Title: Infant and Child Mortality within Social Networks and Perceptions of Mortality Change in Niakhar, Senegal

Social Networks for Mortality Perceptions: Background

The potential influence of social networks on demographic and health behaviour has been the subject of intense research in the last decade. This has been due in part to theoretical statements of the likely importance of learning about demographic processes through social networks (Bongaarts and Watkins 1996; Casterline 2001; Montgomery and Casterline 1996). Social learning and the effects of social influence (or social pressure) through interpersonal channels have been thought to play a major role on a myriad of demographic phenomena, including the acceptance and use of contraceptives and fertility limitation (Behrman Kohler and Watkins 2002; Kohler 1997; Kohler, Behrman and Watkins 2001; Montgomery and Chung 1999; Montgomery et al. 2003), control over and pace of family building (Sandberg 2005; Sandberg 2006), migration decisions (Deléchat 2001; Massey 1987; Massey 1990; Palloni et al. 2001) and perceptions of risk of and preventative measures taken against infection from the AIDS virus (Behrman, Kohler and Watkins 2002; Buhler and Kohler 2003; Helleringer and Kohler 2005). Recent research in the field of public health has also highlighted potential influences associated with a wide range of other health outcomes and behaviours (Smith and Christakis 2008).

Social learning about mortality has a relatively special place in the demographic literature. In large part, this is because of the central role mortality has been theorized to play in the onset of fertility transitions, with lower infant and child mortality hypothesized to lead after a lag period to lower fertility (Chesnais 1992; Mason 1997; Freedman 1979). Though aggregate level associations between infant and child mortality and fertility over the years have tended to support this general relationship, they have been received sceptically due to the possibility of spurious causation associated with other factors in socio-economic development and the well know reverse causal path from higher, faster fertility to higher infant mortality (Hobcraft 1992). The problems with aggregate analyses, in conjunction with a conviction that individuals should make decisions about having children (and what to do with them) at least in part based not only on their own experience with child mortality, but also on evidence gleaned from their interpersonal environmental contexts led many to a search for individual level volitional mechanisms linking infant and child mortality and fertility. The majority of work in this area focused on the well known 'replacement' (where the loss of a child influences the family/individuals fertility) and 'insurance' (where expectations concerning potential future mortality influences fertility) effects (Preston 1978). Almost no research has been able to indentify consistent insurance effects, however, which in principle would have had the largest impact on fertility change. This is in part because such effects are fundamentally related to *perceptions* of mortality (Sandberg 2005; Montgomery 1998), and perceptions are notoriously difficult to measure well. Early research that attempted to do so directly yielded mixed results, at best (see Taylor, Newman and Kelley 1976 for a summary).

In order to avoid problematic measurement aspects related to perceptions, later research would attempt to model the influence of contextual mortality on fertility beliefs, attitudes and behaviour directly, using aggregate measures of mortality as independent variables in models of fertility and family building processes. Such specifications however rest upon an assumption of homogenous mixing, modeling all individuals as exposed to the same fixed distribution of information with regards to infant/child mortality and survivorship as others in their area. This assumption is problematic because even small differences in contextually available information due to differential patterns of association may lead to differing perceptions on the individual level within the same broad aggregate of a population. Recent research has attempted to address both these problems- measurement of informational context and homogenous mixing- by modeling contextual mortality information through the experiences of social network associates. Using this methodology, significant associations have been found between between both perceptions of agency with regard to family building (as indicated by nonnumeric response to questions regarding family size) and the tempo of fertility and the level and variance of mortality in individual social networks (Sandberg 2005; Sandberg 2006).

Social Networks and Mortality Change: Better Network Data

Building on this recent work, the present research steps back to investigate if and how the context of heterogeneous interpersonal contextual information concerning infant and child mortality is associated with perceptions of mortality change directly. To do so, we employ an innovative and unique source of network data, the Niakhar Social Networks Pilot Survey, or NSNPS, conducted in concert with the Niakhar demographic surveillance system (NDSS) maintained by *L'Institut de recherche pour le développement* in rural Senegal.

