



CAHIER 17-2000

**IS CHILD MORTALITY IMPORTANT?  
REPRODUCTIVE DECISIONS, STRATEGIES  
AND OUTCOMES IN SENEGAL**

Sara Claire RANDALL and  
Thomas K. LEGRAND

**Centre de recherche  
et développement en économie**

C.P. 6128, succursale Centre-ville  
Montréal QC H3C 3J7

Téléphone : (514) 343-6557  
Télécopieur : (514) 343-5831  
crde@crde.umontreal.ca  
<http://www.crde.umontreal.ca/>

Université   
de Montréal

CAHIER 17-2000

**IS CHILD MORTALITY IMPORTANT? REPRODUCTIVE DECISIONS,  
STRATEGIES AND OUTCOMES IN SENEGAL**

Sara Claire RANDALL<sup>1</sup> and Thomas K. LEGRAND<sup>2</sup>

<sup>1</sup> Department of Anthropology, University College London

<sup>2</sup> Centre de recherche et développement en économique (C.R.D.E.) and Département de démographie, Université de Montréal

November 2000

---

\* This study is part of a research program on child mortality-fertility relations funded by the Rockefeller Foundation and jointly run by Kenneth Hill (Johns Hopkins University) and Thomas LeGrand. Additional support was received by the A.W. Mellon Foundation and CIDA. Many thanks are due to the hard work of the qualitative data team in Senegal led by Cheikh I. Niang, Dominique Gomis and T. LeGrand : Hamadou Boiro, Fatou Cissé, Alioune Diagne, Rokhaya Nguer, Moustapha Diagne, Ndella Diakhaté and Fatima Traoré.

## RÉSUMÉ

Les auteurs examinent les liens entre mortalité des enfants et comportements de fécondité à partir des données qualitatives collectées en milieu urbain et rural au Sénégal. L'analyse examine l'existence et la forme des effets de remplacement et d'assurance tel que décrits habituellement, où les risques de mortalité des enfants sont pris en compte de façon consciente. Les autres mécanismes possibles entre mortalité des enfants et comportement de fécondité sont décrits en détail, mais leur validité n'est pas examinée. Les comportements de remplacement et, plus rarement, d'assurance ont été exprimés dans les entretiens, mais leurs effets sur le niveau de fécondité sont probablement mineurs. Cela dit, il est difficile d'évaluer l'importance réelle de ces comportements, parce que les sénégalais n'aiment pas parler ouvertement des sujets liés aux stratégies de la fécondité, de la taille idéale de la famille, et de la mortalité des enfants. Le déclin de la fécondité au Sénégal se concentre parmi les femmes âgées de moins de 30 ans et semble lié à un retard de l'âge du mariage et de la première naissance. Dans nos entretiens, les décisions de mariage ne semblent pas être influencées par les risques de perdre les enfants. Si un tel effet existait, il opèrerait au niveau des parents du jeune couple et serait d'une importance mineure. Dans les trois sites, les personnes interviewées ont une connaissance générale des méthodes de contraception, où se les procurer, et le contrôle des naissances pour protéger la santé des femmes est perçu comme acceptable. Contrôler sa fécondité pour limiter le nombre de naissances est une raison plus controversée, non acceptable en zone rurale. En ville, vouloir limiter sa fécondité pour pouvoir mieux élever ses enfants est une motivation souvent exprimée. Pour les citadins, la "qualité" des enfants se réfère plus à leur éducation morale et à l'entretien de l'autorité parentale, afin de produire un enfant qui ferait honneur à sa famille et sur lequel la famille peut compter; sa scolarité est d'une importance secondaire. En ville par rapport au village, bien élever un enfant nécessite beaucoup plus de temps des parents et un plus grand investissement financier.

Mots clés : fécondité, comportements de fécondité, stratégies de fécondité, préférences en matière de fécondité, taille idéale de la famille, espacement des naissances, planification familiale, contraception, mortalité des enfants, survie des enfants, santé des enfants, santé maternelle, Dieu, fécondité naturelle, perceptions, remplacement, assurance, mariage, données qualitatives, EDS, Sénégal, Afrique, Wolof, Dakar, capacité d'agir

## ABSTRACT

This study examines the links between child mortality risks and fertility strategies, based primarily on qualitative data collected in three urban and rural sites in Senegal. The analysis focuses on the existence and form of the typical replacement and insurance effects, in which a conscious consideration of mortality risks enters into reproductive decisions. The many other ways by which infant and child mortality may affect fertility are presented in detail, but their validity is not explored. People expressed replacement and more rarely insurance motivations, although their overall effect on fertility is probably small. That said, it is difficult to assess the true importance of these motivations and their likely effects on reproductive decisions, given people's reluctance to talk of issues related to desired family size, fertility strategies and child deaths. The decline in fertility in Senegal has occurred mostly among women under 30 and appears related to delays in women's first marriages and childbirth. There is no evidence that people take into consideration child mortality risks when making marriage decisions. To the extent that mortality may be a factor, it would occur at the level of the parents of the young couple and would have, at most, a mild effect. In all sites, interviewees had a general knowledge that effective methods for fertility control exist, where to find them, and fertility control was viewed as acceptable when necessary for the mother's health. Fertility control for restricting family size was much more controversial, largely unacceptable in the rural area. In urban areas, the need to control fertility in order to be able to bring children up well was a major concern. There, child "quality" refers to their moral upbringing, maintaining parental authority, and producing a child who will be a credit to family and on whom parents can count when in need; child schooling is only of secondary importance. Compared to life in villages, in cities much more parental time and investment is required to produce a well-brought up child.

Key words : fertility, fertility behavior, fertility strategies, fertility preferences, ideal family size, birth spacing, family planning, contraception, child mortality, child survival, child health, women's health, maternal health, God, natural fertility, perceptions, replacement, insurance, hoarding, marriage, qualitative data, DHS, Senegal, Africa, Wolof, Dakar, agency

## Introduction

A reduction in infant and child mortality is generally thought to be an important, if not necessary, determinant of the onset of the fertility transition. In the words of Notestein (1945:39) in his classic description of the demographic transition: “Any society having to face the heavy mortality characteristic of the premodern era must have high fertility to survive. All such societies are therefore ingeniously arranged to obtain the required births. Their religious doctrines, moral codes, laws, education, community customs, marriage habits, and family organizations are all focused toward maintaining high fertility.” With gradually falling mortality risks due to factors such as improvements in health services or economic development, the need for motivating behaviors conducive to high fertility lessens; young adults may be allowed more latitude in terms of age at marriage and have less incentive for having many children within union. More recent theoretical arguments have recognized the potential importance of mortality reductions by emphasizing surviving children rather than total number of children born. In order for children to be of real value to their parents and family in terms of economic production, old age support, and lineage considerations, survival to adulthood is essential.

Surprisingly, relatively little empirical work has been done on this topic to date. Most research has focused on the physiological and replacement effects, whose impacts on fertility levels are relatively small (e.g., Preston 1978). Few studies have attempted to assess the potentially more important insurance effect or the numerous other ways by which child mortality may affect fertility, including through marriage behavior and the amount of time women spend in sexual union. Similarly, little attention has been put on the underlying hypotheses and pathways through which these effects are presumed to operate. This paucity of research is in large part due to the lack of appropriate data and to the difficult methodological issues<sup>1</sup> which afflict studies on the topic, along with demographers' traditional reticence to make use of qualitative research methods in their work.

Yet the hypothesized mortality-fertility link remains central to most theories of the fertility transition, and important questions remain to be answered. In specific contexts, how do women, men and families cope with the risk or occurrence of multiple child deaths, with their heavy emotional, social, and economic consequences? To what extent are families aware of changes in these risks, and how does this affect their family building strategies, especially in terms of marriage and fertility? Does the decline in infant and child mortality observed over the past four decades in sub-Saharan Africa predispose the region to a forthcoming decline in fertility rates? Or does the leveling off and even increase in mortality levels observed in several countries in the 1990s imply that there will be a delay in this fertility transition?

In this study, we use qualitative data collected in 1999 in three sites in Senegal - a rural village, a secondary town and a neighborhood in central Dakar - to investigate these issues. The next section reviews the main theoretical arguments by which mortality reductions are

---

<sup>1</sup> See Cohen and Montgomery (1998) and Brass and Barrett (1978) for reviews of these issues.

thought to affect fertility. We then present a brief overview of relevant demographic trends and statistical evidence of a mortality-fertility link in Senegal, based on Demographic and Health Survey (DHS) data followed by a detailed consideration of perspectives of these issues based on the qualitative data. The final section summarizes and discusses the implications of our findings.

### **Theoretical overview of the child mortality-fertility link**

In this section, we review the pathways by which infant and child mortality are presumed to affect fertility, distinguishing between those that are grounded in the conscious strategies that aim to affect ultimate family size and those that are not.<sup>2</sup>

#### *Conscious strategies*

The hypothesized behavioral mechanisms make a lot of sense to northern demographers who, for the most part, developed them. Of the strategies described below, only the one proposed by Bledsoe and her colleagues is based on qualitative research in a specific sub-Saharan African context; the rest have emerged largely from northern demographic logic and quantitative associations. African societies have evolved to survive in a context of high uncertainty including high mortality risks, and they are surely gradually adapting to changes in their environment: falling mortality, greater integration in the international community, etc. But the rationales behind their organization, founded in their specific histories and emerging from their cultures, may give rise to reproductive strategies that do not necessarily match our theories. In addition, these strategies are often not mutually exclusive: several may coexist in a given society or even family at one time and, since the viability of different strategies changes over the course of development, there may be a succession of strategies with overlapping, lagged effects.

