Life-course predictors of mortality inequalities

COMPASS Seminar Series
August 10, 2015

COMPASS RESEARCH CENTRE

FACULTY OF ARTS
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Whare Wānanga o Tāmaki Makaurau

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hrc Health Research Council of New Zealand

Outline

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- Background & Aims
- Methods
  - New Zealand Longitudinal Census (NZLC)
  - New Zealand Census Mortality Study (NZCMS)
- Some early results
  - Siblings discordant for income
  - Unemployment
- Conclusions and Next Steps

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Background

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- Mortality rates in New Zealand (and worldwide) continue to decline
  - Number of deaths per year standardised by age, sex
- But socio-economic inequalities have increased (or, at least, not decreased)
  - Large variation in mortality rates by socio-economic conditions (and ethnicity)
- What can be done about this?
  - Need to understand nature of socio-economic influences in mortality in New Zealand, and the factors that ameliorate the effects of socio-economic risk.
    - One way – take a life-course approach

Background

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- New Zealand Census Mortality Study (NZCMS)
  - Linked Mortality Data to each Census from 1981–2006
  - Number of proximal factors important
    - Socio-economic status (SES), ethnicity, smoking, air pollution
  - Determine time trends and cause of death trends
- New Zealand Longitudinal Census (NZLC)
  - Link individuals across censuses 1981-2006 (2013)
- Linking the two gives up to 25 years of socio-economic & other data linked to mortality
  - Understand life-course factors important for mortality

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Aims

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Four research aims:

1. To test which 'life-course hypotheses' best explain associations between socio-economic status and mortality
2. To test whether social and cultural factors protect against socio-economic risk
3. To assess whether ethnic disparities in mortality are explained by the greater experiences of long-term socio-economic disadvantage
4. To assess mortality among siblings discordant for (i) socio-economic risk, or (ii) social and cultural factors

Aim 1.
Life course Hypotheses

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1. **Accumulation Hypothesis**

- Socio-economic influence on mortality accumulates across the life-course
  - Mortality risk increases with increasing time in poverty

2. **Critical or Sensitive Period Hypothesis**

  - *Critical.* Socio-economic circumstances affect mortality only if experienced at certain periods of life
  - *Sensitive.* Effect of socio-economic experiences on mortality are stronger at some ages than others.

Aim 1.
Life course Hypotheses

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3. Social Mobility Hypothesis

- Directional change in socio-economic circumstances impact mortality
  - Mortality risk increases with deteriorating socio-economic conditions; and decreases with improving socio-economic conditions

4. Instability Hypothesis

- Unstable socio-economic conditions over the life-course will be associated with mortality
  - Mortality risk increases with increasing socio-economic instability

Life course Hypotheses Intervention Implications

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- **Accumulation hypothesis** suggests an intervention targeting all age groups
- **Critical/Sensitive period hypothesis** suggests intervention at certain life-stages only
- **Mobility hypothesis** suggests lifting people out of poverty (or preventing slides into poverty) should be an intervention target
- **Instability hypothesis** suggests buffering against unpredictability

Aim 2.
Social and Cultural Factors

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- What ameliorates effects of socio-economic conditions?
  - Important from intervention point of view
  - Social factors? Social support has been shown to lower mortality risk
    - Other factors: volunteering
  - Cultural factors? Ethnic density (neighbourhood concentration of one's own ethnic group) has been associated with better health among Māori, and with mortality in other jurisdictions
    - Other factors: language, religion, time in New Zealand

Aim 3.
Explain Ethnic disparities

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- Ethnic disparities in mortality in NZ are large
  - Māori have mortality rates that are 2.5 times, and Pacific 1.6 times, that of non-Maori, non-Pacific.

- 30-40% of inequalities between Māori and non-Māori explained by socio-economic factors in the years immediately preceding death.
  - How much could be explained if socio-economic factors were assessed over a greater portion of the life course?
  - And do social and cultural factors play a role?

Aim 4.
Discordant Sibling Analyses

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- Use of a Census cohort containing data within family units allows us to compare mortality rates for siblings differently exposed to socio-economic risk
  - 'Discordant sibling design' eliminates confounding associated with shared family background, and partly controls for genetic confounding
- RQ: Is life course SES associated with mortality once family background effects have been controlled using a discordant sibling design

METHODS

Methods - Overview

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- **Link**
  Longitudinal census records (NZLC)
  - Individuals linked between adjacent Censuses: 1981, 1986, 1991, 1996, 2001, 2006
- **To**
  Mortality records (NZCMS)
  - Individuals from Censuses in 1981, 1986, 1991, 1996, 2001 and 2006 linked to mortality records for
    - 3 years following 1981, 1986, 1991 and 1996 censuses
    - 5 years following 2001 and 2006 censuses
- **Using**
  Census IDs

Methods - Ethics

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- Privacy and Ethics
  - Individuals not identifiable, and not monitored. Group comparisons only
  - Two privacy impact assessments undertaken for NZLC
    - "risk to an individual of a privacy breach is extremely low"
    - Risk of breach no greater than for individual census data use
  - NZCMS undergone privacy assessment and has ethical approval from the Central Regional Ethics Committee
  - University of Auckland Human Ethics Committee granted approval for proposed research (ref 012400)

NZLC
- What is it?

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- A data link between adjacent NZ Censuses: 1981, 1986, 1991, 1996, 2001, 2006, (2013!)
  - 'Backwards': t → t-1 (e.g., 2006 → 2001)
  - Theoretical population: those >=5yo who have lived in the country for at least 5 years (82-88% of total popn)
  - Largely deterministic, based on sex, dob, area of residence 5y ago, (country of birth, Māori descent)
    - Approx 3% probabilistic
  - 15 cohorts altogether
    - Joining links of adjacent Censuses

