Development of Demographic Measures and Theory

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1 Background

Demographic research lies at the nexus of social science research and shares much in common with other fields. The overlap between demography and other fields often puts it in a difficult place in terms of solidifying it's place as a unique field. This may be especially true in the current era of large scale data production where research concerning "populations" is used by a larger number of research fields. These large N studies allow for more detailed divisions and sub populations within a particular population to be studied, making the distinction between demography and other fields more blurred. While one could imagine a scenario where this could drain demography of its standing while other fields take over the space it once occupied this seems not to be the case. The expansion of data has come alongside an expansion in those that take a demographic mindset into their analysis and incorporate demographic methods into their respective fields of study. It may be because of this that we have seen a relative growth in the size of instutions in the United States that are associated with demographic research, while at the same time a collapsing down in the size and number of academic institutions that house a proper school of demography (Xie 2000). In order to best summarize how we arrived at the current state of demography research I will discuss and review a brief series of papers that cover the history of demographic research in the 20 and 21st century, with particular attention to the development of the field in the United States.

2 Formal Demography and Population Studies

It is likely impossible to find a credible account of the history of demography in the United States without acknowledging Hauser and Duncan 1959 piece *The Study of Population*. The work attempted to establish demography as a legitimate social science and the particular research domains for which the field holds a special claim to. Though the work spans nearly 900 pages the often most cited passage comes to us as the direct, albeit vague, statement of what constitutes the field of demography. Hauser and Duncan state *Demography is the study of the size, territorial distribution, and composition of population, changes therein, and the components of such change.* While not stated specifically here the elements that constitute population changes in a society can be traced back to the forces of the demographic balancing equation, namely the increase contributed by births and the decreases attributed to death. If we subdivide our population into specific geographic areas then we must also consider how

populations move in space and how these spaces may deferentially experience births and deaths and thus, the particular focus that is placed on *territorial distribution*. How the age distribution of deaths, and the age of and number of children, predominately, woman have are "shaped", i.e. their age distributions, and how that shape changes are at the heart of what is now considered formal demography. On the other hand we have population process and social demography. This set of demography is more interested in the social drivers that alter the distributions of mortality, fertility, and migration. The distinction between the two fields has seen development of theoretical opposition happen in one field even if it was at the dismay of the other, a topic that I will touch on further in this report.

3 The Demographic Transition and Mortality

Whether the distinction between these two fields is helpful or not it's separation has helped shape the current state of the demographic field. Perhaps one of the most influential aspects from the formal demographic group has been the development of age-specific profiles of mortality and fertility and their relationship to developmental change in what is known as the demographic transition. Briefly the demographic transition states that as a country develops in it's technologies and economic infrastructures it experiences a decline in it's child mortality and then in it total fertility rate which leads to a period in the disruption of the equilibrium of balancing forces, causing an uptick in population (Lee 2003). Child mortality declines are often associated with advances in care but can also be due to greater and more egalitarian access to care, an increase in the social status of women, increased education of both men and women, as well as better overall access to reproductive health needs (Caldwell 1990).

While the original theory was coined in the United States by demographer Warren Thompson around 1930, a number of subsequent articles have been written that expand on the timing, the population effect, and the applicability of the transition on a number of countries. One of the more discussed papers on the topic has been Caldwell's 1986 paper "Routes to Low Mortality in Developing Countries" (Caldwell 1986). The paper uses the 1984 World Development Bank report in order to assess how both Infant Mortality Rate (IMR), the rate of death of persona under the age of 1, and Child Mortality Rate (CMR), the rate of death of persons under the age of 5, have varying country level differences and how those differences compare with over all period life expectancy at birth, level of income, as well as some qualitative assessments of investment by a country into the health systems infrastructure of the state, especially in Costa Rica, Cuba, and Vietnam. His primary focus on the analysis was on developing countries, termed third world countries in the original text, and how they ranked on their child health indicators.

In Caldwell's analysis he placed a strong focus on the idea of economic expectation of health outcomes. Whether by intention or not, his focus on the parallels between economic success and health outcomes helped to cement the role of economic theory into the demographic transition. This is not to say that economics role was not present before this paper, much of the demographic transition research was originally formulated based on increasing economies within countries, however, the shear influence of this paper has led to the continued use of

expectation of health outcomes conditional on economic success even in contemporary work. A prime example of this is the use of the Socio-demographic index (SDI) measure used by researchers such as those from the work of the Institute for Health Metrics and Evaluation (IHME) in their work measuring IMR and expectations of IMR at a country level (Wang et al. 2012).