Reproductive goals and strategies may also differ for men and women, and for the younger and older generations. There may be differences in the significance of a child death, in terms of gender and the social, economic, lineage and emotional consequences; these are further complicated in contexts of polygamous marriages, where there may be competition between wives (Blanc and Gage, 2000) and where the father's set of children is usually larger than that of each of his wives. Perceptions of mortality risks, the desired style of life, or the goals of childbearing may also vary between young couples and family elders. For these reasons, power relations within the family - specifically, how fertility decisions are made and who influences them - may affect the importance of these different reproductive strategies.

Replacement effect: the act of attempting to replace a child who dies by an additional birth, either by postponing the end of a woman's reproductive life or by shorter birth intervals. This strategy can occur only after a woman has had her first child; it cannot affect the timing of the first birth or her entry into union. Replacement behavior concerns only *desired* children. It is plausible that couples will often not seek to replace a child who was

---

<sup>2</sup> Detailed reviews of several of these mechanisms can be found in Cohen and Montgomery (1998), Preston (1978), and United Nations (1987).

not initially desired, even if he or she grew to be loved by the parents. Similarly, in a family with five sons and one daughter, the death of the daughter may lead to a greater replacement effect than that of a son, as presumably the daughter would be more highly valued.

The replacement of a child who dies must also be feasible. This means that families must exercise some degree of conscious control over their fertility and, thus, that it is possible for them to choose to have an additional birth, one that would not have occurred in the absence of the child death. In a truly natural fertility context, the replacement effect cannot exist. Children's deaths must also occur before the end of the mother's fertile period. Mothers may often be unable to replace children who die during their adolescence or early adulthood, the case of many deaths from HIV/AIDS. Given that some couples may not wish to replace a child who dies, and that some women may be unable to replace the child, the replacement effect is thought to be small and less than compensatory (i.e., on the average a child death will not be fully replaced by a new birth). Empirical results have generally supported this prediction.

Insurance (or hoarding) effect: the act of building up a “stock” of children in anticipation of possible future child deaths. This occurs by starting childbearing earlier, ending it later, or having more tightly spaced birth intervals, leading to higher fertility than would otherwise have been the case. The insurance strategy presumes that people put a relatively high importance on the number (or at least an acceptable range of numbers) of children compared to other aspects of the children such as child “quality”. In very high mortality environments, couples face an enormous degree of uncertainty in terms of the number of children who survive to adulthood.<sup>3</sup> If the consequences of having too few children are more serious than having too many, as is often thought to be the case (e.g., it is better to have 12 children than none), then this could lead to a strategy where people tend to “aim high” in their childbearing behavior. In this situation, mortality reductions and a rising certainty in children's survival could have a more than compensatory effect on fertility. The

---

<sup>3</sup> An extension of the insurance effect, called the transition hypothesis, has been proposed by Lloyd and Ivanov (1988, and in United Nations 1987). According to them, the degree of uncertainty over the ultimate surviving composition of the family is so great in high mortality contexts that active long-range family building strategies simply don't work. As a result, a natural fertility regime develops in which social and cultural norms largely determine fertility behaviour and result in relatively large family sizes (early ages of women's marriage, rapid remarriage after widowhood or divorce, regular childbearing by women over their reproductive years, and a sharing of the costs and benefits of children within the wider family). In this environment, there is no need for conscious family-building goals or strategies focusing on ultimate family size, and even the notion of desiring a specific number of children may be foreign to members of the society (van de Walle 1992; see also Cohen and Montgomery 1998). With a sustained fall in child mortality, couples grow to realise that they are no longer pawns of fate, that they can actively engage in family-building strategies and create the families they desire by altering their health and fertility behaviours. This realisation may occur through a social learning or diffusion process that could rapidly affect the entire society, causing dramatic changes in both mentality and fertility behaviour.

potential impact of the insurance effect on fertility outcomes is larger than that of the replacement effect.

An insurance strategy can be viable in situations where a replacement strategy is not: high mortality contexts (especially where a fair proportion of children die after early childhood) and, through its effects on marriage, in natural fertility societies. A recent study of 22 sub-Saharan African countries (LeGrand and Barbieri 1998) found evidence of a strong negative association between the level of infant and child mortality in the community and women's ages at marriage and at first birth, even after controlling for a large number of other factors. These results are consistent with the contention that an insurance effect operates through the timing of women's entry into their reproductive lives.

The insurance strategy is empirically hard to study, because it depends on people's perceptions of risks and whether they pursue a specific strategy to deal with these risks. In the usual presentation of this strategy, couples perceive that children's mortality risks are falling over time and thus that it is safe for them to have fewer births. Important issues here are the accuracy of people's perceptions of mortality levels and trends, and the extent to which these perceptions enter into fertility decisions. Assessing the general climate of child mortality risks is far from obvious, in contrast with experienced own child mortality that underlies the replacement hypothesis.<sup>4</sup> Mortality can vary enormously over time and across families and communities, and there is a great degree of chance in terms of individual experience with deaths in the family or awareness of deaths in the community or social network. Perceptions may also be heavily influenced by random occurrences (e.g., the death of a child) or recent events such as a radio report on meningitis in the area. It is also possible that people tend to view the past through "rose coloured glasses", believing that life - including health - was better when they or their parents were young (S. Watkins, personal communication 1998). The little evidence that exists indicates that peoples' assessment of mortality levels and trends can be very inaccurate (Montgomery 1998).

However, accurate perceptions of mortality may not be essential for individuals and couples to show a semblance of insurance behavior. It is plausible that, when developing or revising family-building strategies, people consider and compare the experiences of others in their family and networks. Either by luck or design, some people in their entourage will have more children and others less, and the consequences of these different family building patterns - their problems and advantages - will be observed and discussed. In a context of high mortality, those with low fertility may often find themselves with too few or no children; in a context of falling mortality, this will be less common and those who maintain their fertility at a high level are typically going to have more surviving children, with all the difficulties that may ensue. If fertility strategies are based on this sort of comparison of the advantages and disadvantages of large and small families in their community, then one could observe high fertility levels in high mortality environments and vice versa in the

---

<sup>4</sup> That said, if the woman has had one or more of her own children die, this will certainly affect her view of the risks faced by her other children, and hence the measured replacement effect may incorporate to some extent an insurance effect.



absence of accurate perceptions of mortality, and even without an explicit consideration of mortality risks *per se* in fertility decisions.

Pregnancy endowment strategy When faced with the tragedy of child deaths, Gambian women follow a rational reproductive strategy that is inconsistent with simple replacement behavior (Bledsoe et al. 1998), and which is based on a different understanding of linkages between women's health, their reproductive potential, and child survival. Gambian women believe that they are endowed by God with a given number of pregnancies that can result in miscarriages, stillbirths, children who survive and children who do not. Giving birth depletes a woman's strength and this is thought to be even more true for miscarriages and stillbirths. A woman who does not have the time to recuperate is thought to be more likely to have a miscarriage, stillbirth or child death the next time around; she will also herself face greater health risks, endangering her long-term reproductive potential and her own survival. From this perspective, a woman who has had several children die early in life, or has had stillbirths or miscarriages, may want to postpone her next pregnancy in order to regain her strength and have a greater chance of success the next time around. This delay is not perceived as affecting the potential number of births that she can have -- those are fixed by God; if anything, they believe that it may result in a larger number of live births over the woman's life. This strategy would result in child mortality leading to longer birth intervals and ultimately lower fertility. Such approaches to reproduction are entirely compatible with the life history theory developed by evolutionary anthropologists.

Economic effects Two effects are hypothesized to operate through couples' family-building strategies (Schultz 1981; Cohen and Montgomery 1998). First, as child mortality declines, the average cost (in terms of money, time, mother's health, etc.) of obtaining a surviving child falls, and the number of *surviving* children demanded should thus *ceteris paribus* tend to rise. The ultimate impact on fertility, which considers both surviving and deceased children, is less clear. Secondly, improvements in the health and survival of children mean that the anticipated return on investments in education of children increase, as there is less risk in losing the investment through a child death and healthy children should be able to learn more at school. This will alter the costs and benefits of child quantity (fertility) versus child quality (mostly education). Insofar as this motivates parents to choose quality over quantity, fertility will fall.

HIV/AIDS. The HIV epidemic (which has not greatly affected Senegal to date) can give rise to several behavioral linkages between child mortality and reproduction (Ainsworth et al. 1998; Grieser et al. 2001). HIV-related deaths of children tend to occur early in life, indicating that the mother is also infected, or in early adulthood, after boys and girls become sexually active. If a young child dies and is suspected of having HIV, the couple has no incentive to replace him or her for old age support reasons, and may actively seek to avoid a new pregnancy, in order to avoid facing the emotional distress of another child death and placing additional physical stresses on the mother's body. As a result, in high HIV prevalence contexts, where people often do not know nor perhaps even want to know if they are infected by the disease, the replacement strategy is no longer viable. In addition, the insurance strategy may take on new forms, for example, with a return to earlier ages of

childbearing, when people think their risks of being infected are lower (see Grieser et al. 2000 for the case of Zimbabwe).

For those who truly believe themselves to be uninfected, the prospect of having children die in early adulthood may cause them to alter their fertility behavior. These child deaths often occur after the mother has passed the end of her reproductive years, making the replacement strategy impossible but an insurance strategy more sensible. Increased risks of losing a child after parents have invested in their education will also cause the expected return to investments in child schooling to fall, possibly causing couples and families to put more emphasis on child quantity - higher fertility - than on quality (e.g., less investments in schooling). If longer years of schooling also leads to delayed marriages and more opportunities for young adults to have multiple sexual relations outside of marriage, schooling investments could even increase the risk of losing a child to the disease.

