Population Ageing: Causes, Consequences and Responses
Sydney, 3–5 July 2023

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Regional variation in lifetime probability of admission to residential aged care

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Introduction

- At any one time, 4% of the older Australian population are in residential aged care
  - ‘older’ in this case means 65+
  - ‘residential aged care’ means permanent cared accommodation—often referred to as ‘nursing home’.
- But previous studies here and overseas have shown that up to 54% of women (42% of men) will move into permanent care at some point in their remaining life.
- This mismatch became affectionately known as the “4% fallacy” (Kastenbaum & Candy, 1973), and various methods were developed to estimate the lifetime probability of admission.
- To date, no regional estimates have been produced for Australia.

- To the extent that admission to care (when it is needed) is a function of the availability of places, the regional variation is of interest to providers, governments, aged care advocates, and anyone interested in equity of access to care.

Approaches to probability estimates

- Analysis of place of death recorded on death certificates
- Prospective or retrospective cohorts
- Life tables
- Transitional probability models

Place of death recorded on death certificates

- Originated in USA in 1970s, initially local and small-scale (Wershow, 1976) and eventually national (Ingram & Barry, 1977; Zappolo, 1981)
- Labour-intensive
- Fails to capture discharges from facility before death (including where a resident is on ‘hospital leave’)
- Possibility of coding errors

- Place of death not recorded on Australian cause of death certificate (except for certain injuries)

Cohort studies

- Seen as an improvement on death certificate method because each case can be traced conclusively
- Most studies done on small samples (Palmore, 1976; Vicente et al., 1979)
- Prospective studies start with random community sample
  - Can also derive additional information about factors influencing admission
- Retrospective studies started with deaths among participants of existing longitudinal studies
  - Potential for recall errors

Life table method

- Uses administrative data to derive rates of deaths, admissions to and separations (mostly deaths) from care at each age interval (McConnel, 1984; Liu, 1998; 2000; Rowland et al., 2002)
- These rates are converted to event probabilities for multi-stage life table analysis

- Allows for clarity on concepts being reported

Transitional probability methods

- Draw on multiple data sources to derive probabilities of transitioning from one state to another (Dick et al., 1994; Hurd et al., 2014)
- Typically focussed on informing risk assessments for long-term care insurance

- Data- and model-intensive

Rationale for choice of life table approach

- No whole-of-population Australian survey data sources suitable for transition probability models or cohort approaches
- No place of death on medical certification of cause of death
- This effectively leaves the life table approach, and
  - long-term, detailed administrative data on the use of residential aged care in Australia—enumerated at the person level—are available, from which all the input values can be derived
  - complete mortality data and population estimates are also available
  - a multi-state life table can be readily constructed for each ‘region’

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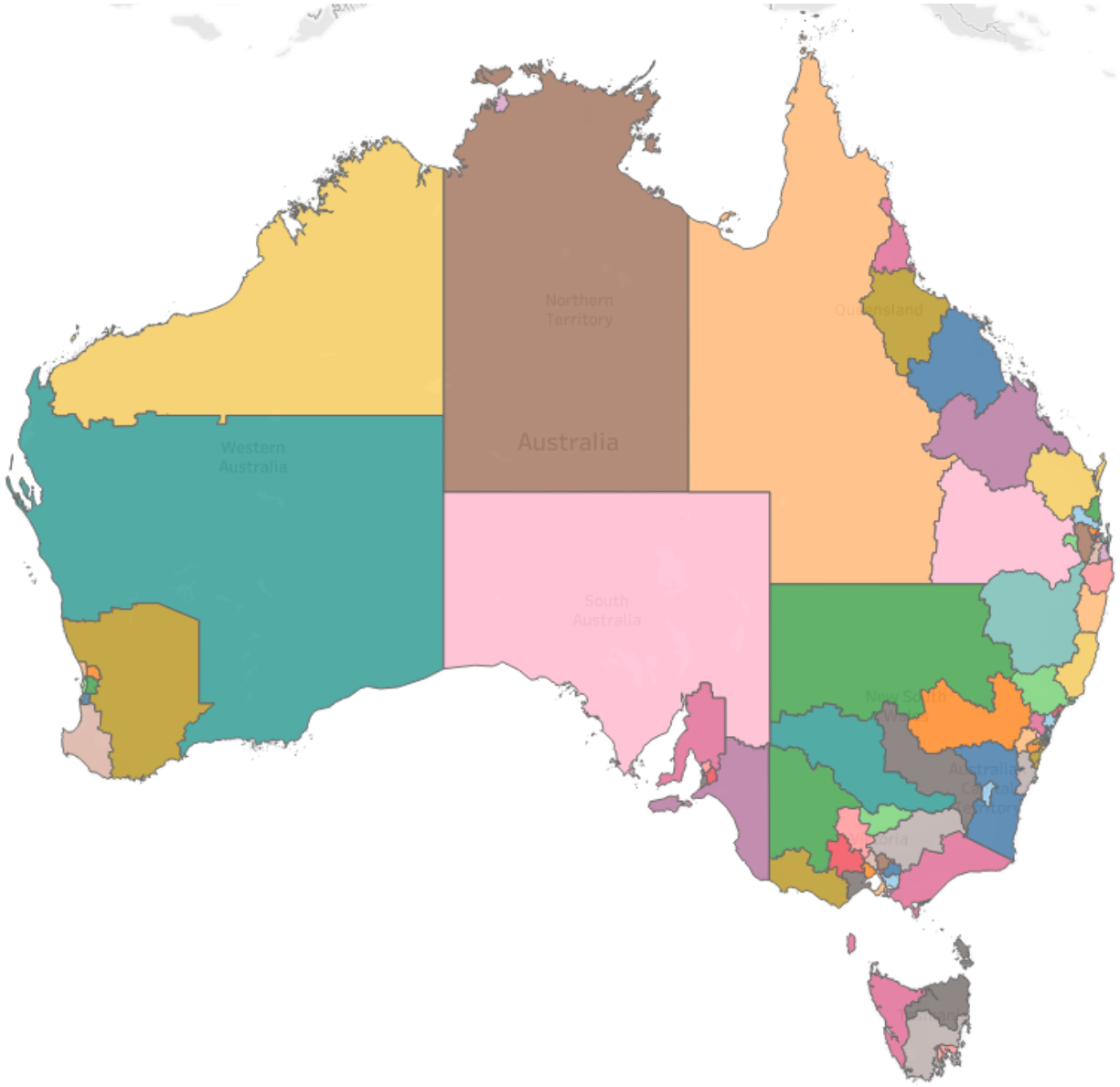
Methods

