2.1 Introduction

There is vast literature on the determinants of under-five mortality and the demand for health care encompassing the entire population or a section of it using cross-sectional or panel data. Often socio-economic, demographic and biomedical factors have been found to be significant predictors of the demand for health care and health care utilization. This chapter presents the literature threefold; child mortality, health seeking behavior in terms of choice of health care provider and demand for health insurance.

2.2 Literature Review

Several studies have been carried out on infant and child mortality using Census, Living Standards and Demographic Health Survey (DHS) data. The literature treats the phenomenon two-fold; using cross-sectional or panel household data on one hand and cross-sectional time series or panel data on the other hand (see Imam, 2004; Hanmer et al. 2003; Fayissa, 2001; Ranis et al. 2000; Waldmann, 1992). However, this study is based on cross-sectional household data. The literature on the determinants of childhood mortality consistently identifies four broad categories of factors; household characteristics that have an indirect effect on mortality (e.g. maternal education, paternal education, region of residence, household income, and access to safe drinking water and sanitation); biological attributes at birth that have direct influence on health and nutrition (e.g. sex of the child, birth order, birth interval and mothers’ age); health inputs before, during and after delivery that directly affect
mortality but can be influenced by parental behavior (e.g. prenatal care, institutional delivery, immunization, postnatal care and breast feeding); supply side factors that indicate the availability of health infrastructure such as community health center, primary health center and private/public hospitals.

Desai and Alva (1998) investigated the effect of maternal education on three indicators of child health-infant mortality, children’s height for age and number of vaccinations received using Demographic and Health Survey data for 22 developing countries. The authors argued that maternal education may be a proxy for the socio economic status of the household as well as for characteristics of the community of residence. Thus more educated women are more likely to have come from higher socio-economic strata and are likely to reside in areas with better health systems as well as water and sanitation systems.

Derose and Kulkarni (2005) using multi-level logistic analysis found community HIV rates, women’s education and immunization as significant determinants of child mortality in Zambia. In Egypt, Aly and Grabowski (1990) used logit analysis to model child death probability using Egypt’s World Fertility Survey in 1980. They concluded that source of drinking water and sanitation was significantly and negatively related to child mortality. Woldemicael (1988) employed logistic regression to examine the effect of some environmental and socioeconomic factors that determine childhood diarrhoea in Eritrea using data from the 1995 Eritrea Demographic and Health Survey (EDHS). The results show that type of floor material, household economic status and place of residence are significant predictors of diarrhoea.
Gangadharan et al (2000) used probit analysis to model child mortality in Pakistan and found that girls have a significant lower probability of dying in age group 0-1 but have a significant higher probability of dying in the age group 1-5. Thus the higher mortality of girls in the age group 1-5 reflects discrimination against girls in the form of lower health and other resource inputs. Additionally, they found mother’s education beyond a certain threshold and increased duration between births to significantly reduce child mortality. Boone and Zhan (2006) employed logistic regression for analyzing child mortality in a cross-section of countries. The study found mother’s and father’s education as significant determinants of child mortality in poor countries.

Wang (2002) using cross-sectional demographic and health surveys and OLS concluded that at the national level, access to electricity, vaccination in the first year of life and public health expenditures can significantly reduce child mortality. In the urban areas, however, only access to electricity has a significant health impact while in rural areas, increasing vaccination coverage is important for reducing mortality.

In their study on Bangladesh, Bairagi et al (1999) using a duration model concluded that changes in mother’s education, birth interval and birth order had little effect on mortality decline. Duration modelling is applied by Hala (2002) to assess water and sanitation’s impact on child mortality in Egypt. The results show that access to municipal water decreases the risk of child mortality but sanitation is found to have a more significant impact on mortality than water. In Malawi, Baker (1999) and Espo (2002) used indirect methods to estimate levels and trends of mortality in Malawi. The main findings are that source of drinking water and sanitation facilities are strong predictors of infant mortality. Berger et al (2002) analyzed the causes of
under-five mortality in Zambia using Bayesian dynamic logit model for discrete time survival data and Markov-Chain Monte Carlo methods. The study showed that several variables, including the age of the mother and the breastfeeding duration exhibited distinct age-dependencies.

The hazard rate framework is utilized by Klaauw and Wang (2003), in which a flexible parametric framework for analyzing infant and child mortality is developed. Their model predicts that a significant number of under-five child deaths can be averted by providing electricity, improving the education of women, providing sanitation facilities and reducing in-door air pollution. Wang (2003), using data from the 2000 Ethiopia DHS examined the environmental determinants of child mortality by constructing three hazard models (the Weibull, the Piece-wise and the Cox model) to examine three age-specific mortality rates: neonatal, infant and under-five mortality. He found a strong and positive statistical relationship between child mortality rates and poor environmental conditions.

In another study, Jacoby and Wang (2004) examined the linkages between child mortality and morbidity in rural China using a competing risks approach. The key findings are that access to safe water/sanitation and maternal education reduce child mortality risks while use of unclean cooking fuels (wood and coal) significantly reduces the neonatal survival probability in rural areas.

Sang-Hyop (2005) estimated a household demand for immunization and the effect of immunization coverage on the probability of child survival in rural India. The author argued that mothers with high risk of child mortality may engage in compensatory behavior in the demand for health inputs and that those who are favorable to prenatal care might engage in complementary behavior in the demand for
postnatal care (i.e. more likely to also obtain postnatal care). To address the problem of self-selection in the demand for health inputs, child mortality model was estimated jointly with the demand for immunization, demand for delivery care, and demand for prenatal care. Child mortality was specified as a proportional hazard model; while the demand for immunization was modeled as an ordered probit. Both the demand for prenatal care and delivery were specified as random effects probit models.

Eldin and Maglab (2003) examined the impact of parent’s education, health services and household standard of living measured by permanent income, on child survival in rural Sudan using household data consisting of 1400 rural residents. Child mortality was assumed to depend on the education levels of the mother and father, household’s income per adult, mother’s age, public program variables related to health (such as availability of hospital beds per capita and services to improve sanitation and water-borne diseases) and rural dummies. It is argued that women’s allocation of time between market and home production (Upbringing and care of children) might influence the health status of children. The two-Stage Least Squares estimation technique was used with household assets used as identifiers in the regression. However, the OLS technique was also used for comparison of results. Both maternal and paternal education was found to have a significant negative impact on child mortality. However, maternal education was found to have a larger and more significant impact than paternal education.

Kravdal (2004) investigated the effects of the educational attainment of mothers and other women in the community on child mortality in India using the National Family Health Survey of 1998-1999. Child mortality was specified as a discrete–time hazard model and some of the explanatory variables considered were
education of the mother, average education of women (capturing education of other women in the community) and women’s autonomy variables (economic, physical, decision-making and emotional) which were incorporated as potentially mediating or confounding factors.

Kravdal (2004) also estimated logistic models for (15) health and health care indicators (including vaccination of children, whether the woman received antenatal care, received tetanus vaccination and had moderate or severe anaemia). Average education of women, mother’s education, religion, wealth, urbanization, availability of health care facilities and the age of the child were some of the explanatory covariates used to model health and health care indicators. The results showed that higher mother’s education and average education of women in the community are significant in reducing child mortality. Also, physical, decision-making and emotional indicators reduce the incidence of child mortality. In the case of health and health care indicators, mother’s education and average education of women also proved to be significant factors influencing their demand. The author recommended policies to enhance women’s autonomy at both the individual and community level since their autonomy is crucial in reducing child mortality.

Blunch (2005) examined the impact of maternal literacy and numeracy skills, formal education and adult literacy course participation on child health inputs (vaccinations and postnatal care) and child mortality in Ghana. He adopted an Instrumental Variable (IV)-based two-stage least squares (2SLS) estimation technique to account for the potential endogeneity of maternal skills, schooling and adult literacy course participation. His preliminary results revealed that formal schooling, adult literacy course participation and literacy and numeracy skills have a positive
impact on child health input demand and hence reduce child mortality. The author recommended improvement in child health knowledge through the inclusion of health topics in the curricula of adult literacy programs.

Maitra and Pal (2005) examined the relationship between early childbearing, parental use of health inputs and child mortality in Bangladesh. The authors argue that mother’s age at birth as well as hospital delivery and child vaccination are chosen by the couple (i.e. they are endogenous in the child mortality regression). Consequently, they attempted to address the potential bias resulting from endogeneity by jointly estimating child mortality, mother’s age at birth and the demand for health inputs allowing for cross-correlations between the unobserved components of the residual terms in these equations.

Early child birth, institutional delivery, child vaccination and child mortality were all estimated as random effects probit models. The results revealed significant adverse selection in that women having early childbirth tended to use health inputs differently from all other women. Prior to accounting for self-selection in the choice of hospital delivery and child vaccination, hospital delivery was significant but was seen as having a harmful effect on child health.