#### More mechanistic links between child mortality and fertility

Physiological effect. An infant's death can truncate breastfeeding, shortening the mother's period of post-partum infertility and making it possible for her to physically become pregnant more rapidly. In many African societies, the birth of a child is followed by an abstinence period of a length prescribed by socio-cultural norms. An early child death can also cause this period to be truncated. Since this behavior is deemed to be unrelated to the couple's desired family size, its impact is similar to that of truncated breastfeeding, and it is often presented as a variant of the physiological effect. The impact of these mechanisms on fertility will be stronger in contexts where the introduction of supplemental foods and children's weaning occurs relatively late, where there is little conscious control of fertility, and among mothers with children who died very early in life.

Time spent in marriage: social and economic effects. Infant, child and young adult mortality can affect fertility through the workings of marriage and inheritance rules. For example, in some African societies, a girl can be promised in marriage early in life, long before the marriage actually occurs. If that girl dies, a younger sister may be called upon to take her place, and it is likely that her age at marriage will be earlier than otherwise. The death of boys in a family means that there are more family resources available for bride wealth for surviving sons, and this may lead to earlier men's ages at marriage and at first birth. There are also *sororate* and *levirate*: the practices of replacing a married woman who dies by her younger unmarried sister, and marrying the widow of a deceased man to his younger brother, respectively. The potential effect of these types of marriage rules is to increase fertility by lowering women's and men's ages at first marriage and by reducing the time spent in widowhood, out of marriage.<sup>5</sup>

Community-level effects. A number of mechanisms may operate at the community level, affecting the context in which reproductive decisions are made. These include:

---

<sup>5</sup> A different set of marriage and inheritance rules in pre-industrial Europe may have caused adult mortality reductions to lead to later men's ages at marriage, resulting in lower fertility. For more on this, see Lee (1977).

A. Marriage squeeze. Sub-Saharan Africa is characterized by exceptionally large age differences between spouses, with husbands often being 5-15 years older than their wives (Barbieri and Hertrich 1999, Blanc and Gage 2000). Reductions in child mortality, in the absence of counterbalancing fertility reductions or migration flows, should lead to a younger age structure and gradually to an increase in the number of eligible women for each of the somewhat older men on the marriage market. This can result in several changes: rising women's ages at marriage relative to that of men, an increase in the incidence of polygamous marriages (including informal unions; see Antoine and Nanitelamio 1990), or to growth in the incidence of permanent celibacy among women. Even a modest marriage squeeze can give rise to substantial changes in marriage patterns, because the supply of eligible women on the marriage market is inelastic at least at the national level. Research has shown that marriage squeezes have led to later women's ages at marriage in South Asia.<sup>6</sup>

B. Institutional change. The social institutions and norms that influence fertility behavior are not immutable: they change over time, perhaps in fits and starts and with a fair degree of inertia, as the underlying environment evolves. In the long-term, with economic development and a decrease in the degree of uncertainty (of which mortality is an important part), certain aspects of these institutions will become progressively less appropriate and there will be increasing pressures to modify them or otherwise allow more flexibility with regard to people's behavior. It is plausible that important reductions in children's mortality will have subtle but ultimately far-reaching effects on family organization, marriage, and other institutions that affect fertility preferences and outcomes.

C. Value of children. If mortality falls and fertility remains high, this will lead to population growth and eventually to an increasing scarcity of natural resources (farm land, environmental commons, etc.). Over time, this will *ceteris paribus* alter the economic value of child labor and may thereby affect fertility decisions.

### **Quantitative evidence on child mortality and fertility in Senegal**

Senegal has had a variety of censuses and surveys (including a World Fertility Survey in 1978 and Demographic and Health Surveys in 1986, 1992/93 and 1997), which allow for a reasonably accurate description of mortality and fertility levels over time. Unless otherwise stated, the overview of demographic trends below are based on the findings of two recent studies, Ndiaye et al. 1997 and Pison et al. 1995.

On the whole, demographic trends in Senegal resemble those of many other countries in the region. Since the end of World War II, infant and child mortality (ICM) has fallen by almost two-thirds, from nearly 400 per thousand to about 140 per thousand in the mid-1990s. Mortality improvements began first in the main urban areas, starting well before the middle of the century. In rural areas, ICM remained high through the early 1970s, when DHS-I and WFS data put it at about 350 per thousand. In the following two decades, rural infant and child mortality fell rapidly, in part due to the effects of vaccination campaigns

---

<sup>6</sup> See Fernando (1975) for Sri Lanka, Caldwell et al. (1983) for southern India and, for contrary evidence, Amin and Cain (1997) for Bangladesh.

especially after the mid-1980s. In urban areas, improvements over this period were more moderate, leading to a decrease in the rural-urban mortality gap. There remain nonetheless significant differences in the survival prospects for children born in rural versus urban areas, as well as for children born to well educated versus uneducated mothers. DHS data collected in 1997 show no improvements in the survival of children aged 0-5 over the preceding 10-year period, indicating that the long-term trend has stagnated in recent years.

Fertility remains high in Senegal, although it has begun to fall. At the national level, total fertility was estimated at 7.1 in the mid-1970s (WFS-1978), 6.6 in the early 1980s (DHS-I) and 5.7 in the mid-1990s (DHS-III). To date, essentially all of this decline has occurred in urban areas: according to the 1997 DHS, total fertility in urban areas was 4.3, versus 6.7 in rural areas. Educated mothers similarly have much lower fertility levels than others: total fertility for women with secondary or university-level schooling was 3.1 versus 6.3 for those without schooling. Interestingly, fertility reductions are concentrated among women aged less than 30 or, in the case of Dakar, less than 35. A proximate determinants analysis indicates that lower fertility is caused in large part by changes in marriage behavior, in particular by rising ages at first marriage for women.<sup>7</sup> Interestingly, this same study did not reveal increases in age at marriage for men; this is consistent with the hypothesized effects of a marriage squeeze. Women's ages at first birth are also rising although to a lesser degree, suggesting either an increase in premarital births or shorter intervals between marriage and first birth. Use of modern contraceptives rose from under 1% in 1978 to just 8% in 1997, and remains too low to explain much of the observed decline in fertility. That said, in our fieldwork in 1999, it was clear that women are well aware of these options and, especially in Dakar, contraceptive use appeared to be widespread.

The DHS provide data on the reproductive histories of women and on their children's survival. This allows us to compute birth intervals for women with different experiences in terms of the survival or death of their previous children, prior to the birth of the child who opens the interval. One would expect that, if there were a strong replacement effect operating in Senegal, it would lead to shorter birth intervals for women who had lost an earlier child, other things being equal. The surveys do not have data on mortality perceptions, making it impossible to directly study the insurance effect.

Pooled data from the 1986, 1992/93 and 1997 DHSs were used in these calculations. A small percentage of women were unable to give accurate information on the dates of birth and death of their children, and their data are omitted from the calculations. All intervals following the birth of twins or triplets are also omitted, as the behavioral impact of the survival or death of these children may be very different from that of single births. An important problem concerns events that occur during the interval under study. For example, if the child whose birth opens the interval dies, this could give rise to either a physiological effect or a behavioral replacement effect. The death of children of lower birth orders could also lead to replacement effects, the size of which will be difficult to measure accurately. When this occurs, the data are truncated eight months following the time of the event.

---

<sup>7</sup> Pison et al. (1995). Jolly and Gribble (1993) present the results of a similar study for the entire subcontinent; see also Adlakha et al. (1991), Cleland et al. (1994), and Cohen (1993).

Finally, a number of birth intervals were truncated by the survey, and we cannot know when they were closed, if ever. In order to handle these issues and limit the effects of sample selectivity, life table (survival data) techniques are used in this analysis.

Table 1 presents median and third-quartile birth intervals measured in months by survival of prior-born children, mother's parity and schooling, urban/rural residence and date. Compared to medians, third-quartile lengths are generally more sensitive to long birth intervals and intervals that are not closed: women who stop childbearing and never have the child to close the interval. In the table, differences tend to be much more pronounced for third-quartile intervals than for the medians. Significance levels are from log rank tests of the differences between the survival curves. These may be somewhat overstated because of autocorrelation from the clustered sample design and the fact that up to three birth intervals can be observed for a single woman in the statistics.

On the whole, these statistics provide little evidence to support the existence of a pronounced replacement effect. Only among educated women, especially those living in urban areas and at higher parities, are birth intervals substantially shorter for women who have lost children. Birth intervals were also estimated for women with primary versus secondary and above schooling levels (data not shown). These calculations ran into problems of small numbers of higher educated women who had lost children, and it was impossible even to calculate their birth intervals between birth orders 6-9.<sup>8</sup> For birth orders 2-4 and 4-6, the estimated replacement effect was much stronger among women with secondary schooling or above than among those with no or simply primary level schooling: their birth interval lengths fell sharply and monotonically with an increase in prior child deaths. This relationship was statistically insignificant for intervals between birth orders 2-4 and significant at the 1% level for intervals for birth orders 4-6. On the whole, the results indicate that, to the extent that replacement behavior affects fertility in Senegal, its impact is concentrated primarily among the urban educated elite.

---

<sup>8</sup> This problem brings up the issue of selectivity through fertility and parity: the possibility of stopping behavior by the highly educated urban elite in recent years. The small percentage of these women who do end up having a large number of children may be very unrepresentative of the group as a whole.

