

Kin-Age-Cohort analysis

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Cumulative child death

We propose an extension to the Goodman-Keyfitz-Pullum kinship equations (GKP equations) (Keyfitz 1985), to estimate the cumulative number of offspring deaths experienced by a woman surviving to age a , standing before us:

$$OD_{(a,c,p)}^k = \sum_{x=\alpha}^a {}_1F_{(x,c,p)} - \sum_{x=\alpha}^a {}_1F_{(x,c,p)} {}_1l_{(\min(a-x,k),c+x,p)}$$

where $k = 1$ for infant deaths, $k = 5$ for child deaths and $k = 100$ for all-age offspring deaths. We restrict the female reproductive age $[\alpha, \beta]$ to $(\alpha, \beta, n) = (15, 50, 1)$, so that $a \leq \beta + k$ for all cases.

Proportion of bereaved mothers per 1,000 mothers

In order to determine the prevalence of bereaved mothers in a population, we start by considering the age-specific probability that an average woman will experience the death of a child:

$${}_1q_{(a,c,p)}^k = 1 - e^{-h(a,c,p)}$$

where $h(a, c, p) = OD_{(a+1,c,p)}^k - OD_{(a,c,p)}^k$ is the hazard rate of experiencing the death of a child younger than k (Wachter 2014). We create a life table (Preston, Heuveline, and Guillot 2001) a unit radix $l_0^k = 1$ where ${}_1q_{(a,c,p)}^k$ is the probability of losing a child. We define $FOD_{(a,c,p)}^k = 1 - {}_1l_{(a,c,p)}^k$ as the fraction of women in a cohort who ever experienced the death of a child younger than k . Next, we account for the mortality of women with the help of $FWS_{(a,c,p)}$, the fraction of women that survived up to a after the start of reproductive age α in each birth cohort. We approximated this using country-specific period life tables from the UN WPP. The proportion of women (per 1,000 mothers) who have ever lost one or more children younger than k is:

$$wOM_{(a,c,p)}^k = FOD_{(a,c,p)}^k * FWS_{(a,c,p)} * 1000.$$

We estimate an equivalent measure for mothers by rescaling our estimates using a similar life table approach. We consider fertility as a “hazard rate” to approximate the number of women that “survive” having children (i.e. remain childless) after experiencing a set of age-specific fertility rates. The fraction of women who have ever been mothers $FM_{(a,c,p)}$ is approximated as 1 minus the fraction of childless women. We can now define, for a given cohort, the proportion of mothers (per 1,000 mothers) who have ever lost one or more children younger than k :

$$mOM_{(a,c,p)}^k = wOM_{(a,c,p)}^k * FM_{(a,c,p)}.$$

We generate period estimates of the prevalence of bereaved mothers, comparable to the empirical DHS estimates, using different combinations of cohort and age for Eq. X.

References

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