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NZLC - 15 Cohorts

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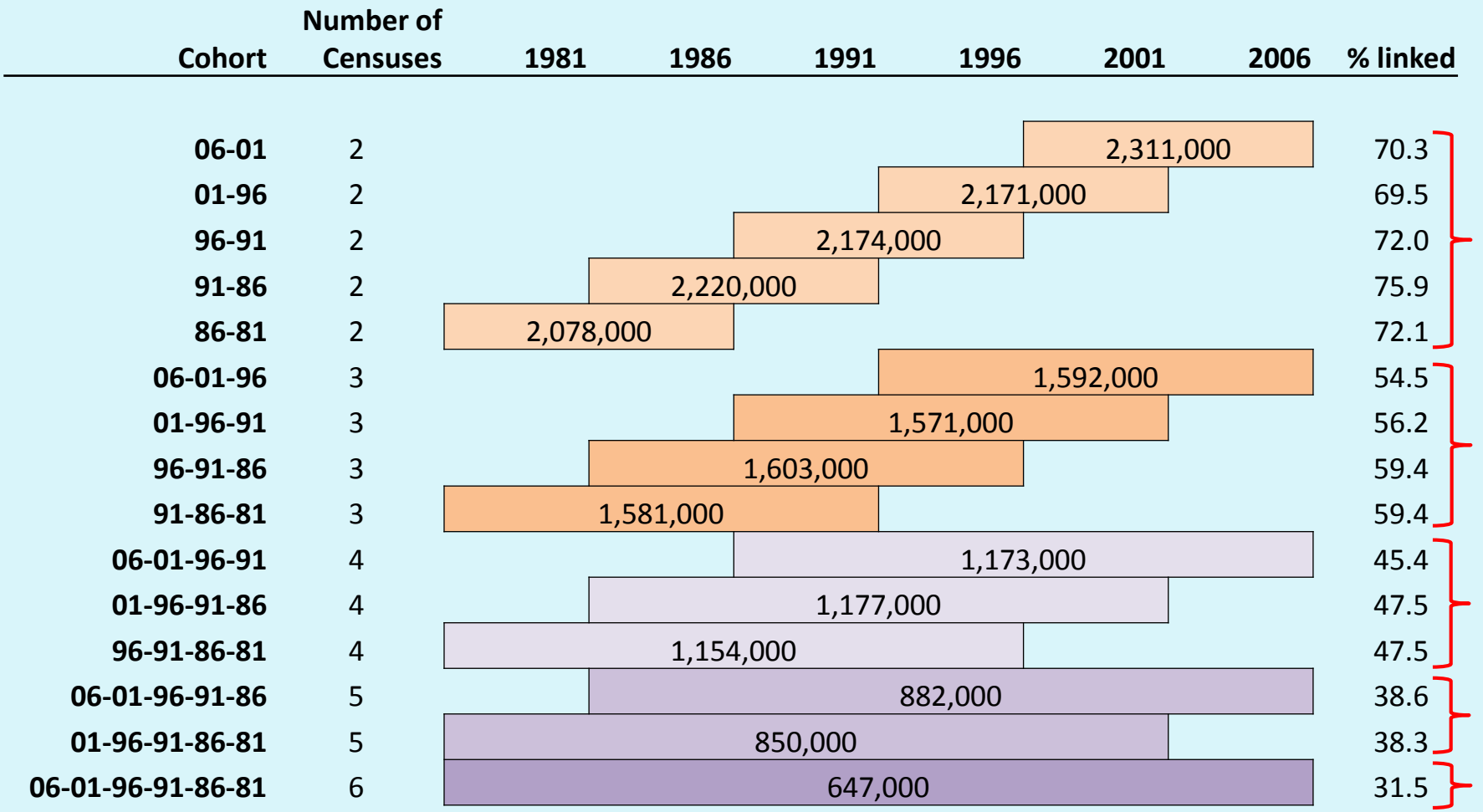

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Linkage Bias
-Why an issue with NZLC?

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- Linkage bias is a specific type of 'selection bias'
  - Those linked (selected) differ from those not linked
  - X-Y associations in the selected sample differ from X-Y associations in the full sample
- Bias likely because
  - Incomplete linkage (31%-75% of population)
  - Linkage varies as a function of various factors
    - Age, Sex, Residential mobility, Deprivation, Relationship Status, Housing Tenure, Ethnicity
- Are associations biased?

Linkage Bias
-Why an issue with NZLC?

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- CAN'T assess full extent of bias
  - Don't know associations among the unlinked
- BUT each linked cohort is nested within another (or within a single Census)
- So, CAN assess bias of nested cohort against cohort (or Census) one level up. E.g.,
  - Among those linked back from 2006 to 2001, are 2006 associations biased?
  - Among those linked back from 2006 to 1996, are 2006-2001 associations biased?

Linkage Bias -Can we adjust for it?

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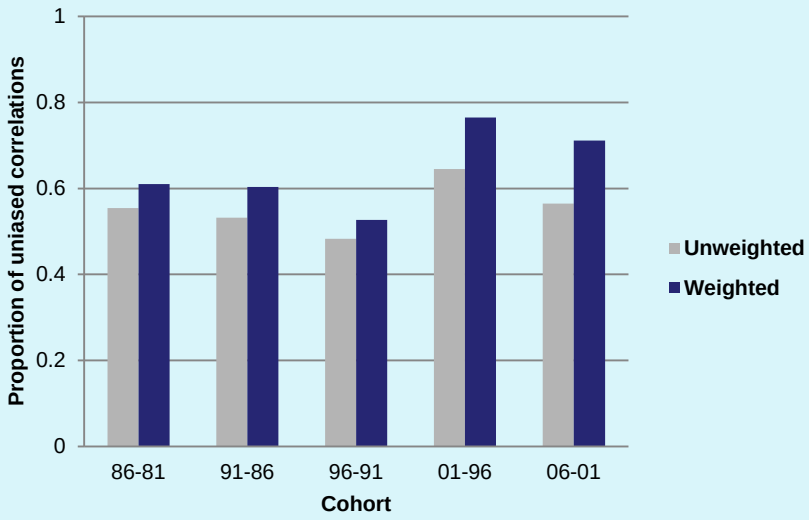
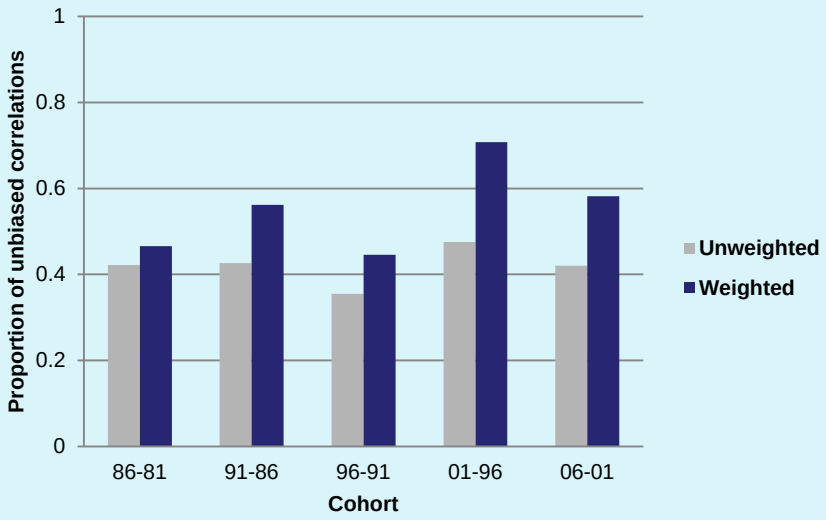
- Compare two-way correlations
  - Full census vs sample linked back to previous census
  - Consider <.01 magnitude differences as unbiased...
  - Modest improvement across all cohorts; more for adults
  - Similar results for 'longer' cohorts (3+ censuses)

Children, 5-14



Adult, 15+



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Linkage Bias - Mortality associations

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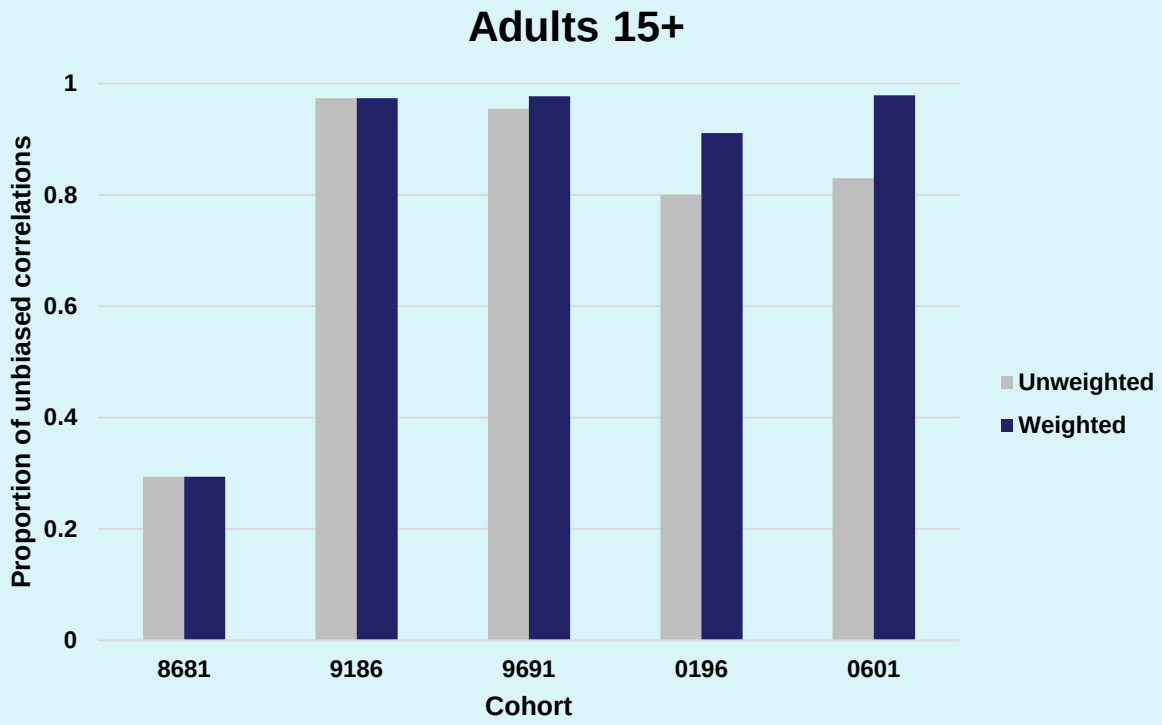
- However, few associations with mortality biased (except 1986-81)



