SHORT DEMO FOR INDIRECT ESTIMATION OF CHILD MORTALITY

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RESEARCH QUESTION

- Exploring new approaches to indirectly estimate child mortality based on summary birth history
  - Using Singular Value Decomposition method to estimate mortality and fertility schedule
  - Improve uncertainty measurement for demographic statistics

OVERVIEW OF METHOD

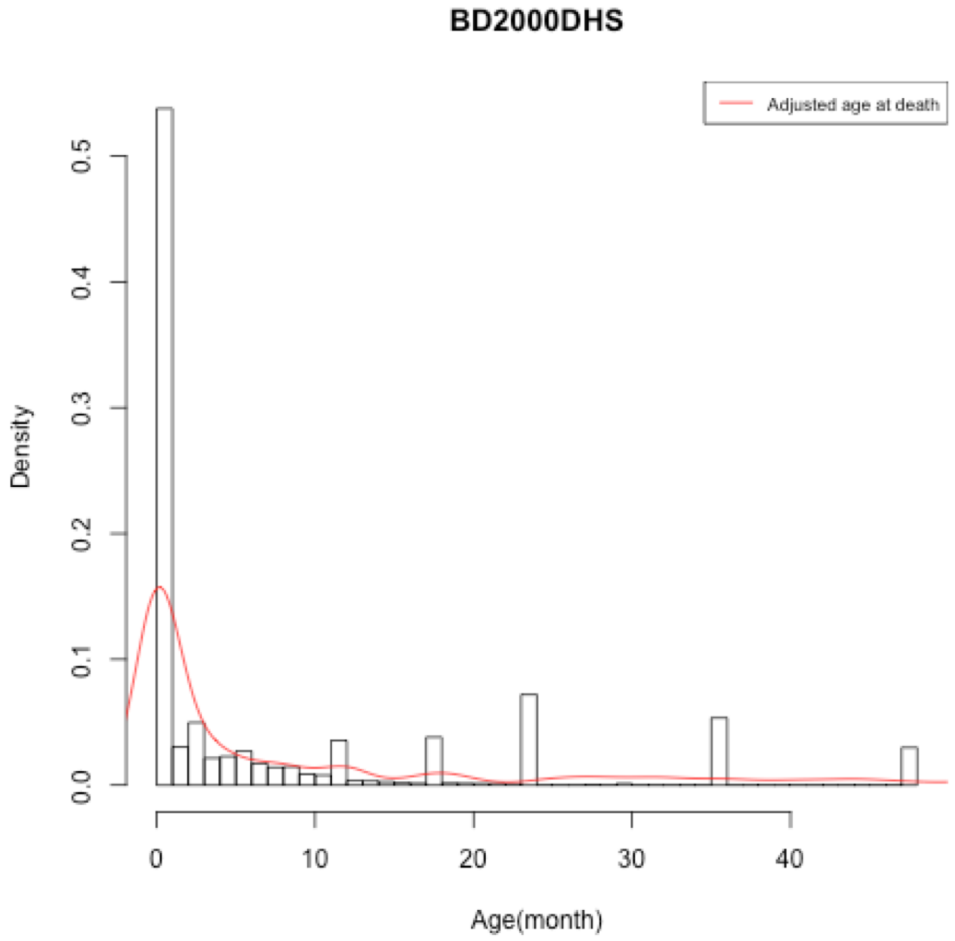
Data source:

- Publicly available DHS surveys
  - Full birth history
  - Women's survey
- A subsample of 10 surveys used in this demo

CountryName	SurveyYear
Afghanistan	2015
Albania	2008
Albania	2017
Angola	2015
Armenia	2000
Armenia	2005
Armenia	2010
Armenia	2016
Azerbaijan	2006
Bangladesh	2000