In his original work, Caldwell simply ranked countries based on their status for IMR/CMR and then by their GNP. He payed special attention to countries who "performed" higher or lower than expected based on their economic ranking using a criteria of having a health ranking either 25 places above or below their economic ranking respectively. Obviously, this measure was crude and ignored the quantitative differences in both IMR and GNP, however, the focus on strong achievers allowed Caldwell to build a set of hypothesis of the drivers of child mortality reduction that are not necessarily tied to the wealth of a country. Of particular note is Caldwell's focus on the autonomy of woman, education and political systems, as well as the cultural attitudes that may drive health outcomes.

While Caldwell's paper was without a doubt a huge step forward in the discussion of drivers of demographic change, it was met with many rebuttals and reflections from other demographers within the field. A particularly noteworthy re-visitation to Caldwell's original piece was Randall Kuhn's 2010 article in Population and Development Review (Kuhn 2010). Kuhn made particular care to recount the limitations of the original article that had been made by himself as well as other researchers since Caldwell's original publication. In particular he focused on the causal language that was used especially related to the impact that religion could play on child mortality outcomes. This was easily refuted in other work by making country comparisons for states that were not included in the original analysis. Nonetheless, the lasting influence of Caldwell's paper led Kuhn to run as similar analysis of countries this time using a perhaps more indicative measure of person level economic standing, the purchasing power parity (ppp). The results led to some similar findings, countries that had high ppp but were primarily oil based economies still lagged behind in health standings related to IMR. The new updated rankings however found the relative lagging of health outcomes by country tend to change over time. This was found to be true for Latin America and predominately Arabic countries (Kuhn 2010).

Despite this more careful attention to details Kuhn's article still places an extreme importance on economic success in the way that we frame health outcomes. Countries in Latin America who have political systems that are more socialist than here in the United States such as Cuba and Costa Rica are seen as exceptions despite both of these countries, as detailed in the paper, spending more on health care infrastructure. In addition the framework presented places a strong importance on average health outcomes and largely neglects variation in health outcomes. This comes along with language that often reflects a causal nature, even though Kuhn himself was critical of Caldwell's causal remarks, and calls into question when exactly a primary focus should be placed on shifting trends in means of population measures in relation to country level indicators, in economics and beyond (Greg J. Duncan 2008).

A more pointed claim of the importance of economics, especially in relation to public health efforts was founded in the so-called "McKeown Thesis" (McKeown, Brown, and Record 1972). McKeown placed a strong importance on the roles of economic growth, rising living standards,

and improved nutrition as the primary sources of most historical improvements in the health of developed nations and population growth. The article is often seen as downplaying the importance of public health's role in altering population change and has been hit with many criticism's across the years. A series of papers commissioned by the American Journal of Public Health sought re-evaluate the original papers claims and rethink how public health and health systems effect health outcomes (Szreter 2002) (Colgrove 2002) (B. G. Link and Phelan 2002). In addition a growing number of articles, including those that were written as responses to Caldwell, show that changes in the vaccination schedule and distribution and access to clean water can have a measurable effect on the rate of child mortality, especially demonstrated in the declines in under five mortality in Latin American Countries (González-Pier et al. 2016) (Kuhn 2010)(Palloni and Rafalimanana 1999)(SZRETER 1988).

4 Developing Theory and Causal Modeling

Again this debate of the importance of changing country or state level indicators and best predicting changes in population structure, child mortality and fertility declines leading to population growth, brings up the question of what data we can use for making causal connections and adapting theory for drivers of population change. This discussion of theoretical drivers of change is much discussed (Lee 2003)(Preston 1993)(Xie 2000) and perhaps what most sets apart formal demography from social demography and population sciences. While there is no doubt value in descriptive statistics and compositional analysis of change, what fuels these changes in different context is especially important not only for our own academic understanding but also because demography is inherently tied to policy and its implementation (Greenhalgh 2009)(Tienda 2002). It is important then that we are critical of the methodology that we use to test our assumptions of causal drivers of population change, but also be critical of the climate that has historically created theories on population changes.

