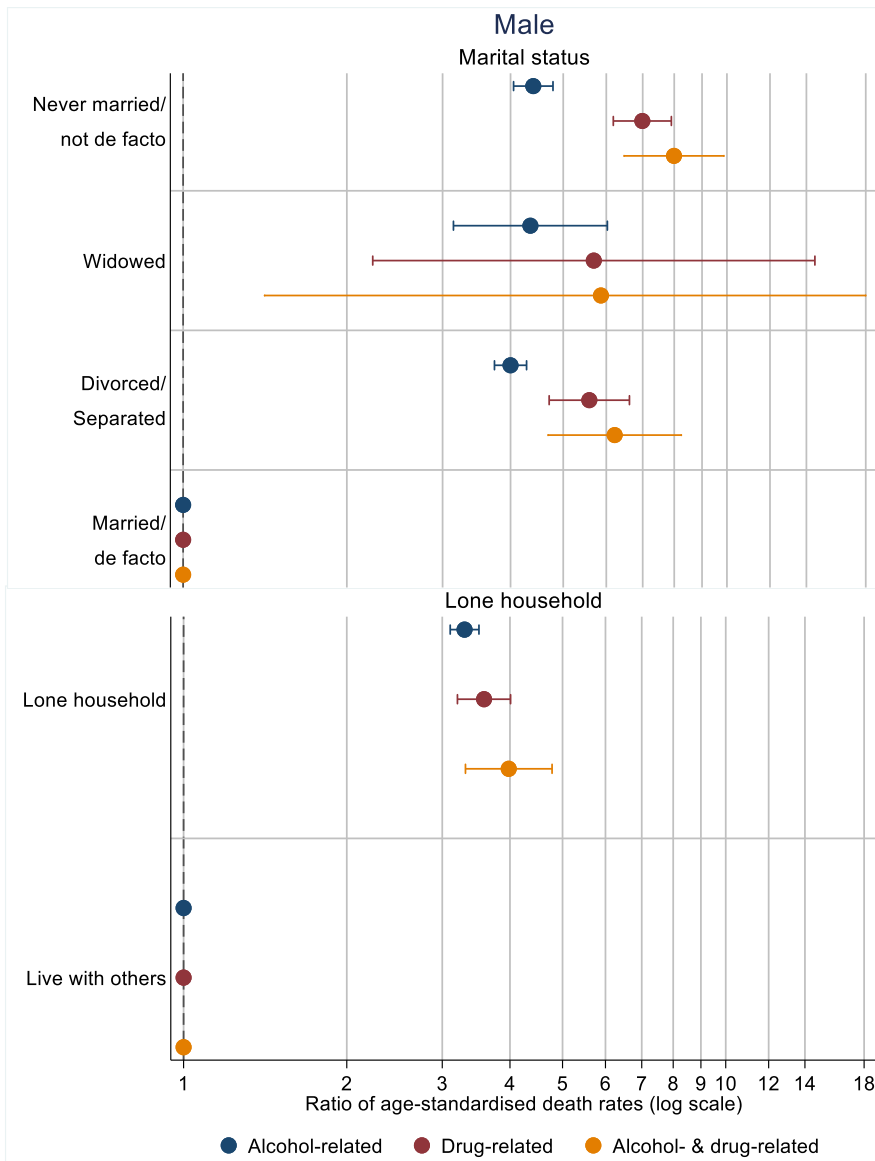


● Alcohol-related ● Drug-related ● Alcohol- & drug-related

● Alcohol-related ● Drug-related ● Alcohol- & drug-related



Drug & alcohol – mortality rate ratios – marital status & lone household





Discussion

- Analysis of Census-linked multiple cause of death data in Australia has revealed substantial inequalities in premature mortality from clusters of comorbidities.
- Mortality from cardiometabolic conditions (DKOLH-CVD) that are related to overweight and obesity have wider inequalities than other CVD mortality.
 - Higher mortality rates for low education, low household income, poorer area socio-economic status, those not working, never-married and lone households – rate ratios often exceeding 3.
 - Multivariate analysis shows that hazard ratios for the lowest v highest education and household income groups are approximately 2.
 - Inequalities particularly wide where obesity reported on the death certificate – some rate ratios exceeding 5.
 - Consistent with literature that obesity is higher among low- socio-economic groups.
 - Inequalities concerning given that premature mortality rates from DKOLH-CVD have been increasing in Australia.



Discussion

- Inequalities for alcohol- and drug-related mortality are wider than for CVDs.
- Inequalities wider for drug- compared with alcohol-related mortality
 - Alcohol- and drug-related mortality has higher inequalities than alcohol-related mortality.
 - Same mortality rate ratio patterns by socio-economic/geographic variable as for CVDs, but magnitude of rate ratios much higher.
 - Hazard ratios from multivariate analyses are more commonly 2-3, although reach 4 for drug-related for the lowest v highest education level.
 - Findings support previous studies showing alcohol- and drug-related mortality and consumption to be higher in low socio-economic groups.
 - Findings are evidence among which population groups that interventions should be targeted to reduce Australia's high mortality from alcohol and drug use.



Discussion

- A limitation of the study is that linkage rates to the 2011 Census are much lower, meaning analysis of trends in inequalities from that earlier period are likely to be biased.
- The MADIP data are a valuable resource for researchers and practitioners, and even more granular analysis of clusters of comorbidities can be conducted to improve understanding of inequalities in causes of death in Australia, e.g. during COVID-19.



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Acknowledgements

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