**Table 1: Birth intervals lengths by survival of prior children and by parity**

<i>Birth intervals 2-3 and 3-4</i>							
Prior child deaths:	- Median -		Third-quartile			Sig.	
	0	1-2	0	1-2			
Total	31	31	41	41			
Schooling: none	31	31	40	41		**	
some	31	31	46	44		**	
Rural areas	31	31	40	40			
Schooling: none	31	31	40	40			
some	30	31	43	41			
Urban areas	31	31	44	47			
Schooling: none	30	31	40	46		**	
some	33	31	50	52			
BI opens < 1988	30	30	39	40			
1988+	33	34	45	45			
<i>Birth intervals 4-5 and 5-6</i>							
Prior child deaths:	-- Median --			Third-quartile			Sig.
	0	1	2+	0	1	2+	
Total	31	31	31	43	41	42	**
Schooling: none	31	31	31	42	41	42	
some	32	30	31	51	43	39	***
Rural areas	31	31	31	42	41	42	
Schooling: none	31	31	31	41	40	42	
some	30	30	31	47	41	43	
Urban areas	32	30	32	48	45	39	*
Schooling: none	31	31	33	44	43	45	
some	33	29	30	58	45	35	***
BI opens < 1988	30	30	31	41	40	42	
1988+	34	34	34	49	46	44	
<i>Birth intervals 6-7, 7-8 &amp; 8-9</i>							
Prior child deaths:	-- Median --			Third-quartile			Sig.
	0	1-2	3+	0	1-2	3+	
Total	33	33	34	50	46	51	**
Schooling: none	33	33	34	47	45	51	
some	35	33	36	71	52	64	*
Rural areas	33	33	34	48	46	50	*
Schooling: none	33	33	34	46	45	50	
some	34	32	38	67	49	64	
Urban areas	34	34	35	57	53	60	
Schooling: none	32	33	35	50	48	60	
some	36	37	32	79	72	36	
BI opens < 1988	31	31	33	45	42	47	
1988+	37	36	38	62	52	79	**

*Notes: Significance levels: \*\*\* 1%, \*\* 5% and \* 10%. Birth intervals are in months. Data are from the pooled Senegal DHSs for 1986, 1992/93 and 1997.*

The statistics for intervals between birth orders 4-9 also often show a “U” shaped pattern, with longer birth intervals occurring for women who have lost no or many previous children and shorter ones for women who have lost just one or two children. This may be evidence of a pregnancy endowment effect, with women who have lost many children taking time to recover their strength before attempting a new pregnancy. The pattern may be also be due to the confounding effects of maternal health and fecundity. It is possible that maternal health problems, such as those caused by STDs, could result both in problems of subfecundity and higher health risks for the children who are born. In addition, a clustering of health problems among children of specific women could cause prior child mortality to be correlated with spontaneous abortions and stillbirths, both of which would lead to longer observed birth intervals in DHS data. In Senegal, where few women appear to practice voluntary stopping behavior, it is conceivable that these factors underlie a sizeable proportion of long and open birth intervals observed for women aged under than 40.

By comparing the results for different rows in the table, it appears that women who attended school have longer birth intervals than others. This finding is evident primarily for the third-quartile interval lengths. Urban/rural differences are also apparent, with intervals in urban areas tending to be longer, and this is especially true for women with schooling. Finally, there is a trend towards longer birth intervals over time: at all parity levels, birth intervals starting before 1988 are systematically and substantially shorter than those starting in more recent years.

## **Qualitative data analysis**

### The study sites

Qualitative semi-structured interview data were collected in three main study sites in Senegal between February and June 1999. The sites were selected to represent the variability of available infrastructure, dependence on agriculture and ultimately changes in fertility and mortality in contemporary Senegal. All sites were dominated by Wolof inhabitants. The sites are:

The village - divided into several hamlets located 3-7 km from the main Thiès-St. Louis road. The village recently opened a primary school in a one room temporary shelter, and during our fieldwork only the first grade was taught. There is no functioning health facility in the village itself, no electricity, and stand pipe taps have only recently been installed in some of the hamlets. The village chief’s household has a battery-run television. Although agriculture and livestock rearing are the traditional mainstay of the village economy, horse ownership and cart transport is an important activity. Most young men leave the village, at least in the dry season and often all year round, to work elsewhere as laborers. Some young women leave temporarily to work in Dakar.

The small town in the interior - situated between Thiès and St. Louis. A *lycée* (high school) has recently opened here and there is a small hospital and good general communications. All the basic services are present. A substantial proportion of the town’s young men emigrate to Italy where they work in factories or in informal commerce. The

remittances have had a major effect on the town in terms of infrastructure, and also on marriage behaviour.

Two zones in the Médina quartier of Dakar: Centenaire is an area with outwardly good modern infrastructure and housing, largely constructed in the 1960s and owned by retired civil servants, who purchased when it was new. In many cases their children and grandchildren continue to live with them and the superficially good housing masks a high level of unemployment and overcrowding. Santhiaba is a traditional Wolof *penc* (community), with very variable quality housing stock and a market atmosphere. It is more heterogeneous than Centenaire and is managed traditionally by the Wolof *penc* elders.

### The qualitative data collection

Interviews were done by a trained team of seven anthropology and sociology graduates, some with substantial previous experience in qualitative fieldwork. A male and a female interviewer worked together in each site; in Dakar, different women worked in the two zones but the same male interviewer covered both sites. In each site, a series of in-depth, semi-structured interviews was undertaken with a range of men and women of different ages and reproductive statuses. Different sampling strategies were used in each site according to the local situation, but in each case respondents who fulfilled the criteria were selected at random.

The interviewers were trained in both interview methods and the particular theoretical issues that the study wished to address. They contributed substantially to elaborating the themes to be covered whilst always retaining the aim of exploring reproductive and marital decision making in a context of changing mortality risks. Interviewers were trained to ask about mortality perceptions only if the subject did not arise spontaneously and to probe carefully whenever it did. While the subjects' own experience of child mortality, either as a child or as a parent, was an essential theme in the interviews, the interviewers were trained not to allow this to contaminate their pursuit of individual perceptions of fertility making decisions, experience and motivations.

The data examined here consist of 137 in depth semi-structured interviews with men and women and 8 focus groups (see Table 2). Most interviews were recorded and transcribed later, although in some cases detailed notes were taken and the interview was written up immediately afterwards.

### Why use qualitative data?

Demographic theories about the relationship between infant and child mortality and fertility are predicated upon quantitative associations. However such associations are not necessarily causal and, even if they were, they could take several forms (see the theoretical overview, above). These associations are often subsequently explained in terms of 'reproductive decision making' although who is making the decisions and what the decisions are based on is not always clear. Evolutionary biologists interested in human reproduction (Dunbar 1995) also use the term 'reproductive decision' to represent behaviors related to human reproduction which are adaptive to maximizing reproductive



success in a particular environment. Such reproductive decisions are actually far from the conscious reasoning and decision-making that we consider here and yet they generate statistically significant associations.

**Table 2: Qualitative Data: Numbers of Interviews and Focus Groups by Area**

Category	Village	Small town	Dakar
<b>Men</b>			
Old married men > 50	7	6	7
Married > 10 years 35-49	7	5	6
Married < 5 years	4	5	2
Unmarried	3	2	3
<b>Women</b>			
Married/widowed >45	7	6	8
Married >10 years 30-44	7	4	5
Married < 5 years	6	5	5
Never married	2 (early 20s)	3 (20s)	4 (3 > 30)
Married Couples	0	0	9X2
<b>TOTAL</b>	<b>43</b>	<b>34</b>	<b>58</b>
<b>Focus groups</b>			
Women	0	3 (22-59 wives of migrants) (32-40 wives of non-migrants)	2 (25-38 <primary) (29-40 secondary +)
men	0	(19-40 married & single) 1 (28-45 married men)	2 (27-43 Married) (27-45 married)

If, however, we are interested in studying a manipulation of reproductive behavior and what might be considered ‘conscious’ decision making, then the validation of theories linking fertility and mortality must be made not only through quantitative evidence but also through an examination of people’s reasoning and their beliefs about the issues under consideration. Pursuing this argument, qualitative analysis of reproductive behavior in a study focusing on the replacement and insurance effects can take three complementary approaches.

Firstly, **do people consciously reason this way?** Is there any evidence that people actually articulate ideas of replacing a dead child with a new birth, and do they actually modify their behavior in order to increase the probability of having another child more rapidly? Is there any spontaneous expression of insurance?

Secondly, **do people perceive the risks in the same way that the demographer formulates them and, if so, do they do this spontaneously or only when prompted by an apposite question?** Thus, do people who have experienced sibling deaths in childhood, or the deaths of their own children, perceive their environment to be more risky than those who don't? Do lay people actually notice the mortality declines which are so prominent in the demographic data? Even if mortality risks are perceived to be high, does this impact on fertility behavior?

Thirdly, **do people have the agency to act upon such perceptions?** What power or control do people have over childbearing, or entrance in marriage? How does this differ between individuals: men versus women, the young couple versus family elders, etc.?

These different sets of issues will be considered in turn using the available interview material.

#### Problems with qualitative interviews on reproductive decision making

Collecting data on reproductive decision-making is not particularly straightforward. Probably the best approach would be a classic anthropological participant observation study over a year or more in one community. However the drawbacks of such a study would be the very limited experience which could be drawn on, since each community has a unique demographic history and environment. In-depth, semi-structured interviews and focus groups, by expanding the sample size and range of experience, are one way around this. However fertility decision-making, husband-wife relationships, and child mortality are very sensitive and personal subjects about which people may be unwilling to talk for a number of reasons – even with their close friends and relatives, let alone with an outsider whom they have only just met. In Senegal, the prominence of religion in daily life may make people reluctant to appear openly to challenge the supremacy of God as a decision-maker even if, in their private lives, they are attempting to control their reproduction. In the course of a single, somewhat formal, encounter it may be impossible to penetrate beyond the socially acceptable facade, however skilled the interviewer. The problem in interpreting the data from the interviews is that, when people state that everything is in God's hands, we are unable to draw the line between those who can do nothing and really believe that this is the case, and those who say the same words because they are the socially acceptable formulae but, in reality, have much more agency over their actions.