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NZCMS - What is it?

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- Probabilistic linkage of each Census (1981-2006) to subsequent (3 or 5 year) mortality records
  - Proportion of mortality records linked ranges from 71% (1981) to 81% (2001)
  - Accuracy of linkage estimated at 97-98%.

- Bias weights (similarly) estimated based on the characteristics predicting linkage

RESULTS

Preliminary Analyses

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- A first peek (preliminary)
- Adjusted for bias (NZLC bias weight x NZCMS bias weight)
- Logistic regression only (dead vs not)
- All cause mortality only
- Analyses among those surviving 1981-2006, who then died (or not) in the subsequent 5 years
- Rudimentary longitudinal variables

1. Sibling comparisons - Income and mortality

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- Is the effect of income on mortality due to familial confounding?
- Test by comparing mortality risk (2006-2010) among siblings discordant for income:
  - Number of times in lowest income quintile 1981-2006
  - Controls: birth order (age), sex, socio-economic factors (education, unemployment, motor vehicle access), family factors (household size and structure, residential moves), disability
- First, need to identify sibling pairs

1. Sibling comparisons - Identify sibling pairs

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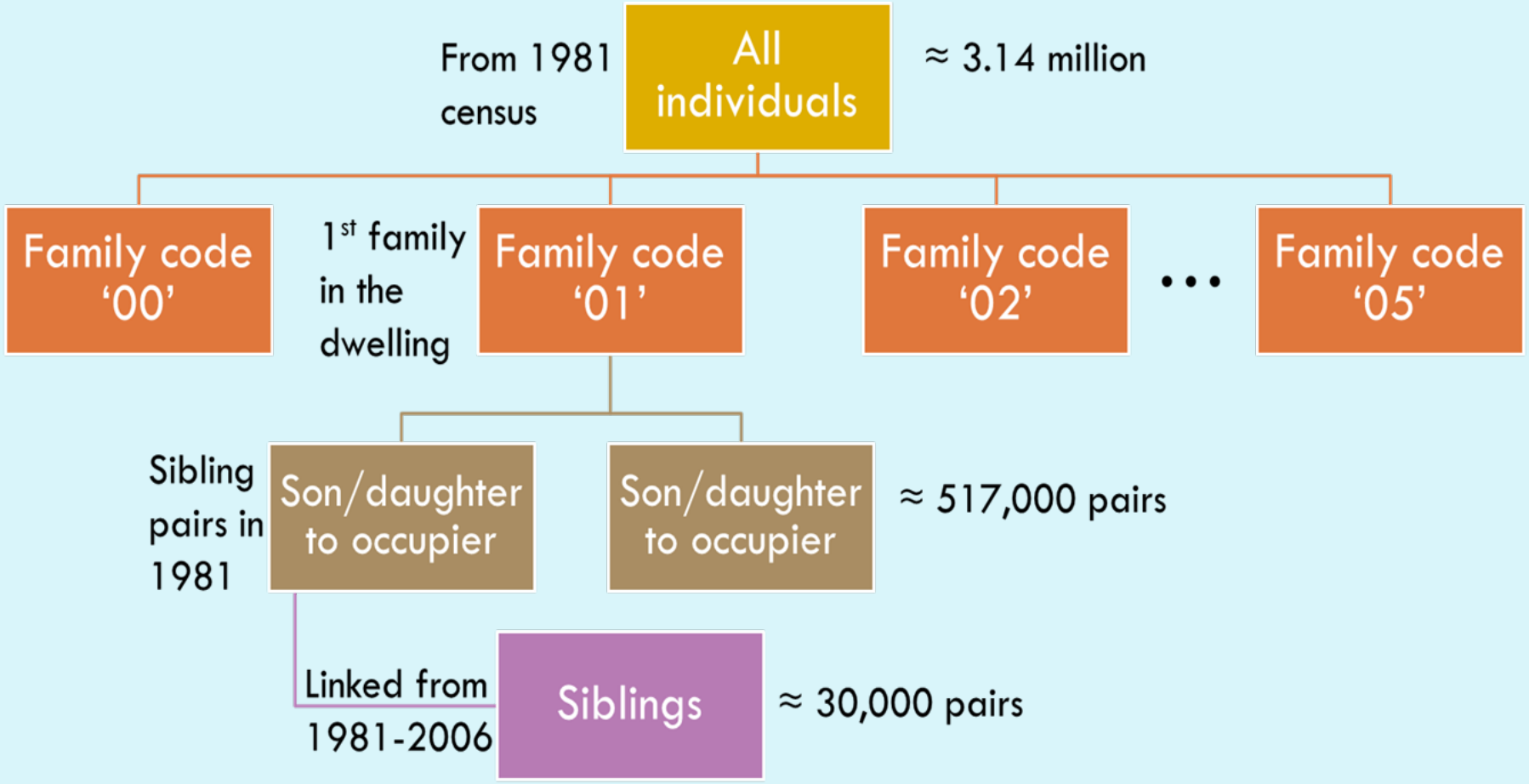