Datasets

- System for Payment of Aged Residential Care (SPARC)
  - Residential care admissions and separations (exits, by ‘mode’), calendar year 2017–2019
    (mode split into death, hospital, return to community, transfer to another facility)
- Australian Bureau of Statistics mortality collection
  - All deaths occurring in 2017–2019
    (death registration is a legal requirement in Australia, so enumeration considered complete)
- Australian Bureau of Statistics population collection
  - Estimated resident population as at June 2018

Regions

- Statistical Area 4 (SA4) from ABS *Australian Statistical Geography Standard* (2016 version).
- In regional areas, SA4s tend to have populations in the range 100,000–300,000, whereas the metropolitan areas are more in the range 300,000–500,000 people.
- There are 107 SA4s in the *Standard*, but 16 are special codes for ‘offshore/ migratory’ areas and ‘no fixed address’ in each state and territory, and 3 are for ‘other territories’, leaving 88 regions in scope for this analysis.

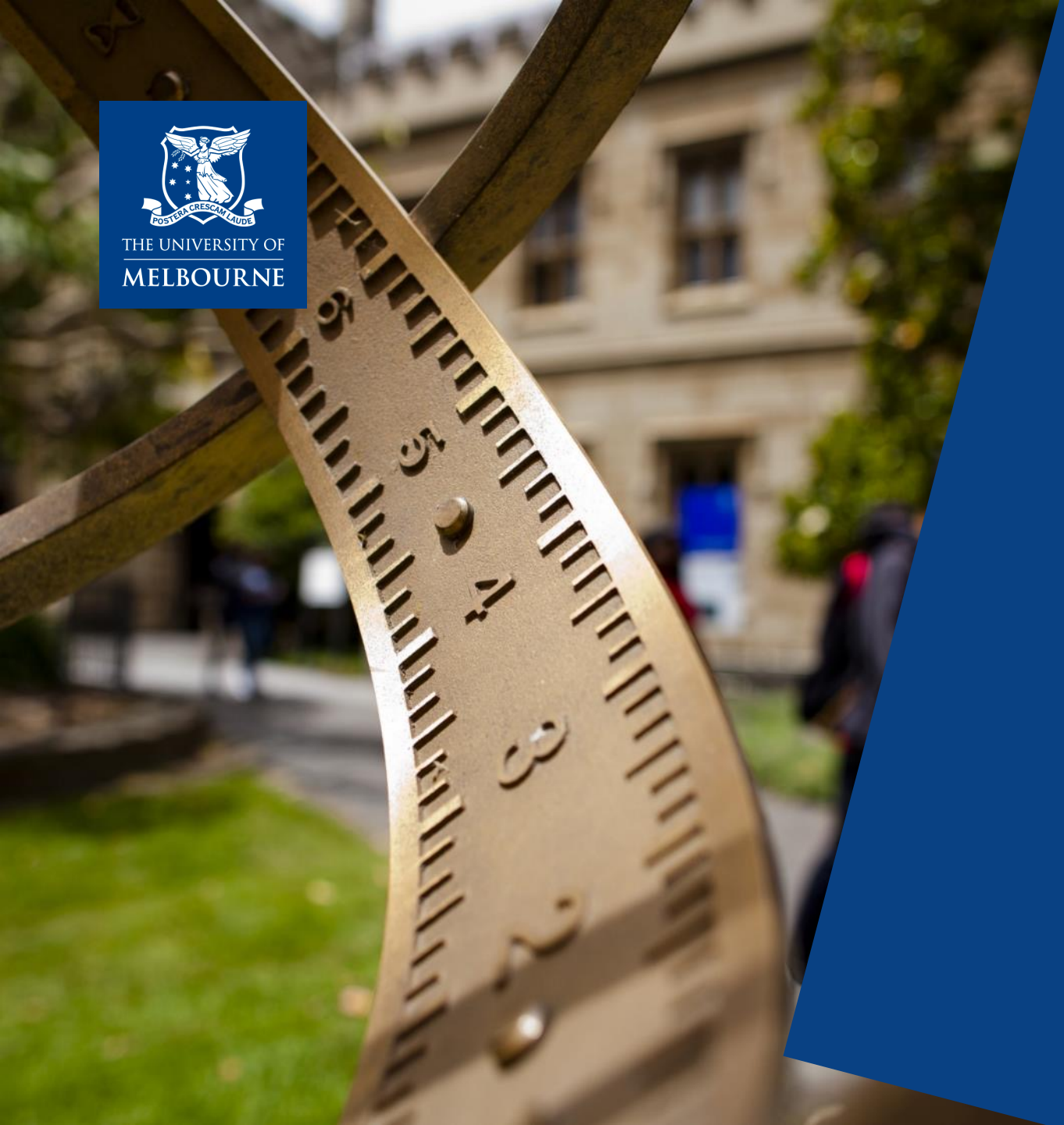


Life table analysis

- Based on Rogers' "multi-region" approach (but rephrased as "multi-population" to avoid confusion with presentation of regional results) (Rogers, 1975; 1995)
  - Allows for transitions from 'community' into 'care' and back again (and potentially re-admission, and so on), while accounting for different mortality rates in each 'population'
- Comprehensive data enabled three enhancements:
  - Specific 'separation factors' for the average period lived by a cohort in a particular population (not to be confused with separation from care)
  - Transitions in the final age group were incorporated—which Rogers rules out—while still ensuring mortality is complete in the last age interval
  - Two separate l_x columns for the community population: one that doesn't include 'returns', and one that does

Other methodological notes

- Care-related events for people under 40 were excluded (for example, 71 admissions out of 214,000 over 3 years)
- Highest age group capped at 90+ to stabilise results
- Conversion of ${}_nm_x$ to ${}_nq_x$
  - Choice of methods, but to utilise as much as possible the ${}_na_x$ values, settled on a 'hybrid' method of Chiang (1978) for ${}_nm_x < 0.3$ and Fergany (1971) for higher values
- Additional improvements
  - Population in care subtracted from estimated overall population—this is material for higher age groups
  - A portion of discharges to hospital were counted as discharge to death, consistent with other research