**NB20 (village, man, age 27, single)**

*NB20 Death is in the hands of God. You can have 20 children and all 20 survive or you can have 10 and watch them all die. It's God's will, God alone knows.*

**DM03 (Dakar, man, age 67 years, >7 children, polygamous)**

*M Could the fact of losing a child push a husband to impose another pregnancy on his wife?*

*DMO3 (in a very serious tone of voice) What are you saying? But it's not linked. The death of a child and wishing for a pregnancy, it's not linked. One makes a child with God's blessing. If he takes it back you can only wait until He gives it back to you.... I can see no possible calculation.*

In the second example, the intensity of the response suggests that this is a genuine belief. In many other cases, however, the interpretation is less clear.

Another issue, again tied up with the interpretation of people's statements, is an understandable reluctance to tempt fate. People are unwilling to talk about possible child mortality or even a potential low risk of mortality because of the fear that simply articulating such beliefs may cause the event to happen. In both high and low mortality environments, few people seem prepared to say publicly 'my child will not die', even if privately they may perceive the risk to be low. Castle (1999; see also Olaleye 1993) has argued that the act of dissimulating one's desires and strategies by referring to God may emanate from an active family-building strategy, in which announcing overtly one's desires is perceived as likely to bring on the "wrath" of supernatural powers, as well as be condemned as being inappropriate and even arrogant by other members of the society. The implication of this is that silence, in the interviews, can not be taken to mean that the topic is unimportant.

Thus we recognize that there are limitations to the conclusions that can be drawn from this sort of qualitative study. Notwithstanding these problems, the arguments and preoccupations of the different participants will certainly contribute to our understanding of Senegalese interpretations of and responses to fertility-mortality interactions.

#### Conscious reasoning: replacement behavior

There is certainly an element of conscious reasoning in terms of child replacement which is reflected in the quantitative data whereby it is evident that for women with some schooling (probably those who exercise some control over fertility), subsequent birth intervals are substantially shorter when the woman has experienced deaths of her children. In the interviews, spontaneous mention of replacement was most marked in the village but this was probably largely due to the fact that this was the only site where many people had recently experienced child deaths. There was little evidence that such replacement was the conscious acceleration of childbearing for economic reasons – more just a desire for a baby to fill the void.

#### ***FC02 (village, woman aged 38, 4 children of which one was dead, married to migrant)***

*FC You were just talking about children dying. How come you had another child so quickly after the death of your oldest child.*

*FC02 [speaking without embarrassment] In fact I wanted another child then because I didn't even have one. But with God's help, three months later I got pregnant. I really wanted to have another child.... I wanted to have one right down to the depths of my soul.*

Towards the end of the fieldwork in Dakar, people were asked very directly about replacement, and many indicated that replacement was something they would expect to do should the situation arise. However, they said that other circumstances would also be taken into account, such as not wanting large age gaps between children, wanting to avoid pregnancy at later ages, etc.

**FTEC02 (Dakar, woman age 20-29, university educated, 0 children, monogamous)**

*F For example, you have decided to have 3 children, and have achieved that, then at 37-38 you lose one of the 3?*

*EC02 I will keep the 2 remaining ones, because that really wouldn't worry me. Sincerely, I could continue with 2 knowing that in my soul that it was God's will.*

*FT So you wouldn't...*

*EC02 No, because I could lose my life with a late pregnancy, so I wouldn't do it.*

Although replacement is a possible response to a child death, the woman's health, both physical and mental is usually given priority (Randall 2000). Child replacement, for both men and women, also appears to be sought largely to fill a void left by the dead child. This is illustrated by the changing response of the respondent below to the deaths of different children.

**NF01 (village, woman aged 37, >7 children of whom 3 died, married, illiterate)**

*FC On the subject of children, can you tell me the age gap between those dead ones?*

*NF01 There were 3 years between the dead twins and the one who came after, Assane.*

*FC And is that the same gap as between Assane and Bouna?*

*NF01 No, then there was one year after which I was pregnant again. I didn't expect it. In truth, I hadn't thought of making another child so soon, but God decided all that.*

*FC You've just said that you didn't think of having another child after Assane's death. Was it the same after the twins' deaths?*

*NF01 No, I wanted to have another child because I had lost my twins and their deaths really affected me. I think it was that which explained my desire for more children.*

*FC And did you feel the same after Assane's death?*

*NF01 No, this time I didn't have the same feeling; before, perhaps I wasn't very aware (éveillée). But I swear that the twins' deaths affected me, affected me a lot... And I think it was because of that that I so much wanted to have another child at that time.*

*FC Can you explain why you didn't feel the same after Assane's death?*

*NF01 Between those times I had matured. You know, women, as they get older they mature. I said to myself, God wanted it like that so I must accept his will.*

The motives for a replacement response of rural African women to a child death may be closer to the response of women in low fertility societies than many demographers have hypothesized: an emotional desire to compensate for an empty place rather than simply aiming to have enough surviving children because of their long-term utility to the family. This example also demonstrates that, when a dead child is rapidly replaced, it is not necessarily desired and may, at times, be caused more by a physiological effect.

### Insurance behavior

In the study interviews, spontaneous evocation of insurance behavior was rare although it did occur occasionally in all sites.

**KD08 (small town, woman mid-20s, no schooling, 4 children, 3rd wife in polygamous marriage)**

D How many children does a woman generally want to have?

KD08 Some have 10 children, others 5, 2 or 3. You have to anticipate deaths among your offspring.

**NF04 (village, woman aged 57, illiterate, 8 children of whom 2 died, sterilised because of health problems)**

FC ... how many children did you want to have?

NF04 My desire was to have 10 or 12 but I know they wouldn't all survive.

FC You say they wouldn't all survive - what makes you say that?

NF04 Ah... in my experience, all the couples who have 10 or 12 children, either one of the parents dies or some children die. Perhaps if I'd had 10 or 12 children, the same would have happened to me. But all that depends on God, it's He who decides. One could have just one child and he could die... all depends on God.

**NDEC09 (Dakar, woman aged 27, secretary, married, 3 children)**

ND If it's just a matter of looking after them is it easier to manage two children?

EC09 Yes, it's easier to manage two children.

ND Then why didn't you go for two children?

EC09 You know, no one knows what God will do. He could give you 4, he could even give you 10 and then take them away all at the same time..... You could have two children, you lose one, you base all your hopes on the other and God takes him too.

ND That's why you are going for 4.

EC09 Yes.

We must reiterate that the lack of spontaneous evocation of such ideas does not mean that people are not internally reasoning that way. However, when the idea of insurance was brought up deliberately by the interviewer and the responses are examined, it was often clear that, as in the second quote above, there is an apparently fatalistic approach to both fertility and mortality where God was frequently cited as controlling both phenomena rather than human beings. There were nevertheless seen to be limits within which God would operate and, in general, there was a belief that if you had enough children, they couldn't all be taken away.

**KA12 (small town, man aged 61, 11 children, first wife died giving birth to 8th, illiterate)**

KA12 I need to be realistic... What is good about having lots of children is that you are sure of having children who will look after you later. For example, if one has 40 children, the 40 will never all die together; there are those who will die together, those who will die before they are 20, but it's certain that some will always remain. Amongst the 40, some will succeed, will take care of the family... that's the importance of having a large family.

This argument was occasionally counteracted by those who, at least in the interviews, were not prepared to challenge God so openly and said that, just as you could have one child who would be a success, you could also have many and all would die.

The main concern is rarely an articulation of needing a specific number of children that could be more or less guaranteed by having an even larger number, but rather having a reasonable number who would provide company, domestic help and old age support. It is clear that a key issue is not just numbers of surviving children, but the quality of those children. Children are seen as being not only human beings whom one loves, but also as investments for the future. One could have one child who would greatly provide help and contribute to your life, or a dozen ne'erdo wells. It may be that this articulation of failed parenthood was more acceptable and less fate tempting than talking of the death of a child. The focus on child quality ties in closely with justifications for limiting family size (where these exist) and makes it clear that, in this respect at least, the Senegalese are reasoning along the same lines as demographers. Although this concern is somewhat evident in the village, it was clearly more important in Dakar and the small town, where issues of quality of children and the difficulties of childrearing are major worries. Prominent considerations are the material resources necessary for investing in children and, just as importantly, the parental attention needed to raise them well and maintain their authority over the children - these are all perceived as being much harder to achieve if one has a large family.

**DF10 (Dakar, woman aged 26, secondary education, unmarried, no children)**

*F You told me you would like to have two children given the current economic crisis. And if you lost a child...?*

*DF10 I would know that God wished it to be so... (silence) You know madame, you mustn't have children if you can't be certain of feeding them. If you can't bring up your children properly it would be better not to have them. And then you could have several children and lose them all... in the same way you could have one child who lives a long time. It's a question of luck. What I ask God for is two children - no more. If they die I will know that God wanted it. But if, at the time of their death I'm still fertile, I will have other children.*

*F How many?*

*DF10 Hum! Have one more child and see what God does next.*

Worries about resources required for raising and educating children were mainly issues in Dakar and, to a lesser degree, in the small town. Urbanites perceived villages (and the past) as environments in which such worries were not an issue. This was reflected in our village interviews where issues of child related expenses were not brought up; children were likely to be perceived as an economic asset and, in any case, there was a strong belief - particularly amongst men - that if God gave a child he would feed it.

