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7

The Consequences of Imperfect Fertility Control for Children's Survival, Health, and Schooling

DHS

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The Consequences of Imperfect Fertility Control for Children's Survival, Health, and Schooling

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Preface

One of the most significant contributions of the DHS program is the creation of an internationally comparable body of data on the demographic and health characteristics of populations in developing countries. The *DHS Analytical Reports* series and the *DHS Comparative Studies* series examine these data across countries in a comparative framework, focusing on specific topics.

The overall objectives of DHS comparative research are: to describe similarities and differences between countries and regions, to highlight subgroups with specific needs, to provide information for policy formulation at the international level, and to examine individual country results in an international context. While *Comparative Studies* are primarily descriptive, *Analytical Reports* utilize a more analytical approach.

The comparative analysis of DHS data is carried out primarily by staff at the DHS headquarters in Calverton, Maryland. The topics covered are selected by staff in conjunction with the DHS Scientific Advisory Committee and USAID.

The *Analytical Reports* series is comprised of in-depth, focused studies on a variety of substantive topics. The studies employ a range of methodologies, including multivariate statistical techniques, and are based on a variable number of data sets depending on the topic under study.

It is anticipated that the Analytical Reports will enhance the understanding of significant issues in the fields of international population and health for analysts and policymakers.

Martin Vaessen
Project Director

Executive Summary

This report explores the consequences of imperfect fertility control for various dimensions of children's human capital formation—their survival, health, and schooling—using Demographic and Health Surveys (DHS) data from five countries across a range of demographic and development regimes. Information on women's fertility preferences is used to investigate two conceptually distinct aspects of imperfect fertility control: unintended fertility and excess fertility. The concept of unintended fertility refers to births that were either unwanted at the time of conception or whose conception was mistimed. Excess fertility is defined as occurring if the woman's parity at survey exceeds her ideal family size. The aim of this report is to determine whether such departures from women's preferences have implications for investments in the human capital of their children. The countries included in the study are the Dominican Republic (1991), Egypt (1988), Kenya (1993), the Philippines (1993), and Thailand (1987).

No source of demographic information other than the DHS permits exploration of this topic for countries at different stages of development using a wealth of data about fertility preferences combined with key indicators of children's nutritional status, survival, and schooling. The DHS also provides measures of access to services at the community level in family planning, health, and schooling. Among the DHS surveys for which such data are available, the five countries selected exemplify the middle to later phases of demographic and development transitions. Taken collectively, they represent major regions of the developing world and a variety of cultural contexts, with total fertility rates as low as 2.2 in Thailand and as high as 5.3 in Kenya. The highest rate of unwanted fertility is in Kenya (1.9) and the lowest in Thailand (0.4). In between these extremes, unwanted fertility rates are 0.7 in the Dominican Republic, 1.2 in the Philippines, and 1.6 in Egypt.

Do unintended and excess fertility have measurable consequences for children? The demographic literature, reviewed in the first section of this report, has given little attention to this central question. The report argues that the consequences of imperfect fertility control are likely to be situation-dependent, with consequences varying in nature and severity according to the socioeconomic position of the family and the surrounding economic and policy environment. It would be naive to expect an unwanted child born to well-off parents to suffer the same disadvantages as an unwanted child born to poor parents. Less obviously, the consequences for children can be expected to vary in accordance with features of the local economy, the design of public policy, and the stage of economic development and demographic transition of the country. To date, no study has considered whether the societal-level consequences of additional unwanted births are likely to differ from the consequences of additional wanted births. Differential consequences are plausible, in part because unwanted and excess fertility are not uniformly distributed over the population of parents, as shown in the report.

The analyses pursued here are based on economic models of family decisionmaking. Models such as these are built on the premise that desired fertility and desired levels of children's health investment and schooling are jointly determined outcomes of a common set of exogenous determinants. Desired fertility is not, in itself, a causal determinant of desired children's schooling; neither is desired schooling a causal determinant of fertility. The key point for this research is that it is only the unintended or excess aspects of fertility that can function as causal determinants of child investment. This is because unintended or excess fertility can be regarded as exogenous shocks that displace parental investment strategies from what would otherwise have been optimal. For this reason, the empirical models estimating the determinants of child survival, health, and education include a measure of unintended or excess fertility as such, rather than fertility overall.

Two indicators have been used to characterize each of the following three broad aspects of children's human capital investment chosen for investigation: *the probability of survival from birth to age 5*, with a separate focus on neonatal mortality risks and the risks from the postneonatal period to age 5; *nutritional status*, as measured by height-for-age and weight-for-height expressed in standard deviations from reference medians; and *educational progress*, as measured by grades of schooling attained and by the probability of completing at least one year of secondary school.

As noted above, in the empirical analysis, the implications of two aspects of imperfect fertility control are explored. The first—*excess fertility*—is derived from comparing a woman's actual fertility with the ideal family size she expressed on the date of the fertility survey. When actual fertility is greater than the ideal, this is defined as *excess fertility*. The measure describes the situation of a family rather than any particular child in that family. In contrast to the family-level nature of excess fertility, the second dimension of imperfect fertility control—*unintended fertility*—is based on birth-by-birth assessment of the intendedness of each birth at the time of pregnancy. If the child was reported to be not wanted at all, or was wanted later, this is defined as *unintended fertility*. These two measures are conceptually distinct. A woman could report her last birth as being wanted at the time of conception and, during the same DHS interview, report excess fertility in the present, without being inconsistent. This could occur because of changing circumstances between the time of her pregnancy and the time of the survey, which led to a change in views about ideal family size. In the same way, a woman who reports not having wanted a particular pregnancy in the past could report no excess fertility in the present if her circumstances had changed to accommodate the initially unwanted pregnancy.

The empirical analysis begins with a multivariate analysis of the determinants of excess and unwanted fertility. With the exception of Kenya, the contribution of less-educated women to the

aggregate pool of unwanted and excess births is found to be disproportionate to their numbers. This has important implications at the societal level for both the growth rate of the (future) labor force and its educational composition. The separate role that access to services and programs plays in reducing unwanted and excess fertility appears to be weak. The independent role of service quality could not be assessed.

In the multivariate analysis of consequences of imperfect fertility control, each dimension of child investment—survival, nutritional status, and education—is examined, first in a baseline equation having no intended or excess fertility measures and, subsequently, with these measures included, so as to highlight the additional effects of imperfect fertility control. Five variables were created to capture different dimensions of imperfect control: (1) a measure of excess fertility at the time of the survey; (2) whether a particular child's parity exceeds the mother's expressed ideal; (3) whether the child's parity exceeds the mother's ideal by 2 or more; (4) an indicator of whether the conception of a particular child was viewed as mistimed at the time of pregnancy; and (5) an indicator of whether the child was unwanted at the time of pregnancy. These measures allow for investigation of cross-sibling effects as well as effects for the child in question.

With respect to mortality, the most consistent and trustworthy evidence on consequences concerns birth interval effects, which exert a very important influence on mortality risks. Because not all women regard short intervals as instances of fertility mistiming, only a portion of the birth interval effects can be attributed to imperfect fertility control. Apart from the birth interval effects, there is evidence that excess fertility is linked to higher mortality risks in Egypt, the Philippines, and Thailand.

With respect to nutrition, significant effects of excess and unwanted fertility appear only in the Dominican Republic, where they are negatively associated with height-for-age. The coefficients, interpretable in terms of Z-score percentages, indicate that excess and unintended fertility produce a shortfall in height-for-age that ranges from a fifth of a standard deviation to just short of a third of a standard deviation. These may not appear to be large effects, but their size should be judged in relation to the performance of other socioeconomic covariates, which generated very few effects of substantive importance.

The results for education are somewhat stronger than for child mortality and nutrition. In the Dominican Republic, the Philippines, and Thailand, both unwanted and excess fertility are clearly associated with reductions in the educational attainment of children. These coefficients are highly significant in statistical terms but relatively small in substantive terms. For example, in no case do we predict an average difference of more than one year of completed schooling for children in families with and without excess or unwanted fertility. Effects of this size should not be dismissed, but they pale by comparison to the influence of covariates such as mother's education.

In collecting results across the three dimensions of child investment, an interesting pattern emerges. The levels of unwanted and excess fertility are highest in Egypt and Kenya. Yet, apart from the birth-interval effects, the family-level consequences of such fertility are most clearly apparent only in the Dominican Republic, the Philippines, and Thailand, countries that, if not wealthy by international standards, are certainly better off than Egypt and Kenya.

What can account for such a pattern? In environments where parents are generally more effective in controlling the timing of births and adhering to their desired number of children, an unintended birth may be perceived as less likely and thus, when it occurs, may be more disruptive to family-building strategies. Moreover, it is reasonable to expect that for the family as a whole, the disruption occasioned by an unintended birth may be greater where three conditions obtain: the returns to human capital investment are perceived to be considerable; the (direct) costs of that investment are also considerable; and there exist reasonably strong preferences for equalizing investments across children. An additional consideration is that the reports of unintended and excess fertility are those of women rather than their spouses. In Egypt, women may cede decisionmaking authority to their spouses, and a woman's own view of whether a birth was wanted or fertility excessive might have little to do with household resource allocation. If the man were to declare a birth unwanted, however, the implications might be quite different. A closely related point is that there is no measure of the *intensity* of preferences in any of these countries, that is, of the degree of motivation to avoid excess family size or unintended births. It is plausible that in Egypt and Kenya, countries that are still in the intermediate stages of demographic transition, such motivations may often be superficial or clouded by ambiguity and second thoughts. Additional contingencies arise in Kenya, where, as in much of sub-Saharan Africa, there are possibilities for meeting unanticipated child-rearing costs through sibling chains of support and networks of relatives. The concluding section of the report places these intriguing but decidedly mixed findings in perspective, and offers suggestions regarding priorities and modes of investigation for future research.

1 Introduction

The individual welfare rationale for family planning programs rests on the belief that family planning programs provide the means for individuals to match fertility to reproductive desires. The benefits secured by effective fertility control are largely measured by the costs avoided, that is, by the costs that undesired conceptions and births would otherwise impose. What is really known of such costs in developing countries? In turning to the demographic literature, one might expect to find extensive documentation of the negative consequences, whether for the woman who experiences such fertility, or for her children, the wider family, or society at large. In fact, the literature is all but silent on these matters. In this report, the implications for children will be explored, with a focus on the dimensions of survival, health, and schooling. Each of these is an aspect of what economists term "human capital," and our research thus seeks to determine whether imperfect fertility control has measurable consequences for human capital formation. If such a link can be established, it would greatly strengthen the rationale for providing family planning.

We take advantage of a combination of data that is very nearly unique to the Demographic and Health Surveys: detailed measures of parental fertility preferences and informative (if somewhat less detailed) data on the three dimensions of children's human capital. Two aspects of imperfect fertility control are explored: *unintended fertility*, by which is meant the birth of children whom the mother reports were either unwanted at the time of conception or whose conception was mistimed; and *excess fertility*, a phrase that refers to the birth of more children than implied by the mother's expressed family size ideal. As we expect the consequences of imperfect fertility control to vary according to setting, a range of regional and cultural contexts will be considered. Using criteria to be discussed later in this report, five countries have been selected for study—the Dominican Republic, Egypt, Kenya, the Philippines, and Thailand. Certainly, these countries do not represent the whole of the developing world, but when taken together, they encompass much of its socioeconomic and demographic variation.

The remainder of the report is organized as follows. Section 2 introduces general concepts and reviews the rather modest empirical literature concerned with the consequences of unwanted or excess fertility. In the next two sections, the specific concepts of unintended and excess fertility are brought to the forefront, and effort is made to isolate their distinct features as well as their common elements. Section 3 develops a simple economic model of decisionmaking about fertility and child investment and embeds that model in the larger context of the demographic transition. Section 4 describes the special advantages of DHS data for this analysis and discusses its inherent limitations. In Section 5, the determinants of unintended childbearing and excess fertility are investigated. Section 6 presents the empirical findings on consequences, as expressed in the dimensions of mortality, child anthropometry, and education. Three levels of effects are considered: the consequences for the unintended child, for the older siblings of an unintended child, and for all children in a family whose size exceeds the mother's expressed ideal. Several technical appendices discuss the linkage of DHS data files, aspects of selectivity in child-based samples, the criteria guiding the choice of service availability measures, and the characteristics of the educational systems in the five study countries.

2 Concepts and Literature

Mention has already been made of the relative scarcity of literature on the consequences of imperfect fertility control, and before turning to the details of a literature review, it may be worthwhile to consider how such a research gap might have come about. The dearth of studies cannot be readily attributed to a lack of data: most fertility surveys gather information on fertility preferences as well as actual fertility. The reasons for neglect must lie elsewhere.

The gap is due in part to the long-standing preoccupation of demographers with population aggregates, that is, with population sizes, growth rates, and their economic and social implications (Coale and Hoover, 1958; Johnson and Lee, 1985). Until recently, the extent to which unintended or excess fertility contributed to these aggregates was not known. It now appears that the proportion of all fertility that is unwanted or unintended is surprisingly large.[1] Bongaarts (1990) has estimated that as many as one birth in five is unwanted in developing countries. Bankole and Westoff (1995) have argued that recent declines in desired family size may well be outpacing declines in fertility overall. If this is the order of magnitude of the problem, its aggregate implications deserve serious consideration.

No study, as far as we know, has considered whether the societal consequences of additional unwanted births are likely to differ from the consequences of additional wanted births. Differential consequences are plausible, in part because unwanted and excess fertility are not uniformly distributed over the population of parents. For example, as shown later in this report, such fertility is more likely to occur among less educated parents. Children born to such parents will themselves tend to receive less education; and it may be that unwanted children in such families will suffer additional educational penalties. In the aggregate, these effects will distort the distribution of the labor force by educational level, and because education is a powerful determinant of economic growth, they are likely to be expressed over time in slower rates of growth.

In view of the consensus that emerged from the 1994 International Conference on Population and Development in Cairo, it is curious that the individual and family consequences of imperfect fertility control have not received greater attention. A number of factors may have contributed to this neglect. Perhaps scholars have viewed the family-level consequences as being so plausibly negative that they have not really required analysis. The prevalence of abortion testifies to the costs that women anticipate were they to take undesired conceptions to term; for some researchers, this may have seemed a sufficient demonstration of the severity of consequences. When an unwanted conception is taken to term, a woman is exposed to the health risks of pregnancy and childbirth, which are considerable in many developing countries. Even if the conception was not intensely unwanted, this additional exposure to risk is needless in that it would have been much less probable with effective fertility control.

Another factor that has hindered research is the contingent nature of the family-level and individual-level responses. The consequences of imperfect fertility control are situation-dependent. It would be naive to expect an unwanted child to suffer the same disadvantages if born to parents who are well-off as would have been the case with desperately poor parents. Less obviously, the consequences for children can be expected to vary in accordance with features of the local economy, the design of public policy, and the country's stage of economic development and demographic transition.

Given the scarcity of research on these issues, only a few general propositions can be offered about the circumstances in which unwanted children, or those in families with excess fertility, might not receive equivalent human capital investments. The consequences are likely to be most severe when the costs of child rearing are high, yet the level of resources available to the parents is low. Developing-country parents are, of course, severely resource-constrained. Yet, in such circumstances, parents may have only limited aspirations for their children and the styles of child-rearing appropriate to such aspirations may not entail high costs. For example, poor rural parents might be well satisfied if their daughters receive any primary schooling at all, and might entertain only slightly higher ambitions for their sons. The arrival of an unwanted daughter then adds to her family's burdens when she comes of school age, but perhaps does not impose a heavy cost. By contrast, when poor parents have higher aspirations for their children—that is, high enough to require significant human capital investments—the arrival of an unwanted child imposes a more significant burden. An additional life-cycle aspect is that unwanted births are more likely to occur late in the reproductive years when, for some parents, income is relatively high, allowing the consequences to be better managed. The tension between resources and aspirations is thus an important factor in the consequences of unwanted and excess fertility.

The costs of such fertility and the distribution of its burden are also affected by parental aversion to inequality in the allocation of resources among their children (Behrman, 1988). For instance, when parents believe that they must treat children equally, the arrival of an additional, unwanted child may exert a multiplicative influence on total child-rearing costs. To adjust to the new arrival, parents may feel they should cut back on other expenditures, and may respond by reducing spending on themselves or on non-child-rearing activities. Responses such as these

[1] This report focuses on the developing countries; see Brown and Eisenberg (1995) on the United States.

are not likely to be detected in demographic survey data on children's schooling, health, or survival. If parents are strongly averse to inequality among their children, they may resist treating the unwanted child differently from his or her siblings. Human capital investment in all the children may then suffer, with the effect on the unwanted child being dissipated compared with the case in which parents are less concerned about inequality.

The boundaries of the family will also affect resource allocation. In family systems involving sibling chains of support or child fostering, parents can distribute the costs of children and child rearing among a network of kin, thereby escaping the constraints imposed by their individual family budgets. Such systems also enlarge the set of concerned adults, so that a child whose conception was unwanted by his or her parents could be found to be much wanted and welcomed by an aunt or uncle (National Research Council, 1993).

Another consideration is the role taken by the state in providing health services and schools and the extent to which the prices of services and tuition are subsidized. In countries where a large share of the costs of services are borne by parents, parental resource constraints are more important in determining which children attend school or use health facilities, compared with settings where these services are provided free by the state. If the parental returns to investment in children are substantial, then it is in the former situation, with parents responsible for a greater share of the costs of investment, where one expects a negative association between unintended childbearing and child investment to emerge.

In short, a particular configuration of preferences and circumstances may be required for a child who is unwanted at conception to receive a detectably different allotment of human capital. Lloyd (1994) and Desai (1995) have made arguments similar to this, not so much with unwanted childbearing in mind as with reference to the family-level implications of high fertility in general. In their view, if the surrounding environment is one of a heavy disease burden, a rudimentary health care system, relatively few schools, and few skilled jobs, parents will have neither the opportunity nor the incentive to invest in their children, irrespective of whether resources are to be spread over many children or only a few, or whether a child's birth was intended or unintended. Likewise, in relatively wealthy societies children are apt to be shielded from the most negative impacts of unintended or excess fertility on the part of their parents. This would be particularly true with child health: as the relative costs of basic nutrition and child health care decline, the quality of care rises and institutions such as health insurance come into being to spread the burden of child health care beyond the family (Jensen and Ahlburg, 1997). In following this line of reasoning, we conclude societies that are situated in an intermediate stage of economic and demographic development must be considered; here the consequences of imperfect fertility control are likely to be most clearly manifested.

Finally, additional individual-level complications are introduced by the selective relationship between contraceptive use and unwanted fertility. To see the issues, consider the extreme case of sterilization. Women who are sterilized no longer face the risk of unwanted fertility, and perhaps for them a consideration in choosing sterilization was precisely that future unwanted fertility would have imposed heavy costs. Since they will not go on to bear unwanted children, these costs will never be revealed. (Sterilization is analogous to abortion in this sense.) At the other extreme, consider couples who use contraception only intermittently, either because they do not anticipate serious negative consequences if they were to conceive or because they view contraception as having health or monetary costs. Such couples are more likely to experience a contraceptive failure resulting in an unwanted birth. Any sample of unwanted births is therefore heterogeneous in terms of the degree to which such births were unwanted. With other things held equal, there would likely be an overrepresentation of two general types of cases: those in which the consequences of an unwanted birth were not perceived *ex ante* to be particularly severe; and those in which the costs of preventive contraceptive use were thought to be high, or even prohibitive.

Perhaps in response to these many conceptual and measurement difficulties, social science disciplines have assigned markedly different priorities to the study of unintended and excess fertility. A few economists (Becker, 1994; Pritchett, 1994) have adopted an extreme stance, arguing that variations in fertility have little to do with imperfect fertility regulation, and maintaining that departures from desired fertility are empirically unimportant. Other economists have not dismissed unintended and excess fertility so lightly, but instead have drawn attention to the methodological difficulties entailed in establishing the consequences.[2] Just as we will later in this report, these economists have often emphasized the importance of distinguishing the effects of unintended (exogenous) from intended (endogenous) fertility. Interestingly, only a few have taken advantage of the now-extensive survey data on fertility preferences (see Rosenzweig and Wolpin, 1993). In studying the consequences of unintended fertility, they have preferred to devise indirect, but arguably more objective, measures of exogenous variation in fertility, such as the birth of twins or estimated fecundability. Such indirect measures impose data requirements that are not easily met by standard demographic surveys, with the result that

[2] The literature on the consequences of teenage pregnancy in the United States has been concerned with conceptual, methodological, and measurement issues that closely parallel those considered here. It was recognized early in the debate on the causal consequences of teen pregnancy that longitudinal data would be required to properly assess such consequences. Regrettably, such data are rarely available in developing countries, although Montgomery et al. (1997b) have employed longitudinal information from Bangladesh on fertility preferences and children's schooling and survival.

only a few studies of this sort are available (e.g., Rosenzweig and Wolpin, 1980; Rosenzweig and Schultz, 1985, 1987).

Meanwhile, sociologists and demographers have undertaken considerable research on the validity, stability, and predictive power of fertility preferences, as these are measured in the DHS and related fertility surveys (e.g., Bankole and Westoff, 1997; Freedman et al., 1980; Westoff et al., 1990). Their main concern, however, has been with the stability of preferences and the link between fertility preferences and subsequent fertility behavior. Little attention has been given to the consequences for children of departures from preferences.

As all this implies, there are few empirical studies of the implications for children of being either unwanted or mistimed, whether in developed or developing countries, despite the high incidence of unintended births in both settings.[3] Some of the existing studies have presented intriguing results that should encourage further exploration. Most have focused on the consequences for the child of being unwanted; only one has examined cross-sibling effects. Likewise, most of the studies have been based on cross-sectional data that rely on retrospective reports of birth status; only a few studies, all of which are from developed countries, have utilized longitudinal data on children.

The first study of which we are aware analyzes the determinants of child mortality in northern Thailand; it is based on all birth events reported by reproductive-aged women in 1977 (Frenzen and Hogan, 1982). After controlling for various child, family, and community factors, Frenzen and Hogan found that infant survival probabilities during the postneonatal period (1-12 months) were significantly higher among children who were wanted by both parents rather than by only one parent or by neither parent. This effect was interpreted by the authors as a measure of parental willingness to care for the child; in their view, the other explanatory variables served as adequate controls for parental abilities to provide care.