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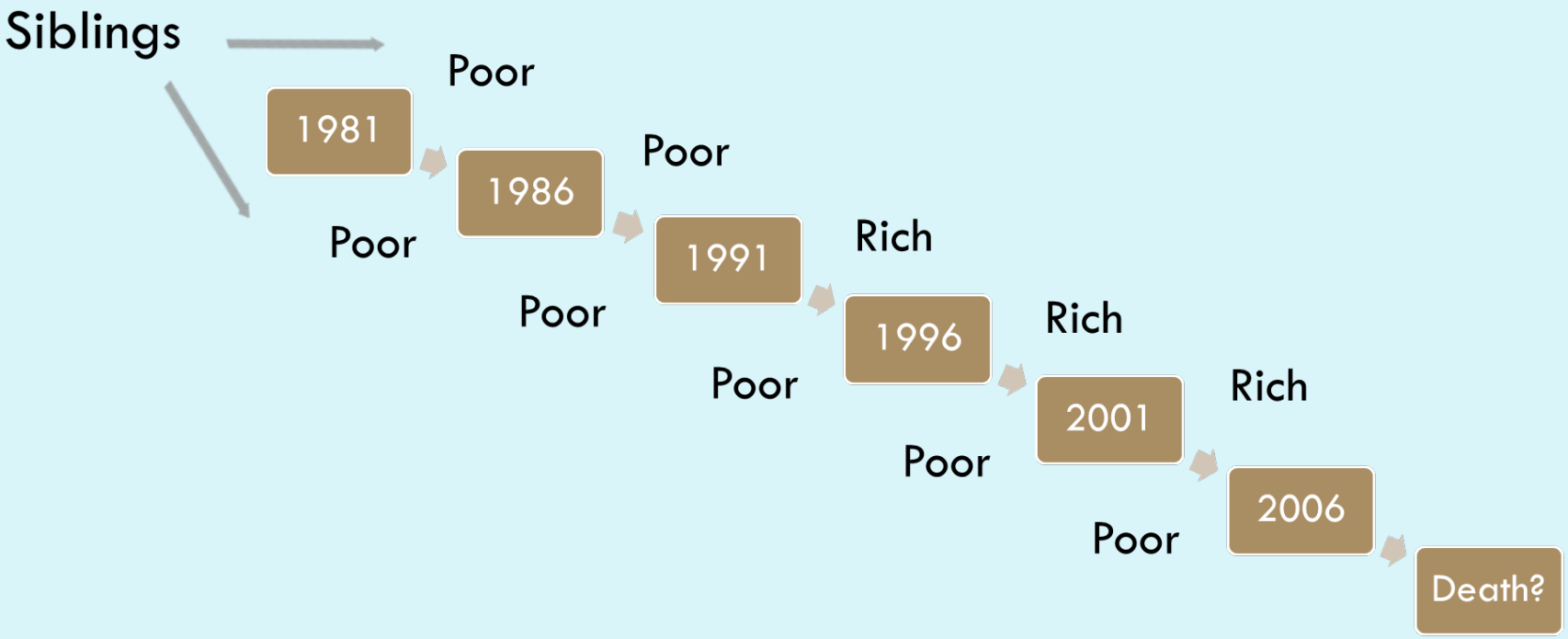

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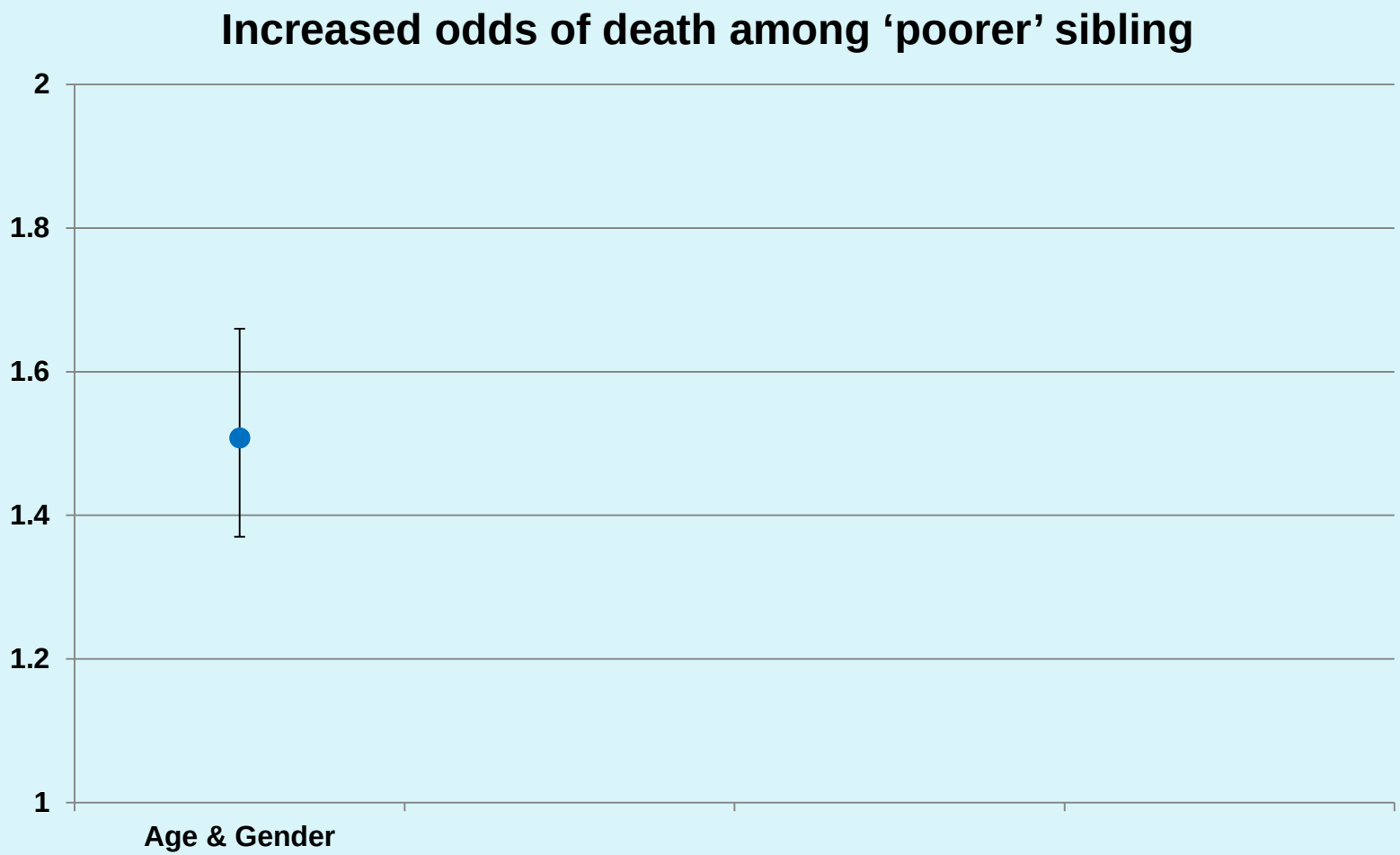