As stated prior, the ways in which we approach causal claims in demography need to be done carefully. Demography concerns itself with changes at the population level, however, the often cited gold standard for making causal claims comes from the set up of a randomized control trial (Moffitt 2005). While we may take studies from psychology, biology, public health, and experimental sociology to help develop our theories, the kind of scale and data that demography deals with does not well lend itself to these kinds of tests. To reference Hauser and Duncan again, one of the main interest of demographers is differences in population by geographic space. The ways which we hypothesize space, the physical area that an individual resides in, and place, the conceptualized area that an individual occupies and its characteristics, are likely things that we could never ethically test in a randomized control style setting. Ways around this limitation have been discussed and examples of such include natural experiments, such as the Moving to Opportunity study which tested how individuals living in poverty who were nearly randomly assigned a new location within a more developed neighborhood, twin studies, selecting individuals that match on all characteristics except some treatment effect, as well as other methodological approaches that allow for weighting of receiving treatment to be taken into account in the model such as in Marginal Structural Models (Sampson and Sharkey 2008).

In 2007 Bhrolchain and Dyson presented an article which attempted to highlight some of the ways in which causal claims have been made in demography in the past and how they were either lacking in adequate testing of causality or could only be evaluated by the existence of previously purported theories (Bhrolcháin and Dyson 2007). This is not to say that causal inference is beyond the realm of population studies, but rather, we need to be careful in how we make causal claims and the data that we use in order to do so. An overview of causality and how it main be assessed was well articulated by Moffitt in his 2005 article "Remarks on the analysis of causal relationships in population research" (Moffitt 2005). Moffit highlights how intuition in traditional modeling approaches can lead to false claims of the importance of some variables on population process and again evokes the importance of theory, and in his own words intuition, must be used when considering causal relationships.

The history of demographic theories of change, however, should be considered within the context of its development. Unlike many other social sciences, demography did not become solidified as a social science until the early half of the 20th century. It's relatively late development and combined with its core based in descriptive statistics have made it relatively young in terms of theoretical development. Nonetheless, the "modernist" theories that have become antiquated or at least more contested in other social science fields as other theoretical perspectives that challenged the western-centric economic and technological based theories have not been as pervasive in the field of demography. Authors such as Greenhalgh and Szreter have argued that the reason for this lack of development is the close ties between the development of the field of demography and the political agenda of developed western countries, primarily the United States (Greenhalgh 2009). Even the founding of the Population Association of America (PAA) was constructed with the thought in mind of demographics role in economic and social planning related to fertility. In addition the expectation of other countries growths related to concerns of asian growth as well as countries that do not follow the western pattern of growth, see the African Exception, firmly center norms around western models. This line of reasonaning is notably absent of cultural and political differences between countries that can drive differences in population growth, read critical theory.

5 Fertility Variation and Demography

In addition to mortality changes demography is strongly concerned with fertility changes as well. The demographic transition closely relates these two factors together, however, the mechanisms for declines should not be seen as causal unless one takes an extremely utilitarian approach to how individuals plan for their children. Perhaps one of the most attractive aspects of the demographic transition theory is its relative simplicity and ubiquity as it is applicable to all countries. However the degree to which the model is applicable depends strongly on the country. When new models are introduced, however, they often do not come as close to being comprehensive as the demographic theory model and often only describe the situation of a few countries. Demography purists often favor the ability of a more general model that can be extrapolated to a large number of situations than one that is dependent on subtle context (Hirschman 1994).