The consequences of being unwanted for early child morbidity due to diarrhea and respiratory disease have been assessed for the Philippines (Jensen et al., 1996) and for the Philippines, Indonesia, and Korea (Jensen and Ahlburg,1997) in two recent studies. In the Philippines and Indonesia, unwanted children under age 5 were found to be significantly more likely than wanted children to have experienced an episode of diarrhea (in one Indonesian survey although not in a second survey), or to have had a fever or cough reported in the two weeks before the survey. However, they were no less likely than wanted children to have received treatment, except in the case of diarrhea in one Indonesian survey. Jensen and Ahlburg interpreted the effect of unwantedness on morbidity as suggestive of a neglect of unwanted children in everyday care, a lack of vigilance that could lead to greater probabilities of illness. Yet, there was no evidence in any of these settings that the wantedness status of births affected preventive health care, insofar as prevention can be measured by the number of vaccinations. Furthermore, in Korea, the wealthiest country in the Jensen-Ahlburg sample, no effects of any kind could be detected with the data available.

Other consequences that have been assessed in developed-country settings include, for the United States, the likelihood and timeliness of prenatal care (Joyce and Grossman, 1990; Sable et al., 1997), low birthweight (Sable et al., 1997), child neglect and abuse (Zuravin, 1991), and early skill development (Baydar, 1995); various measures of psychological adjustment in the United States, Sweden, and Czechoslovakia (Baydar, 1995; David et al., 1988); and educational attainment in Finland (Myhrman et al., 1995). Several of these studies had the advantage of using longitudinal data in which the planning status of the birth could be assessed at the time of the pregnancy rather than being retrospectively reported.[4] The measured consequences of being unwanted ranged from greater physical neglect[5] to fewer opportunities for early skill development, more authoritarian parenting, other psychological adjustment difficulties (David et al., 1988), and lower educational attainment. The most impressive of these studies is the Finnish analysis (Myhrman et al., 1995) that for 24 years followed almost all children born in the two northernmost provinces of Finland in 1966 after an initial assessment of their wantedness status at the time their mothers were pregnant. Myhrman et al. found that the children who were unwanted during pregnancy were subsequently less likely than their wanted counterparts to progress beyond the basic nine years of education. The educational attainments of children who were mistimed fell in between.

Note that apart from educational attainment, which is readily measured at least in its cruder aspects, the developed-country studies have found consequences in dimensions of child care and investment that are not easily studied except by dedicated surveys. If consequences such as these exist in the developing countries, one could not reasonably expect them to be detected in conventional demographic indicators.

[3] There is a growing literature in the United States and elsewhere on the consequences of adolescent childbearing, primarily for the young mother but increasingly also for the children of these women (e.g., Buvinic et al., 1992; Furstenberg et al., 1987; Garfinkel and McLanahan, 1986). While such children are not necessarily unwanted, in these contexts teen births represent extreme cases of mistiming.

[4] In Sweden and Czechoslovakia, the measure of unwantedness was particularly strong, as it included children born to mothers who had requested but been denied an abortion.

[5] Physical neglect was measured by various scores on nutrition, physical health care, mental health care, personal hygiene, household sanitation, physical safety in the home, supervision, and child care (Zuravin, 1991).

3 Conceptual Framework

In summarizing this discussion, we want to emphasize the differences in perspective that are needed to explore high fertility versus unintended or excess fertility. Children with many siblings (or closely spaced siblings) are often thought to be disadvantaged with respect to their health and schooling compared with other children. These disadvantages are believed to be due mainly to resource constraints, with children in larger families receiving smaller shares of total family resources. Economists have written about such issues under the heading of the *quantity-quality tradeoff* (see, among others, Becker and Lewis, 1973; Hanushek, 1992; Parish and Willis, 1993). As used in this literature, the term *tradeoff* refers not to any fixed or mechanistic causal relationship between fertility and children's human capital, but rather to the often-found negative association between them.

Economic models are built on the premise that desired fertility and desired levels of children's health investments and schooling are jointly determined outcomes of a common set of exogenous determinants. In this way of thinking, a negative association between fertility and schooling (or between fertility and health status) is only one of a number of associations that might emerge from family productive and reproductive strategies. Desired fertility is not, in itself, a causal determinant of desired children's schooling; neither is desired schooling a causal determinant of fertility. The simple economic theory can be expressed in the set of equations

$$N^* = X\beta_n + \varepsilon_n$$
$$S^* = X\beta_s + \varepsilon_s$$
$$H^* = X\beta_h + \varepsilon_h$$

in which X represents the common set of exogenous determinants whose effects are evident in the dimensions of desired fertility N^*, desired schooling S^*, and desired health investments H^*. The terms denoted by ε_n, ε_s, and ε_h represent exogenous but unmeasured influences. In view of the above, it cannot be meaningful to ask how desired fertility might affect desired levels of children's schooling or health. Such questions are ill-defined; they confuse association with causation. It is appropriate, however, to ask how the exogenous *determinants* of desired fertility, denoted by X, might affect desired schooling or desired health status. When the issue is posed in these terms, there is a proper causal linkage to be considered.

The key point for our research is that it is only the unintended or excess aspects of fertility that can act as causal determinants of child investment. This is because unintended or excess fertility can be regarded as *exogenous shocks* that displace parental strategies from what would otherwise have been optimal (that is, from N^*, S^*, and H^*). An unintended birth imposes new and unanticipated demands on the resources that can be marshaled to support investments in children. Parents of unintended or excess children may be less able, or less willing, to increase the total resources devoted to their children or to reallocate resources among children on a particular child's behalf.

3.1 A THEORETICAL MODEL

To approach the issues more formally, let us imagine that parents make a set of one-time decisions at the beginning of their reproductive lives so as to maximize a unitary utility function $V(C,N,S,H)$, in which C refers to the level of parental consumption, N to the number of their children, S to the children's schooling, and H to their health or some other dimension of human capital investment.[6] Parents face a budget constraint and must restrict their total expenditures to be no more than W, the level of their exogenous income. The decision problem yields a set of optimal or desired values C^*, N^*, H^*, S^*, where among these, N^* represents the desired number of children. These optimal values yield utility level V^*.

Now suppose that an unwanted birth occurs, so that family size exceeds its optimal value N^*. Actual fertility is then $N = N^* + 1$. With all else equal, this additional birth must reduce parental well-being, causing actual utility to fall below V^*. How can one gauge the magnitude of the impact? One approach is to ask what increment in income, ΔW, would be required to restore utility to V^*, that is, to just compensate the parents for the additional child. The required compensation will depend on numerous factors: the initial level of income W, the many child-rearing prices and constraints faced by the parents, and the nature of the utility function V, in particular, its curvature in the neighborhood of N^* with respect to the number of children.

These concepts are easily generalized to the situation in which parents have, for instance, two life-cycle periods in which they can bear children. In period 1 they might desire to have N_1^* children and in period 2, N_2^* children. Associated with these fertility desires are the desired levels of child investment for the different groups of children. With schooling, for example, these can be denoted by S_1^* and S_2^*. (The subscripts on S^* refer to the period of the child's birth.) These educational investments are planned to take place in periods 2 and 3. Among other things,

[6] The simple model to be outlined here assumes that parents act as a unit in making decisions about family size and child investments. If mothers and fathers differ in their desires (and there is much evidence to suggest that they often do in the case of expressed family size ideals, see Lloyd (1996) for a review), the question arises as to whether the couple strives for compromise or one partner tends to override the wishes of the other. Likewise, the model abstracts from issues such as sibling chains of support, transfers of resources among the wider family, and child fostering. Montgomery and Lloyd (1997) present a more formal version of the model described in the text.

optimal choices about fertility and schooling depend on the anticipated sequence of parental incomes, W_1, W_2, and W_3.

Suppose that the parents succeed in having N_1* births in period 1, but in period 2 have U_2 unintended births, giving $N_2 = N_2^* + U_2$. The unintended births may then affect the schooling of both the older and younger children. One might distinguish effects felt mainly by the unintended child herself (or himself) from the consequences borne by other children in the family, as when an older child is withdrawn from school to help care for a younger sibling whose conception was unintended.

The effects considered here may also be produced by changes in circumstances that render nonoptimal the parents' initially desired levels of fertility. Suppose that, anticipating life-cycle income levels of W_1, W_2, and W_3, parents initially desire to have N_1* and N_2* children. Imagine that they succeed in meeting these fertility goals exactly. Upon entering period 3, however, the parents encounter an unanticipated shortfall in their income. This shortfall in W_3 imposes new constraints on the remaining schooling investments they can afford and find it rational to make. Had the actual level of income been known in advance, the parents' desired fertility levels might well have differed from N_1* and N_2*. Our point is that although births N_1* and N_2* might have been fully desired at the time of their conception, later events can bring about revisions in desired family size and force a rethinking of educational investments. Viewing the situation in retrospect, the parents might well say, in response to a survey question, that the number of children they actually bore exceeded the number they would have found ideal. They have experienced *excess fertility* even though, strictly speaking, no birth was *unintended.*

A more realistic and interesting model could be formulated with multiple decision periods, so that parents would have the opportunity to learn about the physical endowments and educational abilities of their children and might adjust fertility and consumption choices over time as such information accumulates. In this more complex, dynamic decision framework, one could investigate the consequences of unwanted fertility (or other exogenous shocks) during the reproductive life cycle on subsequent fertility and subsequent child investments. Such consequences might well depend on the level and age pattern of prior wanted births. Such prior births (and likewise, prior child investments) would act as predetermined constraints (or sunk costs) that could limit the scope and nature of any post-shock adjustments on the part of parents. Moreover, in a dynamic decision problem in which the spacing and arrival of wanted births is not fully controllable by parents, it becomes conceptually appropriate to ask how the timing of wanted births affects subsequent fertility, child investment, and parental consumption. Likewise, one can ask how imperfectly predictable factors, such as children's educational abilities and their intrinsic healthiness, might affect the parents' fertility as information about these factors becomes known.

Unfortunately, daunting empirical difficulties stand in the way of such dynamic modeling. If lagged, predetermined values of *ex ante* choice variables are to be included in the model, a means must be found to protect the empirical estimates against the effects of persistent omitted variables, which would be expressed first in the lagged values of choices and again in the current values that are being modeled. Such dynamic decision models are extremely complex to estimate and require rich longitudinal data sets of a type not available to us here. Given that this report is based on cross-sectional data with only limited retrospective reach, we cannot hope to pursue empirical estimation of the dynamic models. We must instead limit ourselves to the less ambitious empirical approach described below.

3.2 AN EMPIRICAL MODEL

Our theoretical framework suggests a simple empirical model of the consequences of unintended and excess fertility. In such a model, the actual level of health H or schooling S is a function not of actual fertility $N = N^* + U$, where U is unwanted or excess fertility, but rather of U itself. Taking children's schooling as an example, one might write the causal model as

$$S = X\beta_s + \gamma_s U + \epsilon_s \ , \qquad (1)$$

This specification isolates the effects of U, the exogenous component of fertility, on S, the level of schooling that a child actually achieves. The coefficient γ_s associated with U measures the direct consequences for the child's schooling. The set of other covariates X includes all remaining exogenous factors (such as income W) that would determine the desired level of schooling S*. Although not shown in this formulation, interactions of U and X could also enter the empirical model, so that the contingent aspects of the response to U could be studied.

Rather little of the literature, unfortunately, has considered the consequences of unintended or excess fertility from such a perspective. What is usually done is to estimate an equation of the form

$$S = Xb_s + g_s N + e_s \ , \qquad (2)$$

a specification that is causally ill-founded, given that actual fertility N is endogenous. Neither the b_s nor the g_s of this misspecified equation is comparable to the β_s and γ_s of the causal model depicted in equation (1).

One can appeal to an errors-in-variables argument to extract from equation (2) a sense of the degree to which an estimated g_s would tend to depart from γ_s. In such an approach, actual fertility N would be regarded as if it were a noisy measure of U, the conceptually appropriate variable. Under the usual errors-in-variables assumptions, the estimated g_s coefficient in equation (2) would tend to be smaller in absolute value than γ_s, that is, it would be biased toward zero (Greene, 1997). Strong

negative effects of unwanted fertility would tend to appear as weak negative effects; strong positive effects would tend to appear as weak positive effects.

Admittedly, the usual errors-in-variables assumptions are problematic in this case. If $N = U + v$, with v being the measurement error, one would usually assume that v and U are uncorrelated. But an equivalent representation is $N = U + N^*$. To proceed under the standard assumption is thus to assert that wanted and unwanted fertility are uncorrelated, an unlikely proposition. If the standard assumption were to be abandoned, then the bias in the estimated g_s coefficient would depend not only on the error variance of v (the variance of wanted fertility), but also on the correlation between v and U. In a linear regression, estimates of g_s would continue to be biased toward zero if wanted and unwanted fertility are positively correlated, but otherwise the direction of bias would be left unclear.

Armed with this result, and returning to the literature that has been based mainly on equation (2), one would expect the empirical estimates reported there to systematically understate the negative effects of unwanted or excess fertility on children's human capital, provided that the correlation between unwanted and wanted fertility is either zero or positive. In recent reviews of this literature, Kelley (1996), Lloyd (1994), and Montgomery and Lloyd (1996) have documented a considerable range of empirical associations between actual fertility and children's health and schooling at the family level. The associations are usually negative, but they are not always statistically significant or quantitatively large, and, in the case of children's schooling, positive associations sometimes appear as well (Hermalin et al., 1982; Montgomery et al., 1995; Parish and Willis, 1993.)

4 DHS Data: Opportunities and Constraints

The research strategy adopted for this report seeks to turn the DHS data to their best advantage. We have repeatedly emphasized the need to compare countries at different stages of transition; we have identified uses for fertility preferences data that have been systematically underexploited; and no other source of demographic data can join these capabilities to the requisite data on children's human capital. Yet, because the DHS designs are cross-sectional in nature, with only limited retrospective coverage, such advantages must be set against the implied constraints. The aim in this Section is to clearly delineate both the merits and the limitations of DHS data for the study of consequences.

We require data on children's schooling and their nutritional status and survival, as well as measures of community access to family planning, health and schooling (see Table 4.1). From the set of DHS surveys for which such data are available, five countries have been selected that exemplify different phases of the demographic and development transitions. These countries—the Dominican Republic, Egypt, Kenya, the Philippines, and Thailand—are drawn from the major regions of the developing world and from a variety of cultural contexts, with recent fertility rates as low as 2.2 in Thailand and as high as 5.3 in Kenya (see Table 4.2). Furthermore, in all these countries, abortion was illegal at the time of the DHS survey.[7]

[7] The illegality of abortion is a key consideration in our research. Where access to abortion is legal, conceptions that are most unwanted or most grievously mistimed will have a greater likelihood of ending in abortion. For example, in the United States, where abortion is legal, 51 percent of unintended pregnancies ended in abortion in 1987 (Brown and Eisenberg, 1995). This induces a type of selection bias: the conceptions that presumably would have had the most negative consequences never become births. In a setting in which abortion is illegal, by contrast, a greater percentage of such conceptions will be taken to term, due to the risks and costs of illegal abortion. This reduces selection bias, even if it does not entirely eliminate it, and permits the consequences of unintended conception to be more fully understood. The Penal Codes in all five countries prohibit abortion on general grounds (United Nations, 1992, 1993, 1995). In the Dominican Republic, Kenya, and Thailand, however, abortion is permitted to save the life of the mother and in Thailand abortion is permitted for the health of the mother and in the case of rape or incest. In the Dominican Republic the grounds for this exception appear to be interpreted liberally, as abortion is reported to be widely performed in both public hospitals and clinics and cases are rarely brought to the courts. In Kenya, hospital-based studies show that illegal abortion is a growing health problem. In Thailand the law is not rigorously enforced and the prevalence of illegal abortion has been widely documented, particularly in rural areas. In the Philippines, despite the severity of the law, abortion appears to be widely practiced and cases rarely prosecuted, although the surrounding climate is one of fear and shame. Little information is available on the extent of illegal abortion for Egypt.

Bongaarts (1997) has shown that over the course of demographic transition, rates of unwanted fertility initially rise as desired fertility falls, but then subsequently fall as contraceptive use increases. The implication is that it is in an intermediate stage of the demographic transition, when fertility has already declined from its pretransitional highs and development has reached a moderate level, that rates of unwanted fertility reach their peak levels. Part of this pattern can be seen in Table 4.2. The five countries included in the sample can be thought of as representing the middle-to-latter phases of the transition, with the highest rate of unwanted fertility found in Kenya (1.9) and the lowest in Thailand (0.4).

We would expect our empirical results on consequences to differ by country in ways that reflect these different contexts. There are also potential countervailing effects that must be kept in mind. For example, in Kenya child fostering is certainly more common than in the other countries of our sample, although fostering exists in both Thailand and the Dominican Republic (Lloyd and Desai, 1992). Such family systems should mitigate any negative effects of unwanted or excess fertility on children's human capital. Yet, it is also in Kenya that schools are relatively expensive, owing to cost-sharing arrangements that require Kenyan parents to pay for everything but faculty salaries (Mensch and Lloyd, 1997). Such arrangements may exert an opposite influence, tending to exacerbate the negative consequences of unwanted or excess fertility. If such countervailing forces are at play, it is difficult to anticipate the pattern of results.

4.1 INDICATORS OF CHILD INVESTMENT

We have chosen to study three broad aspects of children's human capital investment, each of which is described by two indicators. The three aspects are: (1) the probability of survival from birth to age 5, with a separate focus on neonatal mortality risks and the risks from the postneonatal period to age 5; (2) nutritional status, measured by height-for-age and weight-for-height expressed in standard deviations from reference medians; and (3) educational progress, measured by grades of schooling attained and by the probability of completing at least one year of secondary school.

These human capital outcome measures are comparatively free of the ambiguities and measurement errors that are likely to affect the fertility preferences data discussed below. Child deaths are likely to be recorded with reasonable accuracy for children born in the last five years. The weighing and measuring of children are undertaken by DHS interviewers trained to perform such tasks in a consistent manner, although some measurement error no doubt remains. Schooling systems vary among our study countries, but in all countries 10-12 years are required for primary and secondary combined, and in each country the achievement of any secondary schooling signals that a significant threshold has been crossed.

Table 4.1 Survey coverage

Survey coverage of data on children and access to community services in five countries, Demographic and Health Surveys, 1987-1993

Country	Children's anthropometry[1]	Children's schooling[2]	Access to community services: Family planning	Health	Schools
Dominican Republic	X	X	X	X	X
Egypt	X	X	rural only	rural only	rural only
Kenya	X	X	X	X	U
Philippines	U	X	X	X	X
Thailand	X	X[1]	rural only	rural only	rural only

U = Unknown (not available)
[1] Individual questionnaire
[2] Household questionnaire

Table 4.2 Demographic and economic indicators

Selected demographic and economic indicators for five DHS countries, various sources

Country (ranked by fertility level)	Date of survey	Total fertility rate[1]	Unwanted fertility rate[1]	Percentage of fertility unwanted[1]	Under-5 mortality[2]	Real GDP/P[3]
Thailand	1987	2.2	0.4	.18	45	3280
Dominican Republic	1991	3.4	0.7	.21	60	3080
Philippines	1993	4.0	1.2	.30	54	2590
Egypt	1988-89	4.4	1.6	.36	102	1930
Kenya	1993	5.3	1.9	.36	96	1400

[1] Bankole and Westoff, 1995; Westoff, 1991
[2] DHS Newsletter, 1997; Sullivan, Rutstein and Bicego, 1994; IEPD, ONAPLAN and IRD/Macro, 1992; selected DHS surveys
[3] UNDP, 1991, 1994, 1996

Consequences for Child Survival

For children born in the last five years—the only children for whom retrospective data on fertility intentions are collected in the DHS—survival probabilities can be compared for children reported to be unwanted or mistimed at the time of pregnancy with the same measures for children who were wanted. The survival probabilities of children in families with (current) excess fertility can also be compared with the probabilities for children whose mothers do not report excessive family size. We take a multivariate life-table approach to these survival data, as described in Section 6.

Consequences Associated with Children's Nutritional Status

The death of a child is an extreme event in that it occurs when a child's health status falls below the critical threshold required to sustain life. Nutritional status is measured in continuous terms, and may, therefore, be more sensitive than mortality to variations in child investment. Height-for-age and weight-for-height are thought to be good proxies for nutritional status.

These measures merit further consideration, because early nutritional deprivation can have long-term consequences for morbidity, cognitive and behavioral development, schooling, and economic productivity. Severe malnutrition leads to stunted growth, which delays motor maturation in infants and young children and thus reduces exploratory behavior. It seems that stunted children evoke caretaking behaviors and social responses that are otherwise reserved for younger children. This, along with their slower maturation, delays the acquisition of important cognitive skills and related social behaviors (Pollitt et al., 1993). Consequently, children who are nutritionally deprived in their first few years of life may be less able to participate in and progress through schooling. Such effects may be manifested early in childhood through a delayed age of entry into school (Glewwe and Jacoby, 1993) and could ultimately result in shorter durations

in school (Bommier and Lambert, 1997). The literature also hints at links between stunted growth and low body mass indexes (BMI) on the one hand, and later productivity and wages, on the other (Kennedy and Garcia, 1994).

Thus, if unintended children or children in families of excessive size are indeed nutritionally deprived—a short-term relationship that can be studied using DHS data—negative consequences can be projected over the long term as well, even though these cannot be directly studied with the DHS data. In the absence of carefully designed longitudinal studies, it is worth exploring such readily available cross-sectional surveys to see what, if anything, can be learned about the short-term nutritional consequences for children.

Educational Consequences

The retrospective structure of DHS surveys prevents us from exploring the direct consequences for educational outcomes for children whose own births were unintended. This is because none of the children born in the five years preceding the survey could have reached school age by the time of the survey. However, the effects of unintendedness on other siblings (cross-sibling effects) can be examined by comparing the educational progress of school-age children who recently experienced the birth of an unintended sibling with the progress of their counterparts who have not. It is also possible to examine the effects of excess fertility on children's schooling, as this measure is not tied to the DHS five-year window. In all this, of course, the lack of proper educational histories forces a reliance on current status educational data, which are less than ideal for our purposes.