Wang (2003) investigated the determinants of child mortality in LDCs using Demographic and Health Surveys data from over 60 low income countries. The results show that at the national level access to electricity, incomes, vaccination and public health expenditure significantly reduce child mortality. For the rural sample, vaccination is the only significant predictor for child mortality while access to electricity is the only significant mortality determinant in the urban sample. Although
pooled cross sectional data improves model performance because of the rich source of data, country specific effects are not captured.

Iram and Butt (2008) estimated the socioeconomic determinants of child mortality in Pakistan using sequential probit model. The study posits that breastfeeding protects children from early exposure to diseases and ill health and that mother’s education is strongly related to neonatal mortality, infant mortality and child mortality through improved child caring practices. Proximate determinants such as prenatal care, income and environmental conditions were also found to be significantly related to child mortality.

Kovsted et al (2002) investigated the impact of health knowledge on child health and mortality in Bissau, the capital of Guinea Bissau using duration modeling. Using the mothers’ knowledge of malaria as a proxy for health knowledge and controlling for covariates, they concluded that the importance of maternal education in child health outcomes diminishes or disappears when health knowledge is introduced into the model. However, it was established that health knowledge has significant effect on both child mortality and health when instrumented for to capture endogeneity.

Earlier studies on childhood and under-five mortality in Ghana have examined socio-economic and bio-demographic factors without recourse to supply side variables such as availability of good roads and health personnel (Benefo and Schultz, 1996; Amankwah, 1996, Binka et al. 1995, Tawiah, 1989; Adansi-Pipim, 1985).

The dependent variable for the fertility equation estimated with OLS is the number of children born alive to women over age fifteen, treating child mortality as exogenous. In the child mortality estimation, child mortality is endogenous and identified by instruments measuring community health services and environment. Some of the main findings were that economic resources of households, maternal education, access to markets and food prices are significantly associated with child mortality in Ghana. In Cote d’Ivoire, households living a greater distance from a clinic experience higher mortality among their children while women’s education was found to be a significant predictor of child mortality. On the issue of fertility, women’s education was proven to be the most important predictor in both countries. One important setback of the study was the omission of child characteristics which constitutes an integral biological endowment in the estimation of a child’s health production function. This omission is attributable to the fact that the data source (Living Standards Survey) lacks such attributes.

Using pooled data from the 1998 and 2003 Ghana Demographic Health Surveys and a piecewise constant hazard model with gamma-shared frailty, Gyimah (2007) found at the bivariate level that children whose mothers identified as Muslims and traditional believers have a significantly higher risk of death compared with their counterparts whose mother’s identified as Christians. However, the religious differences disappeared after the mediating and confounding influence of socioeconomic factors were controlled. In his previous study on ethnicity and infant mortality in Ghana, he found significant ethnic differences at the bivariate level. However, the ethnic differences disappeared after controlling for socio-economic variables (Gyimah, 2002). Although, Gyimah’s paper provides an excellent
contribution to the body of knowledge on child health outcomes, he did not control for supply side factors such as access to roads.

Bour (2003) studied the effect of maternal education on childhood mortality in Ghana using the Ghana Demographic and Health Survey data (1998) and World Bank data of 2000. Using graphic and linear regression models, the study confirmed that there is an inverse relationship between mother’s education and child survivorship. While the study provides insight into the relationship between maternal education and child survivorship, it failed to account for the role of the public sector via public health investment. In addition, the hypothesized linear relationship employed in the study is oversimplified.

Asante (2003) using OLS found contrasting results regarding some covariates of under-five mortality including significant and positive association between income, use of safe drinking water and higher education on under-five mortality in Ghana. The unexpected outcome might be attributable to the use of inappropriate econometric model since OLS is incapable of capturing the dynamics. Additionally, maternal and child specific biomedical factors were not controlled for. The use of survival analysis in the current study, coupled with the introduction of supply side variables makes interesting comparisons with previous results.

As stated by Agnihotri (2001), declining infant and child mortality levels are sure indicators of development. But these may not evenly benefit male and female children especially if the girl children are unable to access the improved health infrastructure and nutritional support. The consequent gender gap in mortality is a good index of discrimination against the girl children. Analysis of time series data on infant and child mortality of major Indian states indicates a more rapid decline in male
mortality rates as mortality levels decline. However, many states known for their
gender bias do show evidence of the ‘substitution effect’, i.e., more rapid decline in
female infant and child mortality rates in the wake of increasing incidence of pre-natal
selection. It is argued here, however, that a mere improvement in mortality rates
among ‘surviving’ girl children does not mean an improvement in the quality of their
survival.

Sakthi Padhi (2001) stated that infant/child mortality is not a simple function
of the level of economic development, pace of economic growth or material
prosperity. Proximate conditions having a direct bearing on infant and child mortality
are such that they cannot be influenced through increases in income and purchasing
power alone and are outside the market domain. The National Family Health Survey
provides rich and variegated data which are useful for studying the early mortality in
Orissa and provide a solid empirical foundation for further probing of certain
questions such as accessibility and quality of a whole range of public goods and
services which have a direct bearing on premature mortality.

Gokhale, et al (2002) has discussed that slow reduction in infant mortality rate
in the last couple of decades is a major concern in India. State level aggregate data
from the National Family Health Survey 1992 and micro-level data on rural mothers
(n=317) were used for examining the influence of female literacy on reduction of
infant mortality through increased use of maternal and child health (MCH) services.
Illiteracy of females was strongly associated with all variables relating to maternal
care and also with infant mortality rate. States were grouped into best, medium, and
worst on the basis of female illiteracy (about 11%, 48.5%, and 75% respectively).
Infant mortality rate (per 1,000 live births) was significantly (p<0.01) higher among
the worst group (90.99) than that among the medium (64.2) and the best (24.0) groups.

Use of maternal health services increased in the worst to become the best groups for tetanus toxoid (from 48.0% to 84.4%), iron and folic acid tablets (36.6% to 76.2 %), hospitalized deliveries (14.2% to 69.7%), and childcare services, such as vaccination (23.8% to 64.9%). Illiteracy of females had a more detrimental impact on rural than on urban areas. In the event of high female illiteracy, male literacy was beneficial for improving the use of services for reducing infant mortality rate. The micro level study supported all major findings obtained for the national-level aggregate data. Programs, like providing free education to girls, will yield long-term health benefits.

Bhalotra (2008) investigated the impact of aggregate income shocks on infant mortality in India and investigates likely mechanisms. A recent OECD-dominated literature reports the provocative finding that mortality at most ages is pro-cyclical. Similar analyses for poorer countries are scarce, and both income risk and mortality risk are greater in poor countries. This paper uses data and methods designed to avoid some of the specification problems in previous studies and it explores mechanisms and extensions that have not been previously considered. It uses individual data on infant mortality for about 150000 children born in 1970-1997, merged by cohort and state of birth with a state panel containing information on aggregate income. Identification rests upon comparing the effects of annual deviations in income from trend on the mortality risks of children born at different times to the same mother, conditional upon a number of state-time varying covariates including rain shocks and state social expenditure. Rural infant mortality is countercyclical, the elasticity being
about -0.33. This is despite the finding that relatively high risk women avert birth or suffer fetal loss in recessions. It seems in part related to recessions stimulating distress labor amongst mothers, in contrast to the case in richer countries, where they discourage labor market participation. Health-care seeking declines in recessions and this appear related to the opportunity cost of maternal time. Disaggregation reveals that the average results are driven by rural households in which the mother is uneducated or had her first birth in teenage, and that it is only girls that are at risk; boys are protected from income shocks. Exposure to poor conditions in the fetal and neonatal period appears to have a larger effect on infant mortality than similar exposure in the post-neonatal period.

Saikia, et al (2010) stated that the trend in mortality from the Sample Registration System data shows a slowdown in improvements, particularly since the mid-1990s. According to official life tables constructed by the Registrar General, there is a stagnating trend in infant mortality and an increasing trend in female child mortality for India. The ratio of child mortality rates to infant mortality rates obtained from the official life tables for the recent period does not follow any of the model life table patterns, which raises questions about the reliability of these rates. Using age-specific death rates from the Sample Registration System (SRS), new life tables constructed for the most recent period show lower levels of child mortality rates compared to those provided by the Sample Registration System (SRS).

According to Rohini Ghosh (2012), the countdown database to track the maternal and child survival rate, as set by the Millennium Development Goal, reported recently that India’s progress is not satisfactory in reducing newborn and child deaths. Articles on neonatal and child mortality in India were accessed from
PubMed/MEDLINE. Risk factors associated with neonatal and child mortality were reviewed in three crucial phases of pregnancy, childbirth and postnatal period. The review revealed economic disparity acts through various avenues of cultural belief and restrictions and is indirectly associated with care seeking behavior and utilization of health care, resulting in slow decline of child mortality rate in India. Secondly, cultural norms, practices, and beliefs are strongly associated with high neonatal mortality, contributing to the sluggish decline of overall child survival rate. Proximate determinants of child mortality, i.e., income, cultural behavior and beliefs, in multiplicity of Indian cultures, are closely associated with health seeking behavior, antenatal care, delivery practices and postnatal care of infants. It is concluded that apart from raising awareness among community leaders, family members responsible for care giving should be specially targeted for removal of hostile perceptions and barriers for improvement of child survival. Also there is need for developing new strategies for health education based on indigenous concerns, addressing socio-cultural barriers.