Results

Scale

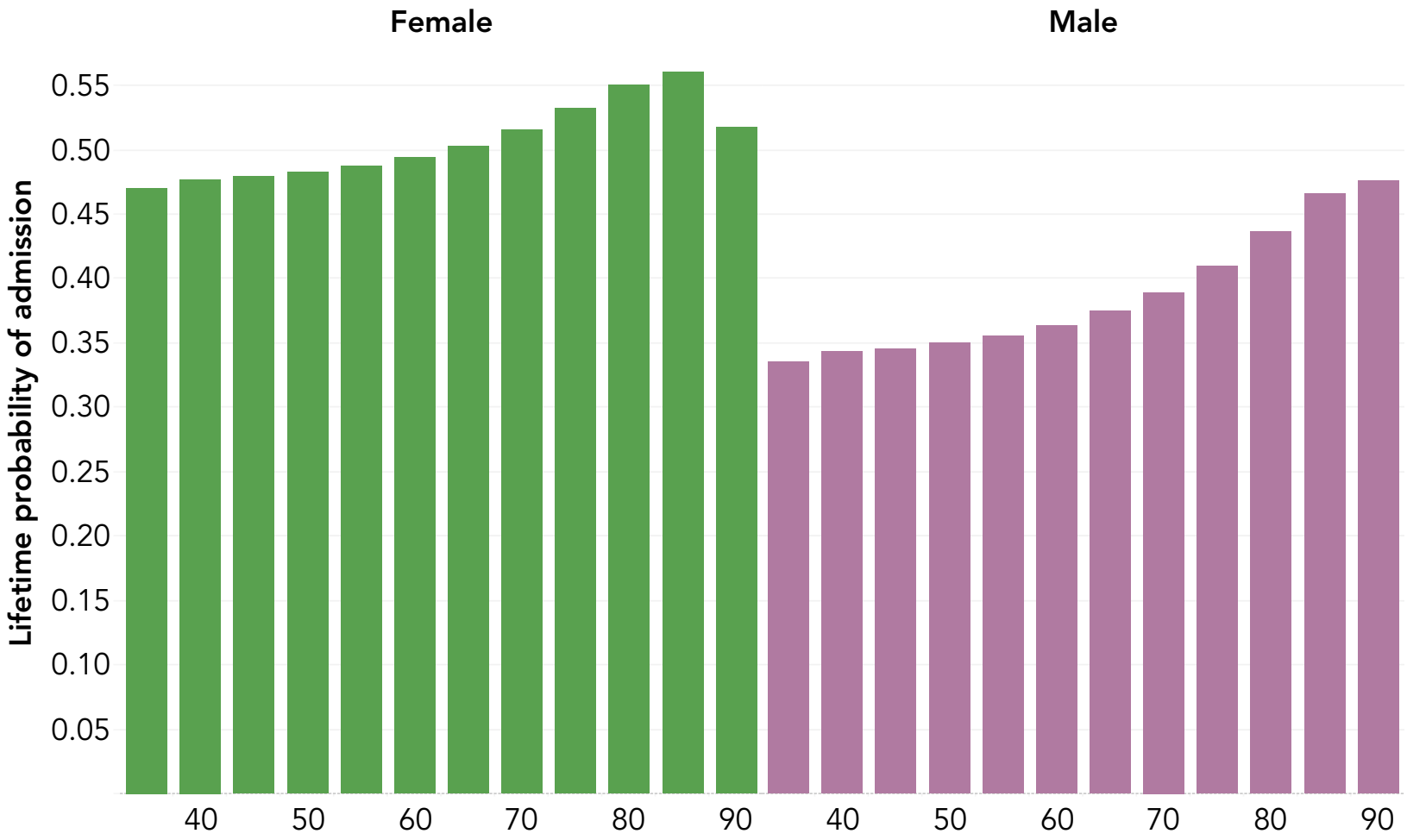
- Analysis based on 396,645 aged care events over 2017–2019 calendar years

		Sex		
Event/measure	**Period**	**Females**	**Males**	**Total**
Total admissions	2017–2019	126,352	87,381	213,733
First admissions	2017–2019	109,499	75,538	185,037
Discharges to death	2017–2019	103,444	68,490	171,934
Discharges to hospital	2017–2019	1,801	1,667	3,468
Discharges to community (return)	2017–2019	4,144	3,366	7,510
Residents	30 June 2018	121,385	59,431	180,816

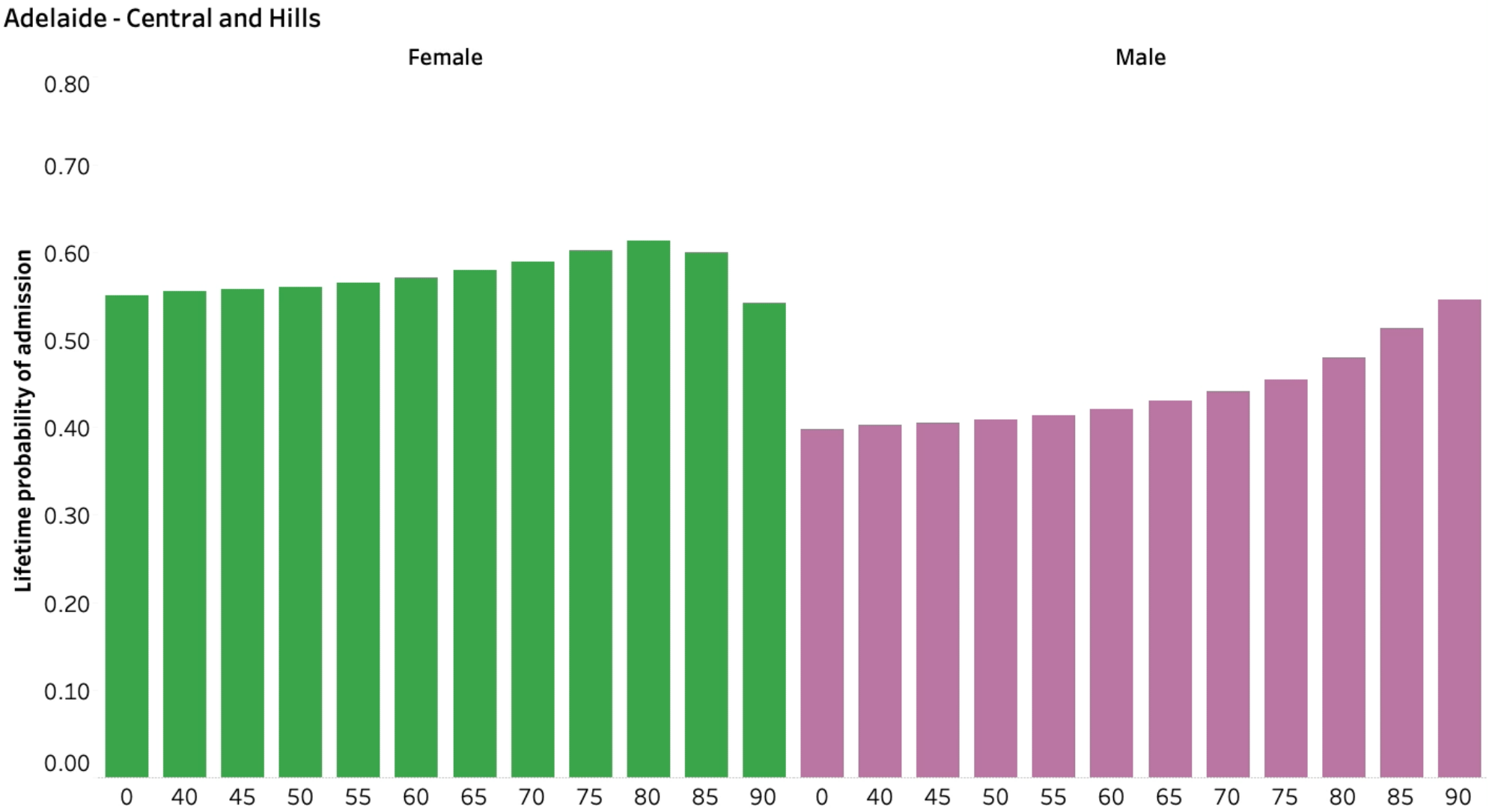
- Underlying whole-of-region life tables based on 479,486 deaths