Stemming from a desire for representative results concerning large populations, network data used in analyses of social effects related to demographic phenomena most often takes the form of what network analysts label 'ego-centric', 'personal' or 'global' networks. This type of network data, implemented in a standard sample survey employs both questions that identify respondents' network members (called 'alters'; the questions themselves are most often called 'name generators') and questions concerning these network members' characteristics (which are called 'name interpreters'). Analyses of network effects using this type of data proceed then with some aggregate measure of the characteristics of network alters used as an independent variable in an analyses of a particular demographic outcome of interest.

Inferences from analyses employing such data however are most likely flawed for a number of fundamental reasons that are well known, all stemming from logistical constraints of the standard survey format. These include restricting the types of network ties for which data are collected to one or two (e.g., in the analysis of contraceptive use, to individuals one has discussed family planning with), the use of arbitrary and low restrictions on the number of network alters identified within these networks (most often to 4 or 5 alters, but sometimes as few as 2), and respondent (or ego) reporting of network members' characteristics which is often systematically incorrect (for a summary of these problems see Rytina et al. 2008).

The NSNPS data, in contrast, was designed specifically to overcome these limitations. The NSNPS uses 15 name generators selected as a result of a qualitative analysis of the patterning of interpersonal association in the Niakhar study area. These name generators were designed to capture four key domains of association within a typology of meaningful subsets of ties within actors' personal networks. These domains include affective, exchange and role-relational ties respectively, as well as ties based on frequency of interaction (Marin and Hampton 2007; van der Poel 1993). Further, the number of network alters elicited under each name generator was not restricted. Respondents named on average 21.84 unique individuals as part of their personal networks across the 15 name generators, capturing larger and more complete personal networks than has been done before. The extensive nature of alter identification was made possible by ignoring, for the most part, name interpreters concerning alter characteristics such as experience with infant and child mortality which would have been measured poorly if reported by respondents. Instead, data on alter mortality experience (and all alter characteristics) were obtained by linking identified alters in the survey instrument to the main NDSS database. The NDSS has maintained extensive, prospectively collected demographic data on the entire population of the study area for over 30 years. The main drawback of the NSNPS data is the small sample size. Because the principle goal of the study was as a methodological pilot, only 147 respondents were administered the survey questionnaire. The sample size for the purposes of our analysis is not much smaller than many others used in the demographic network literature (Sandberg 2005).

Modeling Perceptions of Infant and Child Mortality Change

Our measure of perceived infant and child mortality change comes from an additional question in the main survey instrument of the NSNPS which asked all respondents the (deliberately) general question whether they ..." believe that child/infant mortality levels have increased, decreased, or remained the same as previously?" Against the backdrop of dramatically declining infant and child mortality in the previous 30 years, but recently stagnating gains (Delaunay et al. 2001), just over 2/3 or respondents perceived a decline in these relative to the past. Fully 27% of the respondents indicated that mortality has increased, while only 5.71% believed it had remained the same.

To model perceptions of mortality change as measured by this question, we include both structural (not related to learning or influence through interaction) and interactional covariates, a necessary condition for isolating learning or other interactional effects (Palloni 2001). Among the structural covariates, we include most importantly respondents' own experience with infant and child mortality. We also investigate controls for urban vs. rural residence, level of education, experience with migration outside the study area and degree of interaction with health services within the study zone . To construct our measures of contextual mortality information, we aggregate infant and child mortality across all network alters, and in separate specifications across alters within each domain of interaction specified above, encompassing affective, exchange, role-relational and interactional ties to determine which types of ties are most strongly associated with perceptions of mortality change. We model these effects both under the assumption that all alters experience carry equal weight in their potential impact on the construction of mortality perceptions, and also under different assumptions of the relative weight of each alter. Weighted specifications include two that examine the importance of gender (same vs. opposite gendered alters), as well as specifications that weight alters' importance to the respondent by respondent reported values on a psychometric rating scale, time they have known the alter and other context specific measures gathered in the NSNPS.

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