4.2 THE MEASUREMENT OF UNINTENDED AND EXCESS FERTILITY

As noted above, the DHS data present an opportunity to measure two distinct dimensions of imperfect fertility control: *excess fertility* and *unintended fertility*. The first measure is derived by comparing a woman's actual fertility with her ideal family size—that is, ideal as expressed on the date of a particular fertility survey. Reports on ideal family size are elicited by the DHS question: "If you could go back to the time you did not have any children and could choose exactly the number of children to have in your whole life, how many would that be?" When actual fertility is greater than the ideal, this is defined as *excess fertility*. The measure describes the situation of a family rather than of any particular child in that family.

For this research, two further issues are faced in the specification of excess fertility. The first is whether to compare ideal family size with the number of births or, alternatively, with the number of surviving children. The demographic literature is characterized by strong views on this aspect of specification, but lacks a clear consensus. Given our focus on child mortality as an outcome measure, there is a particular concern to avoid defining excess fertility, an explanatory variable, in terms of child survival. We have therefore adopted a specification in terms of births in relation to family size ideals. The second issue is how to treat women who give nonnumeric responses to the ideal family size question. Such women are characterized as not having excess fertility.

In contrast to the family-level nature of excess fertility measures, those based on unintended fertility are derived from a birth-by-birth assessment—within a set window of time preceding the survey date—of the intendedness of each birth at the time of pregnancy. In DHS surveys, a woman is asked to recall her feelings at the time she became pregnant with each child born within the last five years and to report whether or not she wanted the pregnancy. If the pregnancy was wanted, she is also asked whether it was wanted then or later. If the child was not wanted at all, or was wanted later, this is defined as *unintended fertility*. Such reports are based on the woman's memory of the feelings she had at a particular point in the past; the measurement issues raised by such retrospective reporting will be discussed shortly.

The conceptual differences between the excess and unintended fertility measures deserve further comment. A woman could report her last birth as being wanted at the time of conception and, during the same DHS interview, report excess fertility in the present. She might do so if, in the interim between birth and survey, she faced deteriorating economic conditions, gained new skills in the labor market that increased the opportunity costs of child rearing, absorbed new ideas about the advantages of small families from the media, experienced unexpected difficulties in properly rearing and disciplining her children, or lost a husband through death or divorce. Similarly, a woman who reports not having wanted a particular pregnancy in the past could report no excess fertility in the present. She might have experienced an improvement in her own or her community's economic circumstances that allowed her to afford more children than previously, the arrival of a new husband who was eager for her to have children with him, or a change in government policies. Our point is that a woman's desire for children can be altered by changes in economic, marital, or health circumstances, or by the receipt of new information or knowledge, even if her underlying preferences are held constant (McClelland, 1983). Excess fertility can arise after childbearing has been completed. Indeed, it can arise after a series of wanted births, if social and economic circumstances change in a manner that was not well anticipated. It is difficult, therefore, to determine from the survey responses whether a woman holds inconsistent views. Moreover, the fact that a woman currently regards her family size as excessive does not necessarily mean that any particular child is or was ever unwanted. Excess fertility means only that the woman now sees her family size as being too large in relation to her current ideals.

Although Bankole and Westoff (1995) have considered recent births in their study of reproductive preferences, the aggregate measures of unwanted fertility reported elsewhere in the literature are based not on reports of the wantedness status of births, but rather on measures of ideal family size (Lightbourne, 1985) or the desirability of a next birth (Bongaarts, 1990). In the terms employed, the Lightbourne measures are measures of *excess fertility*. Bongaarts (1990) has compared such excess fertility measures with alternative, forward-looking measures based on the desirability of a next birth. He found strong correlations between these two indicators, but much weaker correlations between the desire for a next birth and the wantedness status of recent births. Evidently, these alternative measures must tap different concepts; they are differentially affected by changing circumstances and, in addition, as discussed below, by recall and reporting error.

4.3 RELIABILITY AND STABILITY OF PREFERENCES

Concerns about the measurement of unintended and excess fertility have focused primarily on the problem of *ex post* rationalization, usually described as the tendency of respondents to later report as being wanted those children whose conception was initially unwanted (McClelland, 1983). The term "rationalization" is perhaps unfortunate, as it tends to trivialize what may be, in some instances, a difficult process of accommodation to the arrival of an unintended birth. In any case, rationalization presents difficulties whenever respondents who have already had children are asked about their ideal family size or about the unwanted status of a particular child. When questions on unintended fertility are asked on a child-by-child basis, a woman may feel that she is being required to affix a label to each child. The effort to do so must bring on great psychological confusion if the child in question has already died. A surviving child whose conception was unwanted might have grown up to become a loved and much "wanted" member of the family, with the result that his unwantedness at conception might be underreported.

The DHS questions have been very carefully worded so as to minimize such *ex post* rationalization, and there is evidence from experimental studies in Peru and the Dominican Republic (Goldman et al., 1989; Westoff et al., 1990) that their emphasis on a woman's feelings at the time of conception helps to reduce the problem. The fact that considerable proportions of women report excess fertility and unwanted births indicates that these reports represent something more substantial than rationalization.

However, a second form of rationalization could lead to biases in the opposite direction. Rosenzweig and Wolpin (1993) have conjectured that women may be overly optimistic at the time of pregnancy about the endowments of their unborn children. In some settings, this might include assumptions about the sex of the child. Fertility preferences arguably have as much to do with the distribution of children by sex as they do with numbers; when a respondent wants a pregnancy because she expects a boy but instead gives birth to a girl, she may be disappointed. In this way, a wanted pregnancy can become an unwanted daughter. Retrospective reports on unwantedness at the time of pregnancy might therefore produce overestimates of the actual level of unwantedness at that time.

If fertility ideals and intentions are transitory or weakly held, their measurement at any point in time—whether at conception or at survey—would not provide a reliable foundation on which to base a study of the consequences of unwantedness. Evidence suggests that over relatively short intervals of time (six weeks to three years) fertility preferences, as expressed through questions on the desire for additional births, are fairly stable.[8] Over longer intervals, however, and particularly when the fertility transition is progressing rapidly, they are not so stable (see, for example, Freedman et al., 1980).

Apart from considerations of recall error (which could be related to transient or weakly held preferences) and *ex post* rationalization, a woman's reports on the intendedness of a particular child at conception should not change over time. Such reports are meant to be based on the memory of feelings that were held at a fixed point in the past. We are aware of only one study, using panel data from Morocco, that has compared retrospective reports on the wantedness of a given pregnancy at two points in time (Bankole and Westoff, 1997). Of the Moroccan births described in 1992 as being unwanted at the time of pregnancy, 62 percent were subsequently reported (in 1995) to have been initially wanted (that is, wanted either at the time they occurred or later). The figure refers to children age 0-2 in 1992 who would have been age 3-5 in 1995. By contrast, only 5.6 percent of pregnancies reported in 1992 as wanted then were subsequently described as being unwanted. Thus, in the Moroccan data, there are transitions between the wanted and unwanted classifications in both directions, but one direction is empirically dominant. This suggests that the first type of *ex post* rationalization discussed above, whereby the family comes to accommodate initially unwanted children, may increase on average with each year since the child's birth. This possibility seems to be confirmed by the Moroccan data, which show that the longer the time since the

[8] Recent evidence from Peru suggests that desired fertility is reasonably stable in the short run (Mensch et al., 1995). In this study, more than 80 percent of women reinterviewed after three years provided consistent responses to a question about future fertility intentions. Responses to the question about future childbearing desires from the 1991-92 DHS survey were compared with responses to the same question in the 1994 follow-up survey; 72 percent of women gave exactly the same response. Of those who did not want more children in 1994 but had wanted more in 1991-92, roughly half had a child in the interval or experienced a marital disruption, which would be expected to call a halt to their childbearing; thus an additional 7-8 percent could be interpreted as giving consistent answers. This provides some evidence that women's fertility desires do not change markedly over three years. Casterline et al. (1996) examined changes in the Philippines over a shorter reinterview period of six weeks and also found considerable evidence of stability.

Moroccan data, which show that the longer the time since the child's birth, the more likely that reports have been revised from unwanted to wanted.

We conclude that the longer the time since pregnancy, the greater the difficulty of achieving accuracy in retrospective reporting on whether the child was unwanted at that time. Among children of a given age reported to have been wanted, some may well have been initially unwanted. When progressive selectivity bias is present, as it seems to be in the Moroccan case, an older child identified as having been unwanted at the time of the pregnancy may have been, in fact, deeply unwanted. In summary, the unwanted/wanted label distinguishes between two groups of children: those who probably have been unwanted since birth, and those who were either wanted during pregnancy or have subsequently become wanted. Children still labeled as unwanted at the survey date are quite likely to be the children about whom we should be most concerned.

4.4 ANGLES OF VISION

To properly assess the consequences for a child and his or her siblings of being born unintended, or the consequences for children of growing up in a family with excess fertility, we need to know whether any children in the family were the product of unintended pregnancies, and at what point a woman began to regard her family size as being excessive. Similarly comprehensive, precise, and time-ordered information on the potential consequences must also be available. As the potential consequences of unwanted and excess fertility are long-term in nature and possibly cumulative over the course of childhood, the ideal study design would be longitudinal. It would require revisits at regular intervals to monitor the progress and family circumstances of wanted compared with unwanted children and of children in families that once had, or currently have, excess fertility.

Retrospective designs, such as those employed in DHS surveys, have attempted to reach a compromise between what is feasible and the longitudinal ideal. The survey questions are framed to determine the circumstances surrounding the demographic events that happened to unfold during the retrospective window. Such a design allows the consequences for the child and his/her siblings to be precisely measured only over the few years that define the window. Even here, more detail is typically gathered on some events and indicators than on others. For example, child deaths are recorded to the month or day, but only current status data are typically available on children's schooling, rather than the schooling histories that might have been collected retrospectively. Some important information simply cannot be retrospectively determined. For example, where excess fertility is concerned, DHS surveys have not sought to establish when in the past a woman began to view her family size as excessive. No doubt this is because it would be difficult to recall and attach dates to such a change in views unless it happened to coincide with a more easily remembered demographic event. Likewise, no retrospective method can be imagined for precise recall of children's heights and weights. All these practical limitations set boundaries on the range of consequences that can be rigorously assessed.

Figure 4.1 illustrates the time range of observed and unobserved effects of an unwanted birth for the unwanted child and for an older sibling, in terms of their survival, health, and schooling. The limited angle of vision is shown over the period of childhood that is permitted by the DHS design. The figure is based only on the woman's expressed ideals and preferences because, typically, DHS surveys gather no comparable data from husbands in the study countries. For an unwanted child and for an illustrative older sibling, the symbol B marks the year of birth, S marks the year in which each child reaches school age, and M marks the age of legal majority or the end of childhood. Figure 4.1 is designed to show how a five-year window of observation overlaps only partially with the childhood experience of the two siblings.

Figure 4.2 illustrates the time range of observed and unobserved effects of excess fertility for an older and younger child in a family. The key differences between Figures 4.1 and 4.2 are, first, that in the case of excess fertility, no child is singled out as being unwanted or mistimed and, second, that the date at which excess fertility initially developed in a family is not known. The example depicted in Figure 4.2 is one in which an older child had already started school before the development of excess fertility and a younger child had already survived beyond the age at which anthropometric assessments would be made by DHS (generally three years). In this case, the effects that can be assessed would be mainly limited to children's schooling.

4.5 THE WINDOW PROBLEM

As we attempt to explore potential cross-sibling effects, the angle of vision becomes even more constricted. Given the imposition of a retrospective window, it is not possible to know whether a school-age child's current situation might have been affected by the arrival of unintended siblings prior to the five-year window of observation. This means that the analysis mixes some children who have never experienced the event in question with others who first experienced it before the five-year window opened.

The so-called "window problem" has recently been investigated by Wolfe et al. (1996) in a statistical exercise designed to evaluate alternative approaches to estimating the determinants of children's attainments. Using several U.S. longitudinal data sets, they compared statistical estimates of the effects of childhood events on selected outcome variables, variously arranging the data so that these events were measured only at selected times or intervals over the course of childhood.

Figure 4.1 Time range of observed effects in relation to unobserved effects of an unwanted birth on investment in that child and an older sibling, according to data from DHS surveys

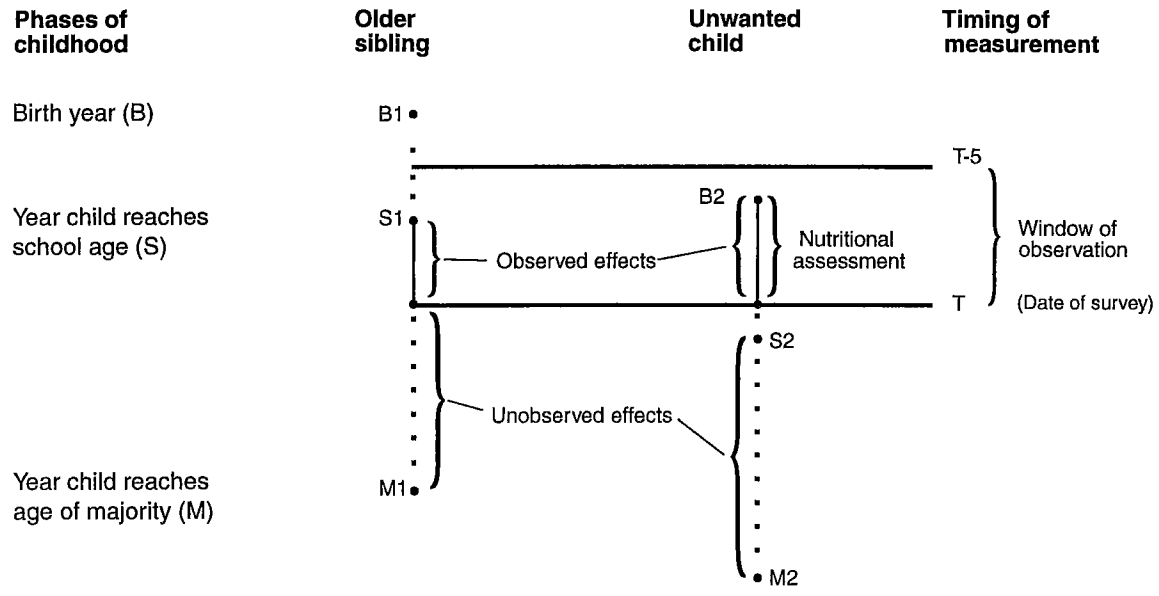
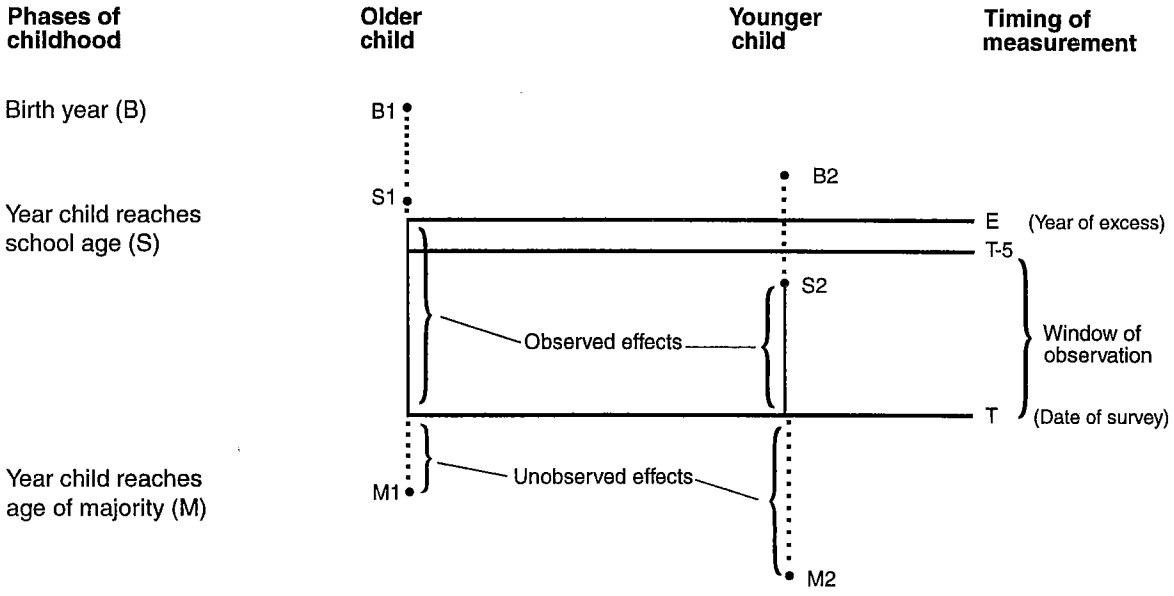


Figure 4.2 Time range of observed effects in relation to unobserved effects of excess fertility on investment in children, according to data from DHS surveys



In comparing the sizes and signs of the resulting coefficients, they found the least conformity in the estimates for relatively rare events, such as parental separation. For example, the measured effect of parental separation on a child's eventual educational attainment differed depending on whether parental separation was measured at a particular point in the child's life (that is, age 14) or over a 10-year interval (from ages 6 to 15).

For the analysis of the cross-sibling effects of an unintended birth, DHS surveys provide a relatively brief window of observation. To extend the window backwards in time would no doubt identify more unintended births, but at the cost of introducing additional errors of measurement and *ex post* rationalization. Perhaps the net gain would be small in any case, for some effects would be expected to be immediately apparent. For example, a girl may be held back from entering school or withdrawn from school immediately upon the arrival of an unintended new sibling. The force of such exogenous shocks may well dissipate over time. In Figure 4.1 these concerns are illustrated by showing the link between the arrival of an unwanted child and the schooling experience for a sibling of school age from the time of the event to the end of the window of observation. Some of this might be measurable with retrospective DHS data, but a fully adequate analysis of the cross-sibling effects of an unintended birth requires a longitudinal design.

No similar "window problem" afflicts the excess fertility measures. However, with these current status variables the difficulty is that there is no way of knowing how long children have been exposed to a situation of excess fertility.

5 Who Experiences Unintended or Excess Fertility?

The consequences of imperfect fertility control cannot be fully understood without reference to the characteristics of those who experience such fertility. In this Section, the levels and distributions of unintended and excess fertility in the five study countries are described. Note that for three of the five countries, the Dominican Republic, Kenya, and the Philippines, the samples represent all women age 15-49, whereas for Egypt and Thailand the samples represent only ever-married women. The section begins with descriptive analyses and closes with a multivariate investigation.

5.1 UNINTENDED FERTILITY

Table 5.1 shows the total number of women in each country from whom information was obtained by DHS, and presents the distribution of women according to the number of births in the five-year retrospective window. The total number of women surveyed ranges from 7,320 in the Dominican Republic to 15,029 in the Philippines. Only in Egypt and Kenya do more than half of these women report a birth in the five years preceding the survey. This reflects the high fertility that is characteristic of Kenya and the relatively high fertility found among ever-married women in Egypt.

The distribution of all births in the last five years according to their intendedness status is presented in Table 5.2. Unintended births include those that were unwanted and those that came sooner than desired. The percentage of births that were said to be unwanted at conception varies from 14 percent in Thailand to 22 percent in Egypt. As argued, due to *ex post* rationalization, this is likely to be an underestimate of the actual level of unwanted pregnancy. Another 13 to 35 percent of births are reported to have been mistimed in the study countries, with 9 to 25 percent mistimed by more than two years. The percentage of recent births that were unintended thus ranges from 51 percent in Kenya, to 44 percent in the Philippines, 39 in the Dominican Republic, 35 in Egypt, and 31 in Thailand. Interestingly, Kenya, with the highest fertility overall, also exhibits the highest rate of unintended pregnancy.

Unwanted Fertility

As demonstrated in Table 5.2, both unwanted and mistimed fertility are significant components of unintended fertility in these settings. Table 5.3 focuses specifically on the unwanted component, with attention to levels and distributions across selected covariates. Two perspectives are presented in this table: the upper panel describes the incidence of unwanted fertility from the viewpoint of women; the lower panel describes the incidence of unwanted fertility in the sample of children born in the five years preceding the survey.

As shown in the upper panel, from 6 to 17 percent of the women in our samples experienced at least one unwanted birth in the last five years, and of those who have had a child in the past five years, the range is from 15 to 28 percent. Among women with such recent fertility, it is clear that the likelihood of unwanted childbearing is strongly associated with education and age. Interestingly, it does not appear to be closely related to urban residence, even though urban areas are generally better supplied with a range of contraceptive services. Among women with a birth in the last five years, roughly one in three uneducated mothers in the Dominican Republic and Egypt had an unwanted birth, while only one in five mothers with secondary schooling had such a birth. As shown in Table 5.3, the relationship between unwanted fertility and women's education is generally negative, with successive increases in education leading to declines in unwanted fertility, although some curvilinearity is apparent in Egypt and the Philippines.

Table 5.1 Births in the last five years

Percent distribution of women by number of births in the five years preceding the survey, Demographic and Health Surveys, 1987-1993

Births per woman	Dominican Republic 1991	Egypt 1988[a]	Kenya 1993	Philippines 1993	Thailand 1987[a]
Number of births in the last 5 years					
0	64	40	48	63	58
1	22	30	27	20	32
2	11	23	21	13	9
3	3	7	3	4	<1
4	<1	<1	<1	<1	<1
Total	100	100	100	100	100
Number of women	7,320	8,911	7,540	15,029	6,775

Note: Weighted data. Totals may not add to 100% due to rounding
[a] Ever-married women

Table 5.2 Desire for birth at time of conception

Percent distribution of births in the five years preceding survey by mother's desire for birth at the time of conception, Demographic and Health Surveys 1987-1993

Desire for birth	Dominican Republic 1991	Egypt 1988[a]	Kenya 1993	Philippines 1993	Thailand 1987[a]
Desire for birth at time of conception					
Wanted then	61	65	49	56	69
Mistimed ≤ 2 years	15	13[b]	9	9	17[b]
Mistimed > 2 years	9		25	19	
Unwanted	15	22	17	16	14
Total	100	100	100	100	100
Number of births	4,164	8,647	6,115	9,152	3,627

Note: Weighted data.
[a] Ever-married women
[b] Preferred waiting time before birth not asked of respondents

Older mothers are much more likely to describe their recent births as unwanted. Within the oldest age group of recent mothers, those 45-49 years of age, approximately two-thirds in the Dominican Republic and Egypt described their recent birth as unwanted; in the Philippines and Thailand, more than half of women used this term. This relationship is largely explainable by the increase with age in the proportion of women who have already achieved their desired family size.