### Perception of risk

Do people perceive the risks of mortality to be high or low? In the village, there was a pervasive awareness of the possibility of child death, with most people able to cite deaths which they had encountered, if not amongst their own children. The majority thought mortality risks had decreased and frequently ascribed this to immunization and better

health care. However, a sizeable minority thought risks had increased or remained the same, especially for adults, although it was usually clear that they were reasoning in terms of the numerator - numbers of deaths - rather than rates. In the small town, mortality risks were usually perceived to be low and there was little association in people's minds between their own experiences, particularly those in childhood, and their perception of the current risks of losing a child. This was probably in part due to the strong reluctance to challenge - at least openly in an interview situation - God's will. Thus, if God is the ultimate determinant of child survival, and because He is God He cannot be challenged, it would be almost blasphemous to state that one was having more children to counter high mortality risks. Even the man who was the only surviving child out of 11, and who had stated that he wanted many children (he had 9 by 5 different marriages with each wife having 1 or 2), did not articulate his desire for children in terms of risk, but rather in terms of the fact that, with no surviving siblings, his only kin would be through the children he produced. Interestingly, this did not deter him from divorcing his wives.

**KA14 (small town, man aged 73, secondary school, 9 children from 5 wives)**

AD Did you want to have lots of children when you were young?

KA Ah yes! Me, I wanted lots (laughs). My great sadness was not having had brothers and sisters [10 siblings had died] and I always perceived that as a 'condemnation'. I remember, my mother always told me to love my children because I was an only child and my children were my only relatives. All that I have done or achieved, I did it alone.

In Dakar, especially for the young, the risk of child deaths is very remote with people willing to state that they expected to die before their children. An interesting issue to emerge though was the idea that such a perception of risk and an insurance response to it is alien to the African way of behaving.

**MDIR07 (Dakar, man aged 25, unmarried, secondary education)**

MD Does the death of children influence a couple's fertility?

MD09 I don't understand you.

MD Would the fact of losing children constrain people's procreation or would it be a sufficient reason to have lots of children?

MD09 I don't think that people here reason as you do. Because there is the phenomenon of God, religion, faith etc. Everything counts. People are believers.

**DGEC03 (Dakar, man aged 55, university educated, monogamous, 3 children)**

EC04 You could go up to 30 [children] and they could all die. Everything depends on God. You shouldn't try and plan like that, wanting to imitate the tubaabs [whites].

These two highly educated Senegalese are certainly rather hostile to the demographers' construction of fertility behavior.

Do people have the agency to act upon their perceptions?

The insurance effect is only an operational interpretation of demographic behavior if entrance into marriage or fertility control are within the realm of conscious choice. Thus

the first thing to establish is the degree of awareness of fertility control in these communities.

The immediate response of most individuals in the rural village, many in the small town and some in Dakar was that the number of children is up to God, that humans must do what they have to do (i.e., have sex with their spouses) and God will determine whether or not a pregnancy ensues. God is often perceived to be the one who will also ultimately provide for the child.

**NB05 (village, man aged 40 monogamous, 8 children all alive)**

*H I don't wish it and may God protect you from it, but suppose one of your children dies, what would you do?*

*NH05 Nothing. I would continue to have sex with my wife until God gives us more, because everything depends on God. We, what we do is our marital duty, that's to say at night make love to the wife (laughs).*

Many people, especially in the village, tended to deny any knowledge about contraception at first, although, as many interviews progressed it became clear that, despite both men and women being unclear about the specifics of contraceptive methods, there was a widespread knowledge that there were means to control fertility which were available through health centers.<sup>9</sup> Health centers were also perceived to be accessible in terms of both distance and affordability. Furthermore, even where fertility control with the goal of limiting births was stated as being contrary to divine will, when couched in terms of women's health it became much more acceptable both for women and men.

**KA02 (small town, man aged 44, three wives, 8 children)**

*A You say you want to have lots of children and yet your wives are still using modern contraceptive methods. How do you explain that?*

*KA02 There is no paradox in that because, if I propose to my wives that they use these methods, it's so that they are in good health and that they rest a bit before wanting to have another child. It's not to say that they are going to stop having children.*

**NB06 (village, man aged 61, 2 wives, 10 children all alive)**

*HB And if your wife doesn't want any more children?*

*NB10 I've heard people on the radio talking about 'palani' (family planning), that's to say, stopping births. If my wife is ill and could have problems, I can accept this, but otherwise I wouldn't do it and, if she does it, I will let her go and find another wife. Because one doesn't have the right to reduce births.*

Of the rare village women who were contracepting (one had a tubal ligation and there were rumors about others), all were said to have had difficult pregnancies, childbirth, or overall poor health, and were towards the end of their reproductive years. For most village men, the initial response to the idea of contraception was very negative. Yet when challenged about its use should their wives be ill or suffering, they generally responded by saying that

---

<sup>9</sup> This calls into question the validity of simple survey questions pertaining to contraceptive knowledge and use, such as those used by the DHS.



they would sanction it if medical advice indicated that the wife needed to avoid pregnancy. The degree to which this is a consequence of media or other campaigns about women's health, rather than being a genuine belief on the part of men, is unclear. But, given that there were clearly cases in all sites of older women using contraception because of perceived health risks, there is some legitimacy in the observation of changes in attitudes and behaviors. Also, it must be borne in mind that, because of polygamy, men do not perceive the end of their wife's childbearing as necessarily an end to their own.

**NB08 (village, man age mid-40s, 10 children 2 dead, monogamous)**

*H If God takes one child from those you have, will you try and have another or not?*

*NB08 I will go on having sex with my wife and hope for another child. If my wife can't have any more children and I have the resources, then I will marry a second wife.*

In justifying polygamy, both men and women frequently stated that it was to provide more help in the household and thereby give the first wife a rest (with the implication that this was from domestic and also sexual and reproductive duties), and to have more children.

The acceptability of fertility control for the wife's health is significant for two reasons. Firstly, it indicates an awareness of fertility control methods which is a necessary precondition for further change. Secondly, as a legitimate arena for women to control fertility, women are clearly aware of their ability to manipulate this socially sanctioned concern of their husbands for their own ends. Several women stated that they would start to use contraception when they were tired and that their husbands would be unable to challenge them, because a husband could not deny a woman what was necessary for her health. With regard to our understanding of the insurance effect, the implication is that, since fertility control is now within the arena of conscious choice even in the village, then it is clearly possible for most people to start reasoning about their fertility behavior.

However, in the village, in much of the small town and to a lesser extent in Dakar, the acceptability of fertility control is still only verbalized in terms of women's health. Although health risks are a permissible reason, just 'wanting' less children is considered by many to be unacceptable, with this unacceptability couched in terms of God's will. This is especially true for men.

**KA04 (small town, man aged 35, monogamous, 2 children)**

*T For 'planning' I am against it because one doesn't have the right to go against God's will. It is God himself who gives children to those he wants to and, if he decides to give me children, I don't see why I should go against his wishes... I can, however, understand that an ill woman decides to have a rest if her doctor says so. In the final count one can understand that, but what women do now is against God's will.*

*A So you wouldn't accept that your wife uses modern contraception?*

*T Never! Except if a doctor asks her to.*

This lack of acceptability for men of contraceptive use for fertility control *per se* is important because, with the partial exception of Dakar, most women did not perceive themselves as having the agency to act independently of their husband's will in this

domain. Although some women might express a desire for family size limitation or even spacing, when asked if they would go against their husband's desires, the majority said they would not.

**KD02 (small town, woman aged 22, married, secondary school, 0 children)**

*D In your opinion, are men in favor of birth spacing using contraception?*

*KD02 No, men here do not value 'planning' - they often stop their wives from using it, which is why some women use it secretly...*

*D If, after having had your 5 children, you don't want to have any more and your husband is of the opposite opinion, what will you do?*

*KD02 Ah, I will follow his will, because he's my husband. I will only do what he wants on condition that he doesn't wish me any harm. I will try to make him understand the reasons why I want to plan but I will do nothing against his will. You know, all women have their ways for making the husband do what they want...*

Of course, from these data we will never know if that is actually how they do act, but certainly this is their stated perception of their agency. Thus a key barrier to fertility control amongst younger rural and small town women is with regard to their autonomy within marriage. As people become more cosmopolitan and more educated, this barrier is broken down in two ways: firstly, women are more likely to do what they want without having to submit to choices made by their husbands and, secondly, the husbands themselves are more likely to find fertility control acceptable.

The articulation of any insurance mechanism needs to be considered within this context. In the village and in much of the small town, although fertility control is probably within the realm of conscious choice, it is predominantly acceptable only towards the end of a woman's reproductive life, when she already has a reasonable idea of the number of surviving children she will ultimately have. Changes in this sort of reproductive behaviour are unlikely to play a major role in a fertility transition, which in Senegal seems to be occurring mainly at younger ages. In Dakar, fertility control is more pervasive at all stages of reproductive life, with ideal completed family size usually set at 3-5 children. This number concerns the completed family size of living children – not just the desired number of births factoring in the perceived risks of child deaths. Fertility preferences have fallen in Dakar not because of an explicit consideration of perceived changes in child survival, but because: (a) times are tough and children are becoming expensive (b) people want to invest more in their children and (c) in an urban environment it is understood that well-brought up children need a lot of parental attention and this is not possible with large numbers of children. On this issue, there was an enormous contrast between the village and Dakar in our interviews, with the small town falling in between.

**DF07 (Dakar, woman aged 33, single, secretary, 0 children)**

*F And you, if you were married, would you have lots of children?*

*DF07 It's true that it's our culture and it's God who manages everything, but I don't want a big family. If I can control the number of children I will, because it's not only a matter of giving birth, you have to bring them up and that need a lot of money, and God's help. But if you want to manage them well they mustn't be too numerous.*

Apart from the village, worries over the child quality and the necessity of investing time and resources in them was foremost in people's minds – much more important than sheer numbers of children and the risks of them dying.

