**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:

where for infant deaths, for child deaths and 00 for all-age offspring deaths. We restrict the female reproductive age to , so that 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:

where is the hazard rate of experiencing the death of a child younger than *k* (Wachter 2014). We create a multiple decrement life table (Preston, Heuveline, and Guillot 2001) where a woman can exit the population of “non-bereaved women” either by losing a child or by dying herself so that is the probability of leaving the state of being a non-bereaved woman. For a unit radix , is the fraction of women in a cohort who ever experienced the death of a child younger than *k*.

Strictly speaking, these estimates do not refer to mothers, since the input UN WPP demographic rates do not report the fraction of women who are mothers. We rescale our estimates using a similar life table approach where 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 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*:

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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**

Keyfitz, N. (1985). *Applied Mathematical Demography*. New York: Springer. http://public.eblib.com/choice/publicfullrecord.aspx?p=3084208.

Preston, S.H., Heuveline, P., and Guillot, M. (2001). *Demography: Measuring and Modeling Population Processes*. Malden, MA: Blackwell Publishers.

Wachter, K.W. (2014). *Essential Demographic Methods*. Cambridge, Mass.: Harvard Univ. Press.