Understanding and addressing the increasing number of social influences on the overall health of the community is a growing concern for many in the public health sector. Infant mortality and morbidity are complex issues, influenced by multiple variants that have forced health systems and communities to reexamine current and new methodologies, means of assessments, and practice procedures in order to effectively impact poor birth outcomes (TCIMTF [Brochure], 2006). Infant mortality is currently the most assessable measure of the overall health and general well-being of a community. It embodies a social mirror of societal inequalities (Wise and Pursley, 1992). In general, infant mortality rates depicts not only the health, but governs how well a community addresses such issues as poverty, unemployment,
racism, societal support and education and their influence on the current and future health of its’ people (Lu et al., 2003).

With the increasing awareness of how biological, social, environmental and economic factors impact and increase the risk of infant mortality, many academic and government entities are researching and introducing innovative statistical models and interventions to identify contributory causes. City at MCH, a freestanding national organization of city and county health departments, maternal and child health (MCH) programs and leaders representing urban communities throughout the United States, is one of many national collaborations exploring ways to enhance infant mortality research (City at MCH, 2007). It is well known for its reconstruction of the current methodology of monitoring and investigating infant deaths. City at MCH employed a process that further investigates risk factors and effectively and efficiently focuses on interventions for specific groups, based on maternal and infant characteristics with introduction of the Perinatal Periods of Risk (PPOR) (TCIMTF, 2005). PPOR is a statistical analysis that allows for targeted interventions and prevention activities. The concept of PPOR is to create a standardized approach for communities and providers to examine infant mortality, identify new and existing gaps in systems, mobilize targeted studies, investigate or prevent activities, while creating easy and simple means of communication between community partners (Perinatal Periods of Risk Workgroup, 1998). The PPOR identifies four periods of risk that contribute to fetal and infant mortality: 1) Maternal Health/Prematurity; 2) Maternal Care; 3) Newborn Care; and 4) Infant Health (TCIMTF [Brochure], 2006; e.g., Appendix B). Based on several analyses nationwide, the majority of the infant deaths are often in the Maternal Health category. The Maternal Health component consists of preconception health behaviors and perinatal care, indicating how critical the role of preconception health
is in reducing infant mortality. In addition to Maternal Health/Prematurity, other components of PPOR and subsequent intervention topics include Maternal Care (Prenatal Care and High Risk Referral Obstetric Care), Newborn Care (Perinatal Management, Neonatal Care, Pediatric Surgery), and Infant Health (Sleep Position, Breast Feeding, Injury Prevention) (Skala, 2006). The PPOR mortality maps provide simple templates upon which to build greater interventions because most risk factors occur at different and multiple developmental stages (Skala, 2006). The frameworks of PPOR include two dimensions; age at death and birth weight. Traditionally, infant mortality has been only examined through a one-dimensional approach of mapping, the age at death. Phase I of PPOR identifies populations and periods with exceedingly high rates of infant death (Perinatal Periods of Risk Workgroup, 1998). For instance, in Tarrant County, the 2000 – 2002 PPOR Phases I analysis indicated that maternal health and prematurity was the largest contributor to infant mortality. Utilizing the PPOR approach provides an advantage to create interventions that are evidence-based and in line with the constant shifts in data.

Findings from the PPOR analysis, suggest social and cultural norms are contributing factors to the high infant deaths and that the current data resources do not adequately assess for such qualitative data. Traditional methodology typically examined infant mortality from a practitioner’s perspective, primarily centered on prenatal care and medical treatment. However, recent studies, have shown that neither the lack of nor late entry into prenatal care has a direct relationship with an increased risk of infant mortality (U.S. Department of Health and Human Services, 2007). Without controlling for poverty and the ability to legally access prenatal care; Hispanic infants have higher birth weights and IMRs equal to or less than those of White infants (CDC, 2002). In Tarrant County, the number of Hispanics who entered
prenatal care in all three trimester was far fewer than Blacks and Whites, yet Hispanics had the lowest number of infant deaths and low birth-weight infants in 2001-2003 (TCIMTF, 2005). Many attribute the positive birth outcomes among Hispanics as the Hispanic Paradox; an explanation for the surprisingly favorable outcomes involving theories of migratory practices (only the healthiest Hispanics immigrate to the United States, cultural protective factors, and elements related to social support (McGlade, Saha, and Dahlstrom, 2004). Although not totally agreed upon, it is evident that interventions centered on medical treatment along cannot solely impact infant mortality.

Simple collections of useful information such as income level, prior birth control methods, and employment, which is either missing or not collected on a majority of birth and death certificates, could potentially improve the observation of infant death from multiple perspectives, thus expanding the number and disciplines addressing the issue (TCIMTF, 2005). The process of integrating the clinical and social aspects of infant and fetal deaths is currently possible with a Fetal Infant Mortality Review Model (FIMR). With the model, information is collected through the FIMR process and aggregated with the current accessible clinical data to provide an insight about factors influencing fetal and infant deaths. Findings from FIMR can possibly isolate root causes, addressing the larger racial disparities (TCIMTF [Annual Report], 2006).

The Maternal and Child Health Bureau (MCHB) designed the community-based review process to address concerns regarding the existing taxed data systems (Hutchins, Grason, and Handler, 2004). During the late 80’s, early 90’s the MCHB funded several demonstration sites to test the original FIMR model, which was later
refined by the National Fetal and Infant Mortality Review Program (nFIMR), a collaboration between MCHB and the American College of Obstetricians and Gynecologists (ACOG) (Grason, Silver, and State Title V Program Representatives, 2004). With over 200 communities now implementing FIMR, the review process has adapted the course of action of improving resources and systems for women, infants and communities. The goal was to examine various social influences and systematic components that emerged from the review process (McDonnell, Strobino, Baldwin, Grason, and Misra, 2004).

FIMR programs bring together communities to review de-identified information from individual cases of fetal and infant death, to examine the social, economic, cultural, safety, and health systems factors surrounding a particular death (Appendix C). FIMR teams make recommendations for interventions and polices that address these factors, participate in or facilitate the implementation of the recommended strategies and policies, and assess their progress (Misra, Grason, Liao, Strobino, McDonnell, and Allston, 2004). Most FIMR teams typically operate with a two-tier structure, Case Review Team (CRT) – obstetric and pediatric providers, public health, SIDS representatives, social services/Medicaid, medical examiner and a Community Action Team (CAT) – consumers, advocates, policy makers, elected officials, hospital administrators, child care licensing, mental health. The CRT is composed of health, social service and other experts that examine the case summary, identifies issues, and makes recommendations for community and system changes. The CAT mainly consists of community stakeholders which take CRT recommendations to action (National FIMR [nFIMR], 2004). This action team reviews recommendations, prioritizes identified issues, and designs and implements interventions. Often the FIMR process is described as a “cycle of improvement” that
encourages new policies, practices, and/or programs to effectively improve the current systems and put new systems in place to consistently monitor emerging or persistent problems (Baltay and Chapin, 1999). The increasing rate of infant deaths and the growing disparity gap requires on-going monitoring of trends, as well as, consistent research of the causes, which the FIMR model supports. The qualitative and quantitative methodology of FIMR allows it to function as a comprehensive vehicle for policy development, quality assurance, and health systems assessment conducted at the community level (Grason et al., 2004).

Although mortality reviews are common in public health, they are often clinical in nature and focuses on improving medical practices. The Child Fatality Reviews (CFR) and Maternal Mortality Review (MMR) demonstrate efforts to improve the health of women and children by preventing mortality and morbidity. However, most result in addressing the medical components of health services. This is often due to a more accessible audience which includes those seeking medical treatment and the medical professionals (Hutchins et al., 2004). Based on the similarities with desired population, most reviews, particularly the CFR and FIMR are often compared and seen as an overlap in services, a mismanagement of funding and legislation. Although similar in intent, improving the well-being of children, the FIMR model qualitative data collection and emphasis on system improvement is what sets it apart from most reviews (Hutchins et al., 2004). CFR primarily uses recommendations/findings to address prosecutorial related issues, investigating child abuse and/or reviewing quality of care in individual cases (nFIMR, 2004). FIMR on the other hand, focuses on improving public health and all related service systems, which could include housing, environmental elements, substance abuse treatment, etc. (TCIMTF [Reference Tool], 2004). Beyond differences in scopes, FIMR and CFR
also differ in areas of structural and organization characteristics, membership, legislative authority, and review features such as the number of cases, case selection, and most importantly the sources of information (TCIMTF [Reference Tool], 2004). The actual source of information is an important element of any review process. However for the FIMR model, it is the most vital component and impacts the success of the entire review process. CFR teams primarily obtain information from the Medical examiner/coroner/justice of peace reports, law enforcement, child welfare program, the district attorney, and mental health services. FIMR teams also receive the same information, but it goes a step further to obtain a more comprehensive, interdisciplinary qualitative data from maternal/familial interviews, prenatal, labor & delivery, child health medical records, social services records, home visit/case management records, EMT transport reports, etc (TCIMTF [Reference Tool], 2004). The FIMR model includes the maternal interviews which may provide the most valuable information that is typically not available from other information sources (Hutchins et al., 2004). Maternal interviews provide insightful information about social, economic issues, as well as, the community’s role in addressing poor outcomes related to fetal and infant health (TCIMTF [Reference Tool], 2004).