### Entrance into marriage

So far the discussion on insurance has focussed on fertility control within marriage. However LeGrand and Barbieri (1998) identified a strong association between community level mortality and women's entry into marriage. They hypothesized that this was another aspect of the insurance effect, where earlier marriage and little fertility control in marriage would allow the earlier marriers to have more children. Even if there were fertility control towards the end of the reproductive years, there would be more opportunity to react to specific circumstances and replace dead children rather than having to rely on an insurance strategy within marriage.

Such behavior could, theoretically, operate through two different mechanisms. The first of these relates to the mechanics of the predominant marriage process. If, for example, children are promised in marriage from an early age and the death of a promised child leads to their replacement by a younger sibling, then higher child mortality would automatically lead to earlier ages at marriage. Similarly, if the *levirate* or *sororate* is practiced (the marriage of a widow to her dead husband's younger brother, or a widower to his dead wife's younger sister) and early adult mortality is again high at the community level, then one might observe a link between high mortality and early age at marriage. Such mechanisms would not need to be the result of a conscious insurance strategy at all, but would give rise to a similar quantitative outcome.

The other mechanism through which perceived mortality risks might operate on age at marriage is speculated to be more conscious, whereby those who live in a high mortality environment or who experienced sibling deaths in their childhood might be encouraged to marry sooner, in order to have more children themselves and thus mitigate such risks, or they might just be encouraged to marry sooner for other reasons unrelated to ideal family size but which ultimately increase fertility.

Betrothals from an early age were not encountered in any of the study sites. Even where marriages took place between close kin, the usual scenario was either a man telling his parents he was ready to marry and they would suggest which related household he would find a suitable wife, or his family taking the initiative to make a proposition. However, the decision to marry and the ultimate choice of the wife was usually made by the man, even though his kin might encourage him, make suggestions and facilitate the proceedings. While people know of the *sororate*, it was never mentioned spontaneously in the interviews. By all accounts, it is very rare today, although it seems to have been more frequent in the past.

***DM10 (Dakar, man aged 51, polygamous – 2 wives, 12 children)***

*DM10 ... Before it was automatic. If a woman died in marriage and had a younger sister, that one replaced her in the marriage*

The *levirate* is practiced, although mostly by the older generation. In our sample, four of the men and two of the women (one in the small town and the others in the village) were in *leviratic* marriages. In one case, this had clearly caused the man to marry much earlier than he had intended.

**NB19** (*village, man aged 32, 3 children of which 1 dead, his wife has 6 other children by his brother*)

NB19 *I got married when I was just a bit older than 15 years.*

HB *Why did you marry so soon?*

NB19 *The 'takko' which I was just talking to you about happened to me. In fact I inherited the wife of my older brother. I was an apprentice driver, and I could drive a car although I didn't have my license. This was the time when my older brother died, and he left me these small children who knew nothing of life. So I had to abandon the job of driver to earn to keep them.*

The reasons given for the decline of *levirate* and *sororate* are themselves clues about changing marital behavior. Comments such as 'they refused', 'you can't inherit love', and a general belief that the different parties would no longer accept such partners imposed on them by kin, was widespread. Both men and women said that, if the situation arose, they would refuse a *leviratic* or *sororate* marriage.

We have already shown that, at least in terms of their articulated fears of a risky environment, people's own childhood experiences seem to have little effect on their perceptions of risk. This is largely because of the rapid and pervasive advent of immunization, with effects well recognized by the population, but also because of confusion about denominators and numerators. Nevertheless, in order to establish whether marital behavior is predicated upon experience of child mortality and desire to have more children, we must consider:

- (a) Who controls entry into marriage and what are the constraints?
- (b) If there is any evidence for earlier marriage amongst those who have experienced high mortality in some form, and
- (c) If so, whether such early marriages are specifically related to potential childbearing.

Young women and their kin have little direct control over when they marry, even in the traditional village setting where the majority of marriages are still between close kin. A girl must wait until someone comes and asks for her. Although young men may often be guided towards specific households by their elders, there is little evidence of marriages arranged from childhood. Thus girls are obliged to wait (a) until they meet a man who wants to marry them (and usually these days who they too want to marry), and (b) until he has amassed sufficient resources. Although in some cases this financial barrier was overcome by the girl's family refusing to take substantial sums for the festivities or bridewealth, this usually occurred when close kin were marrying. This might be a way in which her family could accelerate the marriage process.

In both the small town and Dakar, there was a clear reduction in the proportion of marriages between kin, although they were still common. Marriages between unrelated

partners gave women (and their families) even less control over the timing of marriage, at least in terms of moving it forward. There was, however, some evidence of delaying tactics on the part of women in order to obtain more resources out of the man. Thus, although control of entry into marriage is more in favor of men, the extent of resources necessary for the bridewealth, the gifts and the ceremony mean that men often cannot act rapidly upon a desire to get married.

There was much evidence of inflation in the prerequisites for marriage, with bridewealth cited of up to 1 million CFA francs in the small town and 500,000 in the village (roughly one to two thousand US dollars), although few actually admitted to that amount themselves. Men certainly saw the expense as a constraint which inhibited them from even considering themselves ready for marriage, and the consequence for girls was that there were less men available.

**DF08 (Dakar, woman aged 33, secretary, unmarried)**

*F And with your friend, haven't you got a marriage project?*

*DF08 Ah him - I really don't know what he's on about. He always says he isn't ready, that he needs a minimum before he can marry.... He hasn't yet got the money... he's missing lots of things... and in his current situation, he can't marry a woman (said in a lamenting worried tone).*

Nevertheless there were still cases of rapid marriages – usually between kin – where substantial resources were not involved. Here the man initiated the move, but it was ultimately the demands, or more so, the lack of demands by the woman's family, which determined the speed of marriage.

Even if a couple does want to marry early in order to have many children, it is hard to see how they would have much ability to manipulate the situation: the woman cannot initiate marriage and the man is usually constrained by the financial requirements. Even becoming pregnant is not necessarily a prelude to a rapid marriage. The only way that marriage behavior could be affected by concerns over child mortality is at the level of the parental generation. For many men, their mother was an important initiator of their decision to marry. This occurred either directly, in that she pushed him to marry and suggested where he could find a wife, or indirectly, in that he sought to marry in order to bring in a daughter-in-law to assist her.

**KA07 (small town, man aged 20, single)**

*AD So for you, you need money before thinking about the woman you will marry?*

*KA07 Absolutely! When I'm not so hard up I'll look for a good wife to look after my mother.*

*AD Will you marry her so that she can look after you or your mother?*

*KA07 She'll be my wife, but it's essential that she can help my mother. She is now nearly 50 and continues to do the cooking and everything. We must find wives to look after her.*

This is significant: although the long-term motive for marriage is to have children, for many men, of immediate importance was the need to bring in a daughter-in-law to help

their mother. This was most acute for men's first marriages and in situations where the mother had no daughters or other daughters-in-law of her own on whom to rely for assistance. Thus, one can envisage a mechanism whereby small sibling groups - small, perhaps, because of previous mortality - would lead a man to marry earlier than he might otherwise. It is however difficult to envisage a similar pathway for female marriage, which was the focus of LeGrand's and Barbieri's (1998) study. The other side of this coin is that many women in all sites expressed a preference for sons or noted that a reason for having sons is that they would bring in daughters-in-law to help them later in life. This suggests a clear motivation for the older generation to be concerned over the speed of their children's marriage.

### **Is mortality important? Conclusions**

A first conclusion of this study is the importance of not oversimplifying our theories concerning peoples' goals, strategies and behaviors. There is a tendency amongst demographers to view people as having a very simple set of motivations and strategies, and then to focus narrowly on just one of their goals (for example, the number of surviving children) rather than on several simultaneous and related ones (child quality, mother's health, spacing and a generally acceptable range in numbers of children, etc.). Women's and men's concerns that occur in the developed world also exist in Senegal; an example would be the desire to replace a dead child in order to fill an emotional or physical void. Acknowledging this does not necessarily mean that the replacement and insurance strategies do not exist or that their hypothesized results - the child mortality-fertility link - do not occur, but rather there are many other things also going on. By limiting ourselves to an overly narrow focus on a few of these strategies, we are gaining only a partial and perhaps biased understanding of how people deal with the tragedy of child deaths.

The interviews do express replacement and, more rarely, insurance motivations and behaviors but the impression is that they are not major determinants of reproductive behavior, and their overall effects on fertility levels and trends are probably small. The results of our descriptive analysis of DHS data on the replacement effect go in the same direction: there is some weak support for the existence of a small replacement effect in Senegal, but it is clear only for the urban educated elite. That said, from the qualitative data it is difficult to assess the true importance of these motivations and their likely effects on reproductive decisions, given people's reluctance to talk of issues related to desired family size, fertility strategies, and the possibility of child deaths. Clearly for some interviewees, there was a strong and probably sincere refusal even to consider such motivations - they could be verging on the blasphemous - as the fertility domain is perceived to be in God's hands with no role for human strategies. This expression was especially common in our rural site but also occurred in urban areas not limited to the older population. For others, references to God may have been a socially acceptable means of avoiding having to answer sensitive questions regarding their real reproductive strategies and behaviors.

Concerns over the difficulties of raising children and the high costs of family life in general are very important reasons for fertility limitation in urban Senegal. There, child "quality" relates to the moral upbringing of children, maintaining parental authority, and ultimately

producing a child who will be a credit to family and on whom parents can count when in need; child schooling *per se* is only of secondary importance. In Dakar, parents spoke of the fear that their sons would become thugs or their daughters prostitutes. The city (especially Dakar) is viewed as an environment in which bringing up children well is particularly difficult, where parents must face the effects of the economic crisis (poverty, unemployment, crowding), the presence of bad elements, and the ease of children to escape from parental authority. Compared to life in villages, in cities much more parental time and investment is required to produce a well-brought up child. It is this time factor, along with the costs of supporting a family, that motivates family size limitation. In this, child mortality is not explicitly a concern, although it is plausible that, in a context of much higher mortality risks, perceived benefits and risks of alternative quantity-quality strategies would change. Interestingly, in the rural areas the expression of such concerns were almost absent.