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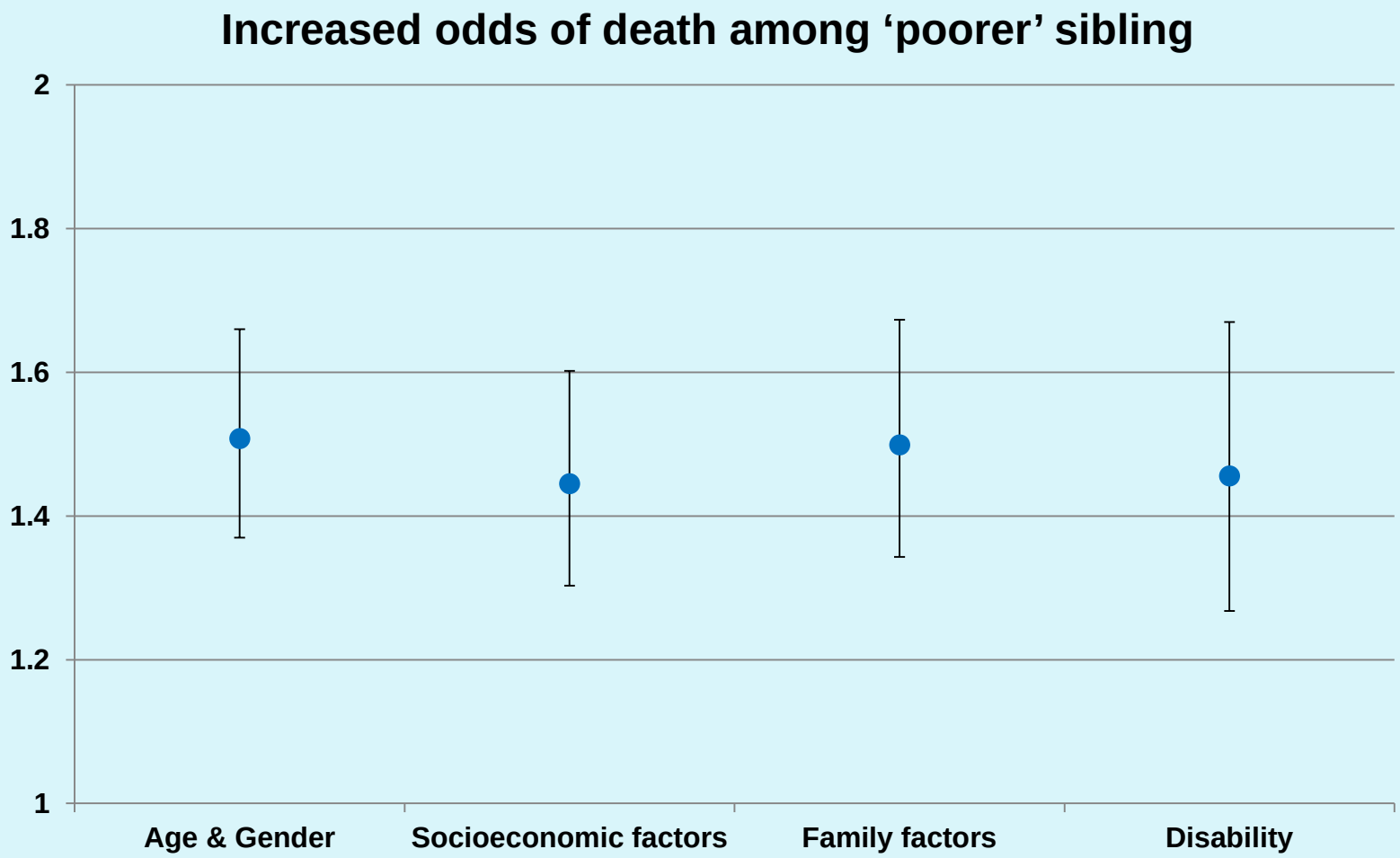

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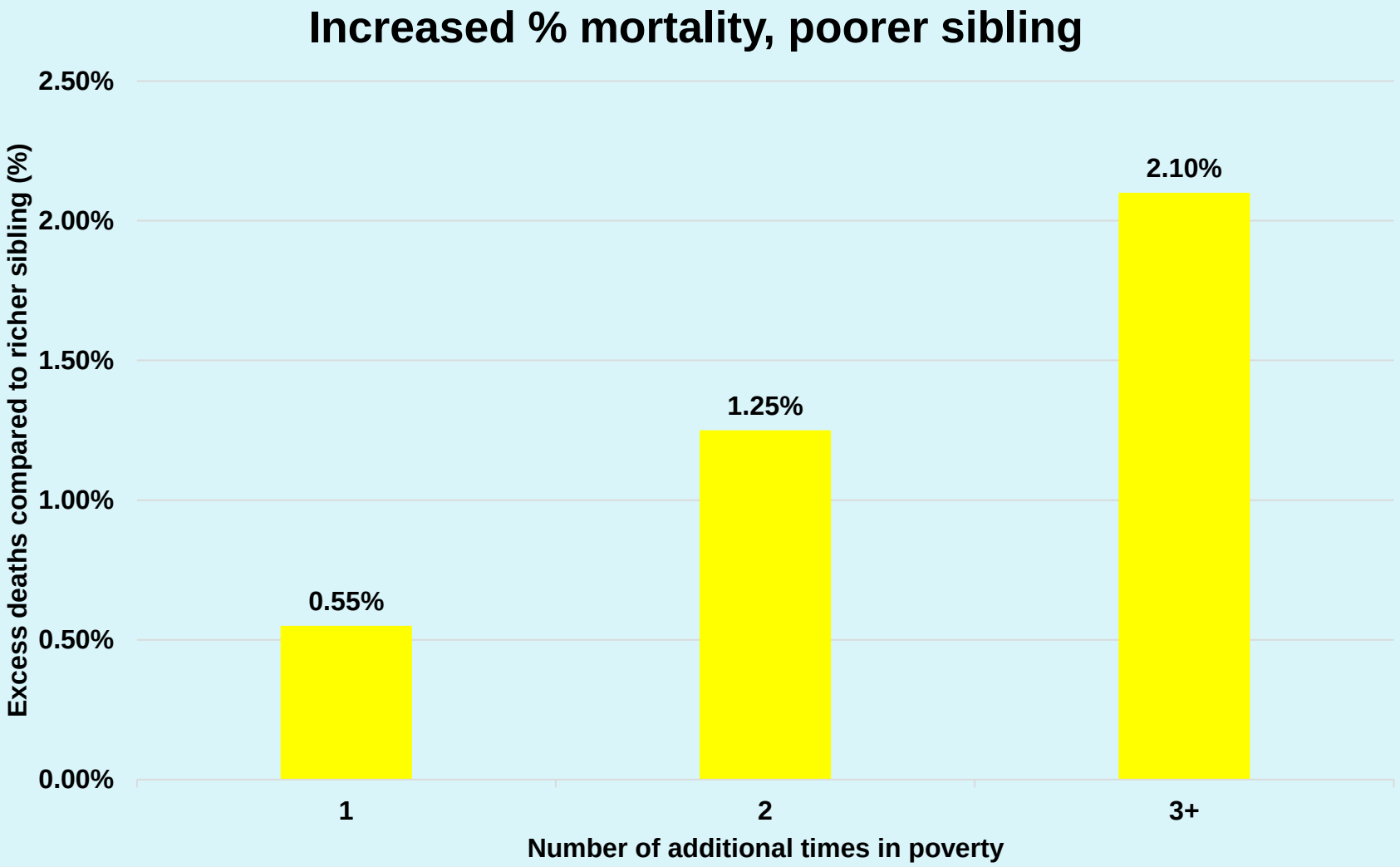

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2. Unemployment and mortality

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- Evidence that periods of unemployment and mortality
  - Mostly short term
  - Often comparing country/state unemployment rates and their effect on mortality rates (as opposed to associations at the individual level)

- Assess impact of number of times unemployed 1981-2006 on subsequent mortality 2006-2010
  - Control factors: Age, gender, ethnicity, socio-economic factors (education, deprivation, crowding, tenure), smoking, family structure, disability