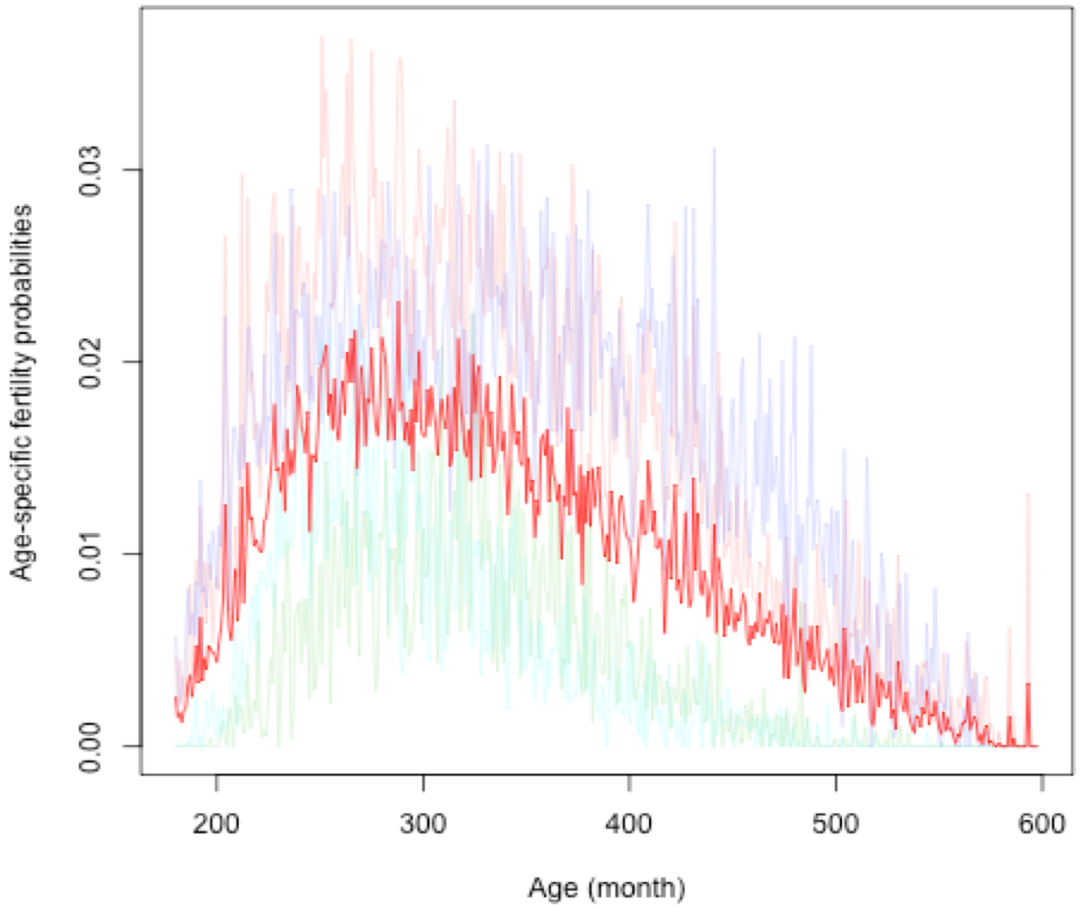
CALCULATE PROBABILITIES OF DEATHS

- Calculate age-specific probability of death for children under-five (ASDP)
  - Redistribute deaths reported in the unit of years to months for 24 months and above, assuming uniform distribution throughout the year.
  - Adjust for age heaping at 6, 12 and 18 months to neighboring months (±2), assuming symmetric graduating probability distribution (0.1-0.2-0.4)