The lower panel of Table 5.3, which is concerned with the sample of children born in the five-year window, shows no difference in the likelihood that a female child would be described as unwanted at conception compared with a male child. A difference might have been expected if parents had a strong preference for children of one sex or the other and systematically revised their reports of unwantedness after a birth on that basis. In the countries of our sample, however, son preference is now relatively weak, apart from the possible exception of Egypt. Some evidence is seen in the lower panel of the type of rationalization suggested by Bankole and Westoff (1997) who, it will be recalled, found that high proportions of children originally reported as unwanted were later reported to have been wanted. Some decline can be seen in the percentage of unwantedness by age of the child, although it is not as dramatic as might have been expected from their results.

A final aspect of unwantedness status is its association with parity. Women are much more likely to describe the conception of their higher parity children as unwanted. For instance, 53 percent of children of parity 6 and greater in Thailand, and 51 percent of such children in the Dominican Republic and Egypt, were labeled as unwanted. In short, unwanted children may be generally characterized as being of higher parity, and born to women who are in the later stages of their reproductive lives.

Mistimed Fertility

Table 5.4 presents a parallel analysis of mistimed fertility. As with unwanted fertility, the percentage of women who had at least one mistimed pregnancy is relatively small in most countries. The main exception to this is Kenya, where nearly a quarter of all women report having had a mistimed pregnancy and where 41 percent of recent mothers report one or more such pregnancies.

The distribution of mistimed fertility across demographic categories is very different from that of unwanted fertility. Mistimed fertility is not particularly prevalent among older mothers. Rather, for the most part, the likelihood of a mistimed pregnancy progressively decreases with the age of the mother. Although the incidence of unintended fertility as a whole rises with age, its mistimed component tends to fall with age. It seems that mistimed births must be more prevalent among young mothers who have not yet achieved their desired family size. In this respect, our results are consistent with other findings from DHS based on a large group of surveys (Adetunji, 1997).

Another difference between the two types of unintended fertility is evident in the educational levels of the mothers.[9] Whereas unwanted fertility decreases significantly with education in the five countries, for mistimed fertility no clear relationship emerges. Among women with births in the last five years, those with secondary or higher education have roughly the same likelihood of a mistimed birth as do women with no education.

[9] One aspect in which unwanted and mistimed fertility are similar is prevalence in urban and rural areas, with no consistent pattern evident in the prevalence of mistimed births by residential area.

Table 5.3 Unwanted fertility

Unwanted births among women by background characteristics, and percentage of children reported as unwanted at conception, Demographic and Health Surveys, 1987-1993

Characteristic	Dominican Republic 1991	Egypt 1988	Kenya 1993	Philippines 1993	Thailand 1987
			WOMEN		
Among all women, percentage with:					
0 unwanted births	94	83	89	92	93
1 unwanted birth	5	13	9	7	6
2+ unwanted births	1	4	2	1	1
Among women with a birth in the last 5 years, percentage with:					
0 unwanted births	82	72	80	79	85
1 unwanted birth	15	22	16	17	14
2+ unwanted births	3	6	4	4	1
Percentage with 1 or more unwanted births, among women with:					
No schooling	33	30	26	18	25
Primary	21	32	21	28	15
Secondary	13	16	} 16	18	12
Higher	11	15		15	4
15-24 yr	9	6	8	6	9
25-34 yr	19	25	20	18	12
35-44 yr	39	53	44	37	35
45-49 yr	63	67	42	54	54
Urban residence	20	29	15	20	15
Rural residence	17	28	21	22	16
			CHILDREN BORN IN THE FIVE YEARS BEFORE THE SURVEY		
Percentage reported as unwanted at conception among:					
All children	15	22	17	16	14
Males	16	21	17	16	15
Females	14	22	16	16	13
Children who died	10	18	16	18	19
Living children age 0-12 mo	19	23	19	20	14
Living children age 13-36 mo	15	23	18	17	14
Living children age 37-60 mo	13	20	14	14	13
Children of birth order					
1	2	.4	5	2	4
2	6	3	5	5	7
3	17	15	8	12	17
4	32	27	11	21	28
5	35	37	20	28	42
6+	51	51	39	38	53
Children of women who were:					
Married[a]	15	U	U	17	U
Unmarried	16	U	U	7	U

Note: Weighted data
U = Unknown (not available)
[a] Marital status at conception is from calendar data where available

Table 5.4 Mistimed fertility

Mistimed births among women by background characteristics, and percentage of children reported as mistimed at conception, Demographic and Health Surveys, 1987-1993

Characteristic	Dominican Republic 1991	Egypt 1988	Kenya 1993	Philippines 1993	Thailand 1987
		WOMEN			
Among all women, percentage with:					
0 mistimed births	90	89	78	88	92
1 mistimed birth	8	9	16	8	7
2+ mistimed births	2	2	6	4	1
Among women with a birth in the last 5 years, percentage with:					
0 mistimed births	73	83	59	69	80
1 mistimed birth	22	15	30	21	17
2+ mistimed births	5	3	11	10	3
Percent with 1 or more mistimed births, among women					
15-24 yr	34	17	53	38	23
25-34 yr	26	21	40	34	20
35-44 yr	14	13	24	24	13
45-49 yr	5	7	17	11	7
No schooling	24	16	28	29	19
Primary	28	18	45	31	19
Secondary	27	21	43	34	22
Higher	26	18	24	29	21
Urban residence	27	20	35	30	19
Rural residence	28	16	42	33	20
		CHILDREN BORN IN THE FIVE YEARS BEFORE THEY SURVEY			
Percentage reported as mistimed at conception among:					
All children	23	13	34	28	17
Mistimed by less than 1 yr	6[a]	b	2[a]	2[a]	b
Mistimed by 1-2 yr	8	U	7	7	U
Mistimed by 2 yr	8	U	23	18	U
First birth	21	3	39	19	16
Birth interval 7-17 mo	41	22	41	41	32
18-23 mo	28	19	42	39	29
24-72 mo	19	13	32	27	17
72+ mo	10	6	14	13	7
Children of women who were:					
Married[c]	22	U	U	28	U
Unmarried	32	U	U	24	U

Note: Weighted data
U = Unknown (not available)
[a] Percentages do not sum to exactly that of all children due to missing cases for this variable
[b] Preferred waiting time before birth not asked of respondents
[c] Marital status at conception is from calendar data where available

This finding is somewhat unexpected, given that more educated women should be able to exert more effective control over the timing of their births.

Turning now to the relationship between length of birth interval and the incidence of mistimed births, there is a tendency for women to describe as mistimed those births that are the result of short birth intervals. For instance, in the Dominican Republic, Kenya, and the Philippines, 41 percent of women whose previous birth interval was of the shortest duration (7-17 months) labeled that birth as mistimed. The length of the birth interval is clearly an important element in whether or not a woman chooses to label a conception as mistimed. These results are consistent with past research that has explored the relationship between shorter previous birth intervals and unintended fertility (Adetunji, 1997; Cartwright, 1988). In both of these studies, the length of birth intervals was found to be strongly associated with the likelihood that a birth would be labeled mistimed.

Yet, as Table 5.4 shows, it is equally clear that women do not uniformly describe their short intervals as mistimed. This is despite the fact that a great deal of demographic research has established that short birth intervals put infants and young children at higher risk of death, and such information has presumably been incorporated in family planning informational and educational programs. It appears the effect of short intervals is not widely appreciated by the mothers in question; or, perhaps, they judge other factors to be more important in defining mistiming. Note that short birth intervals are much less likely to be described as mistimed in Egypt than in the other four countries, a point we will return to later.[10]

The final statistic of interest in Table 5.4 is the respondent's preferred waiting time before becoming pregnant, data which are available only for the Dominican Republic, Kenya, and the Philippines. In Kenya and the Philippines, the overwhelming majority of births are said to have been mistimed by more than two years.

In sum, it is apparent from a review of these descriptive statistics that mistimed and unwanted fertility are distributed rather differently. Among women with recent births, those who are older or less educated are more likely to describe recent births as unwanted, while younger women are more likely to refer to recent births as mistimed. Each component accounts for a significant percentage of children in the five study countries, and indeed, as Adetunji (1997) has shown, in developing countries taken as a whole.

[10] We pursued this issue further in a multivariate analysis, the intent being to determine what socioeconomic or program factors would encourage women with short birth intervals to describe them as mistimed. We could uncover no systematic effect in this analysis. In particular, neither the measures of mother's education nor access to family planning made a difference, and yet it would have been reasonable to suppose that knowledge of the risks of short intervals would be greater among the better-educated and those exposed to family planning programs.

5.2 EXCESS FERTILITY

Excess fertility is derived by comparing a woman's ideal family size with the number of children she has borne. The incidence of excess fertility among all women (or ever-married women in Egypt and Thailand) and among women with at least one birth in the last five years is presented in Table 5.5 according to various demographic characteristics. This table also contains information on the percentage of children born in the last five years who live in a family with excess fertility, or whose birth order exceeds the mother's ideal.

Excess fertility is distributed among subgroups of the population in much the same fashion as unwanted fertility. Like unwanted fertility, excess fertility is more prevalent among older women who have at least one birth in the last five years. If a woman age 45-49 has had a child within the last five years, it is highly likely that her family size exceeds her ideal. With the exception of the Dominican Republic, women in this age group in the remaining four countries are more likely to report excess fertility than unwanted fertility. For example, Table 5.3 shows that 42 percent of women aged 45-49 with a recent birth in Kenya report an unwanted birth but in Table 5.5 it can be seen that 68 percent of the same group of women report actual fertility in excess of ideals. This difference may reflect the reluctance of women to identify specific births as unwanted. It may also stem from the rapidity of recent socioeconomic change and associated declines in family size ideals.

The likelihood of excess fertility is significantly lower among better-educated women. This is especially apparent for the Dominican Republic, Egypt, and Kenya, where 43 percent or more of mothers with no education have fertility in excess of ideals, compared with less than half this percentage among better-educated mothers. Excess fertility is somewhat more common among rural mothers, although such urban-rural differences are small in both Egypt and Thailand. Women who are currently married are also more likely to report excess fertility, no doubt because those whose marriages have been dissolved by death or divorce are less likely to have attained their desired family size.

All this might suggest that excess and unwanted fertility are highly enough correlated that one of the measures is redundant. To obtain a sense of their empirical overlap, we investigate in Table 5.6 the prevalence of reported unwantedness for those births whose birth order exceeds the mother's ideal family size. Among such births, the percentage reported to be unwanted at conception ranges from 35 percent in the Philippines to a high of 47 percent in Egypt. This is several times the percentage for children whose birth order did not exceed the mother's current ideal, as shown in the table. However, since the percentage reported to be unwanted falls considerably short of 100, one can conclude that excess fertility and unwanted fertility are sufficiently different empirically—their conceptual differences have been previously emphasized—to justify pursuing each in the multivariate analyses.

Table 5.5 Excess fertility

Excess fertility among women by background characteristics, percentage of children living in a family with excess fertility, and percentage of children whose birth order exceeds the mother's ideal, Demographic and Health Surveys, 1987-1993

Characteristic	Dominican Republic 1991	Egypt 1988[a]	Kenya 1993	Philippines 1993	Thailand 1987[a]
		WOMEN			
Average number of children wanted	3.1	2.9	3.7	3.2	2.8
Percentage of all women reporting excess fertility	19	42	28	19	26
Among women with a birth in past 5 years, percentage reporting excess fertility among those:					
15-24 yr	9	11	5	5	4
25-34 yr	28	44	42	27	19
35-44 yr	49	66	72	58	47
45-49 yr	46	63	68	78	73
No schooling	47	43	48	29	29
Primary	28	49	36	45	21
Secondary	16	25	24	26	7
Higher	11	22	16	18	9
In union	25	42	38	32	20
Not in union	18	34	21	16	19
Urban	20	43	21	28	18
Rural	30	40	37	35	20
		CHILDREN BORN IN THE FIVE YEARS BEFORE THE SURVEY			
Percentage living in family with excess fertility	27	43	38	35	22
Percentage whose birth order exceeds mother's ideal	22	36	34	30	19

Note: Weighted data.
[a] Based on ever-married women

Table 5.6 Overlap of unwanted and excess fertility

Overlap of unwanted and excess fertility, Demographic and Health Surveys, 1987-1993

Unwanted and excess fertility	Dominican Republic 1991	Egypt 1988	Kenya 1993	Philippines 1993	Thailand 1987
Percent unwanted among all children born in last 5 years	15	22	17	16	14
Percent unwanted among children whose birth order is less than or equal to the mother's ideal	8	7	6	8	7
Percent unwanted among children whose birth order is greater than the mother's ideal	40	47	37	35	43

Note: Weighted data.

5.3 MULTIVARIATE ANALYSIS

In Table 5.7, by way of multivariate methods, the determinants of unwanted and excess fertility are explored. The table presents two models for each country, one in which the outcome measure is the woman's experience of any unwanted fertility over the five-year window, and another in which current excess fertility is the dependent variable. These are binary outcome variables that take the value 1 if any unwanted births occurred, in the first case, and if the woman reports any excess fertility, in the second. Probit models are estimated (see Greene (1997) for a lucid textbook exposition of this model).

The reference category for the analysis of unwanted fertility is defined so that the variable takes the value of 0 if the woman had no births in the five-year window, and also takes that value if she had only wanted (or mistimed) births. This approach to the data is generally consistent with our theoretical perspective, in that we aim to focus attention on departures of actual fertility from wanted fertility. Cases in which no births occurred are thus interpreted as reflecting desired outcomes. Of course, some women are constrained from having the births that they desire because of low fecundability, and ideally one would like to distinguish these cases from others in which no births were wanted. Such an approach has not been pursued here because it would require a retrospective determination of fecundability constraints. The treatment of mistimed births also deserves comment. We have experimented with a multinomial logit model in which the four outcome categories are, respectively, no births or only wanted births; any unwanted but no mistimed births; any mistimed but no unwanted births; and any combination of both unwanted and mistimed births. The estimates derived from this model are not readily interpretable, and therefore the simpler approach shown in Table 5.7 has been taken, recognizing that it is less well-grounded in our theoretical perspective than we would like.

In addition to the covariates that have been mentioned above, considerable interest attaches to the measures of the family planning, health, and educational service environments. Appendix A describes the construction of the measures used in the analyses. By devising a reasonably consistent set of measures that have cross-national comparability, we hope to determine the extent to which these services figure into the probabilities of unwanted and excess fertility. Although only family planning services are involved in the prevention of such fertility, the other services have a role to play through their influence on the woman's motivation to exercise effective fertility control.

The estimates shown in Table 5.7 reconfirm much of what has been learned through the earlier descriptive analyses. In particular, they underscore the importance of education in enabling women to avoid both unwanted and excess fertility. In Figure 5.1, the education coefficients are translated into estimates of the probabilities of unwanted and excess fertility.[11] As can be seen, better-educated women are markedly more effective in averting such fertility in all countries but Kenya. Perhaps in Kenya, a country at an intermediate phase of demographic transition, better-educated women are among the first to conceive of their fertility in these terms.

[11] The predicted probabilities are derived by holding the education level constant and allowing all other covariates to vary as they do in the sample. A predicted probability is then generated for each woman, and the average of these probabilities is shown in the figure.

Table 5.7 Multivariate estimates of unwanted and excess fertility models

Multivariate estimates of unwanted and excess fertility models, Demographic and Health Surveys 1987-1993

Variable	Dominican Republic		Egypt		Kenya		Philippines		Thailand	
	Any unwanted	Any excess	Any unwanted	Any excess	Any unwanted	Any excess	Any unwanted	Any excess	Any unwanted	Any excess
WOMEN'S CHARACTERISTICS										
Woman's age	.535	.542	.338	.757	.163	.954	.281	-.272	.216	.273
(|z| statistic)	(4.30)	(5.67)	(2.56)	(6.94)	(1.52)	(5.85)	(2.45)	(4.45)	(1.50)	(1.95)
Age, squared	-.012	-.012	-.002	-.016	.001	-.020	-.004	.012	-.005	-.004
	(3.07)	(3.97)	(0.62)	(4.94)	(0.25)	(4.04)	(1.05)	(6.11)	(1.00)	(0.86)
Age, cubed	-.000	-.000	-.000	.000	-.000	.000	-.000	-.000	.000	.000
	(1.93)	(2.97)	(1.12)	(3.54)	(1.56)	(2.80)	(0.17)	(6.66)	(0.51)	(0.39)
Woman, primary schooling	-.189	-.072	-.024	.030	.151	.258			-.147	-.122
	(2.36)	(1.08)	(0.56)	(0.79)	(2.50)	(4.82)			(1.76)	(1.95)
Woman, secondary schooling	-.448	-.456	-.314	-.540	.017	-.117	-.152	-.188	-.127	-.414
	(4.45)	(5.51)	(4.09)	(8.35)	(0.21)	(1.59)	(3.46)	(5.34)	(1.01)	(4.14)
Woman, higher schooling	-.523	-.955	-.480	-.751			-.270	-.404	-.522	-.702
	(4.05)	(8.63)	(4.14)	(7.85)			(4.49)	(8.61)	(2.54)	(4.85)
Currently in union	.237	.238	.859	.325	-.029	.374	.621	.410	.170	.184
	(3.83)	(5.05)	(9.19)	(5.72)	(0.50)	(6.66)	(8.61)	(8.33)	(1.67)	(2.73)
FAMILY CHARACTERISTICS										
Spouse, primary schooling			0.63	.115						
			(1.45)	(2.98)						
Spouse, secondary schooling	.069	-.046	-.063	.003	-.092	.069	-.058	-.110	.002	-.086
	(0.99)	(0.82)	(0.95)	(0.46)	(1.59)	(1.33)	(1.28)	(2.93)	(0.02)	(1.46)
Spouse, higher schooling	-.190	-.167	-.130	-.180			-.206	-.302	-.129	-.203
	(1.67)	(1.92)	(1.46)	(2.46)			(3.37)	(6.26)	(0.82)	(1.74)
Spouse's occupation skilled, professional	.106	.012	.039	.085	-.058	.043	.100	.051	.134	.165
	(1.88)	(0.27)	(0.97)	(2.42)	(1.05)	(0.89)	(2.65)	(1.61)	(2.24)	(3.55)
Standard of living index	-.167	-.111	.104	.070	.059	.107	.009	.026	-.153	-.155
	(2.84)	(2.22)	(1.73)	(1.35)	(1.27)	(2.63)	(0.26)	(0.97)	(2.80)	(3.48)
Index, squared	.008	.005	-.014	-.001	-.012	-.015	-.007	-.011	.006	.013
	(1.16)	(0.83)	(1.87)	(0.09)	(1.72)	(2.45)	(1.67)	(3.52)	(0.97)	(2.54)
CLUSTER CHARACTERISTICS										
Town	-.056	-.098	-.691	-.527	-.087	-.214	.078	.106		
	(0.51)	(1.15)	(3.30)	(2.72)	(0.58)	(1.56)	(1.47)	(2.45)		
Small city	.144	.183			.091	-.162	.024	.041	-2.059	-.159
	(1.64)	(2.61)	-.767	-.629	(0.60)	(1.10)	(0.51)	(1.08)	(0.98)	(0.17)
			(3.64)	(3.23)						
Capital city	.211	.263			-.679	-.563	.034	-.029	-1.964	-.117
	(1.87)	(2.98)			(5.68)	(6.07)	(0.47)	(0.52)	(0.94)	(0.12)

Continued

Table 5.7—*Continued*

Variable	Dominican Republic		Egypt		Kenya		Philippines		Thailand	
	Any unwanted	Any excess	Any unwanted	Any excess	Any unwanted	Any excess	Any unwanted	Any excess	Any unwanted	Any excess
EDUCATION AND HEALTH SERVICES										
Travel time to primary known[a]	U	-.227 (0.64)	U	U	U	U	-.573 (1.48)	-.264 (0.73)	U	U
Travel time to primary	.005 (2.56)	.003 (1.83)	-.035 (4.15)	-.015 (2.13)	U	U	-.007 (2.79)	-.001 (0.87)	-.000 (0.11)	.001 (0.54)
Travel time to secondary known	.678 (1.49)	-.015 (0.67)	-.028 (0.23)	-.343 (3.02)	U	U	-.187 (2.02)	-.116 (1.50)	U	U
Travel time to secondary	-.001 (0.19)	.000 (0.97)	-.007 (2.37)	-.001 (0.39)	U	U	-.000 (0.72)	.001 (2.50)	.001 (0.68)	.000 (0.17)
Distance to hospital or health center	.011 (2.10)	.011 (2.47)	.011 (0.81)	-.018 (1.45)	-.004 (0.50)	-.013 (1.93)	.006 (0.25)	-.002 (0.08)	-.073 (1.18)	-.002 (0.08)
Family planning available at hospital/health center	.245 (2.83)	.116 (1.79)	.154 (0.92)	-.028 (0.19)	.104 (0.72)	-.140 (1.08)	.066 (0.44)	.039 (0.32)	-2.368 (1.14)	-.291 (0.31)
Distance × availability	-.010 (1.57)	.004 (0.93)	-.015 (1.07)	.016 (1.24)	.003 (0.36)	.011 (1.70)	-.004 (0.18)	.003 (0.16)	.076 (1.22)	.006 (0.23)
Number of health services at hospital/ health center	-.002 (0.10)	.017 (0.98)	-.002 (0.05)	.010 (0.30)	U	U	-.015 (0.19)	-.004 (0.07)	U	U
Number of family planning services at hospital/heath center	-.034 (2.35)	-.006 (0.56)	-.021 (0.76)	-.008 (0.32)	U	U	U	U	U	U
Health center in community	.026 (0.27)	.073 (0.94)	U	U	-.051 (0.25)	-.385 (2.13)	U	U	U	U
Distance to nearest public heath center	.020 (0.95)	.000 (0.00)	-.032 (1.74)	.017 (1.09)	-.000 (0.04)	.005 (1.83)	.005 (0.08)	-.101 (1.80)	.017 (1.44)	.015 (1.34)
Family planning available at nearest health center	.134 (1.18)	-.084 (0.95)	-.141 (1.11)	.312 (2.80)	.173 (0.87)	.377 (2.15)	.118 (1.07)	-.018 (0.21)	.244 (1.56)	.020 (0.18)
Distance × availability	-.022 (1.10)	.005 (0.26)	.027 (1.41)	-.010 (0.64)	-.000 (0.08)	-.004 (1.67)	-.006 (0.09)	.101 (1.81)	-.022 (1.51)	.002 (0.14)
Number of health services at nearest heath center	-.021 (0.78)	-.002 (0.08)	-.097 (2.50)	-.133 (3.88)	-.003 (0.07)	.027 (0.71)	-.052 (1.79)	-.016 (0.68)	U	U
Number of family planning services at nearest health center	-.024 (1.10)	.002 (0.09)	.043 (1.38)	-.040 (1.45)	U	U	-.004 (0.32)	-.024 (2.30)	U	U
Community has heath worker	-.013 (0.16)	-.006 (0.09)	U	U	.146 (2.90)	.157 (3.31)	U	U	.028 (0.25)	-.039 (0.48)
Community health worker provides family planning	-.013 (0.17)	.033 (0.52)	U	U	U	U	U	U	-.151 (1.94)	-.058 (1.01)

Continued

Table 5.7—*Continued*

Variable	Dominican Republic		Egypt		Kenya		Philippines		Thailand	
	Any unwanted	Any excess	Any unwanted	Any excess	Any unwanted	Any excess	Any unwanted	Any excess	Any unwanted	Any excess
Community family planning worker	U	U	.013 (0.24)	.062 (1.24)	-.087 (1.70)	-.061 (1.25)	U	U	U	U
Community has trained midwife	U	U	0.47 (0.73)	.157 (2.80)	U	U	U	U	.113 (1.79)	.180 (3.69)
Pharmacy provides contraceptives	-.105 (1.45)	-.153 (2.53)	U	U	U	U	U	U	U	U
Mobile health clinic visits community	U	U	U	U	U	U	-.467 (2.08)	-.029 (0.33)	.082 (0.65)	-.061 (0.60)
Mobile family planning clinic visits community	U	U	U	U	-.115 (2.13)	-.088 (1.76)	-.043 (0.19)	-.059 (0.35)	-.121 (0.92)	.091 (0.89)
Distance to nearest mobile outreach point	U	U	U	U	U	U	.003 (2.08)	-.001 (0.45)	U	U
Number of health services provided by mobile clinic	U	U	U	U	U	U	.177 (1.50)	.012 (0.14)	U	U
Number of family planning services provided by mobile clinic	U	U	U	U	U	U	.037 (0.75)	.039 (1.04)	U	U
χ^2 (d.f.) (p-value)	479 (32) 0.00	2,110 (33) 0.00	882 (30) 0.00	2,181 (30) 0.00	626 (24) 0.00	3,225 (24) 0.00	1,311 (32) 0.00	3,833 (32) 0.00	136 (27) 0.00	1,424 (27) 0.00
Number of women	7,271	7,292	8,391	8,391	7,011	7,011	14,129	14,129	6,331	6,331

Notes: Unweighted data. Omitted categories and dummy variable coding are as follows:

Woman's schooling:

Omitted categories are none (Dominican Republic, Egypt, Kenya, Thailand), none or primary only (Thailand); upper categories are secondary or higher (Kenya), and higher for the other countries.