The FIMR model is complex compared to other review processes. Consequently, few are evaluated for effectiveness and impact on infant mortality. Methodological strategies to increase the productivity of FIMR have been continuously tested and revised (Buckley and Chapin, 1999). Areas regarding the number of cases, cost, and staffing concerns are examples of a few components that have changed since the inception of the process. Home interviews are now regarded as the most critical element of FIMR (Buckley et al., 1999). A national evaluation of the FIMR process conducted over ten years ago resulted in researchers basing their
focus on characteristics vital to the model: recommendations, implementation of recommendations, performance of MCH services, and the assessment of the variations in the recommendations (Misra et al., 2004). Other evaluation efforts involved studies that identified and compiled categories, including such risk factors as smoking and congenital malformations as areas to improve FIMR efforts (Buckley et al., 1999). Although these factors were no surprise to researchers, other categories were created because of the number of recommendations made that were not directly related to medical or physical health, such as grief support, or the high cost of funerals. The evaluations have shown the comprehensiveness of FIMR, while providing best practices and insight for new and existing sites. The involvedness of the model creates many challenges in assessing the overall effectiveness FIMR. The lack of a comprehensive evaluation component cannot provide sites with define methods of improving the death review process, creating strategies on the implementation of recommendations, policy development, securing home interviews, and community mobilization (Hogue, 2004).

Mattijns Vandezande; Koenraad Matthijs  In an effort to unravel the diffusion and mechanisms of long-term fertility change, there is a growing body of literature on the intergenerational transmission of reproductive behavior. Several reproductive traits have already been studied in an intergenerational dimension, but the impact of infant deaths and their clustering within families on these intergenerational mechanisms of reproduction has been overlooked. This paper explores the continuity of infant deaths between successive generations. Data are from the COR*-database, a longitudinal multigenerational life course dataset covering the larger Antwerp area in the second half of the nineteenth century. We use the family as main unit of analysis, a perspective that proves a useful alternative to that of the individual child.
Abimbola Adebimpe Allen; Paul Oluwatomipe Adekola 2014 Improve sanitation and health delivery has become an important issue because of it significant implication of quality of life in the society. This paper examines the effect of poor sanitation on infant mortality and effort of both government and individual at combating the menace. Demographic records of the Ibadan North LGA from 2006 to 2010 and perceptions of the people were obtained from Focused Group Discussions, with mothers of between 15 and 49 years at 6 purposively selected residential areas. Analysis of the demographic records shows that the study area, whose average total population was 306,795 as at 2006 national census recorded about 1431 infant deaths. The study indicates that poor sanitation attitude of the residents of the LGA were the reason of high infant mortality. The study therefore concludes that infant mortality can be reduced to the barest minimum if good sanitation is mandated for each household by the relevant local authorities.

Karen L Kramer; Russell D Greaves ;Sonia Bhalotra; Christopher French; Juliet Warren; Nidhi Jain; Abhishek Singh; Praveen Pathak This paper examines the trends in economic inequalities with respect to infant and child mortality in India using three rounds of the Indian National Family Health Survey conducted in 1992–1993, 1998–1999, and 2005–2006. The paper uses concentration index, and pooled discrete-time survival regression model to examine the aforementioned trends and regional patterns. The findings suggest a decreasing trend in economic inequality in infant mortality but an upward trend in economic inequality in child mortality in India. Economic inequalities in infant mortality have narrowed in the southern region, whereas they have widened in the western region and risen in the northern region.
However, mixed trends in concentration indices were found in the different regions of India in the case of child mortality.

KM Mustafizur Rahman; Prosannajid Sarkar; Engin Erdoan; Meliha Ener; Feyza Arica; Chukwuedozie Kelechukwu Ajaero; Obianuju Linda Owoh; Andrew K Jorgenson; James Rice Drawing from various bodies of social scientific literature and research, the authors assess the extent to which infant and child mortality rates in less-developed countries are affected by the percent of domestic populations living in urban slum conditions. Results of first-difference panel model estimates of 80 less-developed countries from 1990 to 2005 indicate that growth in the percent of populations living in urban slum conditions positively affects both forms of mortality, and the effects are much more pronounced for African countries than for less-developed countries in Latin America and Asia. These findings hold, net of economic development, fertility rates, world-economic integration, and other factors. Cross-sectional analyses of infant and child mortality rates in 2005 that include additional controls provide further evidence of the mortality/urban slum relationships found in the panel model estimates. The authors conclude by highlighting the theoretical implications of the results and describe the next steps in this research agenda.

Sanjit Sarkar; Kasturi Mondal; Gregory Brock; Yinghua Jin; Tong Zeng; Ade Nitin Dhanusing; Rachel A Gordon, Hillary L Rowe; Karina Garcia Evidence-based policy making often has a direct or indirect goal of promoting family resilience. The authors consider the ways in which scholarly disagreements about evidence can challenge this goal, focusing on the debate regarding whether adult–infant bed sharing increases the risk of infant mortality. A central issue is whether scholars conclude that public policy should recommend against all bedsharing or only bedsharing in
particular risky circumstances. The authors use context-based evidence-based policy making (Dobrow, Goel & Upshur, 2004) as a framework for a review of studies of sudden infant death syndrome (SIDS) correlates and SIDS mechanisms related to bedsharing as well as the reasons parents bed share. The authors discuss the implications of different interpretations of the evidence and point to the potential of adversarial collaboration in helping to address the points of disagreement and ultimately better support family resilience. The issues discussed in this case are broadly relevant to other debated evidence for family policy making.

Tania Barham; Audrey K L Siah; Grace H Y Lee In reviewing the population policy in 1984, the Malaysian government called for a major shift from family planning to family and human resource development to achieve an ultimate population of 70 million by 2100. However, regardless of the government's initiatives since 1984, Malaysia's fertility rate still declined. This study examines the short-run and long-run relationship and causality between female labour force participation rate, infant mortality rate and fertility in a developing country in Asia – Malaysia. We employ the unit root test which allows for two structural breaks, and the break dates are then used as dummy variables in the bounds testing procedure within an autoregressive distributed lag (ARDL) modelling approach and Granger-causality test. The results indicate that mortality changes have a significant and positive long-run impact on fertility rate and women's child bearing decisions are unaffected by their employment situation. In addition, we do not find evidence that presence of children hinders re-employment and continuous female employment.

Maria Aparecida Vedovato; Roberto Wagner Loureno; Maria Rita Donalisio Cordeiro Janetmccalman; Ruthmorley; Lensmith; Iananderson This paper presents
results from the first two longitudinal historical cradle-to-grave datasets constructed in Australia: the Aboriginal population of the state of Victoria, reconstituted using genealogical research and vital registrations, 1835–1930; and an impoverished European population sample born at the Melbourne Lying-In Hospital, 1857–1900 and traced until 1985. It investigates the comparative infant mortality between these two severely disadvantaged population samples and finds apparently contradictory results. Aboriginal people had shorter survival at all ages apart from infancy. Infant mortality among the poor white women delivering in an urban charity hospital was extreme but their survival at all later life stages were superior to that of the Aborigines. Critical for both groups of babies and their mothers was the presence or absence of household support during pregnancy and the first year of life, and the poor whites' birth weights embodied a social gradient of degrees of family and breadwinner support. Aboriginal babies spent their first year of life, despite the community trauma of cruel government ‘management’ and exclusion from entitlements, in an ecology that protected them from the disorders of feeding and gastrointestinal disease that cut down so many of the poor white babies. The differences in both mortality and causes of death indicate very different relationships between babies and their mothers and fathers and with the state. The sudden fall in the Lying-In Hospital infant mortality from 1887 was effected by direct state and medical interventions. The equally sudden and continuing rise in infant mortality among the Victorian Aboriginal community can be traced to their expulsion from the support of the reserves and the commencement of decades of ‘invisibility’ and denial of state entitlements and medical care.☆ Funded by the Australian Research Council.