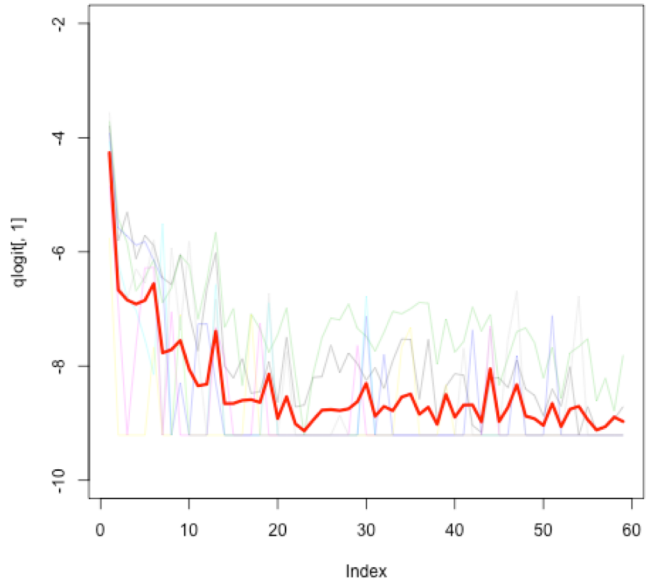
CALCULATE PROBABILITIES OF BIRTHS

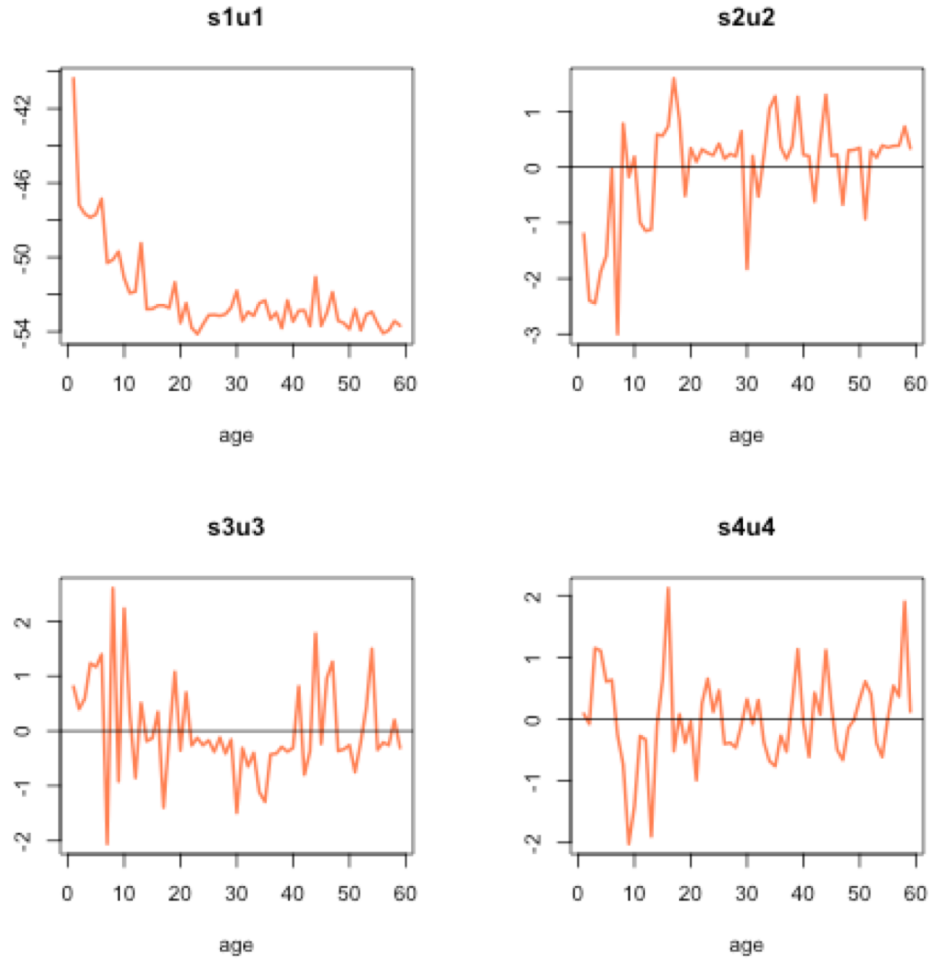
- Calculate age-specific probability of births for women of reproductive age (ASFP)
  - Probability calculated by months
  - High level of bumpiness for individual surveys



SVD FOR ASDP

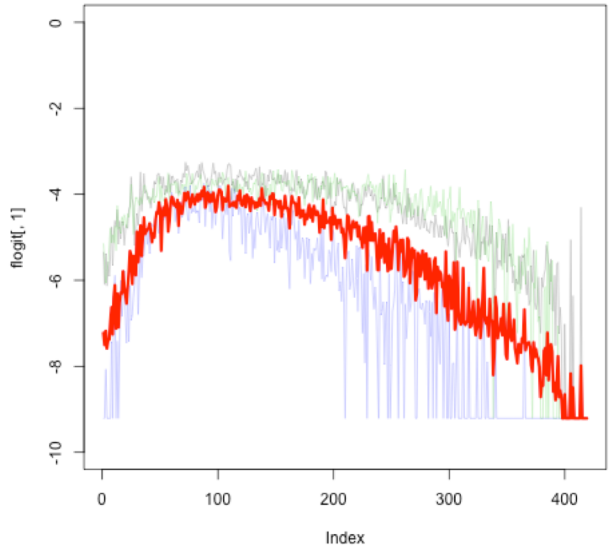
- Use Singular Value Decomposition (SVD) model to estimate age schedules for ASDP