While many papers in the field of demography focus on the large social determinants of change related to demographic outcomes, it is often helpful to limit the scope of research to the direct process that leads to changes. While no doubt culture (Bongaarts and Casterline 2013), economics (Easterlin 1975), development (Bryant 2007), and ideational shifts (Hirschman 1994) play a role in the changes of fertility, the mechanisms by which these forces exhibit change are limited to much narrower range of proximate causes. Easterlin's 1975 article, An economic framework for fertility analysis, represents a response to the simple economic demand model and its criticisms that were present in the field at the time. He states that fertility rates are a function of three main factors, the threshold factor which places an upper limit on the maximum number of children possible, the demand for children which is dictated by economic, cultural, and social needs, and the means by/access to which pregnancy may be avoided. The model expands on previous notions of what influences differences in time and cultures of fertility rates while still providing a testable model by which the demographic transition could happen, although he is very vague in the way that he says that culture, society, and the economy do affect fertility. Three years later Bongaarts wrote on the importance of understanding the causal factors by which fertility is regulated and not just the social factors (Bongaarts 1978). He places extreme importance on three categories of factors that mechanistically restrict fertility and claims that understanding of their relationship to fertility rates is a requirement in order to understand and test how social factors can lead to changes fertility via these mechanisms.

While these articles place a strong focus on the proximate measures of fertility changes, they bring to question where the the theoretical focus of demographic research should be placed. It is difficult to argue against Bongarts's claims that the rate limiting factors that lead to changes in fertility are not much beyond exposure factors, deliberate marital fertility control factors, and natural marital fertility factors. However, while Bongarts would later claim that his factors accounted for a large percentage of variation in follow up papers, the ability to assess how these factors change remains up for debate. For example, the introduction of broadened reproductive health care systems allows for the uptake of contraceptive use, yet, how much demand there is for contraceptive is still a function of other social forces and, depending on the payment and insurance structures of reproductive health in the country of concern, economic forces as well. These more "upstream", to use the language of the social determinants of health researchers, causes are more difficult to predict and build theoretical models of fertility change for, however, are essential for future research. For example, the aim of planning for future population growth is contingent on changes in fertility and building forecasts that include scenario's of culture shifts in a probabilistic manor, see (Raftery, Alkema, and Gerland 2014), would be immensely helpful from an institutional planning standpoint.

6 Ethnic, Racial, Gendered, and Geographic Differences In Demography

Up to this point much of the work that we have been describing has focused on change and theory as it is related to country level differnces of change. However, more and morre recent research has taken into account variation within countries and its role in creating small area population differences among subgroups. How this variation manifests under a single state often reflects differences in social status much researched by other fields and has been a more focused topic of demography since the late 80's, especially in the United States. When discussing variation within countries, conversations of social drivers of change are much more common. Much of the dialouge around socio-economic level differnces in fertility and mortality outcomes have looked at how culture attitudes and social status alter decision making patterns related to family planning. Perhaps no greater focus on demographic variation in the United States has been placed on the difference in black and white mortality and fertility outcomes.

In Ruggles 1994, Ruggles gather US census data for years spanning from 1880 to 1980 in order to understand the history of the black white differences in family structures. At this point differences between black and white family structures in the United States had long been studied, and its consequences were actively being debated such in the, controversial, Moynihan report "The Negro Family: The Case For National Action". In the report Moynihan attributes the economic plight of the African Americans up until the 1960's to the family structure, that African Americans or more likely to be part of single family homes. Ruggles finds in his historical analysis that although blacks have historically had a higher rate of fragmented households, the prevalence of fragmented families was much smaller in the past for both black and whites and the absolute difference between the two was much smaller in the 19th century (Ruggles 1994). Tolnay expands on the historical differences between black and white family structures by analyzing the differences within the black community in the north and south during the era of great migration out of the south. Tolnay finds that it is unlikely that southerners brought with them a culture of fragmented households and that the differences, at least to some extent, were generated within the north, possibly due to social factors (possibly reversing the causality asserted in the Moynihan report) (Tolnay 1997). These articles both lend evidence to the notion that socioeconomic status (SES), plays an important role in health inequalities, a sentiment that would be echoed more causally in future literature (Geronimus 1992, Gortmaker and Wise (1997), J. C. Phelan, Link, and Tehranifar (2010), Singh-Manoux and Marmot (2005)).