Marco Antonio Palma-SolS; Carlos Álvarez-Dardet Daz; Álvaro Franco Giraldo; Ildefonso Hernández-Aguado; Santiago PRez-Hoyos; Pushkar A number of
Cross-national studies find that democratic rule has beneficial effects on the health of nations. These studies, however, sidestep the key role of state governments—especially in federal systems like India—in providing those public goods and services that have an impact on health outcomes. Like national governments, state governments differ in the quantity and quality of public goods they provide. Consequently, interstate variations in health outcomes are quite common and even substantial. This article examines infant mortality rates (IMRs) in India’s 29 states—or ‘mini-democracies’—to show that many Indian states have achieved good/moderate IMRs, but others lag behind. To explain such divergent health outcomes across India’s states despite six decades of democratic rule, the article scrutinizes the causal logic of three mechanisms that are said to activate the democracy-good health link: (1) political competition; (2) civil society activism; and (3) ideational changes. The discussion points to a long list of other enabling factors—whose presence varies across India’s states—that are necessary for democracy’s virtuous effects to be realised.

Carrie L Shandra; John M Shandra; Brucelondon The authors conduct a cross-national analysis that tests the hypothesis that International Monetary Fund structural adjustment adversely affects health in Sub-Saharan Africa. In doing so, the authors use two-way fixed effects regression models for 30 nations from 1990 to 2005 to analyze infant mortality. The authors find substantial support for this line of reasoning. Specifically, the authors find that higher levels of International Monetary Fund structural adjustment correspond with higher levels of infant mortality within Sub-Saharan African nations. The results indicate that structural adjustment affects infant mortality indirectly via human immunodeficiency virus prevalence, access to an improved water and sanitation source, female educational attainment, debt service, foreign investment, international trade, and gross national product per capita. The
authors conclude by discussing the findings, methodological implications, policy suggestions, and possible directions for future research.

Ana-maria Burlea Appraise infant mortality evolution at different territorial scales, identify disparities in terms of trend evolution and explore the contribution of some socioeconomic factors (educational attainment, unemployment rate and ethnicity) in the existing regional differences of infant mortality levels. As the aim of our study is to identify geographic disparities based on different spatial tendencies in infant mortality evolution, trend analysis was the most suited method. Cluster analysis was used to organize data into meaningful structures and allowed the identification of relatively homogenous groups of counties and municipalities. With the help of GIS techniques we have created cartographic material for a better visualization of the results. Linear regression was used to analyze the contribution of some socioeconomic factors on regional differences in infant mortality level. The results have demonstrated that, although the general downward trend is characteristic for infant mortality evolution in Romania, important variations between different geographic areas and between different social classes remain. Determined by the level of analysis, the results will vary. The model that summarizes the combined influence of all variables on infant mortality at national level explained 25% of the infant mortality variability and only 7% at district level. Of all independent variables, percentage of population with no education was the only indicator identified as having a significant influence on infant mortality. Multilevel analysis of infant mortality can give to scientists a better perspective and a better understanding of its relations with socioeconomic and biological determinants.
Lucy Burns; Elizabeth Conroy; Richard P Mattick Introduction and Aims. The rate and correlates of infant death in those born to opioid-dependent women are unclear. This study aims to determine the infant mortality rate of infants born to women on a methadone program during pregnancy and to identify any modifiable risk factors. Design and Methods. A retrospective study of live births to all women in New South Wales, Australia during the period 1995-2002. Using record linkage four groups were compared: (i) live births to women on a methadone program during pregnancy who subsequently died during infancy; (ii) live births to women not on a methadone program who subsequently died during infancy; (iii) live births to women on a methadone program during pregnancy who did not die during infancy; and (iv) live births to women not on a methadone program who did not die during infancy.

Results, Discussion and Conclusion. The infant mortality rate was higher among infants whose mothers were on methadone during pregnancy (24.3 per 1000 live born infants in group 1 and 4.0 per 1000 live born infants in group 2) compared with infants of all other mothers. The single main cause of death for all infants was Sudden Infant Death Syndrome. There was a higher rate of smoking among women on methadone. The findings suggest that methadone and non-methadone infant-mother pairs have different symptom profiles, diagnostic procedures and/or different patterns of access to care.[Burns L, Conroy E, Mattick RP. Infant mortality among women on a methadone program during pregnancy.

Alan Fernihough; Mark E Mcgovern The timing and sequencing of fertility transitions and early-life mortality declines in historical Western societies indicate that reductions in sibship (number of siblings) may have contributed to improvements in infant health. Surprisingly, however, this demographic relationship has received little attention in empirical research. We outline the difficulties associated with
establishing the effect of sibship on infant mortality and discuss the inherent bias associated with conventional empirical approaches. We offer a solution that permits an empirical test of this relationship while accounting for reverse causality and potential omitted variable bias. Our approach is illustrated by evaluating the causal impact of family size on infant mortality using genealogical data from 13 German parishes spanning the sixteenth, seventeenth, eighteenth, and nineteenth centuries. Overall, our findings do not support the hypothesis that declining fertility led to increased infant survival probabilities in historical populations.

Akira Nishiyama This study investigates the effects of GDP per capita on infant mortality using panel data from 83 developing countries over a period of 40 years. Although economic growth broadly decreases infant mortality, the impact of economic growth on infant mortality for the periods of economic booms and slumps is asymmetrical. Positive economic growth may have weak, mixed effects on a reduction in infant mortality, but negative economic growth has a strong, adverse impact.

Nynke Van Den Boomen; Peter Ekamper At the end of the nineteenth century, infant mortality rates started to fall rapidly in the Netherlands. Unfortunately, not all regions benefited from this development. High infant death in the Roman Catholic provinces of North-Brabant and Limburg has often been ascribed to a growing reluctance of Catholic mothers to breastfeed their infants after 1870. This was supposedly caused by the combination of a strict, prudish Roman Catholic norm prohibiting women from baring their breasts and a refusal to accept new medical insights into healthy childcare. The food given to weaned children was generally of such poor quality that many infants succumbed to gastrointestinal diseases.
Consequently, infant mortality rates caused by water- and food-borne infectious diseases would have been higher amongst weaned babies. By using recently digitised municipal cause-of-death registration statistics, it is possible to see if there are, indeed, indications of a shift in breastfeeding patterns after 1870. First, the authors look at infant deaths from all causes to see whether Roman Catholic municipalities underwent a rise in the mortality of children under the age of one. Second, the authors do the same for cause-specific infant mortality from typhus, typhoid fever, diarrhoea, dysentery, acute diseases of the digestive system and cholera. Based on the outcomes, there was no homogenous rise in infant mortality in all Roman Catholic municipalities. Furthermore, there is no indication that infant mortality due to digestive diseases increased uniformly in all Roman Catholic communities between 1875 and 1899. Either some communities were able to counteract the negative effects of a shift towards weaning or changes in breastfeeding patterns were not a specific Roman Catholic phenomenon at all.

John M Shandra; Carrie L Shandra; Bruce London According to world polity theory, international health and women’s non-governmental organizations should improve health in poor nations by providing health, reproductive, and educational services. However, there are suggestions that their effectiveness may be limited by a variety of factors. These factors include their projects being small-scale, ad hoc, or reformist. Further, non-governmental organizations may implement projects that satisfy donor interests rather than a local population’s needs. In order to evaluate these claims, we construct cross-national models of infant morality from 1990 to 2005 for a sample of 74 poor nations. Initially, we find no support for world polity theory claims that health and women’s non-governmental organizations decrease infant mortality. However, we re-specify the models to test a ‘political opportunity structure’
hypothesis that democracy enhances the ability of non-governmental organizations to improve health. We do so by including interaction terms between these two variables and find substantial support for this hypothesis. Specifically, the results suggest that health and women’s non-governmental organizations decrease infant mortality in democratic but not repressive nations.

Tommy Ferrarini; Thor Norström Ferrarini T, Norström T. Family policy, economic development and infant mortality: a longitudinal comparative analysis.

Arindam Nandi India has long struggled with persistent problems of sex-selective abortions and the neglect of female children. In 1996, the Pre-Natal Diagnostics Techniques Act was implemented to stop the practices of prenatal sex determination and selective abortions. This paper examines whether the law has been effective in reducing gender imbalance, and in turn potentially exacerbated post-natal discrimination against newborn girls. Using retrospective birth history data from the Indian District Level Household Survey (2002–2004), we exploit a natural experiment involving a variation in the timing of the law across states. We analyse the differential impact of the law on newborn sex ratios and infant mortality rates. Our findings indicate that the law significantly increased the likelihood of a female birth, improving female-to-male sex ratios at birth. We also find that it was generally associated with no change in the relative mortality of infant girls.

Sarah Genevieve Hastings; Ian Gregory; Paul Atkinson Making effective use of digital texts is one of the major challenges facing the humanities. This article explores a novel method of using a large corpus of British newspapers to help explain why three neighboring rural districts in England showed very different patterns of infant mortality decline in the second half of the nineteenth century. Quantitative
analysis does not reveal any major differences between these districts that might explain this. Repeatedly querying the corpus using different combinations of search terms and place-names, the authors show significant differences in the quality of local government between these districts. They argue that place-centered reading, as they term this approach, can be used to help explain patterns found using conventional quantitative geographical information systems (GIS) approaches.