Our interview data give a qualified “yes” to the question of whether men and women in Senegal have the agency to control their fertility. Throughout our three sites, fertility control was viewed as being acceptable when it was necessary for the mother's health. In the rural village, such acceptability was not always foremost in people's minds; at times it required focused questions to draw it out. Fertility control for the goal of family size limitation was, however, much more controversial. For the most part, in the rural area this was stated as being unacceptable – an attempt to meddle in God's domain and ultimately not even feasible. In urban areas and especially in Dakar, although this same view was sometimes expressed, it was much less pervasive. In urban areas, the need to control fertility in order to be able to bring children up well (discussed above) was a common concern. In all three sites, interviewees had a general knowledge that effective methods for fertility control exist and that these were accessible at health clinics and elsewhere.

With regard to marriage behavior, prior studies have shown that most of the fall in total fertility in Senegal prior to 1997 was concentrated among women under 30 and appears to be related to delays in women's first marriages and childbirth. In our interviews, there is no evidence that people take into consideration child mortality risks when making marriage decisions. To the extent that mortality may enter into these decisions, it would occur at the level of the parents of the young couple and would have, at most, a mild effect. While it is possible that a mortality-marriage effect could occur through the operation of the traditional marriage institutions of *levirate* and *sororate*, these are increasingly rare - *sororate* is already extremely uncommon - and it is implausible that their overall effect would be important in our study sites.

Finally, it should be emphasized that this study focuses primarily on replacement and insurance effects as they are typically depicted, in which a conscious consideration of children's mortality enters into fertility decisions, and thus affects marriage behavior. There are other pathways through which infant and child mortality may possibly affect fertility, and it would be premature to conclude that mortality reductions are of little importance in explaining the fertility transition. In the theoretical overview, we showed how a semblance of an insurance effect could exist even in the absence of an accurate and conscious consideration of child risks in fertility decisions. The transition hypothesis describes

another pathway, and the spectrum of perceptions, 'fatalistic' attitudes, behavior, and fertility and child survival outcomes that we found in Senegal, with very sharp contrasts between rural and urban areas, is consistent with it (see footnote 4). Mortality reductions over the past four decades may also have provoked a demographic marriage squeeze and underlie part of the rise in women's age at marriage. Finally, it is possible that mortality reductions are an important aspect of the changing environment in which people live in Senegal, and that this has contributed to institutional changes including in the marriage process, and hence onto fertility trends. All of these possibilities merit more research on the part of demographers.



## References

- Adlakha, A., M. Ayad and S. Kumar. 1991. "The role of nuptiality in fertility decline: A comparative analysis", *Demographic and Health Surveys World Conference*, (5-7 August 1991, Washington, DC), Columbia MD: IRD/Macro International, Vol. II, pp. 947-964.
- Ainsworth, M., D. Filmer and I. Semali. 1998. "The impact of AIDS mortality on individual fertility: evidence from Tanzania", in: M.R. Montgomery and B. Cohen (eds.) *From death to birth: mortality decline and reproductive change*, Washington, D.C.: National Academy Press, pp. 138-181.
- Amin, S. and M. Cain. 1997. "The Rise of Dowry in Bangladesh", in G.W. Jones et al. (eds.) *The Continuing Demographic Transition*, Oxford: Clarendon Press.
- Antoine, P. and J. Nanitelamio. 1990. "La montée du célibat féminin dans les villes africaines. Trois cas: Pikine, Abidjan et Brazzaville", *Les Dossiers du CEPED* no. 12, Paris: CEPED.
- Barbieri, M. and V. Hertrich. 1999. "Écarts d'âges entre conjoints et transition de la fécondité en Afrique sub-Saharienne", in *The African Population in the 21<sup>st</sup> Century*, proceedings of the Third African Population Conference, Dakar Senegal: UAPS and NPU, pp. 163-212.
- Blanc, A.K. and A.J. Gage. 2000. "Men, polygyny, and fertility over the life-course in sub-Saharan Africa", in C. Bledsoe et al. *Fertility and the Male Life-Cycle in the Era of fertility Decline*, New York: Oxford University Press, pp. 163-187.
- Bongaarts, J. and S.C. Watkins. 1996. "Social interactions and contemporary fertility transitions", *Population and Development Review* 22(4): 639-682.
- Brass, W. and J.C. Barrett. 1978. "Measurement problems in the analysis of linkages between fertility and child mortality", in S.H. Preston (ed.) *The Effects of Infant and Child Mortality on Fertility*, London: Academic Press, pp. 209-234.
- Caldwell, J.C., P.H. Reddy and P. Caldwell. 1983. "The causes of marriage change in South India", *Population Studies* 37(3):343-361.
- Castle, S. (forthcoming). " 'The tongue is venomous': Perception, verbalisation and manipulation of mortality and fertility regimes in rural Mali", *Social Science and Medicine*.
- Cleland J., N. Onuoha and I. Timaeus. 1994. "Fertility change in sub-Saharan Africa: A review of the evidence", in T. Lohco and V. Hertrich (eds.), *The Onset of Fertility Transition in Sub-Saharan Africa*, Liège, Belgium: Derouaux Ordina Editions, pp. 1-20.
- Cohen B. 1993. "Fertility levels, differentials, and trends", in K.A. Foote, K.H. Hill and L.G. Martin (eds.) *Demographic Change in Sub-Saharan Africa*, National Research Council, Washington DC: National Academy Press, pp. 8-67.
- Cohen, B. and M.R. Montgomery. 1998. "Introduction" in M.R. Montgomery and B. Cohen (eds.) *From Death to Birth: Mortality Decline and Reproductive Change*, Washington DC: National Academy Press, pp. 1-38.
- Davis, K. 1945. "The world demographic transition", *Annals of The American Academy of Political and Social Science*, Volume 237, special edition edited by K. Davis, *World Population in Transition*: 1-11.

- Dunbar, R.I.M. 1995. *Reproductive Decisions: Biological and Social Perspectives*, London: Galton Institute.
- Fernando, D.F.S. 1975. "Changing nuptiality patterns in Sri Lanka 1901-1971", *Population Studies* 29(2): 179-190.
- Grieser, M., J. Gittelsohn, A. Shankar, T. Koppenhaver, T. LeGrand, R. Marindo, W. Mavhu and K. Hill (forthcoming). "Reproductive Decision Making and the HIV/AIDS Epidemic in Zimbabwe", *Journal of Southern African Studies*.
- Grieser, M. et al. 2000. "Reproductive Decision Making and the HIV/AIDS Epidemic in Zimbabwe", unpublished manuscript.
- Jolly, C.L. and J.N. Gribble. 1993. "The proximate determinants of fertility", in K.A. Foote, K.H. Hill and L.G. Martin (eds.) *Demographic Change in Sub-Saharan Africa*, Washington DC: National Academy Press, pp. 68-116.
- Lee, R.D. (ed.) 1977. *Population Patterns in the Past*, New York: Academic Press.
- LeGrand, T. and M. Barbieri. 1998. "The effects of children's mortality risks on young women's entry into marriage and motherhood in sub-Saharan Africa", presented at the 23rd IUSSP General Population Conference, Beijing, China, 10/1997, and at the PAA annual meetings, Chicago, 4/1998.
- Lloyd, C. and S. Ivanov. 1988. "The effects of improved child survival on family planning practice and fertility", *Studies in Family Planning* 19(3):141-161.
- Locoh, T. 1995. "Familles africaines, population et qualité de la vie", *Les Dossiers du CEPED*, no. 31, Paris.
- Montgomery, M.R. 1998. "Learning and lags in mortality perceptions", in M.R. Montgomery and B. Cohen (eds.) *From Death to Birth: Mortality Decline and Reproductive Change*, Washington DC: National Academy Press, pp. 112-137.
- Ndiaye, S., M. Ayad and A. Gaye. 1997. *Enquête Démographique et de Santé au Sénégal (EDS-III) 1997*, Calverton Maryland: Macro International and Ministère de l'Économie, des Finances et du Plan du Sénégal.
- Notestein, F.W. 1945. "Population - the long view" in T.W. Schultz (ed.), *Food for the World*, University of Chicago Press, pp. 36-57.
- Olaleye, O.D., 1993. "Ideal family size: a comparative study of numerical and non-numerical fertility desires of women in two sub-Saharan African countries", *Demographic and Health Surveys Working Paper No. 7*, Calverton, Maryland: Macro International.
- Pison, G. et al. (eds.). 1995. *Population Dynamics of Senegal*, Washington DC: National Academy Press.
- Preston, S.H. 1978. "Introduction", in S.H. Preston (ed.) *The Effects of Infant and Child Mortality on Fertility*, London: Academic Press 1978, pp. 1-18.
- Randall SC. 2000 "Women's health as a justification for contraceptive use: Wolof in Senegal" Paper presented at BSPS Annual Conference, Leiden, September 2000
- Schultz, T.P. 1981. *Economics of Population*, Addison-Wesley Publishing Cie., 240 p.

Timaheus, I.M. 1997. "Mortality in sub-Saharan Africa", proceedings of the *Symposium on Health and Mortality* sponsored by the UN Population Division and the Population and Family Study Center of the Flemish Scientific Institute, Brussels 19-22 November 1997, pp. 367-391.

United Nations. 1987. *Family Building by Fate or Design. A Study of Relationships between Child Survival and Fertility*, Department of International Economic and Social Affairs, New York, 103 p.

Van de Walle, E. 1992. "Fertility transition, conscious choice, and numeracy", *Demography* 29(4):487-502.