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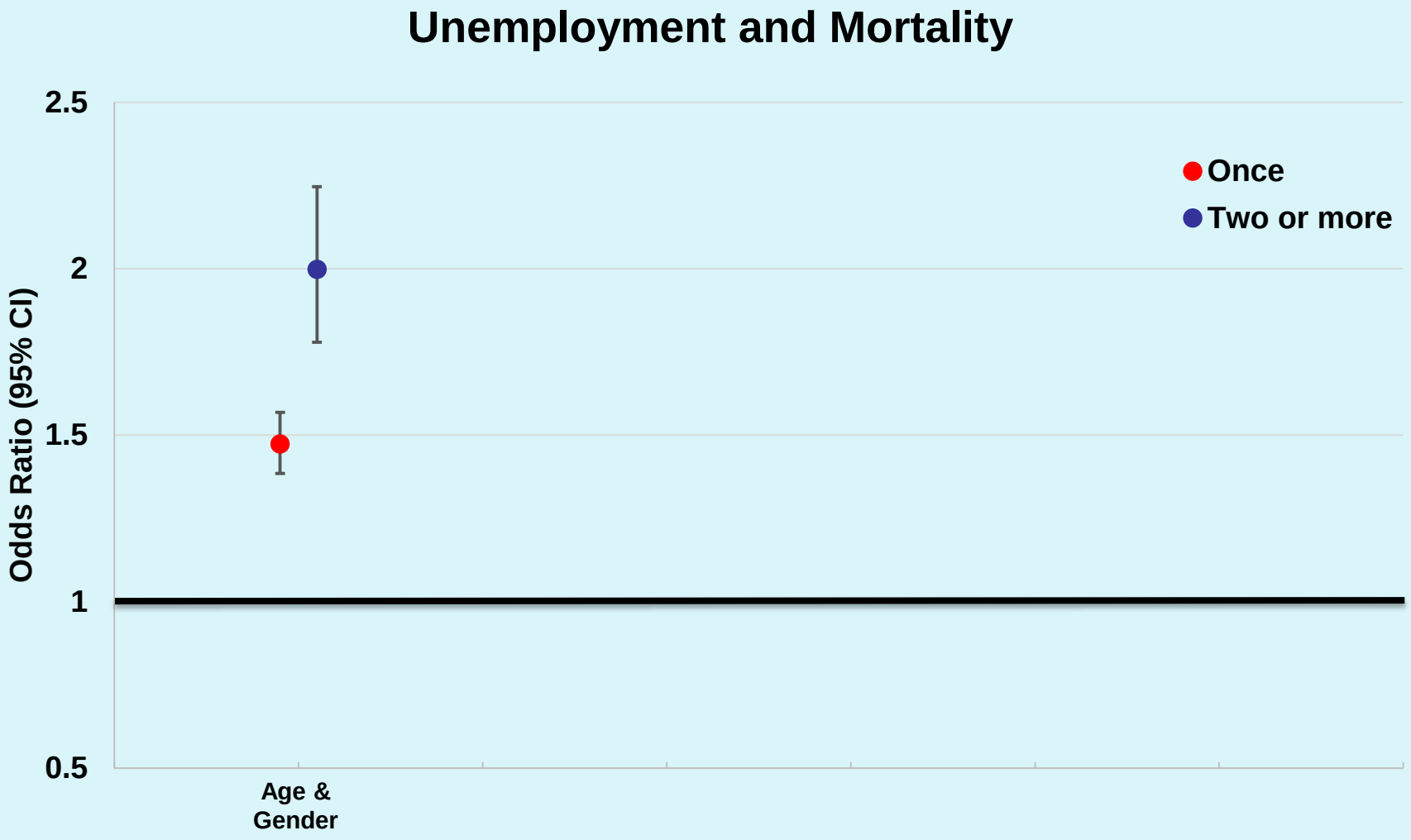

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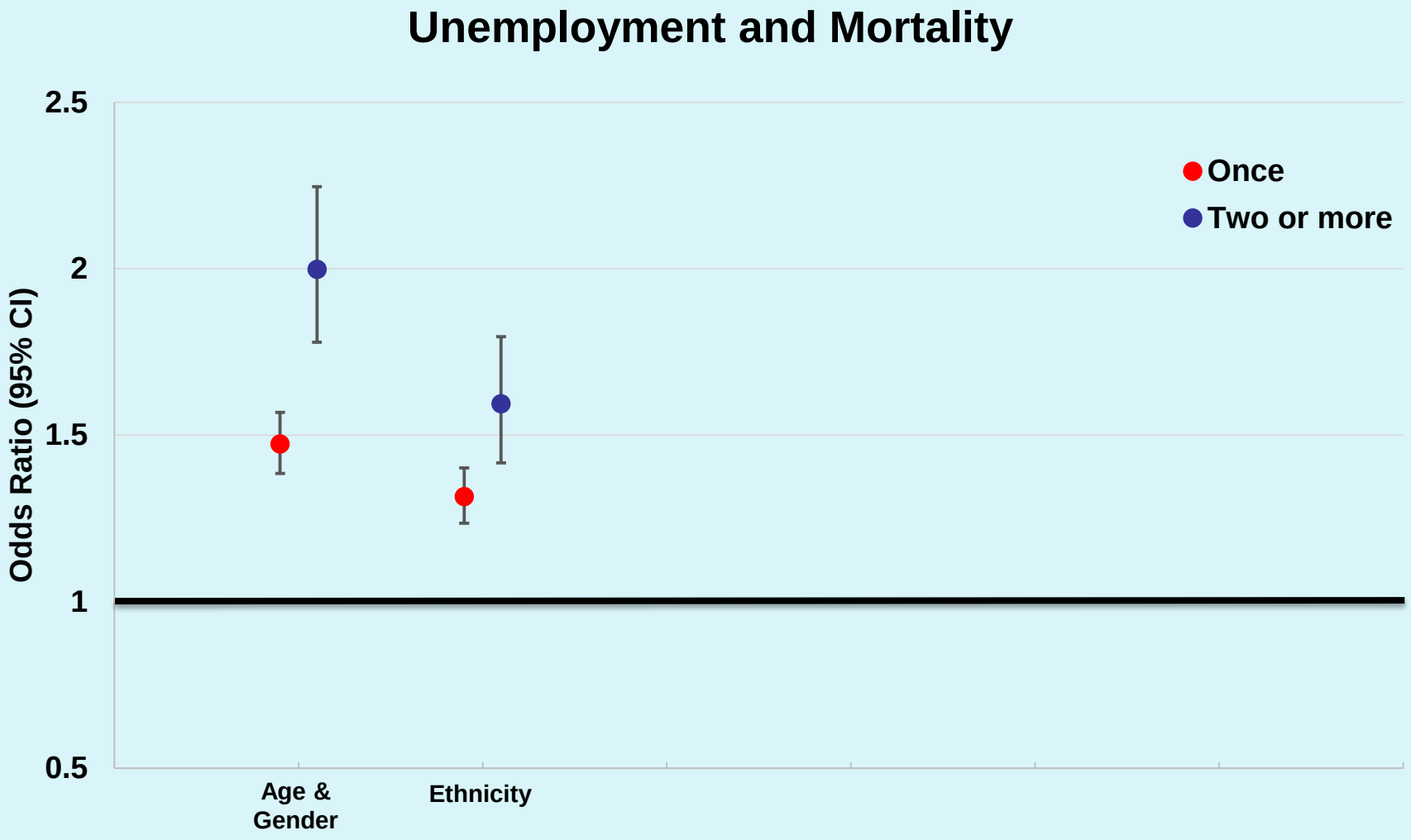