Emilio Gutierrez This paper exploits the sharp change in air pollutants induced by the installation of small-scale power plants throughout Mexico to measure the causal relationship between air pollution and infant mortality, and whether this relationship varies by municipality's socio-economic conditions. The estimated elasticity for changes in infant mortality due to respiratory diseases with respect to changes in air pollution concentration ranges from 0.58 to 0.84 (more than ten times higher than the Ordinary Least Squares estimate). Weaker evidence suggests that the effect is significantly lower in municipalities with a high presence of primary healthcare facilities and larger in municipalities with a high fraction of households with low education levels.

Cvorovic Jelena Gypsies/Roma make up the largest minority in Europe. Roma communities tend to be segregated and characterized by poverty, unemployment, poor education, and poor quality housing. So far, the European strategy for Gypsy/Roma integration proved insufficient because it fails to account to the normative nature of the isolationist and ethnocentric nature of certain elements of Gypsy culture, as well as the deep and mutual distrust between Gypsies and non-Gypsies within European countries. In Serbia, the Gypsy population tends to suffer disproportionately from higher rates of poverty, unemployment, illiteracy, and disease. At the same time, the
Serbian Gypsy women average an infant mortality rate between 10-20%. For most of these girls/women, endogamous, arranged marriages are negotiated at an early age, usually without their consent. Among these women, a certain level of infant mortality is “expected”, following an underinvestment in some children manifested in their care, feeding, and the response to their illnesses. These juvenile arranged marriages, subsequent reproduction and child mortality are culturally self-sufficient and hence pose a challenge for international human rights: while many Gypsy girls/women are being denied the right to choose whom and when to marry, the Gypsy community itself openly accepts juvenile arranged marriage as a preservation strategy and means of cultural, economic, and societal maintenance and independence. Although efforts to improve education, health, living conditions, encourage employment and development opportunities for Gypsies/Roma are essential, these objectives cannot be attained without directing the changes needed within Gypsy/Roma culture itself. The initial point for change must come from an increased sense of responsibility among the Gypsies themselves.

Amy Kaler; Krishnarajah Nirantharakumar; Tom Fowler; Karen L Saunders; Sam Ramaiah; Marian F Macdorman; William M Callaghan; T J Mathews; Donna L Hoyert; Kenneth D Kochanek; John Sandberg; Steven Rytina; Valrie Delaunay; Adama S Marra; Bárbara A Revuelta-Eugercios This paper examines the existence of a mortality penalty for illegitimate abandoned infants in the Foundling Hospital of Madrid, La Inclusa, during the period 1890–1935, in the context of the mortality experience of the city. A rich dataset on the life histories of all infants abandoned in the city of Madrid (almost 60,000 children), nominally linked to births, has allowed the study of the determinants of mortality of foundlings, newborns in the city, and the study of the determinants of abandonment. Contrary to previous findings, our results
for La Inclusa show no evidence of an illegitimacy penalty among foundlings and, in some cases, show even better prospects for them. However, this situation did not reflect the circumstances of the city, as illegitimate infants were both more likely to suffer a neonatal death and to be abandoned. The explanation proposed in this paper is that the health of infants born of wedded couples that ended up resorting to abandonment was possibly poorer than that of those born of single or migrant mothers, as the situation triggering abandonment meant that infants were under very hard conditions, possibly worse than those single women faced in the event of a pregnancy.

Gretchen A Condran; Jennifer Murphy Historically, public health workers, physicians, and reformers have used the infant mortality rate as an indicator of the goodness of a society—its general welfare, the justness of its political system, the efficacy of its public works, the benevolence of its powerful; a high rate of death among the very young was an index of a community's shame. These views of the infant mortality rate as reflecting general characteristics of a society were widely displayed in the second half of the nineteenth century even as most disease entities were becoming more narrowly defined and ordinarily linked not to the nature of society or individual predisposition but to specific pathological organisms. Using Philadelphia as a case study, we examine the history of the infant mortality rate from 1870 through 1920, both the technical aspects of its calculation and its use as an indicator of broad societal problems and a catalyst for policy. Our emphasis is not on explaining the trends in the death rates of the very young but on the uses and meanings given to the infant mortality rate during the second half of the nineteenth century and the first decades of the twentieth century specifically as they related to
three efforts to lower infant death rates—removing infants from the city, improving the supply of milk, and establishing child hygiene programs.

Roberto M Gonzalez; Joseph J Mangano; Mian B Hossain; James F Phillips; Brian Pence In South Asia women are often the primary decision-makers regarding child health care, family health and nutrition. This paper examines the proposition that constraints on women’s status adversely affect the survival of their children. Survey data are used to construct indices of women’s household autonomy and authority, which are then linked to longitudinal data on survival of their children. Proportional hazard models indicate that enhanced autonomy significantly decreases post-neonatal mortality. Enhanced household authority significantly decreases child mortality. A simulation based on estimated effects of eliminating gender inequality suggests that achieving complete gender equality could reduce child mortality by nearly fifty percent and post-neonatal mortality by one-third.

Pushkar Maitra; Anu Rammohan In this paper, using the 1998-1999 National Family Health Survey data-set from India, we study whether there are gender differentials in infant mortality and child nutrition. Our analysis finds no evidence of gender differentials in survival probability. However, conditional upon surviving the first year, girls are found to have poorer height-for-age outcomes. There are also significant regional differences in both survival probabilities and nutritional outcomes. We show that the height-for-age z-score is significantly lower for higher birth-order children (later-born children), and the effect is monotonically increasing. Finally, parental education and household wealth have statistically significant effects on both survival outcomes and child nutrition.
Sren Edvinsson; Anglique Janssens This introduction surveys the field of family clustering of deaths and discusses the contributions in this special issue. The main focus is on mortality in historical contexts. Clustering of deaths in families has been found both in historical and contemporary populations, and we argue that the ‘family approach’ to infant and child mortality yields important and interesting insights for our understanding of different mortality patterns and the mortality transition. The articles in this issue, representing different but complementary approaches to the problem of death clustering, demonstrate that we should be aware of the strong family effects on child health, but also that we need to develop adequate methods for the analysis of this complex phenomenon. Here we discuss several explanations for death clustering, such as different biodemographic factors and those focusing on socioeconomic and cultural variables. We also discuss some of the methodological challenges in studying family clustering, and emphasize the need for comparison and the adoption of common measures.

Henrik Holmberg; Gran Brostrm This article considers the interfamily clustering of infant mortality (defined as mortality during the first year of life). We developed and evaluated statistical tools to detect clustering and a measure to quantify excess clustering for nineteenth-century data from Skellefteå, Sweden. The detection was performed using the standard methods of generalized linear models and logistic regression. The index of clustering was constructed by comparing the observed numbers of families with specific numbers of deaths to the corresponding observed numbers, after correcting for explanatory variables. To the best of our knowledge, no clustering index of this kind has ever been created.
Kristina Popova (1983-2002); Daniel A Powers; Grayna Liczbiska The purpose of this study was to show the differences in the mortality rates of children from Catholic and Lutheran families in 19th century Poznań, and to elucidate the causes of these differences. Data from Catholic and Lutheran parish death registers were used. The infant death rate (IDR), neonatal and postneonatal death rates and life table biometric functions were calculated and causes of deaths were characterized. The worst child mortality values (IDR=394.4; neonatal and postneonatal death rates, respectively, 117.1 and 277.4; \( e_0 = 16.14 \) years; Crow's Index=2.47) were obtained for the poor Catholic Parish of St Margaret. The lowest infant and neonatal and postneonatal death rates were observed to have occurred in the Catholic Parish of St Maria Magdalena situated in the city's more affluent central area (mortality rates, respectively, 269.9, 93.1 and 176.9; \( e_0 = 24.63 \) years; Crow's Index=0.96). The widest range of differences with regard to death rates was found for the Lutheran Parish of St Cross (the infant, neonatal and postneonatal death rates were, respectively, 293.1, 99.1 and 193.9; \( e_0 = 28.03 \) years; Crow's Index=0.92). The St Cross Parish encompassed a fairly large area of the city characterized by varying ecological conditions. Among infants and young children from the three studied populations a high frequency of deaths due to infectious diseases, diarrhoeas, dysenteries and tuberculosis were observed. Differences in the mortality of children from Catholic and Lutheran families in 19th century Poznań resulted from ecological conditions, among which water played the most important role, rather than from religious differences.

Aigbe; Gladys O; Zannu; Ajibola E 2012; Louis Anthony Tony Cox; Christopher Wildeman This article extends research on the consequences of parental incarceration for child well-being, the effects of mass imprisonment on black-white inequalities in child well-being, and the factors shaping black-white inequalities in
infant mortality by considering the relationship between imprisonment and infant mortality, using individual- and state-level data from the United States, 1990 through 2003. Results using data from the Pregnancy Risk Assessment Monitoring System (PRAMS) show that parental incarceration is associated with elevated early infant mortality risk and that partner violence moderates this relationship. Infants of recently incarcerated fathers who are not abusive have twice the mortality risk of other infants, but there is no association if the father was abusive. Results from state-level analyses show a positive association between the imprisonment rate and the total infant mortality rate, black infant mortality rate, and black-white inequality in the infant mortality rate. Assuming a causal effect, results show that had the imprisonment rate remained at its 1990 level, the 2003 infant mortality rate would have been 3.9 percent lower, black-white inequality in the infant mortality rate 8.8 percent lower. Thus, results imply that imprisonment may have health consequences that extend beyond ever-imprisoned men to their social correlates and that these health spillover effects are not limited to infectious disease.