Spouse schooling:

Omitted categories are none or primary (Dominican Republic, Kenya, Philippines, Thailand), none (Egypt); upper categories are secondary or higher (Kenya), and higher for the other countries.

Urban residence:

The DHS categories of town, small city, and capital city are used except in Egypt (town, city), and Thailand (city, capital). The omitted category in Thailand is rural or town, whereas for the other countries rural is the omitted category.

Education and health services:

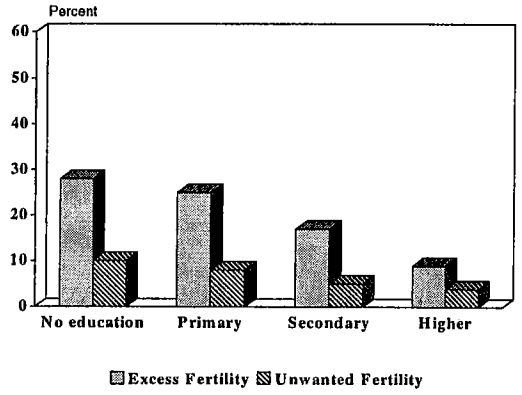
For urban areas in Egypt and Thailand, all these variables are set to zero. The variable "Travel time to primary known" takes the value 1 if the respondent could provide this information; for cases in which the travel time was not known, this variable is set to 0 and the mean value of travel time substituted into the "Travel time to primary" variable. The same procedure was followed for time to secondary schools.

U = Unknown (not available)

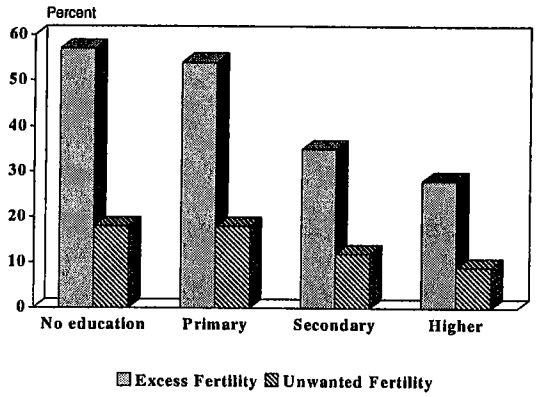
[a] For the Dominican Republic, known travel time to primary school perfectly predicts unwanted fertility. The variable is dropped from the analysis, together with 21 cases.

Figure 5.1 Predicted percentage of women with excess and unwanted fertility by level of education, five DHS surveys, 1987-1993 (Note: In all five surveys the level of excess fertility among women with secondary or higher education is significantly different from that among women with no education.)

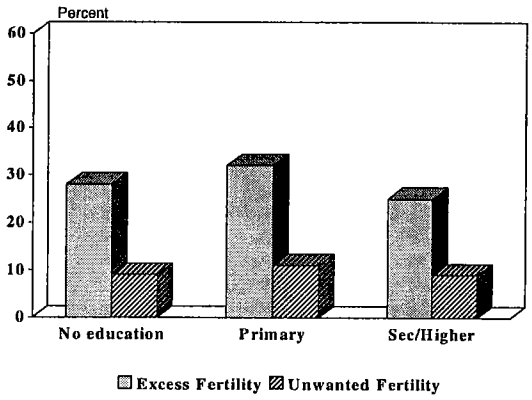
Dominican Republic 1991



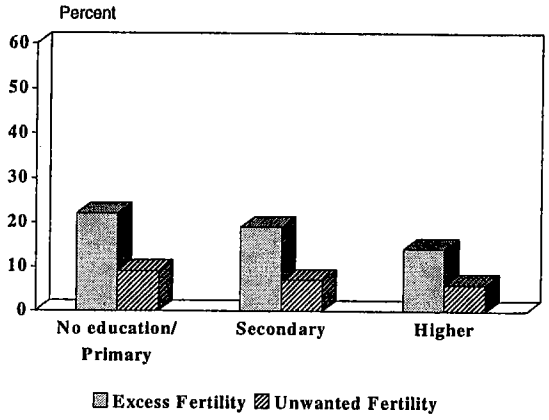
Egypt 1988



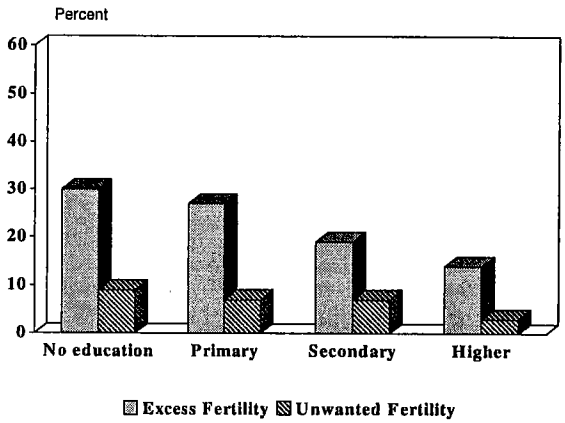
Kenya 1993



Philippines 1993



Thailand 1987



From the results presented in Figure 5.1 it can be seen that with other things held equal, less-educated women will make a contribution to the aggregate pool of unwanted and excess births that is out of proportion to their numbers. This is likely to have important society-wide implications. To appreciate the point, consider the distribution of all children according to their levels of human capital investment. It is reasonable to suppose—and later analyses in Section 6 will strongly confirm this view—that better-educated mothers will strive to ensure that their children are also better-educated. Less-educated mothers, by contrast, will often lack the means or the motivation to similarly advance their children's education. The social consequences will be expressed in greater aggregate proportions of poorly educated children than would have been the case had all women been able to engage in effective fertility control.

The separate role that services and programs play in reducing unwanted and excess fertility is not easily determined. A great number of service covariates have been included in the models of Table 5.7, and of course many of these are inter-correlated and partly redundant. In examining the effects across countries, little evidence is seen that family planning services exert a decisive influence in preventing such fertility. Admittedly, these indicators are mostly measures of access to services, rather than measures of service quality. Results regarding access to services, which are mixed and rather weak on the whole, are not unlike those found elsewhere in the literature, as discussed in Appendix A.

6 Consequences of Unintended and Excess Fertility

This Section addresses the central question of the research, whether unintended and excess fertility have measurable consequences for children's human capital. In each of the dimensions of consequences studied, we begin by describing special features of the variables and estimation procedures, and then provide brief descriptive results. Following this, estimates are presented from a multivariate model in which all covariates are included except for those having to do with unintended or excess fertility. The idea is to provide a benchmark conventional specification. As in the analyses of the preceding Section, these multivariate models include a considerable number of covariates, and to maintain focus on the principal line of argument, no comment is made except in passing on the effects of these covariates. Note, however, that in the case of the schooling analyses, we require a control for time trends, and use the mother's age for this purpose. Having established a baseline specification, attention is then concentrated on the additional influences of the covariates having to do with unintended or excess fertility.

6.1 CONSEQUENCES FOR MORTALITY

Focus is directed to two indicators of mortality among children born in the five years before the DHS surveys, the probability of neonatal death and, among children who survive the first month, the probability of death before age five. An ordinary probit model is used to explore the determinants of neonatal death. For the postneonatal period to age five, a conditional Weibull hazards model is employed.[12] The Weibull specification is commonly employed in mortality research; Greene (1997) gives a clear exposition of this model and provides pointers to the literature in both demography and economics.

In dividing duration since birth into these two periods, we aim to distinguish between the behavioral factors that are expressed in neonatal risks, which mostly have to do with the effects of birth intervals and use of prenatal services, and those postnatal behaviors that may have an influence on later risks of mortality. To put this differently, we have in mind a nonproportional model of the risks of death, such that covariates X exert distinct influences in the neonatal and postneonatal periods.

In a Weibull hazards model, the unconditional risk of death at month t would be given by the hazard function

$$r(t|X) = \theta\alpha t^{\alpha-1}$$

where the parameter θ indexes the level of risk and α governs the age pattern of risk. With $\alpha<1$, the hazard function is downward-sloping with duration since birth, as is appropriate in an application to child survival. The θ parameter is specified to be a function of covariates X, that is, $\theta=e^{X\beta}$. The unconditional probability of survival to age t is then given by

$$S(t|X) = e^{-\theta t^{\alpha}}.$$

To apply this model only to the postneonatal period, the expressions above must be modified so that they are made conditional on survival to month $t=1$. Doing so yields an expression for the conditional probability of survival associated with child survival to age $t>1$, which is given by

$$S(t|X) \,/\, S(1|X) = e^{-\theta(t^{\alpha}-1)}$$

and a similar expression can be derived in the case of a child death at month t.

Table 6.1 presents a set of descriptive statistics on the neonatal and later mortality probabilities for the five study countries. The probabilities of neonatal deaths are calculated using DHS reports on the child's date of birth, survival status, and age of death in months. For the postneonatal period, similar data are used on children born within the five-year retrospective window, and for those who survive the neonatal period, the probability of death before age five is calculated by applying the Weibull model described above. (The results are virtually identical to estimates derived from a standard life table.) As the table shows, mortality risks are generally higher in Kenya and Egypt. In Thailand, there are so few deaths after the neonatal period that we do not estimate the Weibull model.

In Table 6.2, a multivariate analysis of these data is presented. Noteworthy aspects of the multivariate specification include the use of two measures of services, antenatal care, and tetanus vaccinations,[13] as well as the inclusion (for births of parity 2 and above) of indicators for the length of the birth interval that ended with the child in question. Where possible, an indicator of prematurity is also included, recognizing that it is associated with shorter birth intervals. As the specifications shown in the table are meant to provide a context for interpreting effects of excess and unintended fertility, comment is made here on only one aspect of the results having to do with birth interval length.

[12] For brevity, we slightly abuse conventional terminology by referring to the span from the second month of life to age 5 as "postneonatal."

[13] We debated whether to include such choice-related variables in the specification, as doing so may expose the estimates to endogeneity bias. Our judgment is that in this instance, the potential bias is unlikely to be severe.

Table 6.1 Neonatal and child mortality

Descriptive statistics on neonatal and child mortality, Demographic and Health Surveys, 1987-1993

Country	Probability of neonatal death	Estimated probability of death by age 5 given survival through neonatal period[a]
Dominican Republic	.0238	.0410
Egypt	.0375	.0603
Kenya	.0257	.0696
Philippines	.0173	.0315
Thailand	.0199	U

Note: Unweighted data.
U = Unknown (not available)
[a] Based on parameter estimates from a conditional Weibull model.

Table 6.2 Multivariate estimates of neonatal and postneonatal mortality

Multivariate estimates of neonatal and postneonatal mortality, Demographic and Health Surveys, 1987-1993

Variable	Dominican Republic		Egypt		Kenya		Philippines		Thailand
	Neo-natal	Post-neonatal to age 5	Neo-natal	Post-neonatal to age 5	Neo-natal	Post-neonatal to age 5	Neo-natal	Post-neonatal to age 5	Neo-natal
CHILD'S CHARACTERISTICS									
Girl	-.417	-.135	-.082	.143	-.056	-.016	-.009	-.243	-.153
(|z| statistic)	(3.59)	(.63)	(1.51)	(1.25)	(0.71)	(.12)	(0.13)	(1.46)	(1.30)
Birth intervals ≤17 months	.224	.546	.552	1.039	.124	.875	.202	.730	.147
	(1.36)	(1.86)	(7.55)	(7.21)	(0.81)	(4.52)	(1.90)	(3.45)	(0.68)
Birth interval 18-23 months	.200	-.181	.251	.420	.143	.361	.062	.386	.449
	(1.18)	(.47)	(2.97)	(2.35)	(1.16)	(1.82)	(0.56)	(1.72)	(2.51)
Birth interval ≥72 months	.037	-.205	.108	.069	-.087	-.013	.160	.756	.030
	(0.13)	(.30)	(0.81)	(.21)	(0.35)	(.03)	(1.05)	(2.04)	(0.14)
First birth	.028	-.301	.126	.137	.334	-.155	.056	-.398	-.148
	(0.17)	(.72)	(1.39)	(.72)	(2.58)	(.65)	(0.47)	(1.20)	(0.84)
Birth order 6+	.108	.691	.111	.243	-.001	-.071	.237	.468	-.088
	(0.46)	(1.55)	(1.37)	(1.49)	(0.01)	(.37)	(2.27)	(2.16)	(0.37)
Twin	.638	1.661	.760	1.70	.876	.790	.670	1.662	1.18
	(2.82)	(4.43)	(6.79)	(8.90)	(6.31)	(2.77)	(3.63)	(4.84)	(4.51)
Premature	1.90	.156	U	U	1.084	.809	1.603	1.824	U
	(14.89)	(.23)			(9.57)	(3.09)	(12.76)	(5.45)	
Prenatal care	-.108	-.191	-.017	-.442	-.313	-.135	.050	-.673	.047
	(0.43)	(.38)	(0.30)	(3.52)	(1.67)	(.35)	(0.54)	(2.48)	(0.29)
Tetanus vaccination	-.266	-.267	-.097	-.331	-.032	.213	-.171	-.619	-.403
	(1.80)	(.76)	(1.05)	(1.39)	(0.29)	(1.01)	(2.26)	(3.54)	(2.85)

Continued

Table 6.2—*Continued*

Variable	Dominican Republic		Egypt		Kenya		Philippines		Thailand
	Neo-natal	Post-neonatal to age 5	Neo-natal	Post-neonatal to age 5	Neo-natal	Post-neonatal to age 5	Neo-natal	Post-neonatal to age 5	Neo-natal
PARENT'S CHARACTERISTICS									
Mother's age at birth ≤ 19 years	.409 (2.21)	.653 (1.47)	.310 (3.06)	.683 (3.68)	-.035 (0.23)	.505 (2.09)	.291 (1.82)	.636 (1.73)	.727 (3.59)
Mother's age 20-24	.233 (1.57)	.907 (2.86)	.109 (1.50)	.265 (1.85)	-.040 (0.35)	.051 (.28)	.087 (0.85)	.173 (.79)	.174 (1.08)
Mother's age ≥ 35	-.012 (0.05)	-.521 (.97)	.120 (1.31)	-.185 (.84)	.215 (1.58)	-.176 (.76)	.141 (1.35)	-.265 (1.05)	.556 (2.94)
Mother, primary schooling	.035 (.19)	.438 (1.26)	.097 (1.05)	-.250 (1.79)	.057 (0.49)	.080 (.45)			.155 (0.81)
Mother, secondary schooling	.230 (1.01)	-.153 (.29)	.230 (1.77)	-.528 (1.67)			-.121 (1.21)	-.224 (1.01)	-.162 (0.48)
					-.015 (0.10)	-.410 (1.47)			
Mother, higher schooling[a]	-.690 (1.74)	-1.304 (-.22)	.276 (1.21)				.252 (1.90)	-.250 (.68)	-.728 (1.32)
Currently in union	.041 (0.27)	.050 (.15)	-.009 (0.05)	-.388 (1.21)	-.163 (1.51)	-.145 (.74)	-.093 (0.38)	.059 (.09)	.073 (0.24)
Spouse, primary schooling			-.031 (0.48)	.165 (1.31)					
Spouse, secondary schooling	-.365 (2.18)	-.422 (1.10)	-.351 (3.03)	-.132 (.54)	.122 (1.26)	-.252 (1.46)	-.080 (0.82)	-.475 (2.09)	-.296 (1.40)
Spouse, higher schooling	.126 (0.56)	-1.242 (.20)	-.641 (3.40)	-.816 (1.82)			-.163 (1.15)	-.417 (1.06)	.633 (2.04)
Spouse occupation skilled, professional	-.270 (2.05)	-037 (.12)	.012 (0.19)	-.150 (.99)	-.058 (0.60)	-.275 (1.62)	-.033 (0.40)	.118 (.61)	-.162 (1.05)
Standard of living index	.019 (0.16)	-.488 (2.49)	-.023 (0.29)	-.342 (2.38)	-.018 (0.21)	-.375 (2.69)	.046 (0.66)	.147 (.85)	-.209 (1.99)
Index, squared	.004 (0.24)	.048 (1.78)	.000 (0.04)	.044 (2.18)	-.008 (0.59)	.041 (1.58)	-.007 (0.85)	-.041 (1.57)	.018 (1.37)
CLUSTER CHARACTERISTICS									
Town	-.482 (1.91)	-.785 (1.67)	.152 (0.86)	-.269 (0.78)	-.376 (0.96)	.228 (0.42)	-.017 (0.16)	-.044 (0.17)	
Small city	-.227 (1.27)	-.608 (1.74)	.203 (1.12)	-.368 (1.10)	.269 (1.05)	.715 (1.48)	-.110 (1.05)	-.173 (0.69)	.892 (2.17)
Capital city	-.446 (1.67)	-.628 (0.99)			.100 (0.56)	.346 (1.15)	-.178 (0.99)	.425 (0.91)	.743 (1.79)

Continued

Table 6.2—*Continued*

Variable	Dominican Republic		Egypt		Kenya		Philippines		Thailand
	Neo-natal	Post-neonatal to age 5	Neo-natal	Post-neonatal to age 5	Neo-natal	Post-neonatal to age 5	Neo-natal	Post-neonatal to age 5	Neo-natal
Distance to hospital or health center	.000 (0.00)	-.010 (0.63)	.007 (1.13)	.003 (0.20)	-.001 (0.29)	.000 (0.00)	.007 (2.82)	-.000 (0.05)	-.003 (0.30)
Number of health services at hospital/ health center	-.023 (0.44)	.138 (0.90)	.028 (0.82)	-.066 (1.03)	U	U	.080 (0.51)	.081 (0.18)	U
Health center in community	.046 (0.24)	.119 (0.29)	U	U	.095 (0.43)	.104 (0.24)	U	U	U
Distance to nearest public health center	-.002 (0.13)	-.045 (1.32)	-.003 (0.44)	-.002 (0.17)	.000 (0.59)	.000 (0.23)	-.001 (0.30)	-.012 (0.62)	-.000 (0.02)
Number of health services at nearest health center	.020 (0.45)	-.098 (1.00)	.056 (1.57)	.097 (1.40)	-.054 (1.02)	.082 (0.85)	-.017 (0.30)	.279 (1.87)	U
Community has health worker	-.074 (0.54)	-.410 (1.26)	U	U	.125 (1.54)	.148 (1.04)	U	U	.650 (1.74)
Community has trained midwife	U	U	-.057 (0.77)	-.065 (0.44)	U	U	U	U	.023 (0.16)
Mobile health clinic visits community	U	U	U	U	U	U	.031 (0.14)	.694 (1.51)	.092 (0.65)
Distance to nearest mobile outreach point	U	U	U	U	U	U	.003 (1.13)	-.029 (1.59)	U
Number of health services provided by mobile clinic	U	U	U	U	U	U	-.041 (0.33)	0.158 (0.63)	U

Notes: Unweighted data. Omitted categories and dummy variable coding are as follows:

Woman's schooling:
Omitted categories are none (Dominican Republic, Egypt, Kenya, Thailand), none or primary only (Thailand); upper categories are secondary or higher (Kenya), and higher for the other countries.

Spouse schooling:
Omitted categories are none or primary (Dominican Republic, Kenya, Philippines, Thailand), none (Egypt); upper categories are secondary or higher (Kenya), and higher for the other countries.