All of these papers comment on the importance of propagation of factors, both social and cultural, that start at early life but further literature expands on this notion by adding a biological component of poor health accumulation in the form of allostatic load, a term coined by neuro-endocronlogist Bruce McEwen. Though strictly attributing poor health outcomes or any population dynamic to any single one of these factors is difficult, namely because of how co-linear they are, it is important to understand all three factors when considering demographic variation. One of the earliest papers in demographic research that described the lasting effects of negative early life conditions was Hayward and Gorman's "The Long Arm of

Childhood: The Influence of Early-Life Social Conditions on Men's Mortality" (Hayward and Gorman 2004). The analysis found that even after conditioning on changes in adult lifestyle, that childhood characteristics still played an important factor in describing differentials in mortality outcomes. The author's concluding statements placed a strong focus on the idea that social welfare policies should be particularly focused on childhood outcomes, not only for the potential causal pathways that may lead a child to better health but also because of the potential permanent biological systems that may be damaged because of early life stress. More recent literature has surfaced that focuses on differences that occur because of neighborhood effects and the inability to access amenities within ones lived environment, the neighborhood, that has further reinforced the notion of the continued detrimental outcomes of early life adversity (Sampson and Sharkey 2008).

Though poor health outcomes in the form of child mortality have a strong connection to socio-economic status of the groups of concern, much like in the case of the demographic transition exception's, their exist subgroups who buck this trend. Most notably is the relative difference in earned income, social status, and autonomy that exists between men and women, men are more likely to be in positions of power and higher status, and the generally more favorable health outcomes that are experienced by women (Read and Gorman 2006). It should be noted that the relative differences in health measures such as life expectancy between men and women change depending on the social and ethnic groups that are examined, and lend evidence to the theory that this is not simply a biological difference that is being measured.

Within the United States another phenomenon that parts with socioeconomic trends of health outcomes is the Hispanic health paradox. The Hispanic health paradox is the idea that Hispanic Migrants, who tend to occupy a relatively lower socio-economic status, tend to have better health outcomes, life expectancy and IMR, than others who occupy a similar socio-economic status (Landale, Oropesa, and Gorman 2000). This phenomena has been observed multiple times, especially within the Mexican origin population in the United States (R. A. Hummer et al. 2007) and has sparked debate about the health of migrants who enter into the country. One line of speculative theory states that migrants in general occupy a better health state than the general population (Hamilton, Villarreal, and Hummer 2009). In order to be able to migrate a certain level of health and economic certainty is hypothesized to be needed and this entry level threshold migration could cause the difference that we observe. This may explain why first generation migrants have better health outcomes than the general population, however, more recent research has found that the Hispanic Health paradox may also apply to the offspring of first generation Mexican migrants as well (R. A. Hummer et al. 2007). Other theories related to the Hispanic health paradox focus on the importance of community support networks that promote better health, which would be applicable not only to first generation Hispanic but also further generations. This may be the case, although, we do see that subsequent generations tend to have worsening health outcomes, especially from mortality and morbidity related to cardiovascular diseases (R. A. Hummer et al. 2007).

7 Data and Methods

Research developing out of the University of Washington adds another contender to the Hispanic health paradox. The developing theory states that individuals who becaome ill will opt to return to their home country were they may better leverage their network in order to pass a time of illness. In order to be able to test this theory using traditional means of demographic inquiry we would need not only access to the Vital registration systems within both countries, but also a way to like individuals who migrate between the two countries. For the United States and Mexico linked migration registration systems with health records are not readily available making testing this hypothesis within the confinds of registration data nearly impossible. In order to overcome this limitation, a limitation that is seen in note just migration related research but also research in any location where comprehensive linked population data is not available, the use of survey data in demographic research has become more widely used (Wakefield et al. 2018). While the bulk of formal demographic methods have been developed around complete data sets with comprehensive coverage of populations in the form of vital registrations (Palmore and Gardner 1994, Preston, Heuveline, and Guillot (2001), Wachter (2014)) a growing number of researchers have seen the utility of using survey data in their demographic analysis (Caldwell 1985). The use of survey data, however, requires a better understanding of sample statistics, as opposed to population statistics, and what we may state when we have a limited sample. Jon Wakefield has been a particularly strong proponent of both direct and statistical models in the use of survey data such as the Demographic and Health Surveys as well as the Multiple Indicator Cluster Surveys for estimating changes in mortality and fertility (Wakefield et al. 2018). Even more recently has been the use of social media data and the growing online population in order track shifts in population movement. While this data does not even explicitly ask question related to demographic estimates, the amount of passive data that is collected from users enables researchers to estimate migration patterns as users connect to the digital world from different locations (Zagheni, Weber, and Gummadi 2017).