Main findings

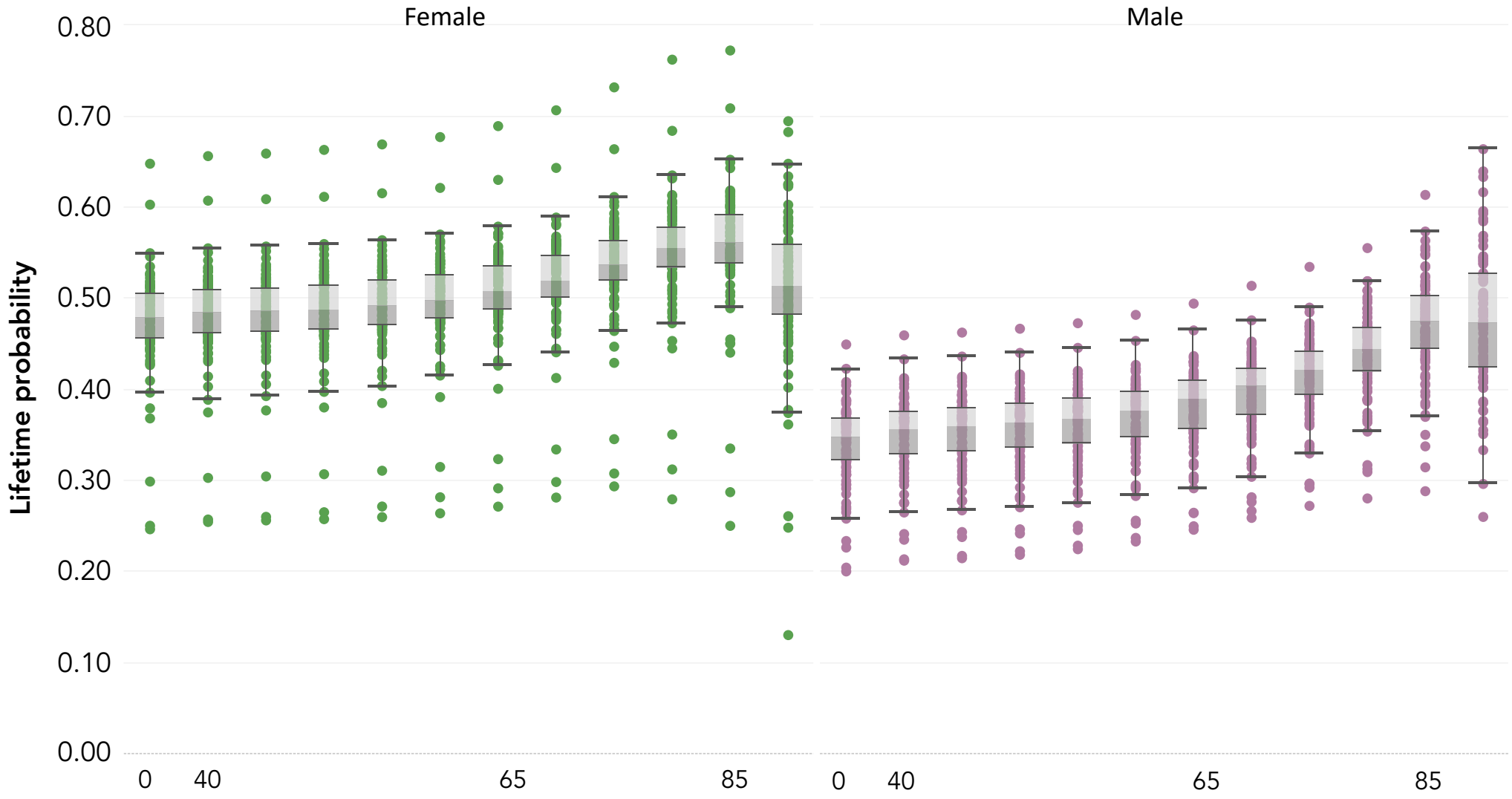
- Probability of admission generally increases with age:
  - nationally, lifetime probability (at age 0) was 47% for females and 34% for males
  - at age 65, the [remaining lifetime] probability is only slightly higher at 50% and 37%, respectively
  - this rises to 56% at age 85 for females and 48% at age 90 for males