Ehsanul Haq; Quamrul Hasan Chowdhury; Rafiqul Islam; Kamal Hossain; Engin Erdoan; Meliha Ener; Feyza Arica; Kulkarni P D; Tiwari V K; Raj Sherin T P; Awasthi Shally; Karen L Kramer; Russell D Greaves National census data show that the modern demographic transition—the recent trend toward declining mortality and fertility—is well underway in most countries. A different picture emerges when data from small-scale societies in unindustrialized parts of the world are considered. Many of these small-scale societies are also adapting to rapid changes in their subsistence economies. In this article, we examine the relationship between the pace of acculturation, infant mortality, and fertility levels among Pumé foragers and horticulturalists, two related groups of native South Americans. During the earliest
stages of acculturation, Pumé horticulturalists experience not only a rapid drop in infant mortality but also a rise in birth rates. An anthropological view of demographic transitions provides important insight into how small-scale societies are affected by exposure to the labor market economy and has practical applications to effective development initiatives and public health policies.

Emiko Higami; Ken’ichi Tomobe; Xi Chen; Rosa M Chow; Gunner W Knutson; Daniel Muoz Navarro; Patrick Wallis; Cliff Webb; Chris Minns; Tine De Moor; Anne-Emmanuelle Birn; Wanda Cabella; Raquel Pollero; Anne-Emmanuelle Birn; Wanda Cabella; Raquel Pollero; Francesca Moore; Elsie R Pamuk; Regina Fuchs; Wolfgang Lutz Research on the social determinants of health has often considered education and economic resources as separate indicators of socioeconomic status. From a policy perspective, however, it is important to understand the relative strength of the effect of these social factors on health outcomes, particularly in developing countries. It is also important to examine not only the impact of education and economic resources of individuals, but also whether community and country levels of these factors affect health outcomes. This analysis uses multilevel regression models to assess the relative effects of education and economic resources on infant mortality at the family, community, and country level using data from demographic and Health Surveys in 43 low-and lower-middle-income countries. We find strong effects for both per capita gross national income and completed secondary education at the country level, but a greater impact of education within families and communities.

Lauren Hale; Julie DaVanzo; Abdur Razzaque; Mizanur Rahman Infant and child mortality rates have decreased substantially in Matlab, Bangladesh, as they have in many developing areas. We use data from the Matlab Demographic Surveillance
System on nearly 94,000 singleton live births that occurred between 1987 and 2002 to investigate the extent to which the change in mortality over this period can be explained by changes in reproductive patterns and socio-economic characteristics. We estimate Cox proportional hazards models for four subperiods of infancy and childhood. Changes over time in reproductive patterns (maternal age, parity, and pregnancy spacing) and in the socio-economic characteristics we consider (e.g. maternal education, SES) explain between 10 and 40% of the decline in mortality rates. Changes in maternal education explain the largest portion of the reduction in infant and child mortality over time that we are able to explain, followed by reductions in the incidence of short interpregnancy intervals. In the other direction, decreases in fertility over time led to increases in the proportion of births that were first births, putting upward pressure on mortality.

Henry-Sanchez Brenda L; Geronimus Arline T Despite shared colonization histories between the United States and Latin America, research examining racial disparities in health in the United States has often neglected Latinos. Additionally, descendants from Latin America residing in the United States are often categorized under the pan-ethnic label of Hispanic or Latino. This categorization obscures the group's heterogeneity, which is illuminated by research showing consistent differences in health for the three largest segments of the Latino population—Mexicans, Puerto Ricans, and Cubans. We examine whether the patterns of infant mortality associated with race in the non-Latino population also follow for Latinos. We also examine whether we can attribute patterns of infant mortality between the three largest Latino sub-groups to a process we term segmented racialization. We find that race operates for Latinos the same way it does for the non-Latino population and that there seems to be some evidence to support our segmented racialization
hypothesis. The results point to the need to abandon the practices of combining Latino sub-groups as well as ignoring the racial diversity within the Latino population in health research.

Joseph Misati Akuma High infant mortality rates remain a great challenge to the Kenyan Government as she strives to attain the Millenium Development Goals (MDGs). In its current Development Blue – Print, Vision 2030, the country aims at eliminating high poverty levels and reduce the high regional inequalities. This comparative paper focuses on the determinants of infant mortality in Kenya. It specifically examines the regional differences in infant mortality among the various regions in the country classified into two broad categories as High mortality and Low mortality regions respectively. Data used was derived from birth histories in the Kenya Demographic and Health Survey (KDHS, 2009). The findings of the study indicate that regional differences in under- one mortality are quite significant. The results show that low educational attainment, low socio–economic status and short intervals between births lead to the observed higher levels of infant mortality in the high mortality region. It is concluded that the regional differences in infant mortality are a result of the differences in the level of economic and social development. It is recommended that the Government implement policies aimed at increasing the length of birth intervals and improving the womens financial and occupational status. Lastly, free secondary education will go along way in improving the welfare of womenfolk especially in the high mortality region.

Xingchen Chiachi Lin; Vikram Nathanial; Michael R Haines; Ratio Ram; Tommy Bentsen; Martin Drive Most micro level studies in the social sciences have focused on the impact of different measured variables. While some studies have also
dealt with unobserved variation, it has usually only been controlled for to perfect the estimates of the observables. In this article, the authors applied a modified version of a recently developed method designed to quantify the effect of unobserved variation in continuous time multilevel models, called a median hazard ratio. It allows a direct comparison of the effect of unobserved heterogeneity with standard relative risks. The method is used in an analysis of infant and child mortality in southern Sweden during the period 1766-1895. The empirical findings indicate that unmeasured differences between families were more important than either socioeconomic status or gender throughout this period.

Katherine E Waller; John B Williamson There is an extensive literature analyzing the relationship between democracy and infant mortality; however, findings are mixed. Some studies find a significant inverse relationship, while others conclude that no such relationship exists. We seek to take the debate in a new direction, overlooked in prior research, by providing a theoretical rational for and empirical evidence of a quadratic relationship, in which countries with components of both autocracy and democracy have higher infant mortality. We test lagged, cross-sectional models on a sample of 47 Sub-Saharan African nations. We find that a quadratic model better explains cross-national variation in infant mortality than the linear alternative. Infant mortality tends to be higher in hybrid regimes, relative to both autocracies and democracies. Hybrids appear to be politically unstable, which may in part account for their greater infant mortality. Hybrid regimes exist in precarious positions with detrimental consequences for population health.

M Rodwan Abouharb; Anessa L Kimball Systematic data on annual infant mortality rates are of use to a variety of social science research programs in
demography, economics, sociology, and political science. Infant mortality rates may be used both as a proxy measure for economic development, in lieu of energy consumption or GDP-per-capita measures, and as an indicator of the extent to which governments provide for the economic and social welfare of their citizens. Until recently, data were available for only a limited number of countries based on regional or country-level studies and time periods for years after 1950. Here, the authors introduce a new dataset reporting annual infant mortality rates for all states in the world, based on the Correlates of War state system list, between 1816 and 2002. They discuss past research programs using infant mortality rates in conflict studies and describe the dataset by exploring its geographic and temporal coverage. Next, they explain some of the limitations of the dataset as well as issues associated with the data themselves. Finally, they suggest some research areas that might benefit from the use of this dataset. This new dataset is the most comprehensive source on infant mortality rates currently available to social science researchers.

Adedini Sunday A; Odimegwu Clifford; Imasiku Eunice N S; Ononokpono Dorothy N; Ibisomi Latifat There are substantial regional disparities in under-five mortality in Nigeria, and evidence suggests that both individual- and community-level characteristics have an influence on health outcomes. Using 2008 Nigeria Demographic and Health Survey data, this study (1) examines the effects of individual- and community-level characteristics on infant/child mortality in Nigeria and (2) determines the extent to which characteristics at these levels influence regional variations in infant/child mortality in the country. Multilevel Cox proportional hazard analysis was performed on a nationally representative sample of 28,647 children nested within 18,028 mothers of reproductive age, who were also nested within 886 communities. The results indicate that community-level variables
(such as region, place of residence, community infrastructure, community hospital delivery and community poverty level) and individual-level factors (including child's sex, birth order, birth interval, maternal education, maternal age and wealth index) are important determinants of infant/child mortality in Nigeria. For instance, the results show a lower risk of death in infancy for children of mothers residing in communities with a high proportion of hospital delivery (HR: 0.70, \( p<0.05 \)) and for children whose mothers had secondary or higher education (HR: 0.84, \( p<0.05 \)). Although community factors appear to influence the association between individual-level factors and death during infancy and childhood, the findings consistently indicate that community-level characteristics are more important in explaining regional variations in child mortality, while individual-level factors are more important for regional variations in infant mortality. The results of this study underscore the need to look beyond the influence of individual-level factors in addressing regional variations in infant and child mortality in Nigeria.