While data that comes to us from samples that may be biased is not the ideal form of data that we may wish to have, it does enable researchers to study more difficult tract populations, and develop theories that move away from the western developed center that has plagued the field in the past. In addition, the community at large seems to have embraced the idea of using statistical models for demographic approaches rather than remaining in the realm of formal mathematical demography. The use of Bayesian hierarchical models has been at the crux of the work of the United Nation's and researchers such as Adrian Raftery, Mark Wheldon, and Haidong Wang (Wheldon et al. 2016, Raftery, Alkema, and Gerland (2014), Wang et al. (2012)). The use of statistical models in demographic research is especially helpful in the case where either data is imperfect and a sample of the total population, or the sample size of the target population of desire is relatively small and subject to numerical instability. As demography as field evolves and expands on reporting beyond means of population processes we may expect that variation in the sample will become of greater focus, especially as it relates to inequalities.

Within the fields of sociology and economics and greater portion of the literature has been

focused on inequalities of social outcomes. These inequalities persist even within ethnic groups and have been expanding since the start of the 21st century. The role of demography in this line of literature should focus on the variation that exists not only in health outcomes, as has been focused on in public health literature, but also on differences in other demographic measures such as fertility and migration. The development of focused studying on variation has the ability to enable demography to come closer to its original stated goal of measuring the composition of the population.

References

Bhrolcháin, Máire Ní, and Tim Dyson. 2007. "On Causation in Demography: Issues and Illustrations." *Population and Development Review* 33 (1). John Wiley & Sons, Ltd (10.1111): 1–36. doi:10.1111/j.1728-4457.2007.00157.x.

Bongaarts, John. 1978. "A Framework for Analyzing the Proximate Determinants of Fertility." *Population and Development Review* 4 (1): 105. doi:10.2307/1972149.

Bongaarts, John, and John Casterline. 2013. "Fertility Transition: Is sub-Saharan Africa Different?" *Population and Development Review* 38 (Suppl 1). NIH Public Access: 153. doi:10.1111/J.1728-4457.2013.00557.X.

Bryant, John. 2007. "Theories of Fertility Decline and the Evidence from Development Indicators." *Population and Development Review* 33 (1): 101–27. doi:10.1111/j.1728-4457.2007.00160.x.

Caldwell, John C. 1985. "Strengths and limitations of the survey approach for measuring and understanding fertility change: alternative possibilities." London England Oxford University Press 1985. https://www.popline.org/node/415554.

———. 1986. "Routes to Low Mortality in Poor Countries." *Population and Development Review* 12 (2): 171. doi:10.2307/1973108.

———. 1990. "Cultural and Social Factors Influencing Mortality Levels in Developing Countries." *The ANNALS of the American Academy of Political and Social Science* 510 (1). SAGE PUBLICATIONS: 44–59. doi:10.1177/0002716290510001004.

Colgrove, James. 2002. "The McKeown thesis: a historical controversy and its enduring influence." *American Journal of Public Health* 92 (5). American Public Health Association: 725–9. http://www.ncbi.nlm.nih.gov/pubmed/11988435 http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC1447153.

Easterlin, R A. 1975. "An economic framework for fertility analysis." *Studies in Family Planning* 6 (3): 54–63. http://www.ncbi.nlm.nih.gov/pubmed/1118873.

Geronimus, A T. 1992. "The weathering hypothesis and the health of African-American women and infants: evidence and speculations." *Ethnicity & Disease* 2 (3): 207–21. http://www.ncbi.nlm.nih.gov/pubmed/1467758.

González-Pier, Eduardo, Mariana Barraza-Lloréns, Naomi Beyeler, Dean Jamison, Felicia Knaul, Rafael Lozano, Gavin Yamey, and Jaime Sepúlveda. 2016. "Mexico's path towards the Sustainable Development Goal for health: an assessment of the feasibility of reducing premature mortality by 40% by 2030." *The Lancet. Global Health* 4 (10). Elsevier: e714–25. doi:10.1016/S2214-109X(16)30181-4.

Gortmaker, Steven L., and Paul H. Wise. 1997. "The First Injustice: Socioeconomic Disparities, Health Services Technology, and Infant Mortality." *Annual Review of Sociology* 23 (1). Annual Reviews 4139 El Camino Way, P.O. Box 10139, Palo Alto, CA 94303-0139,

USA: 147–70. doi:10.1146/annurev.soc.23.1.147.