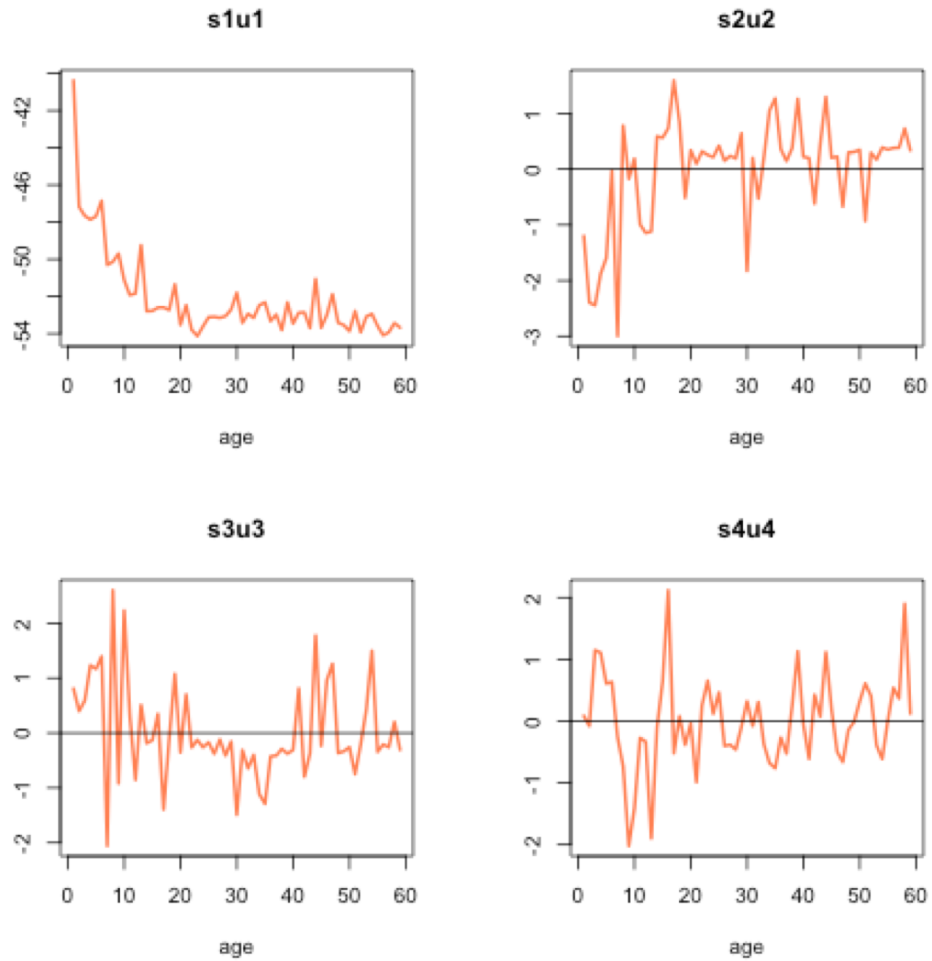




SVD FOR ASFP

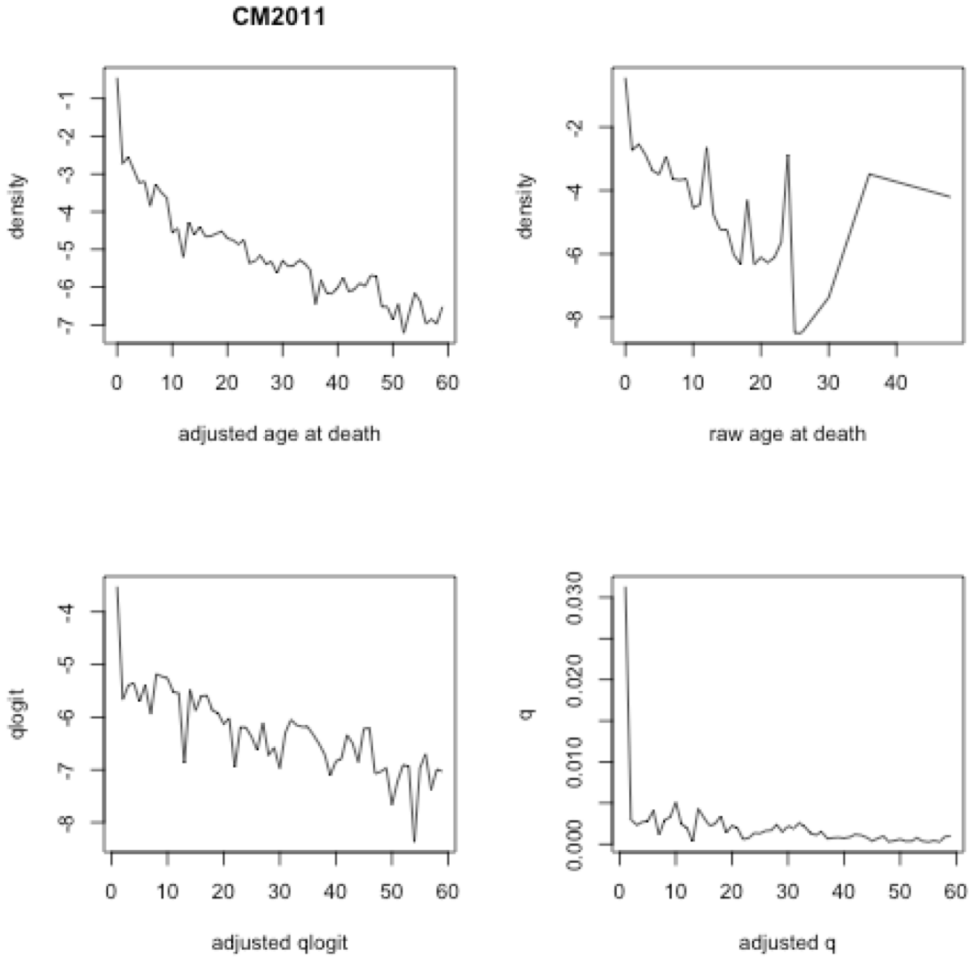
- Use Singular Value Decomposition (SVD) model to estimate age schedules for ASFP





ISSUES WITH MODELED SCHEDULES

- SVD overall captures the shape of ASDP and ASFP well
- However the modeled trends are very bumpy
  - Increasing the number of input survey data-points helps a little
  - For ASDP, the adjustment for age heaping and redistribution doesn't make the trend very smooth – bumpiness more obvious under log-transformation (e.g. figure for CM2011)
- Further smoothing of monthly deaths and births estimates could be considered



MICROSIMULATION

- State-transition microsimulation
- Possible outcome for mother for each month during reproductive ages: no birth, give birth, or death
  - Fertility probability schedule following SVD modeled ASFP estimates
- If a child is born on timepoint t, for each month of the child's living, possible status outcome for child: alive, death
  - Survival probability schedule following SVD modeled ASDP estimates

REMAINING ISSUES AND NEXT STEPS

- Smoothing of input data
  - Test SVD with smoothed ASDP and ASFP inputs
- Issues need to address in microsimulation
  - Maternal mortality: currently assumed no maternal deaths in this population
  - Adjust probability of fertility during gestational period: currently assuming probability of births are independent between adjacent time points
  - Maternal mortality and child mortality: currently assumed independence, might not be true among high HIV-prevalence population

REMAINING ISSUES AND NEXT STEPS

- Fit SVD under Bayesian framework
- Uncertainty estimation
- Validation of modeled results

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REFERENCES

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Croft, Trevor N, Aileen MJ Marshall, Courtney K Allen, and others. 2018. “Guide to DHS Statistics.” Rockville, Maryland, USA: ICF

Quattrochi, J., Salomon, J. A., Hill, K., & Castro, M. C. 2019. Measuring and correcting bias in indirect estimates of under-5 mortality in populations affected by HIV/AIDS: a simulation study. BMC public health, 19(1), 1516.