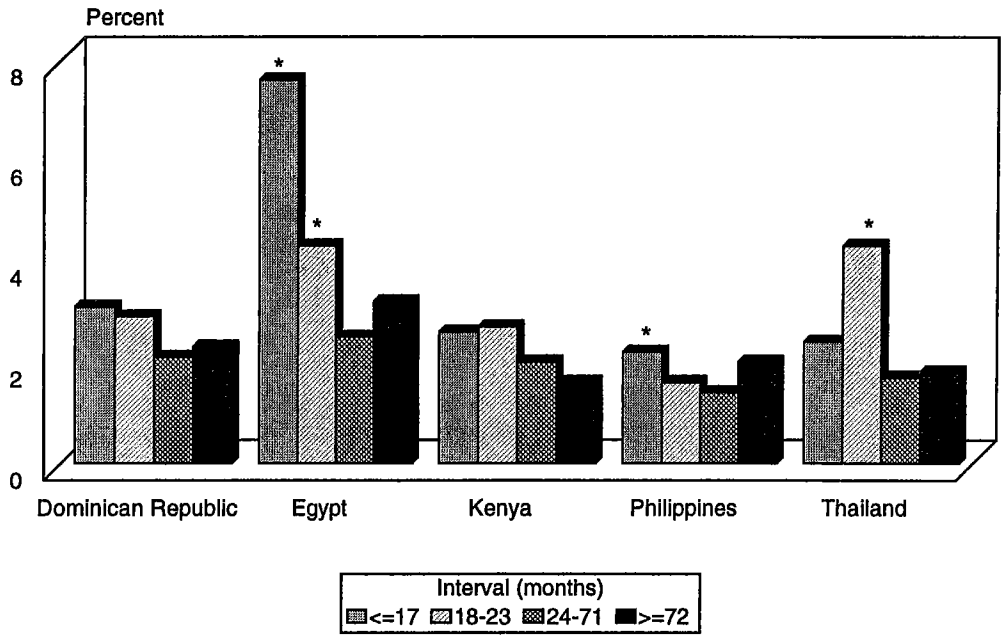
Urban residence:
The DHS categories of town, small city and capital city are used except in Egypt (town, city), and Thailand (city, capital). The omitted category in Thailand is rural or town, whereas for the other countries rural is the omitted category.

Education and health services:
For urban areas in Egypt and Thailand, all these variables are set to zero. The variable "Travel time to primary known" takes the value 1 if the respondent could provide this information; for cases in which the travel time was not known, this variable is set to 0 and the mean value of travel time substituted into the "Travel time to primary" variable. The same procedure was followed for time to secondary schools.

U = Unknown (not available)

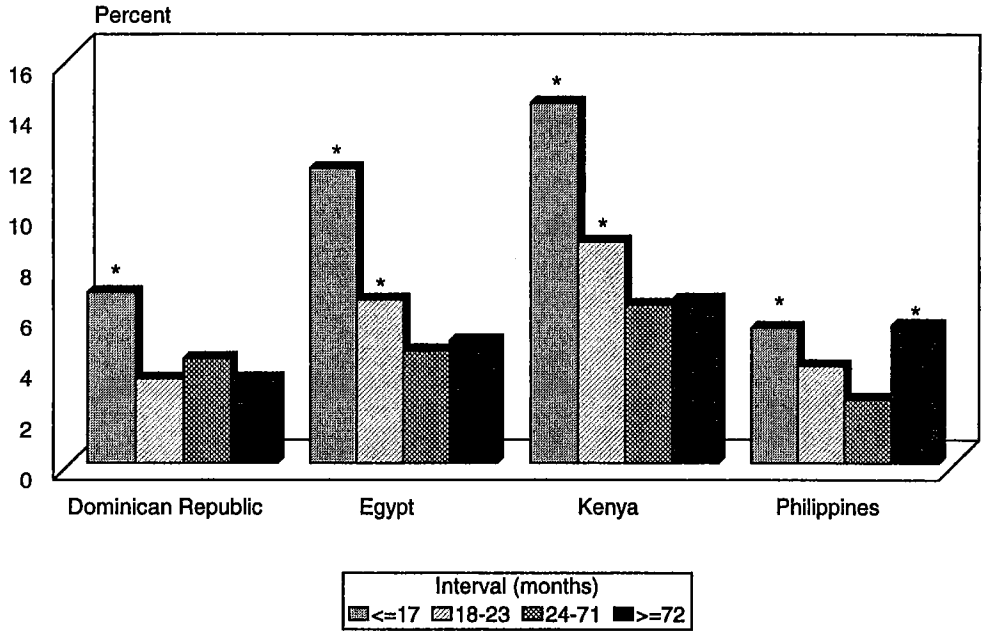
[a] For Egypt, in the postneonatal analysis, higher schooling and secondary schooling were combined for the mother, as there were too few deaths to justify separate categories.

Figure 6.1 Predicted neonatal mortality (percent) by length of preceding birth interval, parity 2 and above, five DHS surveys, 1987-1993



Note: An asterisk indicates that the level of neonatal mortality for births following the interval is significantly different from that for births following an interval of 24-71 months.

Figure 6.2 Predicted postneonatal mortality (percent) by length of preceding birth interval, parity 2 and above, four DHS surveys, 1987-1993



Note: An asterisk indicates that the level of neonatal mortality for births following the interval is significantly different from that for births following an interval of 24-71 months

Figure 6.1 presents estimates of the effects of birth interval length on neonatal and later mortality. (The figure refers to children of parity 2 and higher.) As might be expected, given controls for other factors such as prematurity, the association of birth interval length with neonatal mortality is weak and sometimes inconsistent. Where postneonatal mortality is concerned, however, the length of the previous birth interval has an important influence, as shown in Figure 6.2. The effects are particularly pronounced in Egypt and Kenya, which happen to be the higher mortality countries in the sample.[14] We would argue that these birth interval coefficients reflect the timing aspect of imperfect fertility control. That is, one of the costs of imperfect fertility control is that some births will occur earlier than would otherwise have been desired, and for birth intervals under 18 months in all four countries, and under two years in two of these, the consequence is a significantly higher risk of postneonatal death.

The interpretation of birth interval effects as reflecting failures of timing is reasonable only to the extent that the women themselves view the short intervals as undesirable. As discussed, some, but certainly not all women, interpret short intervals in this way. Indeed, in Egypt, where, as we have just seen, the risks associated with short intervals are substantial, only a minority of women seem to be aware of the risks. Only one Egyptian woman in five with a birth interval under 18 months describes such an interval as the result of mistimed fertility (see Table 5.4). There is a sizable gap between the perception of risk on the part of these women and reality. Viewed more positively, the gap may be seen as an opportunity for focused information and education campaigns.

Excess and Unintended Fertility

We now explore the additional influences of excess and unintended fertility on mortality risks. Although such fertility could influence neonatal mortality risks, in general one would expect the effects to be more clearly expressed in postneonatal risks. We do not want to rule out neonatal effects. Sable et al. (1997), among others, have noted the tendency for women with unintended pregnancies to deny the existence of the pregnancy, and to avoid using appropriate antenatal care services. Behaviors such as these could well affect neonatal survival.

Three measures associated with excess fertility are defined; these are labeled *excess1*, *excess2*, and *excess3* in the tables to follow. The *excess1* variable indicates whether the woman reports excess fertility at the time of the DHS survey. It is a family-level measure that does not make reference to any particular child. The *excess2* variable, by contrast, indicates whether the child's parity exceeds the mother's expressed family size ideal. The *excess3* variable indicates whether the child's parity exceeds the mother's ideal by 2 or more, the implication being that both the child in question and his or her immediately older sibling could be viewed as excess births.

Specifications also include a child-specific measure of birth mistiming (the *later* variable) and the effect for the child of being unwanted at conception is examined, a situation that is summarized in the indicator *no more* in the tables. In addition, interactions of the excess and unwanted variables with a standard-of-living index are explored, with the expectation that the consequences will tend to be more negative among relatively poorer families.[15]

Table 6.3 presents the estimates associated with these measures of excess and unintended fertility. For each measure of excess or unwanted fertility, two specifications are presented, one with interactions and one without. (The other covariates of the previous table are retained in the models, but we do not show their coefficients, which were little affected.) The array of estimates shown in this table can be summarized as follows. First, with the actual length of the birth interval controlled, subjective reports of mistiming (the later variable) show few significant additional effects on mortality risks.[16] The measures of excess and unwanted fertility are generally insignificant, although in Egypt, the Philippines, and Thailand (neonatal only) a significant positive effect is observed on mortality risks for the *excess1* variable, which is the family-level measure indicating that the woman views her family size as excessive in relation to her ideals. The child-specific variables (*excess2, excess3,* and *later*) exhibit weak or inconsistent effects.

Finally, the interactions with the standard-of-living index do not consistently draw out interesting effects. This is very surprising in view of the argument that consequences must be contingent on family circumstances, but it is a feature of the empirical results encountered in analyzing all of the human capital outcome measures. Given this, we will not report further on such interactions.

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[14] Short birth intervals are common in all of the sample countries. For example, among children of parity 2 and higher, some 19 percent were born after intervals shorter than 18 months in the Dominican Republic, and 18.6 percent after intervals of 18 to 23 months. Comparable figures for the other countries are, for Egypt, 18.0 and 16.2 percent; for Kenya, 9.5 and 16.0 percent; for the Philippines, 16.5 and 20.2 percent; and for Thailand, 11.5 and 12.7 percent.

[15] The index is defined as the sum of the following items: access to clean water; the availability of water on premises; time to water less than 30 minutes; any toilet facility; flush toilet; non-dirt flooring; electricity; possession of a radio; TV; refrigerator; bicycle; motorcycle; and car. See Montgomery et al. (1997a) for an analysis of the performance of such indices as proxies for household income and consumption expenditures.

[16] We are frankly puzzled by the cases in which *later* appears to be associated with lower mortality risks. We speculate that this may reflect a tendency among better-informed women to be more attentive to birth spacing.

Table 6.3 Estimated effects of excess and unintended fertility on mortality

Estimated effects of excess and unintended fertility on mortality, Demographic and Health Surveys, 1987-1993

	Regression 1				Regression 2				Regression 3				Regression 4			
	Neonatal		Post-neonatal		Neonatal		Post-neonatal		Neonatal		Post-neonatal		Neonatal		Post-neonatal	
Dominican Republic																
Later (|z| statistic)	-.329 (2.21)	-.345 (2.30)	.101 (0.40)	.098 (0.38)	.340 (2.27)	-.348 (2.32)	.118 (0.46)	.140 (0.55)	-.336 (2.25)	-.337 (2.26)	.095 (0.38)	.124 (0.48)	-.405 (2.67)	-.404 (2.66)	.083 (0.32)	.100 (0.38)
Excess 1	-.010 (0.07)	.375 (1.26)	.021 (0.08)	.080 (0.18)												
Excess 1 * sli		-.097 (1.47)		-.018 (0.16)												
Excess 2					-.233 (1.34)	.068 (0.21)	-.157 (0.56)	-.305 (0.61)								
Excess 2 * sli						-.080 (1.06)		.040 (0.30)								
Excess 3									-.354 (1.55)	-.304 (0.74)	-.026 (0.08)	-.155 (0.30)				
Excess 3 * sli										-.014 (0.15)		.039 (0.28)				
No more													-.524 (2.64)	-.193 (0.49)	-.074 (0.21)	.053 (0.08)
No more * sli														-.091 (0.91)		-.052 (0.27)
Egypt																
Later (|z| statistic)	-.077 (0.90)	-.079 (0.92)	-.089 (0.49)	.088 (0.48)	-.082 (0.95)	-.083 (0.97)	-.087 (0.48)	-.087 (0.48)	-.080 (0.93)	-.080 (0.93)	-.085 (0.47)	-.084 (0.46)	-.093 (1.05)	-.090 (1.01)	-.145 (0.78)	-.139 (0.75)
Excess 1	.164 (2.67)	-.182 (1.09)	.277 (2.28)	.253 (0.83)												
Excess 1 * sli		.087 (2.23)		.006 (0.09)												
Excess 2					.078 (1.19)	-.282 (1.57)	.121 (0.90)	.093 (0.28)								
Excess 2 * sli						.089 (2.17)		.007 (0.09)								
Excess 3									.095 (1.28)	-.083 (0.43)	.006 (0.37)	-.105 (0.28)				
Excess 3 * sli										.044 (1.00)		.028 (0.33)				
No more													-.034 (0.44)	-.602 (2.50)	-.270 (1.48)	-.813 (1.56)
No more * sli														.134 (2.54)		.133 (1.14)

Continued

Table 6.3—*Continued*

	Regression 1				Regression 2				Regression 3				Regression 4			
	Neonatal		Post-neonatal		Neonatal		Post-neonatal		Neonatal		Post-neonatal		Neonatal		Post-neonatal	
Kenya																
Later (|z| statistic)	-.106 (1.22)	-.106 (1.22)	-.363 (2.36)	-.359 (2.33)	-.106 (1.22)	-.107 (1.23)	-.361 (2.35)	-.359 (2.33)	-.099 (1.14)	-.102 (1.17)	-.367 (2.37)	-.364 (2.35)	-.108 (1.19)	-.108 (1.19)	-.390 (2.43)	-.391 (2.42)
Excess 1	.243 (2.24)	.267 (1.48)	.116 (0.64)	-.286 (0.98)												
Excess 1 * sli		-.010 (0.17)		.173 (1.76)												
Excess 2					.127 (1.10)	.351 (1.85)	-.010 (0.05)	-.300 (0.96)								
Excess 2 * sli						-.094 (1.48)		.125 (1.24)								
Excess 3									.196 (1.49)	.331 (1.60)	-.200 (0.88)	-.421 (1.20)				
Excess 3 * sli										-.056 (0.83)		.097 (0.89)				
No more													-.011 (0.09)	.047 (0.21)	-.135 (0.67)	-.062 (0.17)
No more * sli														-.025 (0.30)		-.032 (0.24)
Philippines																
Later (|z| statistic)	-.242 (2.55)	-.242 (2.55)	-.182 (0.95)	-.168 (0.87)	-.250 (2.75)	-.248 (2.64)	-.183 (0.95)	-.177 (0.92)	-.247 (2.64)	-.247 (2.64)	-.188 (0.97)	-.183 (0.94)	-.261 (2.70)	-.257 (2.66)	-.205 (1.00)	-.207 (1.01)
Excess 1	.463 (4.76)	.256 (1.60)	.471 (2.38)	-.073 (0.21)												
Excess 1 * sli		.060 (1.60)		.204 (1.92)												
Excess 2					.279 (2.75)	.231 (1.41)	-.097 (0.47)	-.370 (1.04)								
Excess 2 * sli						.014 (0.38)		.102 (1.00)								
Excess 3									.229 (1.95)	.243 (1.36)	.232 (1.01)	.015 (0.04)				
Excess 3 * sli										-.004 (0.10)		.083 (0.80)				
No more													-.048 (0.45)	.175 (0.95)	-.087 (0.34)	-.257 (0.60)
No more * sli														-.072 (1.41)		.060 (0.46)

Continued

Table 6.3—*Continued*

	Regression 1			Regression 2			Regression 3			Regression 4		
	Neonatal		Post-neonatal	Neonatal		Post-neonatal	Neonatal		Post-neonatal	Neonatal		Post-neonatal
Thailand												
Later	-.082	-.105		-.080	-.077		-.072	-.072		-.109	-.108	
(|z| statistic)	(0.57)	(0.65)		(0.51)	(0.49)		(0.46)	(0.45)		(0.67)	(0.67)	
Excess 1	.539	.990										
	(3.72)	(3.59)										
Excess 1 * sli		-.127										
		(1.94)										
Excess 2				.058	-.143							
				(0.37)	(0.50)							
Excess 2 * sli					.058							
					(0.86)							
Excess 3							-.359	-.214				
							(1.53)	(0.57)				
Excess 3 * sli								-.051				
								(0.48)				
No more										-.136	.130	
										(0.79)	(0.39)	
No more * sli											-.088	
											(0.95)	

Note: Unweighted data. See text for definitions of excess 1, excess 2, and excess 3 variables.

To sum up the evidence on mortality, the most consistent and trustworthy evidence on consequences is that concerned with birth interval effects. Because not all women regard short intervals as instances of fertility mistiming, only a portion of the birth interval effects can be attributed to imperfect fertility control. Nevertheless, this is an important aspect of the consequences associated with ineffective fertility regulation. Apart from the birth interval effects, there is some evidence that excess fertility is linked to higher mortality risks in Egypt, the Philippines, and Thailand, but perhaps this evidence is best regarded as a starting point for more focused research.

6.2 CONSEQUENCES FOR NUTRITIONAL STATUS

We now turn to the health status of surviving children. Anthropometric data on children age 3 to 36 months provide useful summaries of children's health, indicating the degree to which they may be affected by chronic or acute malnutrition. The DHS surveys have relied on a series of measures recommended by the World Health Organization (WHO 1983, 1986, 1995). These measures are based on the height and weight of the child, which are combined with the child's age to take natural growth patterns into account.

The anthropometric measures used in this analysis are height-for-age and weight-for-height, each expressed as Z-scores, that is, as standard deviations from a reference median.[17] Height-for-age, which when low is described as "stunting," is indicative of the long-term circumstances affecting a child's nutritional intake and health. Children with chronic malnutrition, and those who have been repeatedly ill, can be expected to have a lower than average height-for-age. When represented in the Z-scores, children with such problems will tend to exhibit a height-for-age value that is 2 or more standard deviations (SD) below the median for their age group (-2 SD).[18] Low weight-for-height is termed "wasting," and implies recent weight loss. Wasting is associated with short-term declines in food intake, and tends to reflect acute malnutrition. Although there is no general consensus in the literature on such measures of nutritional status (Pelletier, 1991), height-for-age and weight-for-height are the measures that are perhaps most commonly employed.

[17] The Z-scores of height-for-age and weight-for-height are calculated as the observed height or weight minus the median of the age group for the variable. The scores are interpreted as the number of standard deviations away from the median of the reference population for children of that age (Sommerfelt and Stewart, 1994).

[18] The selection of cutoff points to measure the prevalence of malnutrition is somewhat arbitrary. Prevalence is also affected by the reference population used. As per WHO recommendations, DHS data are normalized with reference to a population distribution based on data from the United States Center for Health Statistics (NCHS).

Table 6.4 Nutritional status of children

Table 6.4 Nutritional status of children, Demographic and Health Surveys, 1987-1993

Country	Height-for-age (Stunted)		Weight-for-height (Wasted)		Number of children
	≥ -3 SD	≥ -2 SD	≥ -3 SD	≥ -2 SD	
Dominican Republic	5.0	17.4	0.1	1.3	1,956
Egypt	12.0	31.0	0.1	1.1	1,885
Kenya	12.0	33.0	1.4	7.0	2,886
Thailand	4.7	22.4	0.4	5.3	1,849

Note: Each index is expressed in terms of the number of standard deviation (SD) units from the median of the NCHS/CDC/WHO international reference population.

Nevertheless, some caution must be exercised in the use of these data. One potential source of bias concerns the fact that anthropometric data are only collected from children who are alive and physically present at the time of the survey. This is problematic if such circumstances are correlated with the nutritional status of children. Additionally, although height and weight can themselves be missing or erroneous, the misreports of birth dates or age induce error by causing the wrong reference standard to be applied (Pelletier, 1991). As is well known, reported dates of birth are often affected by a variety of misreporting errors (Bicego and Boerma, 1994; Sullivan, Bicego, and Rutstein, 1990).

Anthropometric data were collected in four of the five countries used in this analysis. Regrettably, no nutritional data are available for the Philippines. For the remaining four countries, such data were collected for all children under five years of age for the Dominican Republic and Kenya, whereas for Egypt and Thailand data were collected for children age 3 to 36 months. To ensure comparability, analyses are limited to ages 3 to 36 months. The prevalence of stunting and wasting in these data are shown in Table 6.4.

Stunting—a shortfall of at least -2 standard deviations (SD) in height-for-age—is most prevalent in the two African countries. In Egypt and Kenya, nearly one child in three is stunted. The likelihood of severe stunting (-3 SD) is also much higher in these countries, afflicting 12 percent of young children. In the Dominican Republic and Thailand, stunting is less prevalent, but nonetheless affects a significant proportion of children, with one in five children showing evidence of long-term deprivation. Thus, a high proportion of children in the study countries appears to suffer from poor daily nourishment or continuous insults to health, the consequences being inadequate physical development for their age.

Wasting, that is, low values of weight-for-height, is less obviously apparent in these countries. This difference in the nutritional measures has often been observed in cross-national comparisons of nutritional levels (Sommerfelt and Stewart, 1994). Wasting is most prevalent in Kenya, where 7 percent of the population of children fall 2 or more standard deviations below the reference median. In Thailand 5 percent of children are wasted. Such children may be receiving less than adequate current nourishment, due either to low food intake or acute illness.

Baseline least squares regressions[19] on height-for-age and weight-for-height are presented in Table 6.5. For these analyses, the dependent variables have been scaled in terms of standard deviations divided by 100; the coefficients can therefore be read as percentages of standard deviations. In scanning the results, one sees immediately that there are relatively few covariate effects of statistical significance. It seems that the fundamental determinants of weight-for-height are not well measured with the covariates employed, although the effects are perhaps slightly stronger in regard to height-for-age, the measure of longer-term deprivation. Surprisingly, factors such as the mother's education, and that of her spouse, do not exert a stronger influence. The standard of living indices appear to capture the relationship between the family's socioeconomic standing and its children's health.

Excess and Unintended Fertility

Table 6.6 shows the multivariate results on the effects of excess and unintended fertility on child anthropometry. As in the analyses of child mortality, the other covariates from the baseline model are included but their coefficients are not reported here. A significant effect appears in only one country—the Dominican Republic. Here, the measures of excess and unwanted fertility are negatively associated with height-for-age. The coefficients, interpretable in terms of Z-score percentages, indicate that excess and unintended fertility produce a shortfall in height-for-age that ranges from a fifth of a standard deviation (-18.702 for the *excess2* measure) to just short of a third of a standard deviation (-30.026 for the *excess3* measure). These may not appear to be large effects, but their size should be judged in relation to the performance of the other socioeconomic covariates, which, as mentioned earlier, generate very few effects of importance.

[19] In results not reported here, we also employed robust regression techniques in which the influence of outliers is restrained. This change in method did not affect the substantive findings.