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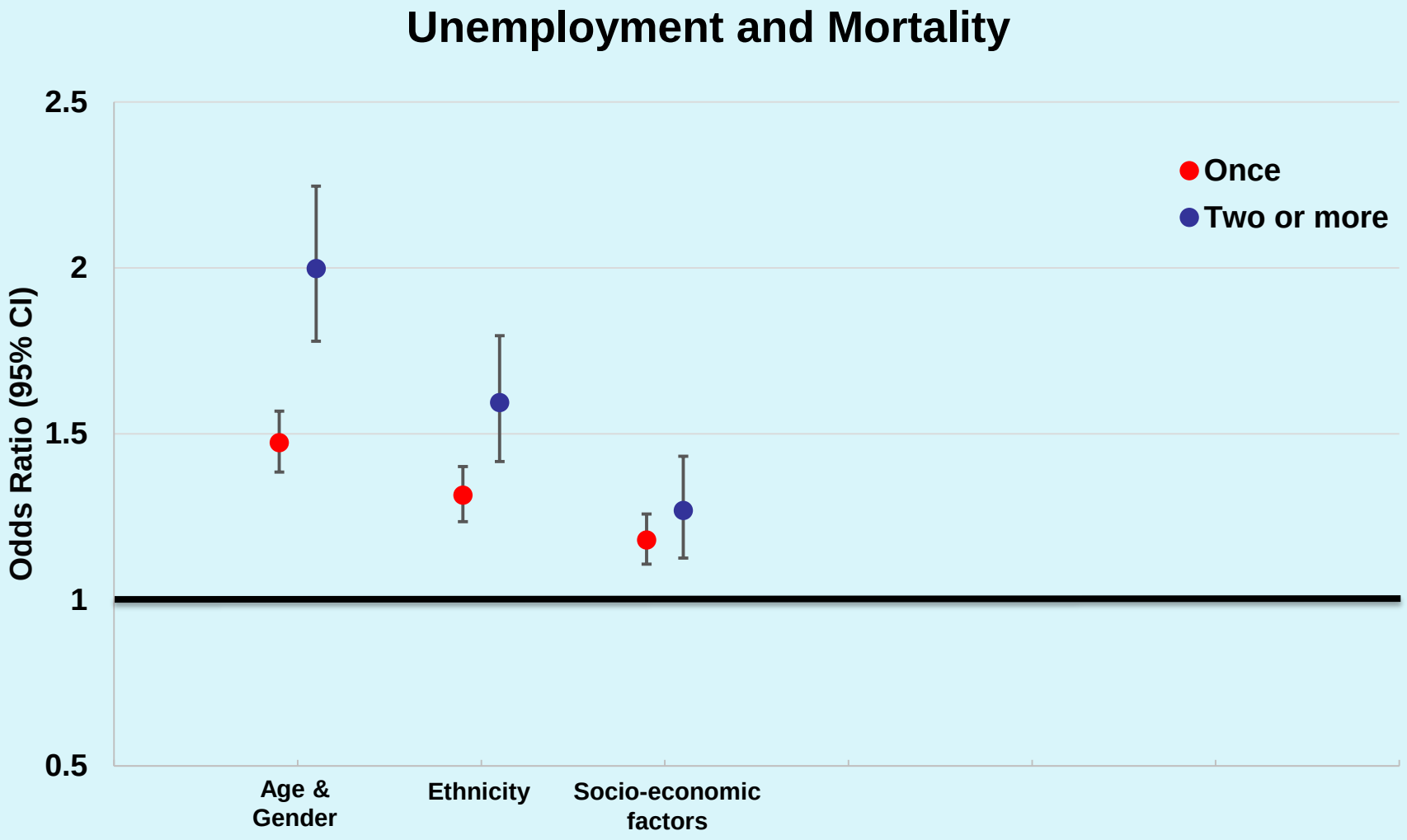

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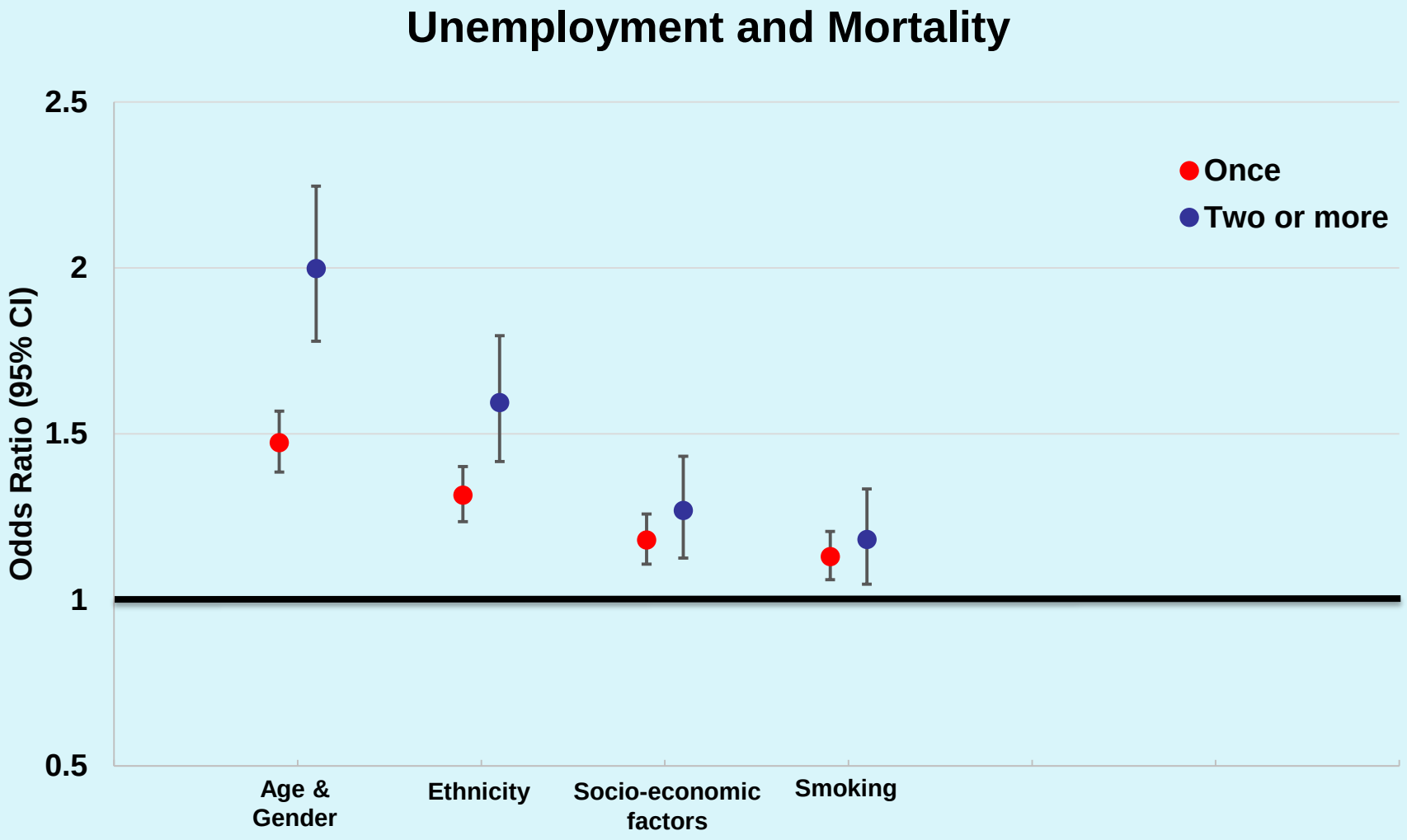

