NICHD R01 Project
“Global Age Patterns of Under-Five Mortality”

Project overview

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Significance

• Importance for health policy of examining how the risk of death varies within the 0-5 age range (by days, weeks, and months of age)
  • Provides useful information about a population’s epidemiological context in the absence of causes of death
  • Useful for indirect estimation of under-five mortality
    • Knowledge about typical patterns can help detect errors and develop models for correction
    • Departure from typical patterns is indicative of errors

• To date, age patterns of under-five mortality have not been systematically examined.
Risk of Mortality

- Increase in weight (biometric argument)
- Decrease of passive immunity
- Transition to the solid diet (weaning period)
- Increase in adaptive immunity
Sweden, Females, 1891
Niakhar (Senegal), Both Sexes, 1962-68

Cantrelle & Léridon 1971
Specific aims

• Gather global database on high-quality mortality information by detailed age (days, weeks, months, trimesters and years) between 0 and 5 years.
  • Historical and contemporary periods
  • More- and less-developed contexts

• Develop models for indirect estimation of mortality by detailed age from 0 to 5 for evaluating and correcting data:
  • Incomplete VR data
  • DHS
Specific contributions

• New database, publicly available
• Modeling approach that takes all age groups at once into account
• New strategy for evaluating and correcting data in LMICs
  • Particularly useful for incomplete VR information in the context of global initiatives to strengthen CRVS in LMICs
• Improved mortality estimates
• New information for informing substantive questions
Baseline model (Model A) based on high-quality VR information from more-developed countries

- Database: similar geographic and temporal coverage as the Human Mortality Database, but with more age details between 0 and 5
- Two components:
  - UN database since 1970
  - Archival work for the pre-1970 period
- Deaths and population
- Typical cut-off points in raw death data (exact age):
  - 1d, 2d, 3d, 4d, 5d, 6d
  - 1w, 2w, 3w, 4w
  - 1m, 2m, 3m, 4m, 5m, 6m, 7m, 8m, 9m, 10m, 11m, 12m
  - 15m, 18m, 21m
  - 2y, 3y, 4y, 5y
UN database

• Focus on HMD countries, excluding small populations (Iceland, Luxembourg) and Former Soviet Republics
• 772 empirical life tables for 24 countries from 1970 to 2015
• Mostly European countries, as well as Australia, Canada, Chile, Japan, New Zealand and the US
Data collection in archives

Norway 1876
Significance of the period of analysis
Preliminary modeling approach

\[ \ln[q(x)] = a_x + b_x \cdot \ln(q(5y)) + c_x \cdot (\ln(q(5y)))^2 + v_x \cdot k \]

- Adapted from Wilmoth et al. (2012)
- Preliminary results based on: Belgium 1841-, Denmark 1890-, England & Wales 1908-, Finland 1881-, France 1899-, Germany 1950-, Japan 1950-, Netherlands 1848-, Norway 1875-, Portugal 1929-, Sweden 1891-, and US 1933-
- Other modelling approaches will be explored over the course of the project
Update Model A with validated prospective data sources from less-developed countries

• Second database

• Four types of sources:
  1. Sample Registration Systems (SRS)
  2. Health and Demographic Surveillance Systems (HDSS)
  3. Cohort Studies (CS)
  4. Urban Vital Registrations (UVR) systems

• All prospective sources

• Data quality assessment prior to inclusion in database
  • Internal consistency checks (age heaping, suspicious age progression during first few weeks, etc.)
Update Model A with validated prospective data sources from less-developed countries

• Use second database to update Model A $\rightarrow$ Model A’
• Model B for populations with pattern distinct from Model A (e.g., populations with age reversals in the force of mortality)
• Set of models covering the range of age-specific variation in mortality by detailed age given a certain level of U5MR
Using model age patterns for the indirect estimation of mortality by detailed age

• Data sources to be evaluated:
  • Demographic and Health Surveys (DHS)
  • Incomplete Vital Registration (IVR) systems

• Possible data errors in these sources requiring adjustments:
  • Misclassification of live births vs. still births
  • Underreporting of deaths, particularly at neonatal ages
  • Age heaping
Using model age patterns for the indirect estimation of mortality by detailed age

- Demographic and Health Surveys (DHS)
  - Full birth histories
  - ~230 surveys covering 78 LMICs throughout the world

- Incomplete Vital Registration (IVR) systems, from UN database (Site PI: Patrick Gerland)
  - Countries with a medium Vital Statistics Performance Index (VSPI)
  - Primarily located in Eastern Europe, Central Asia, Western Asia, South-East Asia, South-East Asia and Latin America
  - More intensive inquiries with VR data from Russia, Turkey, Iran via local collaborations
Using model age patterns for the indirect estimation of mortality by detailed age

• Approach based on Models A’ and B
• Use robust age ranges as entry points in model and use model parameters to produce adjusted mortality estimates
• Generate uncertainty bounds for adjusted mortality estimates
• Prior experience with Kyrgyzstan produced promising results
Implications for the ESCWA region

• Proposed approach would be particularly useful for estimating coverage of under-five deaths in countries of the ESCWA region
• VR coverage in the region is not complete but high enough to provide robust anchors for applying the model and generating adjusted under-five mortality estimates

• Data requirements
  • Microdata on under-five deaths with exact dates of birth and death or
  • Aggregate tabulations of deaths: distributions of deaths by detailed age (days, weeks, months, years) from 0 to 5.