Table 6.5 Multivariate estimates of anthropometric models

Multivariate estimates of anthropometric models: children aged 6 to 36 months, Demographic and Health Surveys, 1987-1993

Variable	Dominican Republic		Egypt		Kenya		Thailand	
	Height-for-age	Weight-for-height	Height-for-age	Weight-for-height	Height-for-age	Weight-for-height	Height-for-age	Weight-for-height
CHILD'S CHARACTERISTICS								
Girl	12.272	9.257	-6.857	-.922	13.025	7.312	7.770	8.964
(|z| statistic)	(2.13)	(1.94)	(1.00)	(0.20)	(2.18)	(1.51)	(1.49)	(1.95)
Age in months	.039	-1.045	-1.501	.839	-2.545	-.819	-1.509	-1.921
	(0.12)	(3.97)	(3.87)	(3.17)	(7.66)	(3.03)	(5.08)	(7.33)
Preceding birth interval ≤ 17 months	-23.699	-2.125	-17.960	-1.926	-7.684	-26.194	-17.246	14.789
	(2.49)	(0.27)	(1.59)	(0.25)	(0.61)	(2.60)	(1.51)	(1.49)
Birth interval 18-23 months	-8.213	.451	-17.591	-7.924	-12.991	-1.579	-.611	10.435
	(0.86)	(0.06)	(1.62)	(1.10)	(1.38)	(0.21)	(0.06)	(1.12)
Birth interval ≥ 72 months	21.205	8.189	6.373	-6.977	35.373	7.519	10.118	12.090
	(1.65)	(0.77)	(0.42)	(0.67)	(2.06)	(0.54)	(1.23)	(1.52)
First birth	20.294	11.052	5.484	11.474	9.561	18.158	-2.476	14.766
	(2.45)	(1.61)	(0.52)	(1.57)	(0.94)	(2.17)	(0.36)	(2.43)
Birth order 6+	-31.263	-6.347	-5.544	-5.397	-13.295	-3.528	-.102	18.569
	(2.53)	(0.62)	(0.52)	(0.77)	(1.39)	(0.45)	(0.01)	(1.53)
Twin	-113.478	-11.424	-14.493	13.317	-20.711	-61.899	-32.487	7.000
	(4.99)	(0.61)	(0.66)	(0.90)	(0.93)	(3.46)	(1.39)	(0.34)
Birth premature	-31.602	-27.353	U	U	-46.191	-31.678	U	U
	(1.90)	(1.99)			(2.77)	(2.31)		
Any antenatal care	31.609	9.777	2.626	2.545	-9.809	30.177	16.870	15.473
	(1.85)	(0.69)	(0.36)	(0.51)	(0.53)	(2.03)	(1.87)	(1.95)
Tetanus vaccination	12.694	-2.727	-9.563	-10.369	-7.042	-7.394	-12.318	-2.040
	(1.25)	(0.33)	(0.94)	(1.50)	(0.73)	(0.94)	(1.78)	(0.33)
MOTHER'S CHARACTERISTICS								
Age at child's birth ≤ 19 years	-35.376	-8.718	-28.815	-16.022	-21.132	-3.810	-3.495	-16.024
	(3.50)	(1.04)	(1.96)	(1.60)	(1.74)	(0.38)	(0.35)	(1.81)
Age at birth 20-24	-12.901	-2.393	2.099	-9.365	-17.888	2.882	-8.793	6.903
	(1.77)	(0.40)	(0.24)	(1.55)	(2.19)	(0.43)	(1.34)	(1.19)
Age at birth ≥ 35	7.742	13.411	12.074	2.495	14.257	3.118	-34.651	-.413
	(0.59)	(1.23)	(1.04)	0.32	(1.30)	(0.35)	(3.40)	(0.05)
Mother, primary schooling	10.641	-2.154	.754	-6.651	-1.767	15.797	18.856	-10.944
	(0.96)	(0.24)	(0.09)	(1.15)	(0.19)	(2.15)	(1.76)	(1.19)
Mother, secondary schooling	23.269	15.217	10.464	.724	25.744	16.003	47.841	12.609
	(1.79)	(1.41)	(0.75)	(0.07)	(2.20)	(1.68)	(3.44)	(1.04)
Mother, higher schooling	30.329	18.576	5.553	-4.302			52.906	20.449
	(1.85)	(1.37)	(0.27)	(0.30)			(2.99)	(1.32)
Currently in union	8.133	5.860	7.662	-15.729	6.313	14.025	5.579	5.752
	(1.03)	(0.90)	(0.27)	(0.85)	(0.69)	(1.88)	(0.38)	(0.44)
Spouse, primary schooling			.263	9.994				
			(0.02)	(1.68)				
Spouse, secondary schooling	13.535	4.595	6.255	12.468			-1.946	1.714
	(1.77)	(0.78)	(0.48)	(1.40)	15.452	14.984	(0.26)	(0.26)
Spouse, higher schooling	39.463	13.414	22.385	-.871	(2.12)	(2.52)	9.007	5.574
	(3.49)	(1.44)	(1.25)	(0.07)			(0.66)	(0.46)
Spouse occupation skilled, professional	3.978	-7.355	18.684	6.235	11.246	6.980	4.028	-3.961
	(0.62)	(1.38)	(2.44)	(1.19)	(1.56)	(1.19)	(0.64)	(0.71)
Standard of living index	18.491	10.526	14.627	5.030	16.034	2.033	7.697	.202
	(2.77)	(1.90)	(1.27)	(0.67)	(2.50)	(0.39)	(1.32)	(0.04)
Index, squared	-.224	-.199	-.157	-.327	-1.202	.357	.149	.478
	(0.28)	(0.31)	(0.10)	(0.32)	(1.16)	(0.42)	(0.22)	(0.81)

Continued

Table 6.5—*Continued*

Variable	Dominican Republic		Egypt		Kenya		Thailand	
	Height-for-age	Weight-for-height	Height-for-age	Weight-for-height	Height-for-age	Weight-for-height	Height-for-age	Weight-for-height
CLUSTER CHARACTERISTICS								
Town	-12.623	-19.363	46.591	5.536	19.761	32.006		
	(1.12)	(2.08)	(2.04)	(0.36)	(0.98)	(1.93)		
Small city	-13.615	-10.527			8.856	15.865	13.384	21.487
	(1.37)	(1.28)	23.051	4.759	(0.33)	(0.72)	(0.98)	(1.78)
Capital city	-9.014	-31.877	(0.99)	(0.30)	25.865	28.907	30.991	1.259
	(0.67)	(2.86)			(1.78)	(2.45)	(2.32)	(0.11)
HEALTH SERVICES								
Distance to hospital or health center	.331	-.091	.289	-.712	.152	.092	-.779	.064
	(0.78)	(0.26)	(0.32)	(1.19)	(0.87)	(0.65)	(1.96)	(0.18)
Number of health services at hospital/ health center	-.660	.288	-4.254	5.124				
	(0.24)	(0.13)	(0.95)	(1.71)	U	U	U	U
Health center in community	-5.142	-8.575	U	U	-14.753	15.121	U	U
	(0.51)	(1.03)			(0.81)	(1.03)		
Distance to nearest public health center	.094	-.363	.908	.258	.017	-.093	1.286	-.078
	(0.11)	(0.52)	(0.96)	(0.42)	(0.30)	(2.00)	(1.82)	(0.13)
Number of health services at nearest health center			2.122	-3.238	7.724	1.295	U	U
	-1.953	3.769	(0.44)	(0.99)	(1.79)	(0.37)		
	(0.76)	(1.76)						
Community has health worker	-4.295	-3.455	U	U	-.853	2.065	-1.684	5.004
	(0.59)	(0.57)			(0.14)	(0.42)	(0.15)	(0.52)
Community has trained mid-wife	U	U	25.446	1.532	U	U	-6.045	5.567
			(2.44)	(0.22)			(0.92)	(0.96)
Mobile health clinic visits community	U	U	U	U	U	U	-8.065	-5.680
							(1.23)	(0.98)
R^2	.17	.06	.09	.02	.07	.07	.17	.10
Number of children	1,785	1,785	1,644	1,776	2,396	2,396	1,578	1,595

Note: Unweighted data. Omitted categories and dummy variable coding are as follows:

Woman's schooling:
Omitted categories are none (Dominican Republic, Egypt, Kenya, Thailand), none or primary only (Thailand); upper categories are secondary or higher (Kenya), and higher for the other countries.

Spouse schooling:
Omitted categories are none or primary (Dominican Republic, Kenya, Philippines, Thailand), none (Egypt); upper categories are secondary or higher (Kenya), and higher for the other countries.

Urban residence:
The DHS categories of town, small city and capital city are used except in Egypt (town, city), and Thailand (city, capital). The omitted category in Thailand is rural or town, whereas for the other countries rural is the omitted category.

Education and health services:
For urban areas in Egypt and Thailand, all these variables are set to zero. The variable "Travel time to primary known" takes the value 1 if the respondent could provide this information; for cases in which the travel time was not known, this variable is set to 0 and the mean value of travel time substituted into the "Travel time to primary" variable. The same procedure was followed for time to secondary schools.

U = Unknown (not available)

6.3 CONSEQUENCES FOR EDUCATION

We now come to the implications of unintended and excess fertility on children's schooling. These effects will be summarized in two ways, first with respect to the number of grades of schooling completed, and second with an analysis of secondary schooling, which focuses on the attainment of at least one year of secondary for children in the relevant age range. The first analysis is conducted using the method of ordered probit (Greene, 1997), which allows us to capture the main features of the distribution of completed schooling. The secondary schooling analysis employs simple probits. Appendix B describes the school systems of each study country.

The analysis is restricted to children of school age (age 6 or older in Egypt, Kenya, and Thailand, and 7 or older in the Dominican Republic and the Philippines) but no older than 18. In establishing this upper cut-off on the child's age, we have been guided by analyses of selectivity described in Appendix C. In four of the five countries, Thailand being the exception, data on children's schooling are available only through the DHS household rosters. For such children to be linked to their mothers, and thereby to indicators of excess and unintended fertility, they must still be resident in the household. The age of a child is obviously an important factor in determining residence; other factors include the prevalence of child fostering and the incidence of marriage dissolution. With the age 18 restriction, however, no evidence of serious selectivity bias could be detected, a point that is discussed further in Appendix C.

Table 6.6 Effects of excess and unintended fertility on child anthropometric measures

Estimated effects of excess and unintended fertility on child anthropometric measures, Demographic and Health Surveys, 1987-1993

	Regression 1		Regression 2		Regression 3		Regression 4	
	Height-for-age	Weight-for-height	Height-for-age	Weight-for-height	Height-for-age	Weight-for-height	Height-for-age	Weight-for-height
Dominican Republic								
Later	-9.000	3.173	-8.890	2.926	-8.858	2.957	-12.962	2.197
(|z| statistic)	(1.30)	(0.55)	(1.28)	(0.51)	(1.28)	(0.51)	(1.81)	(0.37)
Excess 1	-20.316	-4.761						
	(2.63)	(0.74)						
Excess 2			-18.702	-8.519				
			(2.29)	(1.26)				
Excess 3					-30.026	-13.253		
					(2.89)	(1.54)		
No more							-25.643	-6.238
							(2.83)	(0.83)
Egypt								
Later	6.869	-6.737	6.824	-6.722	6.949	-6.147	6.984	-7.131
(|z| statistic)	(0.67)	(0.97)	(0.67)	(0.97)	(0.68)	(0.89)	(0.66)	(0.99)
Excess 1	1.460	.597						
	(0.18)	(0.11)						
Excess 2			4.374	-.099				
			(0.52)	(0.02)				
Excess 3					1.305	10.359		
					(0.14)	(1.60)		
No more							.383	-1.394
							(0.04)	(0.21)
Kenya								
Later	-8.876	.304	-8.863	.328	-8.828	.287	-9.819	1.301
(|z| statistic)	(1.40)	(0.06)	(1.40)	(0.06)	(1.39)	(0.06)	(1.44)	(0.24)
Excess 1	10.244	10.510						
	(1.27)	(1.60)						
Excess 2			7.246	10.536				
			(0.88)	(1.57)				
Excess 3					3.031	-.552		
					(0.31)	(0.07)		
No more							-3.331	3.635
							(0.37)	(0.49)
Thailand								
Later	-2.974	4.944	-2.959	4.934	-3.008	4.859	-3.364	3.848
(|z| statistic)	(0.43)	(0.82)	(0.43)	(0.82)	(0.44)	(0.80)	(0.48)	(0.62)
Excess 1	-4.218	-.141						
	(0.55)	(0.02)						
Excess 2			-7.593	-6.074				
			(0.97)	(0.88)				
Excess 3					-8.731	-13.160		
					(0.78)	(1.36)		
No more							-2.232	-5.741
							(0.28)	(0.82)

Note: Unweighted data. See text for definitions of excess 1, excess 2, and excess 3 variables.

Descriptive statistics on the dependent variables are presented in Table 6.7 In interpreting these statistics, it should be borne in mind that significant proportions of children are still in school and have not yet completed their education. In the multivariate analyses, several variables are introduced to describe the child's age, the aim being to control for the length of the period over which a child could have progressed through school.[20]

Table 6.8 presents estimates of a baseline model for all five countries. The findings in this table reaffirm the central role played by the mother's education in furthering the educational achievements of her offspring. Likewise, there is evidence here that the education of the spouse is also important. The standard-of-living indices function much as expected (the squared term needs to be taken into consideration in interpreting these coefficients, as does the range of the index, which runs from 0 to 9), with higher values of the index being associated with greater educational attainment for children. Urban residence is associated with greater educational attainment in most cases, particularly if the family lives in the capital city, but there are examples of weak or inconsistent results, such as for the Philippines.

Four of the five countries (Kenya is the exception) provide community-level measures of travel time to the nearest primary and secondary school. In some cases, the community informant could not supply an estimate (this occurred for both primary and secondary schooling in the Philippines, and for secondary schooling in the Dominican Republic and Egypt). Therefore, dummy variables were included indicating knowledge of travel time together with the estimated time itself. These access-to-schooling measures fall well short of what would be ideal, but the DHS surveys collected no additional information on schools. It is interesting that in the Philippines, Egypt, and Thailand, longer travel times are associated with reductions in educational attainment. The effects are statistically significant but, within the range of travel times in the data, of limited importance.

Excess and Unwanted Fertility

We now turn, in Table 6.9, to the estimates of the consequences of excess and unwanted fertility. These results are somewhat stronger than in the cases of child mortality and nutrition. In the Dominican Republic, the Philippines, and Thailand, both unwanted and excess fertility are clearly associated with reductions in the educational attainment of children. These coefficients are highly significant in statistical terms. In Egypt and Kenya, by contrast, no such effects emerge.

Table 6.7 Children's schooling

Descriptive statistics on children's schooling, Demographic and Health Surveys, 1987-1993

Schooling	Dominican Republic	Egypt	Kenya	Philippines	Thailand
Years of schooling[a] completed (mean)	3.4	4.1	3.1	4.1	5.3
Percent with any secondary, among relevant age group[b]	45.6	66.1	16.4	72.0	48.5

Notes: Unweighted data.
[a] Age range 6-18 for Egypt, Kenya and Thailand; 7-18 for Dominican Republic and Philippines.
[b] Relevant age groups for secondary schooling: Dominican Republic (14-18 years), Egypt (13-18), Kenya (15-18), Philippines (14-18), Thailand (13-18).

[20] See Montgomery et al. (1995) for an alternative approach based on multivariate life tables, which uses information on whether a child is currently enrolled as well as information on the number of grades completed as of the survey date. Although methodologically superior to the approach employed in the current research, the life table method gave very similar estimates of the effects of covariates (apart from those having to do with the child's age, which take on different meanings in the two approaches).

Table 6.8 Multivariate estimates of children's schooling models

Multivariate estimates of children's schooling models, years of schooling (ordered probit) and any secondary schooling (probit) Demographic and Health Surveys, 1987-1993

Variable	Dominican Republic		Egypt		Kenya		Philippines		Thailand	
	Years of schooling	Any secondary	Years of schooling	Any secondary	Years of schooling	Any secondary	Years of schooling	Any secondary	Years of schooling	Any secondary
CHILDREN'S CHARACTERISTICS										
Girl	.353	.361	-.267	-.274	.146	.099	.241	.441	-.014	-.233
(|z| statistic)	(12.22)	(5.35)	(14.56)	(6.78)	(6.46)	(1.25)	(14.14)	(9.51)	(0.59)	(4.67)
Age	.515	-11.647	2.180	19.60	1.129	-8.776	2.351	.370	2.340	8.617
	(2.40)	(0.78)	(20.40)	(4.37)	(11.21)	(0.78)	(21.88)	(0.04)	(13.37)	(0.74)
Age, squared	.003	.794	-.142	-1.195	-.035	.536	-.126	.028	-.093	-.518
	(.17)	(0.85)	(15.34)	(4.09)	(4.19)	(0.84)	(13.61)	(0.04)	(6.44)	(0.71)
Age, cubed	-.000	-.017	.003	.024	.000	-.010	.003	-.001	.001	.010
	(.99)	(0.90)	(13.59)	(3.84)	(1.74)	(0.86)	(10.50)	(0.12)	(2.40)	(0.68)
First birth	.198	.286	.124	.221	.137	.142	.178	.271	.146	.253
	(5.23)	(4.34)	(4.96)	(3.88)	(4.22)	(1.32)	(8.03)	(4.38)	(4.79)	(3.69)
Birth order	-.337	-.331	-.075	-.156	-.177	-.230	-.271	-.321	-.252	-.303
	(8.01)	(3.91)	(2.71)	(2.62)	(4.92)	(1.72)	(9.33)	(4.09)	(5.42)	(3.12)
PARENT'S CHARACTERISTICS										
Mother, primary schooling	.522	.476	.182	.237	.321	.386			.455	.232
	(10.70)	(3.84)	(8.41)	(5.04)	(11.91)	(4.24)			(11.67)	(3.08)
Mother, secondary schooling	.951	1.055	.249	.783			.252	.412	.674	.623
	(14.39)	(6.10)	(5.59)	(4.87)	.655	.730	(11.37)	(6.94)	(9.99)	(3.43)
Mother, higher schooling	1.192	1.457	.218	.952	(15.50)	(4.63)	.277	.625	.663	
	(14.18)	(5.12)	(3.09)	(3.52)			(8.85)	(5.76)	(6.49)	
Mother, age	.008	.016	-.000	.002	.018	.041	.007	.001	.005	-.001
	(2.80)	(2.22)	(0.16)	(0.42)	(8.66)	(4.50)	(4.31)	(0.30)	(2.02)	(0.19)
Currently in union	-.001	-.075	.075	.147	-.088	-.012	.060	.158	.020	.071
	(.02)	(0.84)	(2.08)	(2.20)	(2.41)	(0.10)	(1.37)	(1.48)	(0.45)	(0.81)
Spouse, primary schooling			.322	.338						
			(14.51)	(7.39)						
Spouse, secondary schooling	.254	.244	.441	.912			.219	.481	.293	.775
	(5.61)	(2.13)	(12.37)	(9.15)	.250	.380	(9.84)	(8.10)	(7.17)	(8.20)
Spouse, higher schooling	.326	.402	.456	.581	(8.39)	(3.70)	.248	.690	.236	
	(4.94)	(1.86)	(9.47)	(4.67)			(8.07)	(6.88)	(2.81)	
Spouse occupation skilled, professional	.069	.161	.067	.139	.128	.189	.041	.023	-.028	.018
	(2.05)	(2.04)	(3.06)	(2.72)	(4.83)	(2.13)	(2.20)	(0.45)	(0.90)	(0.26)
Standard of living index	.234	.140	.355	.222	.158	.002	.259	.254	.121	-.085
	(6.36)	(1.48)	(11.16)	(3.25)	(6.97)	(0.02)	(15.98)	(5.85)	(4.13)	(1.36)
Index, squared	-0.00	.010	-.025	-.005	-.005	.023	-.016	-.007	.002	.034
	(0.02)	(0.96)	(6.32)	(0.60)	(1.33)	(2.15)	(8.43)	(1.36)	(0.68)	(4.87)
CLUSTER CHARACTERISTICS										
Town	-.083	-.097	.374	.436	-.044	-.216	-.028	.179		
	(1.43)	(0.71)	(5.94)	(3.34)	(0.49)	(0.65)	(1.08)	(2.46)		
Small city	.050	.090			.340	-.045	-.041	-.084	.115	.441
	(1.24)	(0.97)	.353	.487	(3.52)	(0.14)	(1.87)	(1.40)	(2.66)	(4.60)
Capital city	.205	.205	(5.50)	(3.62)	.126	.460	-.010	.197	.192	.496
	(3.62)	(1.58)			(2.08)	(2.62)	(0.29)	(1.68)	(4.61)	(5.27)
SCHOOL CHARACTERISTICS										
Travel time to primary known	.248		U	U	U	U	.288	-.227	U	U
	(0.72)						(1.65)	(0.41)		
Travel time to primary	.000	.004	.018	.022	U	U	-.010	-.002	-.001	.001
	(0.18)	(1.30)	(4.85)	(2.92)			(10.80)	(1.11)	(0.99)	(0.55)
Travel time to secondary known	-.208	-.047	.230	.305	U	U	-.011	.222	U	U
	(1.29)	(0.12)	(3.71)	(2.37)			(.28)	(2.32)		
Travel time to secondary	-.001	-.002	-.015	-.017	U	U	-.001	-.001	-.003	-.008
	(1.66)	(1.07)	(11.10)	(6.21)			(3.95)	(2.03)	(4.10)	(5.32)
χ^2 (d.f.)	5,817 (21)	623 (20)	13,669 (20)	1,383 (20)	13,052 (15)	455 (15)	25,261 (20)	1,286 (20)	10,432 (18)	861 (16)
(p-value)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Number of children	5,468	1,814	13,476	5,158	9,451	1,993	15,795	4,481	7,683	2,902

Note: Unweighted data. Omitted categories and dummy variable coding are as follows:

Woman's schooling: Omitted categories are none (Dominican Republic, Egypt, Kenya, Thailand), none or primary only (Thailand); upper categories are secondary or higher (Kenya), and higher for the other countries.

Spouse schooling: Omitted categories are none or primary (Dominican Republic, Kenya, Philippines, Thailand), none (Egypt); upper categories are secondary or higher (Kenya), and higher for the other countries.

Urban residence: The DHS categories of town, small city and capital city are used except in Egypt (town, city), and Thailand (city, capital). The omitted category in Thailand is rural or town, whereas for the other countries rural is the omitted category.