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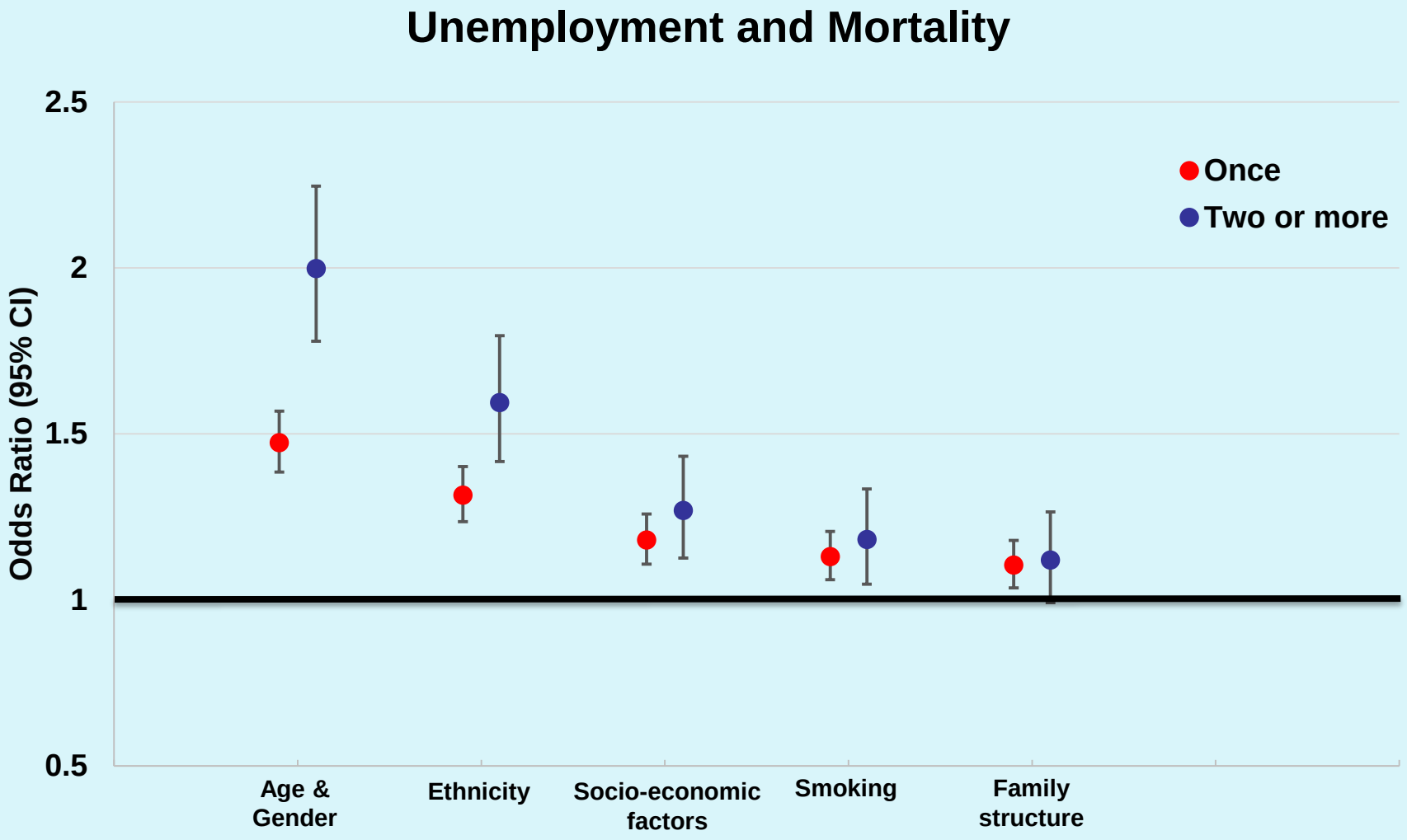

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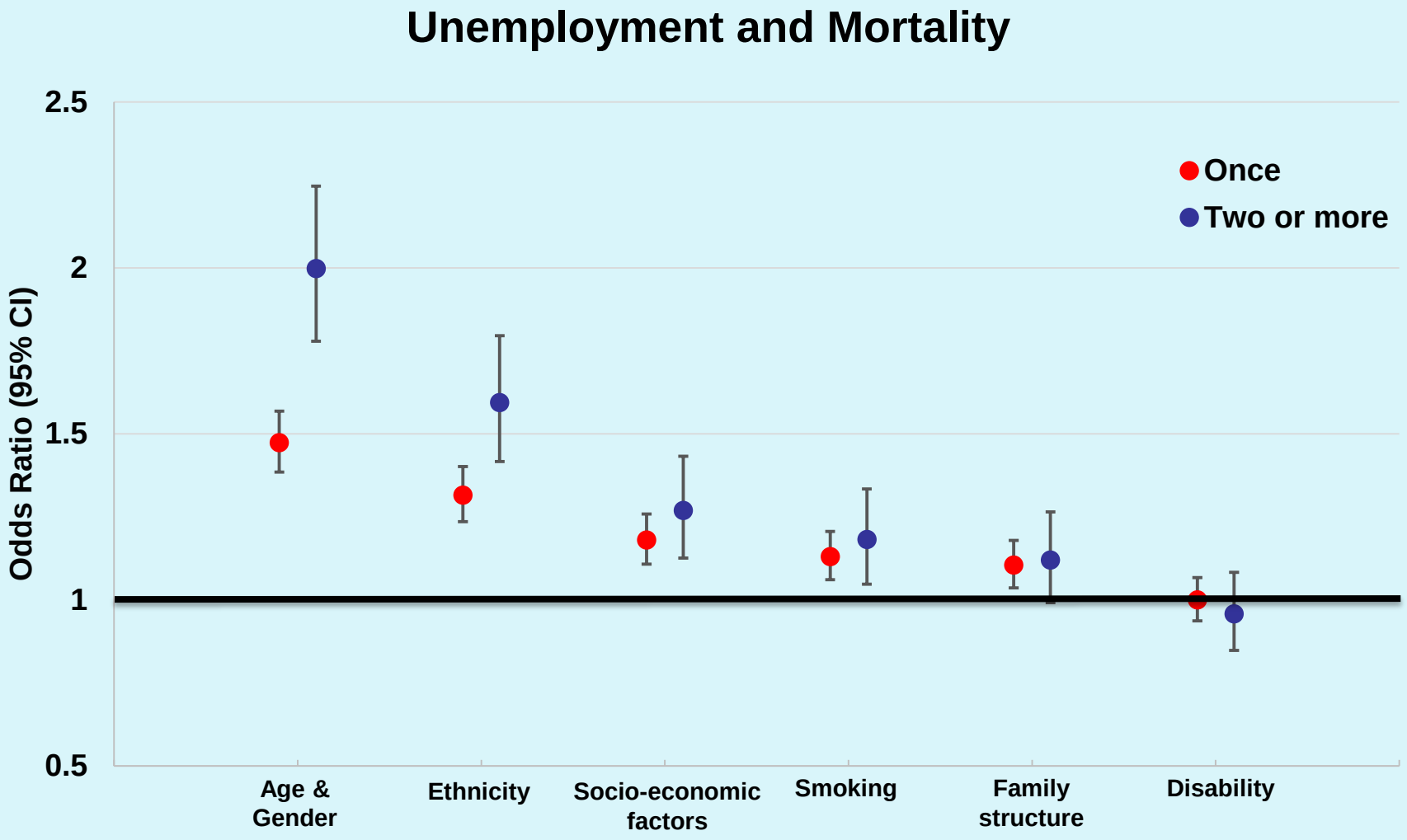

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CONCLUSIONS

Conclusions

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- LOTS of possibilities with these data
  - More nuanced analyses, with more sensitive variables, will help elucidate association between life-course SES and mortality, and mediating factors
- Early analyses are revealing
  - Association between life-course poverty and mortality robust to family confounding
  - Periods of unemployment increase risk of mortality (mediated by other socio-economic factors, family turmoil and disability)

Next Steps

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- Test the life-course hypotheses
- Investigate how much of ethnic differences in mortality risk is explained life-course socio-economic experiences
- Further test of sibling analyses
- Explore the role of social and cultural factors
  - Ethnic density appears to have some effects (need to disaggregate by ethnicity)
  - Living alone (lack of social support) also appeared to be important

QUESTIONS?

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QUESTIONS?

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Accumulation hypothesis

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