Greenhalgh, Susan. 2009. "The Social Construction of Population Science: An Intellectual, Institutional, and Political History of Twentieth-Century Demography." *Comparative Studies in Society and History* 38 (01): 26. doi:10.1017/s0010417500020119.

Greg J. Duncan, Greg j. 2008. "When to Promote, and When to Avoid, a Population Perspective." *Demography* 45 (4). Springer-Verlag: 763–84. doi:10.1353/dem.0.0031.

Hamilton, Erin R., Andrés Villarreal, and Robert A. Hummer. 2009. "Mother's, Household, and Community U.S. Migration Experience and Infant Mortality in Rural and Urban Mexico." *Population Research and Policy Review* 28 (2). Springer Netherlands: 123–42. doi:10.1007/s11113-008-9097-2.

Hayward, Mark D., and Bridget K. Gorman. 2004. "The Long Arm of Childhood: The Influence of Early-Life Social Conditions on Men's Mortality." *Demography* 41 (1). Springer-Verlag: 87–107. doi:10.1353/dem.2004.0005.

Hirschman, Charles. 1994. "Why Fertility Changes." *Annual Review of Sociology* 20 (1). Annual Reviews 4139 El Camino Way, P.O. Box 10139, Palo Alto, CA 94303-0139, USA: 203–33. doi:10.1146/annurev.so.20.080194.001223.

Hummer, Robert A, Daniel A Powers, Starling G Pullum, Ginger L Gossman, and W Parker Frisbie. 2007. "Paradox found (again): infant mortality among the Mexican-origin population in the United States." *Demography* 44 (3). NIH Public Access: 441–57. http://www.ncbi.nlm.nih.gov/pubmed/17913005 http://www.pubmedcentral.nih.gov/articlerender.fcgi?artic

Kuhn, Randall. 2010. "Routes to low mortality in poor countries revisited." *Population and Development Review* 36 (4): 655–92. http://www.ncbi.nlm.nih.gov/pubmed/21174865.

Landale, Nancy S., R. S. Oropesa, and Bridget K. Gorman. 2000. "Migration and Infant Death: Assimilation or Selective Migration among Puerto Ricans?" *American Sociological Review* 65 (6): 888. doi:10.2307/2657518.

Lee, Ronald. 2003. "The Demographic Transition: Three Centuries of Fundamental Change." *Journal of Economic Perspectives* 17 (4): 167–90. doi:10.1257/089533003772034943.

Link, Bruce G, and Jo C Phelan. 2002. "McKeown and the idea that social conditions are fundamental causes of disease." *American Journal of Public Health* 92 (5). American Public Health Association: 730–2. http://www.ncbi.nlm.nih.gov/pubmed/11988436 http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC1447154.

McKeown, Thomas, R. G. Brown, and R. G. Record. 1972. "An Interpretation of the Modern Rise of Population in Europe." *Population Studies* 26 (3): 345. doi:10.2307/2173815.

Moffitt, Robert. 2005. "Remarks on the analysis of causal relationships in population research." *Demography* 42 (1): 91–108. http://www.ncbi.nlm.nih.gov/pubmed/15782897.

Palloni, Alberto, and Hantamala Rafalimanana. 1999. "The Effects of Infant Mortality on Fertility Revisited: New Evidence from Latin America." *Demography* 36 (1). Springer-Verlag:

41. doi:10.2307/2648133.

Palmore, James A., and Robert W. Gardner. 1994. *Measuring mortality, fertility, and natural increase : a self-teaching guide to elementary measures*. East-West Center.

Phelan, Jo C., Bruce G. Link, and Parisa Tehranifar. 2010. "Social Conditions as Fundamental Causes of Health Inequalities: Theory, Evidence, and Policy Implications." *Journal of Health and Social Behavior* 51 (1_suppl). SAGE PublicationsSage CA: Los Angeles, CA: S28–S40. doi:10.1177/0022146510383498.

Preston, Samuel H. 1993. "The Contours of Demography: Estimates and Projections." *Demography* 30 (4): 593. doi:10.2307/2061808.