Sanjukta Chaudhuri; Roshina Yusufi; Nathan Pilkington Variables from modern epidemiological models can be used to reconstruct infant-mortality rates, childhood-growth patterns, and the onset of fertility in the Roman Empire from osteoarchaeological evidence. The anthropometry of Roman sub-adult skeletons compares closely to that of the unhealthiest modern and premodern populations, thus supporting pessimistic estimations of life expectancy at birth for Roman populations. Furthermore, the onset of female fertility was delayed due to childhood morbidity and malnutrition.

Judge This paper investigates variations in policy responses to perceptions of social inequities in infant mortality in Canada, Chile, Sweden and the United
Kingdom. It outlines patterns and trends in inequalities in infant mortality and some other birth outcomes, distinguishing between the use of routine data in some settings and research evidence in others. It suggests that some distinctive approaches about policies to reduce inequalities can be identified in the four countries. A number of emerging issues are also identified. One concerns the focus of interventions. Another relates to the use of targets. The third concern relates to the ways in which health inequalities are measured and monitored. Finally, the paper recommends the need for more research into areas such as the effectiveness of interventions, the nature of the problems facing ethnic minorities and the possible role of different social welfare regimes in achieving desired outcomes. (author )

Edwin Pelfrene; Heidi Cloots; Erik Hendrickx; Franklin W Goza; Edward G Stockwell; Kelly S Balistreri This study presents an ecological analysis of the relationship between infant mortality and economic status by race in metropolitan Ohio, using census data on mother’s residence and economic status determined by the percentage of low-income families living in each area. The analysis updates previous studies as white-non-white comparisons for total infant mortality are examined for the US censuses of 1960, 1970, 1980, 1990 and 2000; and more detailed period- and broad cause-specific rates are presented for 2000. A pronounced inverse association is consistently found between income status and infant mortality for whites, while for non-whites this pattern first emerges in 1979-81, disappears during the 1980s and then returns more strongly during the 1990s. Similarly, the 2000 data reveal a consistent inverse pattern between income status and infant mortality for white and non-white neonatal and postneonatal death rates, as well as exogenous cause-specific death rates. It is concluded that low-income whites and non-whites have infant mortality rates
substantially higher than the overall rate for the population. Policy implications are discussed.

Madhav Joshi; Sren Edvinsson; If Gararsdttir; Gunnar Thorvaldsen; Katerina Sadetskaya The popular view of New Zealand during the first half of the twentieth century is one of a healthy country with exceptionally low infant mortality rates. This article reviews the non-Māori ‘health transition' and its determinants from a socioeconomic perspective and draws comparisons with Australia. Regional health inequalities are analysed through the lens of infant mortality. Socioeconomic correlates with infant mortality are investigated empirically. Panel regression estimates suggest that during the 1874–1919 period, improvements in real wages corresponded with falling infant deaths and thus better health outcomes, while increased housing density created unfavourable conditions for infant survival chances.

Zainab Ijaz; Ariane Kemkes Based on the U.S. Federal Mortality Schedules from the years 1850-1880 infant deaths <1 year were investigated in order to determine whether mortality attributed to "smothering" or "overlaying" followed known SIDS trajectories. By comparing a case sample of 2,236 smothered/overlaid deaths with an age-, regionally and time-matched control sample of all-cause infant deaths (N=?58,293), striking similarities with SIDS became apparent, which were not mimicked in the control sample. These epidemiological traits included a disproportionate vulnerability during the second to fourth month of life (Poisson RR 12.94, p?

M Rodwan Abouharb; Anessa L Kimball Systematic data on annual infant mortality rates are of use to a variety of social science research programs in demography, economics, sociology, and political science. Infant mortality rates may
be used both as a proxy measure for economic development, in lieu of energy consumption or GDP-per-capita measures, and as an indicator of the extent to which governments provide for the economic and social welfare of their citizens. Until recently, data were available for only a limited number of countries based on regional or country-level studies and time periods for years after 1950. Here, the authors introduce a new dataset reporting annual infant mortality rates for all states in the world, based on the Correlates of War state system list, between 1816 and 2002. They discuss past research programs using infant mortality rates in conflict studies and describe the dataset by exploring its geographic and temporal coverage. Next, they explain some of the limitations of the dataset as well as issues associated with the data themselves. Finally, they suggest some research areas that might benefit from the use of this dataset. This new dataset is the most comprehensive source on infant mortality rates currently available to social science researchers.

Ojewumi Titus K; Ojewumi Johnson S; Louise Humphrey; Silvia Bello; Emily Rousham This study examines sex differences in infant mortality in Spitalfields, London, and the estimated contribution of endogenous and exogenous factors to neonatal and infant mortality using the biometric model from 1750 to 1839. There was a marked decline in the risk of death during infancy and the neonatal period for both sexes during the study period. There was significant excess male infant mortality compared with that of females in the 1750-59 cohort, estimated from baptism and burial registers, but not in later cohorts. Similarly, males had higher neonatal mortality rates than females in 1750-59 but not in later cohorts. Biometric analyses suggest that the observed decrease in neonatal mortality in both sexes was caused by a reduction in both endogenous and exogenous causes of death. The
contribution of maternal health and breast-feeding practices to the observed patterns of mortality is discussed in the light of available evidence.

Mazen Abuqamar; Danny Coomans; Fred Louckx; Gregory Brock; Yinghua Jin; Tong Zeng; Ramesh Kumar S; Marian F Macdorman; T J Mathews; Ariane Kemkes Based on the U.S. Federal Mortality Schedules from the years 1850-1880 infant deaths <1 year were investigated in order to determine whether mortality attributed to "smothering" or "overlaying" followed known SIDS trajectories. By comparing a case sample of 2,236 smothered/overlaid deaths with an age-, regionally and time-matched control sample of all-cause infant deaths (N= 58,293), striking similarities with SIDS became apparent, which were not mimicked in the control sample. These epidemiological traits included a disproportionate vulnerability during the second to fourth month of life (Poisson RR 12.94, p<0.001), a remarkable birth and death seasonally, as well as pronounced racial disparities. The study could also corroborate sex-specific discrepancies—such as differential impact of month of birth on age-at-death. Results of a Cox regression furthermore indicate that age, sex, race and death season were significant predictors of mortality. This strongly supports the hypothesis that these infant deaths represent empirical evidence of 19th century SIDS.

Anita Raj; Ulrike Boehmer; Rocky Rajabu Akarro; Adam Hancy; Carolyn Coburn; Michael Restivo; John M Shandra We conduct a cross-national analysis to examine the effects of different forms of African Development Bank (AfDB) on infant mortality. We analyze data on 31 countries from the period 1990–2006 using a two-way fixed effects regression model. The results of our analysis indicate that Sub-Saharan African nations receiving an AfDB structural adjustment loan are associated with increased infant mortality compared to nations that do not receive such a loan,
consistent with existing literature drawn from dependency theory. We also evaluate a second hypothesis that AfDB investment loans in the health sector will be associated with decreased infant mortality, and the results of our analysis confirm this as well. We conclude by highlighting the contradictory effects of these two lending strategies on infant mortality and the theoretical implications that emerge.

Adam Storeygard; Deborah Balk; Marc Levy; Glenn Deane We describe the compilation of a spatially explicit data-set detailing infant mortality rates in over 10,000 national and subnational units worldwide, benchmarked to the year 2000. Although their resolution is highly variable, subnational data are available for countries representing over 90% of the non-OECD population. Concentration of global infant deaths is higher than implied by national data alone. Assigning both national and subnational data to map grid cells so that they may be easily integrated with other geographical data, we generate infant mortality rates for environmental regions, including biomes and coastal zones, by continent. Rates for these regions also show striking refinements from the use of the higher resolution data. Possibilities and limitations for related work are discussed

Gretchen A Condran; Jennifer Murphy Historically, public health workers, physicians, and reformers have used the infant mortality rate as an indicator of the goodness of a society—its general welfare, the justness of its political system, the efficacy of its public works, the benevolence of its powerful; a high rate of death among the very young was an index of a community’s shame. These views of the infant mortality rate as reflecting general characteristics of a society were widely displayed in the second half of the nineteenth century even as most disease entities were becoming more narrowly defined and ordinarily linked not to the nature of
society or individual predisposition but to specific pathological organisms. Using Philadelphia as a case study, we examine the history of the infant mortality rate from 1870 through 1920, both the technical aspects of its calculation and its use as an indicator of broad societal problems and a catalyst for policy. Our emphasis is not on explaining the trends in the death rates of the very young but on the uses and meanings given to the infant mortality rate during the second half of the nineteenth century and the first decades of the twentieth century specifically as they related to three efforts to lower infant death rates—removing infants from the city, improving the supply of milk, and establishing child hygiene programs.
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