Variation by region

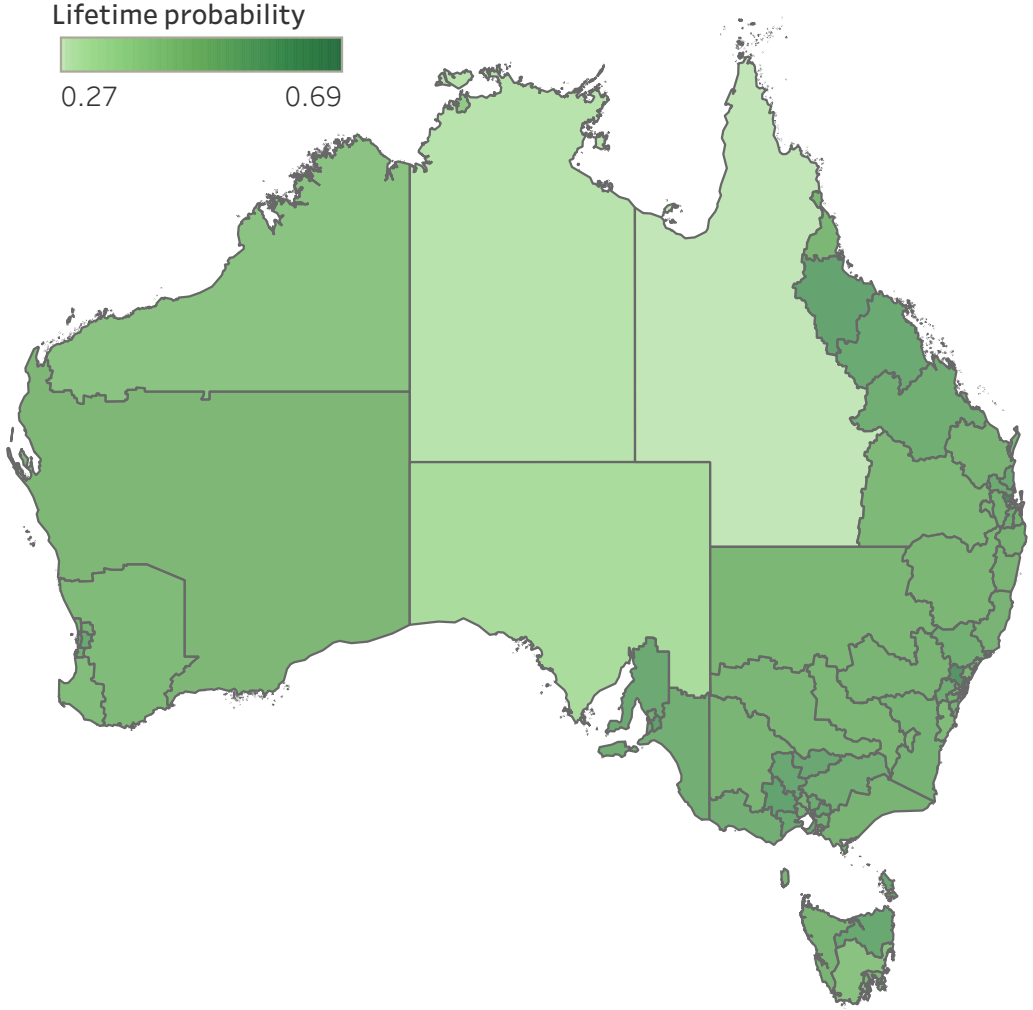


Variation by region

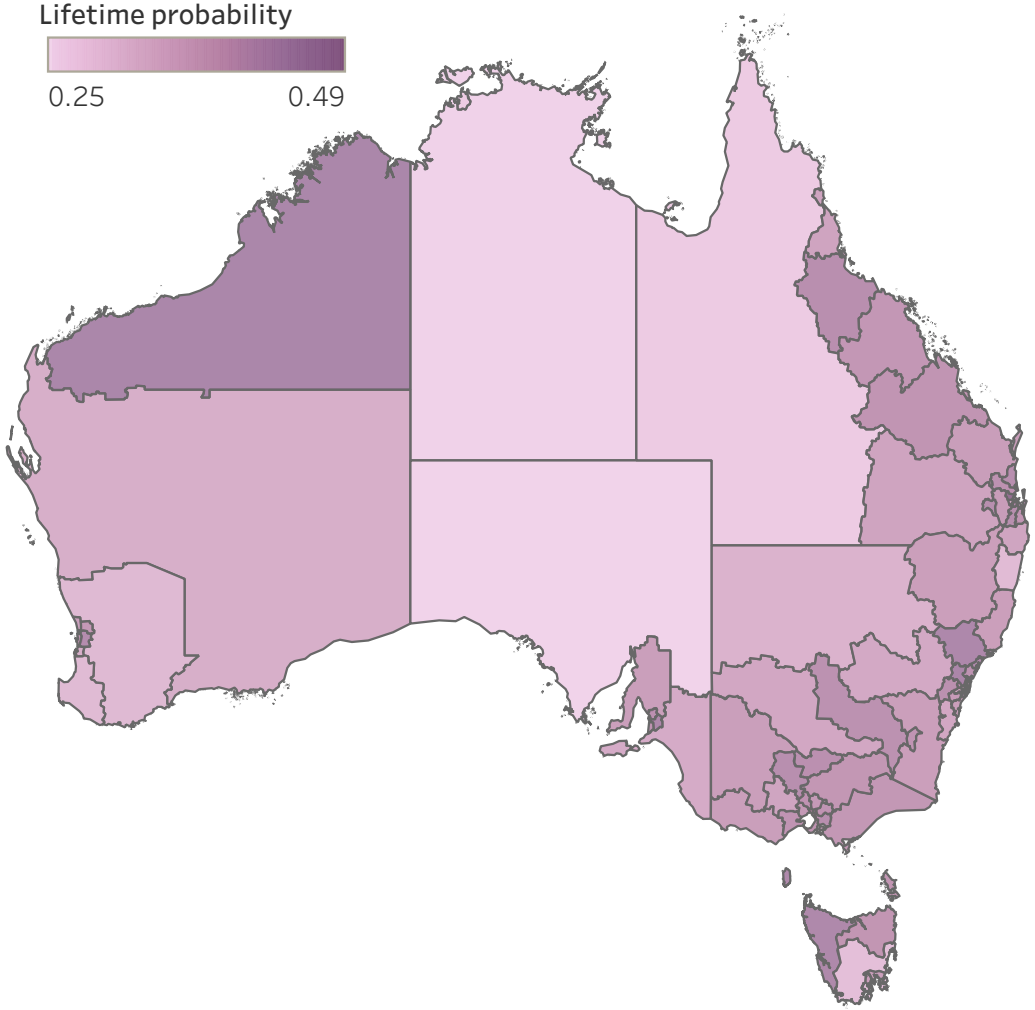


Variation by region (age 65)