Preston, Samuel H., Patrick. Heuveline, and Michel Guillot. 2001. *Demography : measuring and modeling population processes*. Blackwell Publishers. https://www.wiley.com/en-us/Demography{\%}3A+Measuring+and+Modeling+Population+Processes-p-9781557864512.

Raftery, Adrian E, Leontine Alkema, and Patrick Gerland. 2014. "Bayesian Population Projections for the United Nations." *Statistical Science : A Review Journal of the Institute of Mathematical Statistics* 29 (1). NIH Public Access: 58–68. doi:10.1214/13-STS419.

Read, Jen'nan Ghazal, and Bridget K. Gorman. 2006. "Gender inequalities in US adult health: The interplay of race and ethnicity." *Social Science & Medicine* 62 (5). Pergamon: 1045–65. doi:10.1016/J.SOCSCIMED.2005.07.009.

Ruggles, Steven. 1994. "The origins of African-American family structure." *AMERICAN SOCIOLOGICAL REVIEW* 59 (1): 136–51. https://www.popline.org/node/277300.

Sampson, Robert J, and Patrick Sharkey. 2008. "Neighborhood selection and the social reproduction of concentrated racial inequality." *Demography* 45 (1). Springer: 1–29. http://www.ncbi.nlm.nih.gov/pubmed/18390289 http://www.pubmedcentral.nih.gov/articlerender.fcgi?artic

Singh-Manoux, Archana, and Michael Marmot. 2005. "Role of socialization in explaining social inequalities in health." *Social Science & Medicine* 60 (9). Pergamon: 2129–33. doi:10.1016/J.SOCSCIMED.2004.08.070.

Szreter, Simon. 2002. "Rethinking McKeown: the relationship between public health and social change." *American Journal of Public Health* 92 (5). American Public Health Association: 722–5. http://www.ncbi.nlm.nih.gov/pubmed/11988434 http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC1447152.

SZRETER, SIMON. 1988. "The Importance of Social Intervention in Britain's Mortality Decline c .1850–1914: a Re-interpretation of the Role of Public Health." *Social History of Medicine* 1 (1). Narnia: 1–38. doi:10.1093/shm/1.1.1.

Tienda, Marta. 2002. "Demography and the Social Contract." *Demography* 39 (4). Springer-Verlag: 587–616. doi:10.1353/dem.2002.0041.

Tolnay, Stewart E. 1997. "The Great Migration and Changes in the Northern Black Family, 1940 to 1990." *Social Forces* 75 (4): 1213. doi:10.2307/2580669.

Wachter, Kenneth W. 2014. *Essential demographic methods*. http://www.hup.harvard.edu/

catalog.php?isbn=9780674045576.

Wakefield, Jon, Geir-Arne Fuglstad, Andrea Riebler, Jessica Godwin, Katie Wilson, and Samuel J Clark. 2018. "Estimating under-five mortality in space and time in a developing world context." *Statistical Methods in Medical Research*, April. SAGE PublicationsSage UK: London, England, 096228021876798. doi:10.1177/0962280218767988.

Wang, Haidong, Laura Dwyer-Lindgren, Katherine T Lofgren, Julie Knoll Rajaratnam, Jacob R Marcus, Alison Levin-Rector, Carly E Levitz, Alan D Lopez, and Christopher JL Murray. 2012. "Age-specific and sex-specific mortality in 187 countries, 1970–2010: a systematic analysis for the Global Burden of Disease Study 2010." *The Lancet* 380 (9859). Elsevier: 2071–94. doi:10.1016/S0140-6736(12)61719-X.

Wheldon, Mark C, Adrian E Raftery, Samuel J Clark, and Patrick Gerland. 2016. "Bayesian population reconstruction of female populations for less developed and more developed countries." *Population Studies* 70 (1): 21–37. doi:10.1080/00324728.2016.1139164.

Xie, Yu. 2000. "Demography: Past, Present, and Future." *Journal of the American Statistical Association* 95 (450): 670. doi:10.2307/2669415.

Zagheni, Emilio, Ingmar Weber, and Krishna Gummadi. 2017. "Leveraging Facebook's Advertising Platform to Monitor Stocks of Migrants." *Population and Development Review* 43 (4): 721–34. doi:10.1111/padr.12102.