Female

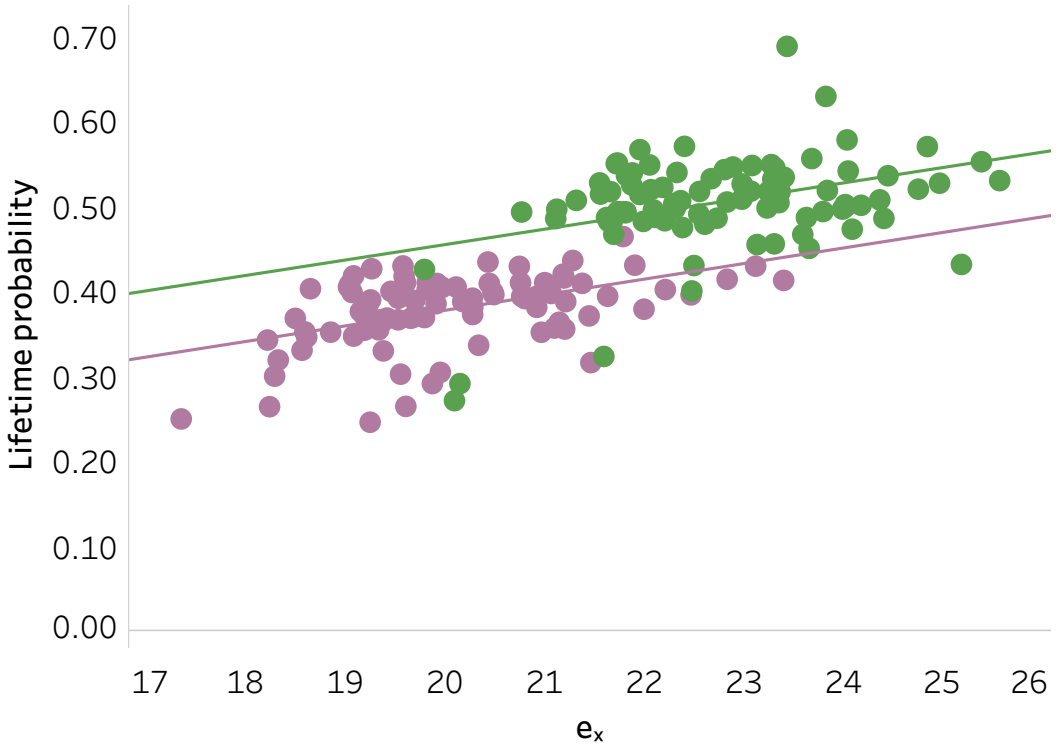


Male

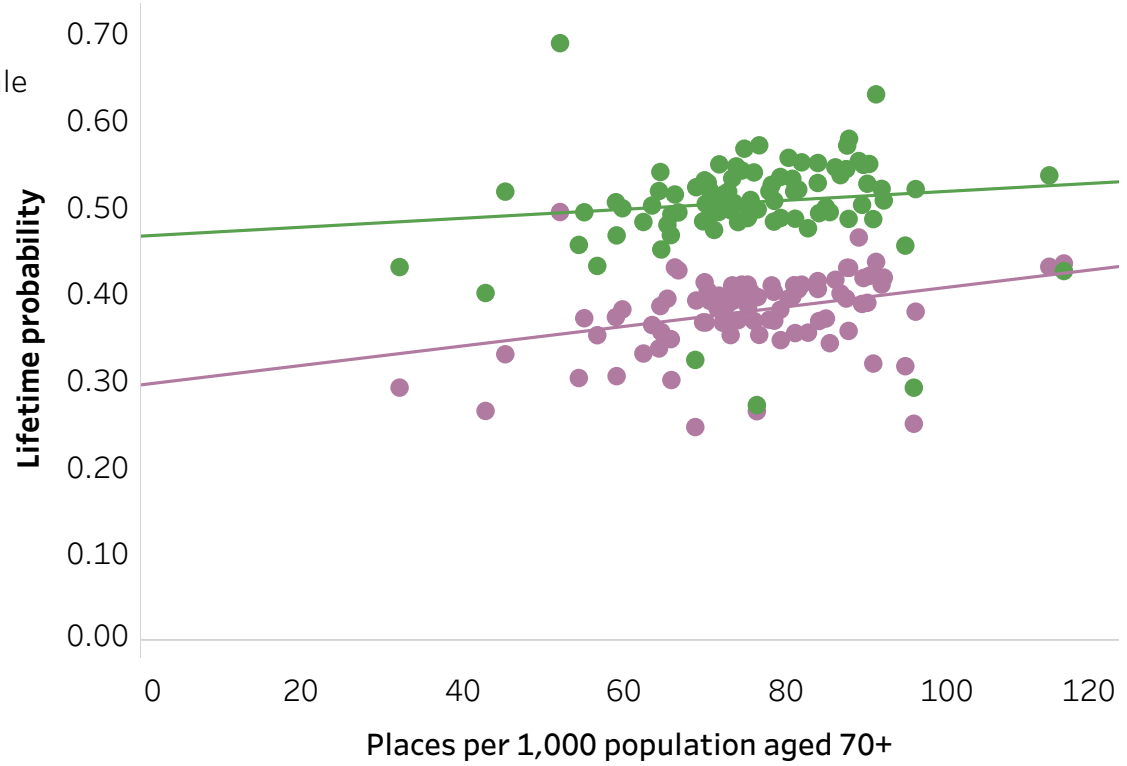


Some associations (age 65)

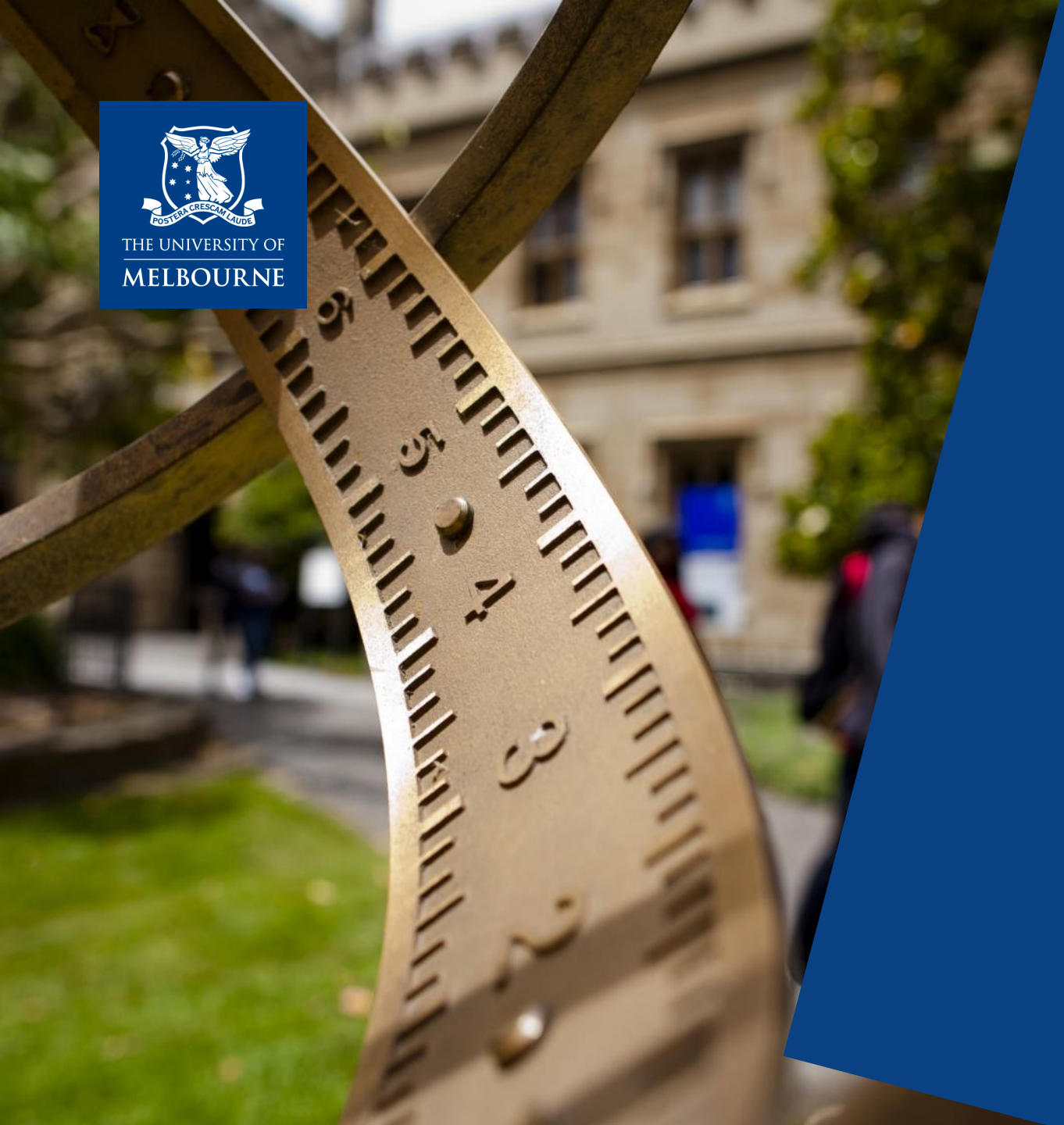
Life expectancy



Supply of places ('beds')



Neither were there clear patterns seen for dementia, disability and living alone—all factors known to be associated with higher risk of admission



Discussion

Summary

- This study has produced new estimates of lifetime probability of admission to permanent residential aged care
- The two-population life table approach appears suitable, given natural ‘migration’ between community and care settings

Pattern of probability across age intervals

- The general drop in probability of admission for the oldest females is consistent with earlier Australian studies (Liu, 1998, 2000; Rowland et al., 2002)
- Perhaps higher risk of mortality just prior to admission, but:
  - life table model shows more deaths among those admitted than not admitted at higher ages
  - Rahman et al. (2019) showed transition from community to residential care was 44% more likely than from community to death
- Perhaps just a particular point in history:
  - atypical resilience because of experience with Great Depression
  - 'healthy migrant' effect from large cohort of mid-20th century migrants

Strengths and limitations

Strengths

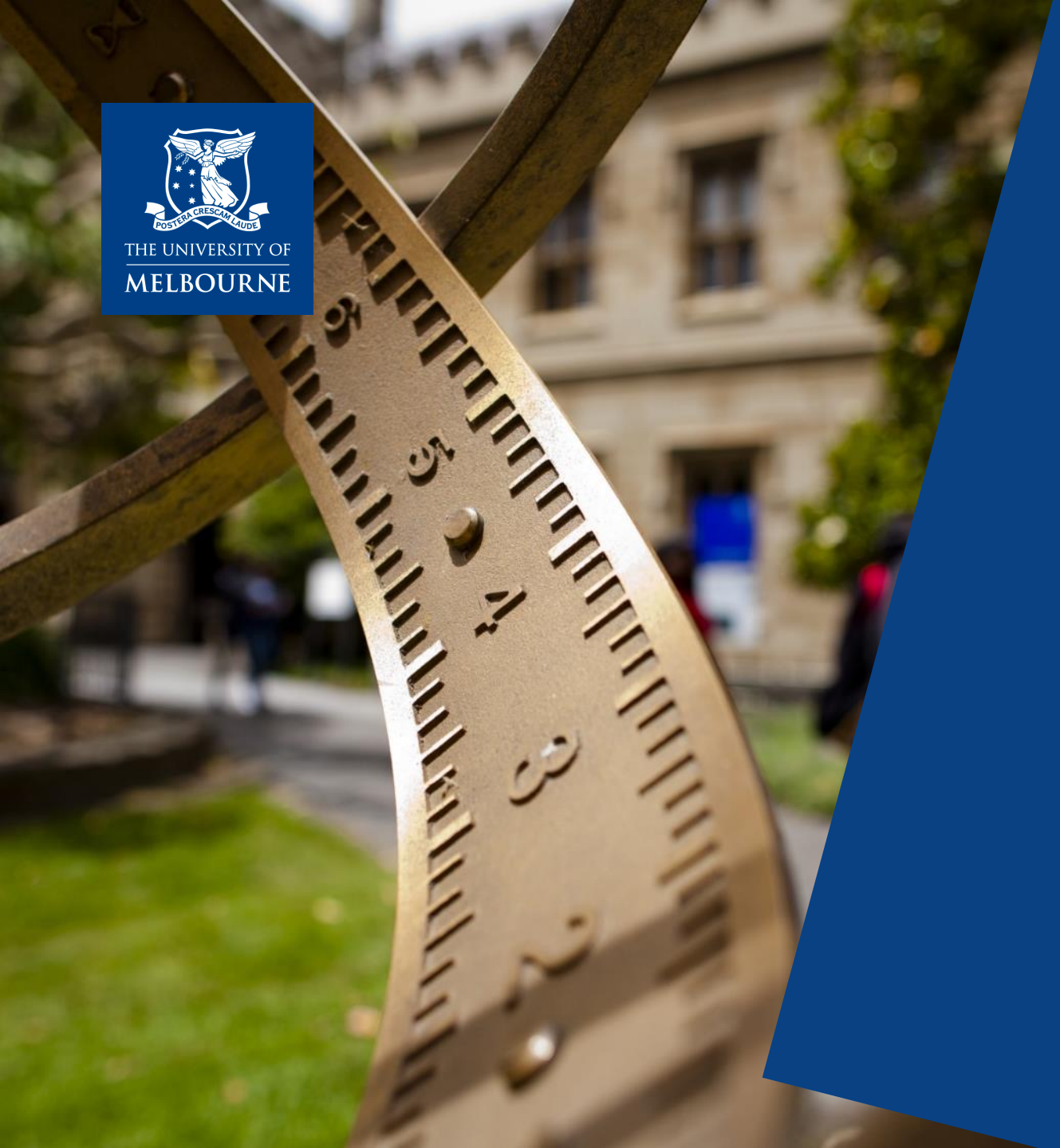
- Large, person-level, time-series dataset
- Use of Rogers' method accounts for return to community and [possible] subsequent admission
- Scalable to other levels of regional hierarchy (subject to running out of numbers!)
- Empirically-informed 'separation' values

Limitations

- Method presumes people don't move region to take up care
  - This is probably reasonable for urban areas, but breaks down for more remote areas
- Challenge with regional population estimates, particularly at older ages (Wilson & Terblanche, 2018)
  - May be possible to use Extinct Cohort and Projected Survivor Ratio methods
- Difficult to 'smooth' aged care event probabilities: grateful for any suggestions

Conclusion

- Most rigorous and comprehensive lifetime probability estimates ever produced for Australia
  - Leverage detailed data
  - Leverage multi-population approach
- Results inform aged care planning by highlighting the variability in probability of admission, independent of traditional planning measures



Acknowledgments

Thanks to…

- Dr Tom Wilson, University of Melbourne, for patient support on the demographic methods
- My other supervisors: A/Prof Jeromey Temple, Prof Briony Dow, and panel chair Prof Peter McDonald

- The Australian Institute of Health and Welfare for extracting and supplying the aged care events data

- The Australian Government's Research Training Program Scholarship

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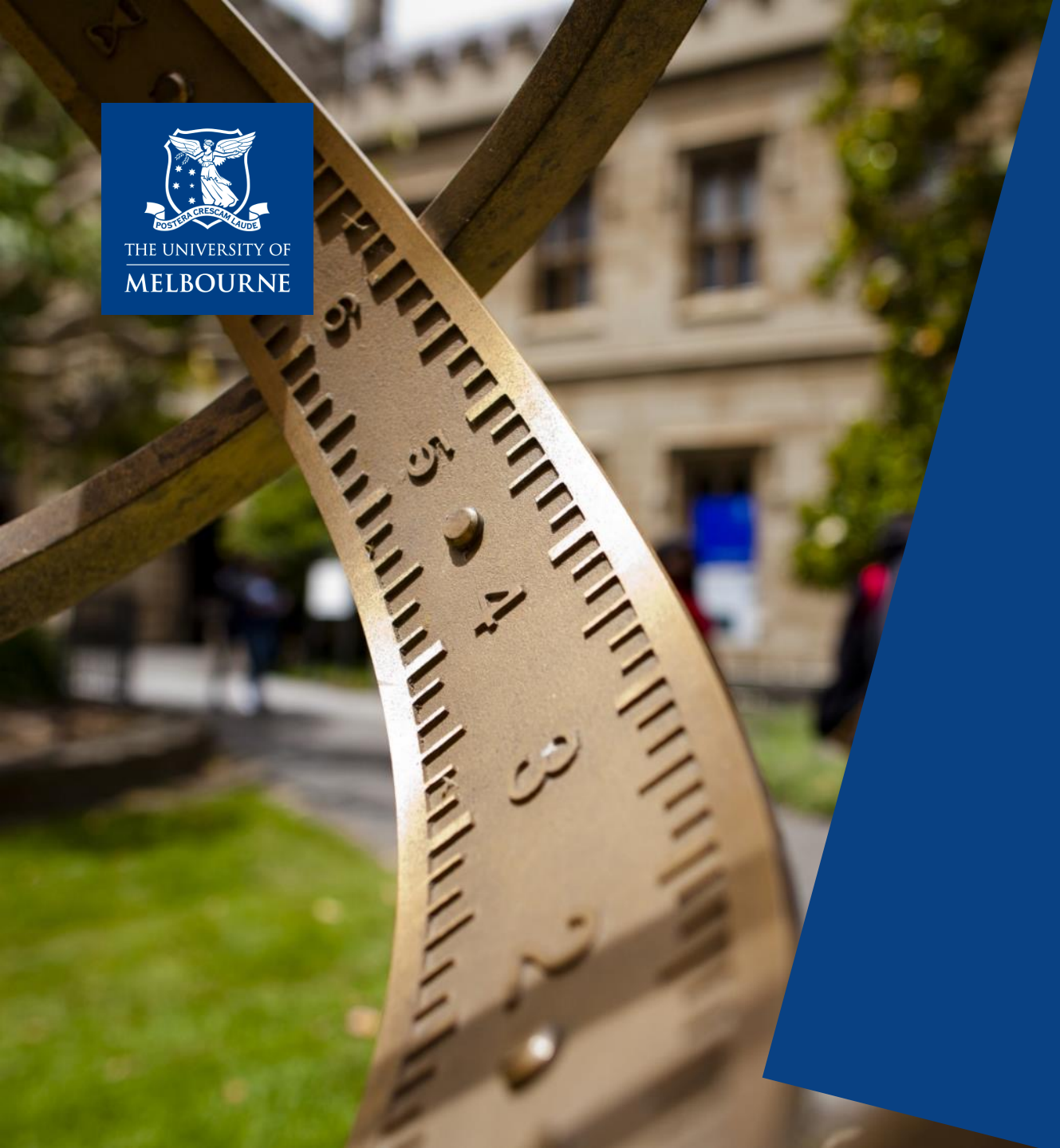

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Questions
Comments