Education and health services: For urban areas in Egypt and Thailand, all these variables are set to zero. The variable "Travel time to primary known" takes the value 1 if the respondent could provide this information; for cases in which the travel time was not known, this variable is set to 0 and the mean value of travel time substituted into the "Travel time to primary" variable. The same procedure was followed for time to secondary schools.

U = Unknown (not available)

Table 6.9 Effects of excess and unwanted fertility on children's schooling

Estimated effects of excess and unwanted fertility on children's schooling, Demographic and Health Surveys, 1987-1993

Variable	Years of schooling	Any secondary schooling
Dominican Republic		
Excess	-.170	-.154
(|z| statistic)	(5.64)	(2.21)
Unwanted	-.337	-.271
	(7.18)	(2.02)
Egypt		
Excess	.090	.031
(|z| statistic)	(4.57)	(0.70)
Unwanted	-.009	-.026
	(0.43)	(0.56)
Kenya		
Excess	.006	-.176
(|z| statistic)	(0.23)	(1.90)
Unwanted	-.001	.029
	(0.05)	(0.30)
Philippines		
Excess	-.127	-.221
(|z| statistic)	(7.12)	(4.56)
Unwanted	-.052	-.121
	(2.39)	(2.09)
Thailand		
Excess	-.150	-.186
(|z| statistic)	(5.82)	(3.43)
Unwanted	-.157	-.123
	(3.63)	(1.26)

Note: Unweighted data.

To aid in interpretation, Table 6.10 translates these coefficients into two measures of differences in completed schooling. Using the results of the ordered probit model, the years of schooling are predicted that would be completed by a child of age 18, with other things held constant, both with and without excess fertility (likewise, with and without unwanted fertility). The predicted difference in average years of schooling is presented in the table.[21] A similar prediction is made for the probability of completing any years of secondary school, with the percentage point differences shown in the table. As can be seen, the estimated effects are relatively small. In no case do we predict a difference of more than one year of completed schooling on average; the likelihood of completing at least a year of secondary differs by 3.7 to 8.5 percentage points. Effects of this size should not be dismissed, but they pale compared with the influence of covariates such as the mother's education.

In related work on the Philippines and the Dominican Republic, Montgomery and Lloyd (1997) found larger effects than these in an analysis of cases in which two or more unwanted births occurred over the five-year period, and in cases in which family size ideals were exceeded by two or more. For example, comparing estimates for the Dominican Republic of the percentage completing primary school according to whether 0, 1, or 2 unwanted births occurred, the gap in completion expanded to 17 percentage points. This is a sizable difference, but one that is less likely to emerge if attention is restricted to a five-year window for demographic events.

Table 6.10 Predicted differences in completed schooling due to excess and unwanted fertility

Predicted differences in completed schooling due to excess and unwanted fertility, Demographic and Health Surveys, 1987-1993

	Dominican Republic	Philippines	Thailand
Difference in average years of schooling completed by age 18			
Any excess fertility	-.38	-.20	-.27
Any unwanted births	-.72	-.08	-.28
Difference in percent ever completing 1 year of secondary by age 18			
Any excess fertility	-4.8	-5.0	-5.7
Any unwanted births	-8.5	-2.8	-3.7

6.4 CONCLUSIONS

In collecting results across the three dimensions of child investment studied, we find that they make a striking pattern. The levels of unwanted and excess fertility are highest in Egypt and Kenya. Yet, apart from the birth-interval effects, the family-level consequences of such fertility are most clearly apparent only in the Dominican Republic, the Philippines, and Thailand. Fertility in these three countries is lower than in Egypt and Kenya, as is child mortality. Although no one would describe the Dominican Republic, the Philippines, and Thailand as wealthy by international standards, they are certainly better off than Egypt and Kenya, which have decidedly lower levels of income per capita.

[21] These predictions were generated by the method described in footnote 11.

What, then, accounts for the pattern of effects? In environments where parents are generally more effective in controlling the timing of births and adhering to their desired numbers of children, an unintended birth may be perceived to be less likely and thus, when it occurs, may be more disruptive to family building strategies. Moreover, it is reasonable to expect that for the family as a whole, the disruption occasioned by an unintended birth may be greater where three conditions obtain: the returns to human capital investment are perceived to be considerable; the (direct) costs of that investment are also considerable; and there are reasonably strong preferences for equalizing investments across children. In such an environment, parents might feel compelled to make across-the-board adjustments when faced with an unanticipated or excess birth.[22] It is arguable that these conditions are more likely to hold in the relatively better-off societies of the Dominican Republic, the Philippines, and Thailand.

Recall that the reports of unintended and excess fertility are those of women rather than their spouses. In Egypt, women are said to cede much decisionmaking authority to their spouses, and a woman's own views of whether a birth was wanted or fertility excessive might have little to do with household resource allocation. If the man were to declare a birth unwanted, however, the implications might be quite different. A closely related point is that in none of these countries is there available a measure of the *intensity* of preferences, that is, of the degree of motivation to avoid excess family size or unintended births. It is plausible that in Egypt and Kenya, countries that are still in the intermediate stages of demographic transition, such motivations may often be superficial or clouded by ambiguity and second thoughts. Additional contingencies arise in Kenya, where, as in much of sub-Saharan Africa, there are possibilities for meeting unanticipated child-rearing costs through sibling chains of support and networks of relatives.

Promising Directions for Research

Our results are suggestive of the consequences of imperfect fertility control; in view of the many difficulties of measurement and conceptualization, they cannot be regarded as decisive. In thinking of priorities for future research, we offer the following suggestions. The greatest need is for tightly focused longitudinal studies, which in other contexts—such as the study of teenage pregnancy and its consequences in the United States—have proven to be essential in separating mere statistical associations from causal consequences. Nationally representative surveys are not necessarily the place to begin; we see considerable potential in designs in which certain subgroups (e.g., less-educated families situated in urban areas) are purposively selected for follow-up.

In addition to exploring systematic errors such as rationalization bias, a valuable theme for such studies would be the implications of random, nonsystematic errors in the measurement of preferences.[23] Such errors in measuring preferences would be likely to bias toward zero (Greene, 1997) the estimated effects of imperfect fertility control, a phenomenon that is termed "attenuation bias." In this way, measurement error might cause large negative effects to appear smaller than they actually are. The degree of such attenuation bias is determined in part by the variance of the measurement error. Perhaps this variance is itself a function of a country's or community's stage of demographic transition.

We would also urge that attention be given to dimensions of human capital investment that are subtler than those examined here. Recall that in the developed countries, the consequences of unwanted fertility have been expressed in psychological aspects of child development and in the authoritarian nature of parenting. Appropriate analogies can be easily imagined for developing-country settings. Detailed schooling histories are likely to prove more revealing about consequences than the current status indicators now collected by DHS surveys. It may be that the effects of unwanted fertility are more easily seen in children's time use than in measures of school enrollment. A girl who must assist her mother in caring for a new sibling may not have enough time to do her school work, or she may be able to attend school only intermittently. We would also urge that closer attention be given to the potential interactions of children's nutritional status and abilities to learn. Such effects are no doubt difficult to detect without a dedicated survey effort.

Finally, the societal implications of unwanted and excess fertility deserve closer scrutiny than they have yet received. We have argued that such fertility may have important compositional effects on the distribution of the labor force by education. In considering all aspects of the rationale supporting family planning efforts, such aggregate implications are of high priority.

[22] The issues are complicated. We argued earlier that strong parental aversion to inequality could also dilute effects, spreading the costs across children.

[23] The authors thank John Casterline for this observation.

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Appendix A

DHS Service Availability Data

The DHS Service Availability Module (SAM) assesses the family planning, health care, and schooling environments within developing countries. Typically implemented at the cluster level, the service availability questionnaire collects information on a range of important topics concerning family planning services and supplies as well as local health care and schooling services, including their availability and quality at various locations. These data are collected during visits to each community in which informed respondents are queried to obtain information about local services. For some countries, this is followed by visits to the facilities that were described by the respondents. Of course, information is not typically collected for all service facilities; rather, depending on the particular country, it is collected on the "nearest facility" of each type (hospital, clinic, pharmacy, school) in the cluster. Although the service availability module provides much useful information that is difficult to obtain by any other means, there are a variety of methodological considerations regarding its use, including the nonrandom placement of services, the possible unreliability of informed respondents, large sampling errors, and non-comparability of service environments across countries. For a review and discussion of some of these methodological issues and problems, see Rosenzweig and Wolpin (1986) and Wilkinson, Njogu and Abderrahim (1993).

The service availability data used in this analysis were obtained at the cluster level for each of the countries utilized in this analysis. However, for two of the five countries (Egypt and Thailand, both DHS phase I studies) information concerning the service environment was collected for rural areas only. Thus, for these two countries no information is available concerning family planning or health care services in urban areas, although it is probably safe to assume that, in such areas, services are generally more prevalent and accessible.[24] For the remaining countries, the Dominican Republic, Kenya, and the Philippines, service availability data were collected in both urban and rural areas.

Measures of Service Availability

The service availability questionnaire gathers information about two general types of services: those provided at stationary facilities and those provided through outreach, whether by mobile clinics or by fieldworkers in local areas. Such outreach services include mobile clinics, visiting health and family planning workers, and trained or traditional midwives.

The collection of information across the countries is by no means standardized. This non-standardization is purposeful, as it is intended to reflect the specific service environment in each country. However, such country-specific features make it difficult to devise consistent sets of measures that can be used for comparative analysis. For the stationary facilities, the available data are dependent on the types of facilities in the local area providing services (e.g., hospital, health center, clinics) as well as the provider of services (e.g., government, private). In addition, the available measures are constrained by the data collection methods and the structure of the survey.[25] These difficulties notwithstanding, the measures utilized throughout this study are based on the availability of services for both stationary and outreach providers. A country-by-country profile of the utilized measures is presented in Table A.1 below.

Availability of Services

For family planning and health care, the assumption is made that the depth and breadth of use of family planning and health services will be inversely related to the costs of obtaining the services. Although measures of monetary costs are not readily available across all the countries in this analysis, other measures of costs can be devised. For stationary facilities, the cost of using family planning, health services, and school attendance can be defined in terms of the time or distance that individuals have to travel to receive services. Termed in past research the "distance decay" model of service use (Entwisle et al., 1984; Tsui and Ochoa, 1992), this approach suggests that the use of facilities by residents declines as the distance or time to the facility increases. This logic is equally applicable to distance

[24] For the multivariate analyses in which urban services data are not available, the services variables were included with an urban-rural interaction term that "zeroed-out" their values for urban areas. This ensures that urban records are not dropped due to missing values for these variables. The approach implies, however, that the coefficients on urban residence (town, small city, capital city) must be interpreted differently for Egypt and Thailand.

[25] For example, the countries used in this analysis have different service availability questionnaires. The Philippines is unique in that it asks the respondent(s) about the "nearest facility" and then, if that facility is not a hospital, e.g., a Barangay health station or a private clinic, it asks for additional information concerning the nearest hospital. The structure of questions may lead to some clusters having information only about the local hospital, whereas other clusters have information on both hospitals and a health station, private clinic, or Rhu/Pericultural center. For the other countries in the study, information is typically asked about the nearest facility of each type, e.g., health center, hospital, pharmacy that exits in an area, potentially providing information concerning four or five facilities in the cluster. The extent of the data in the latter case is determined by the range (and types) of service providers in each country.

Table A.1 Service availability information

Service availability information, Demographic and Health Surveys, 1987-1993

Service	Dominican Republic 1991	Egypt 1988	Kenya 1993	Philippines 1993	Thailand 1987
Stationary facilities					
Schools	X	X	X	X	X
Hospital	X	X	X	X	X
Health center	X	X	X	X	X
Pharmacy	X	X			X
Mobile, community-based					
Mobile clinic			X	X	X
Health, FP worker	X	X	X		X
Trained midwife/nurse		X			X

to the nearest primary and secondary schools, which are the measures utilized in the schooling analysis (see Section 6.3), Distance to schools is hypothesized to affect a variety of schooling outcomes, including attendance, and drop-out and completion rates.

For health and family planning outreach services, our analysis has extended the logic of availability of services by including measures of the *presence* of certain outreach services (e.g., mobile clinics, health workers, trained midwives) as additional indicators of availability and costs. Residents of areas where outreach services exist and are readily available are thus assumed to face lower access costs.

It is not a novel hypothesis that distance, time, and the presence of services should affect their use; but empirical support for the relevance of these measures is surprisingly thin. For instance, one set of studies utilizing proximity measures of services failed to find any significant or consistent results, either for use of family planning (Cochrane and Guilkey, 1991) or with regard to health services (Barrera, 1990; Thomas, Lavy, and Strauss, 1995). Further, only mixed results linking access and use of family planning across a selection of developing countries were obtained by Wilkinson et al. (1993). Yet, a third set of studies found the physical proximity of services to be important. Focusing on the availability of family planning and a collection of measures of fertility behavior, Ochoa and Tsui (1991) and Tsui and Ochoa (1992) found that increasing distance to family planning facilities has a negative effect on total and method-specific use of family planning across a set of Latin American countries. The latter studies clearly support the inclusion of such variables in multivariate analyses.

Given the variety of service environments in each country, a standardized set of variables is difficult to construct. In an attempt to adequately represent the service environment in each country and yet retain some basis for comparison, a series of measures was constructed for two of the most important stationary service providers in each country: the nearest hospital and the nearest health center. An additional variable, distance to the nearest outreach point, was included for the Philippines due to its importance in local service provision. These measures are presented in Table A.2. The availability of services can be indexed either by the time or distance to the facility. Unfortunately, for two countries data on time are lacking, and for the others, there is considerable country-specific variation in the amount of missing data. This rules out the use of time to nearest facility as the common specification. In its place, a series of variables was constructed based on the distance in kilometers to the nearest hospital and distance to the nearest health center.[26]

In addition to the continuous distance measures, for each country a series of dichotomous variables was created to more completely represent the unique features of the local service outreach environment. This selection of variables serves to control for the important role that outreach plays in the supply of health and family planning services. Although such services are not at all standardized across countries, their potential importance argues for their inclusion in the specification.

[26] One exception to this concerns the Kenya service availability data. Due to missing values for distance to the nearest health center for this country, time to nearest health center was used instead.

Table A.2 Measures of service availability

Measures of service availability, Demographic and Health Surveys, 1987-1993

Measure	Dominican Republic 1991	Egypt 1988	Kenya 1993	Philippines 1993	Thailand 1987
Distance to the nearest					
Primary school	X	X	X	X	X
Secondary school	X	X	X	X	X
Distance to nearest					
Hospital	X	X[d/]	X	X	X
Hospital w/ FP	X	X[d/]	X	X	X
Health center	X	X[d/]	--[a/]	--[b/]	X
Health center w/ FP	X	X[d/]	--[a/]	--[b/]	X
Mobile outreach	--[c/]	--[c/]	--[c/]	X	--[c/]
Time to nearest					
Hospital	X	X[d/]	X	--[a/]	--[a/]
Hospital w/ FP	X	X[d/]	X	--[a/]	--[a/]
Health center	X	X[d/]	X	--[b/]	--[a/]
Health center w/ FP	X	X[d/]	X	--[b/]	--[a/]
Mobile outreach	--[c/]	--[c/]	--[c/]	X	--[c/]
Outreach services					
Mobile clinic	--[c/]	--[c/]	X	X	X
Health worker, family Planning promoter	X	X	X	--[c/]	X
Trained midwife/nurse	--[c/]	X	--[c/]	--[c/]	X

[a/] Not available due to large percentage of missing cases
[b/] Not available due to structure of questionnaire
[c/] Not asked in SAM, not applicable to country specific service availability environment
[d/] Available only for facilities within 30 miles of cluster

Quality of Services

Another important aspect of the local service environment is the quality of the family planning and health services at the nearest hospital or health center. Quality can be defined across a variety of dimensions (Jain et al., 1992). However, relatively few of these dimensions are measurable with any existing data, including the DHS Service Availability Module. Previous attempts to capture the notion of quality of services have included such measures as the type of facility providing services to the cluster, i.e., dispensary, clinic, the availability of drugs at the facility (Strauss, 1990; Thomas, Lavy, and Strauss, 1995), and the availability of immunizations (Thomas, Lavy, and Strauss, 1995). In the latter two cases, these proxies were found to be useful and significant predictors of children's nutritional status in Côte d'Ivoire.

In the analysis, the quality of care in the local cluster is measured using data on the range of services available at the nearest hospital and/or health care center. For family planning, this implies that the quality of family planning is measured by the number of contraceptive methods that were recorded as being available at the facility at the time of the survey. The number of such methods should serve as a useful proxy for the depth of family planning services that are available to patrons; those facilities with low quality of services and an inability to provide the full range of contraceptive methods should be less effective at meeting the contraceptive needs of the local community. This lack of service availability should translate into fertility behaviors that are associated with imperfect fertility control, including lower acceptance rates, greater likelihood of termination of use, and greater unmet need for contraception. The specific distribution of services measured at the nearest hospital for each country in this

analysis can be seen in Table A.3 below.[27] The final variable used to measure the quality of services is represented by an additive index of the available methods: zero represents no services available at the facility, whereas the highest number, which depends on the total number of services recorded in the SAM, represents all services available.

For health services, a similar approach was taken to measure quality. In each country, the service availability module assesses the number and type of health services provided at the local facility. The measures of interest in this study are the health care services (whether curative or preventive) provided at the nearest hospital, as well as those services at the nearest facility. As suggested above, an additive index of services should serve as a proxy for the overall quality of the facility in providing health care, although with some degree of measurement error. Once again, no standardized measure based on precisely the same services is possible, since the SAM asks about different services in different countries. However, each SAM provided a useful set of indicators that could be utilized to construct measures. A country-by-country breakdown of the number and type of health services included in the index can be found in Table A.4. Unfortunately, owing to the lack of variance in the indices, comparable measures of the quality of services for Kenya and Thailand could not be employed.[28]

In summary, the Service Availability Module offers a unique opportunity to describe the local service environment within the cluster. The variables derived from measures of the service environment should prove useful in accounting for factors that are not otherwise controlled through the individual and household data alone. This study has utilized the SAM in a variety of ways. It has created a measure of the continuous distance in kilometers to the nearest health center and hospital to capture of physical distance between individuals and appropriate family planning and health care. By constructing a series of dichotomous variables to measure the presence of certain outreach services, it is also able to account for the unique role these services play in the service provision environment. Finally, the study has created a series of indices which capture the quality of services provided in both hospitals and health centers with regard to both family planning and health services. Although merely an additive index of the number of services (by type) provided by each facility, these constructs should serve as useful proxies for the breadth of care that is available.

Table A.3 Family planning services at nearest hospital

Family planning services at nearest hospital, Demographic and Health Surveys, 1987-1993

Family planning service	Dominican Republic 1991	Egypt 1988	Kenya 1993	Philippines 1993	Thailand 1987
Materials and information	--[a/]	X	--[a/]	X	--[a/]
Pill	X	X	--[a/]	X	--[a/]
IUD	X	X	--[a/]	X	--[a/]
Injections	X	X	--[a/]		--[a/]
Condom	X	X	--[a/]	X	--[a/]
Vaginal methods	X	--[a/]	--[a/]		--[a/]
Female sterilization	X	--[a/]	--[a/]	X	--[a/]
Male sterilization	--[a/]	--[a/]	--[a/]	X	--[a/]
Other method unspecified	--[a/]	X	--[a/]	[a/]	--[a/]

[a/] Not asked in SAM, not applicable to country-specific service availability environment

[27] A similar additive index was created for the nearest health facility (not shown). For Kenya 1993 and Thailand 1987, no assessment of available family planning services was carried out in the SAM.

[28] Although these questions were asked in the SAM for these two countries, there were very few facilities in each cluster that did not offer the full range of service.

Table A.4 Health services at nearest hospital

Health services at nearest hospital, Demographic and Health Services, 1987-1993

Health service	Dominican Republic 1991	Egypt 1988	Kenya 1993	Philippines 1993	Thailand 1987
Family planning	--[a/]	X	X[b/]	X	X[b/]
Prenatal care	X	--[a/]	--[a/]	X	--[a/]
Delivery care	X	--[a/]	X[b/]	X	--[a/]
Postnatal care	X	--[a/]	X[b/]	X	--[a/]
Vaccinations	X	--[a/]	X[b/]	X	--[a/]
Child care	X	--[a/]	--[a/]	--[a/]	--[a/]
ORT therapy	X	--[a/]	--[a/]	--[a/]	X[b/]
Maternal and child health	--[a/]	X	--[a/]	--[a/]	X[b/]
Radiology unit	--[a/]	X	--[a/]	--[a/]	--[a/]
Dental clinic	--[a/]	X	--[a/]	--[a/]	--[a/]
Emergency services	--[a/]	--[a/]	--[a/]	--[a/]	X[b/]
General services	--[a/]	--[a/]	--[a/]	--[a/]	X[b/]
Other medical services	--[a/]	X	--[a/]	--[a/]	--[a/]

[a/] Not asked in SAM, not applicable to country-specific service availability environment
[b/] Could not be utilized due to lack of variance across clusters

Appendix B

Educational Systems

To understand school enrollment and educational attainment in the five study countries, it is important to be familiar with certain structural aspects of their educational systems, such as school starting ages, grade-to-grade promotion policies, the duration of primary and secondary levels, and the critical transition points where performance on national exams may limit opportunities for advancement. Each country presents distinctive structural features.

Table B.1 summarizes the main elements of these educational systems, not only at the time of the DHS surveys but also for the relevant school years of all children in the sample age 6-18.[29] Egypt, Kenya, and Thailand have starting ages of 6, whereas children do not normally begin primary school until age 7 in the Dominican Republic and the Philippines. Six grades of primary school characterize all school systems except for the Kenyan system, where primary school lasts 8 years. Neither the Dominican Republic nor the Philippines imposes national exams during the primary and secondary years; to determine pass rates they rely instead on internal exams administered separately in each school. In Thailand, external exams are administered in grades 2, 4, and 6. The Kenyan system is rather different, allowing students to progress automatically from grade to grade until the end of standard 8 in primary, a point when students sit for a national exam that determines eligibility to enter secondary school. Roughly 44 percent of those completing primary school in Kenya are able to enroll in secondary school (UNESCO, 1994).[30] In Egypt, the critical transition points occur more frequently, in that local exams are administered to all schools in a district at the end of grades 2, 4, and 6. A national exam for basic education is administered at the end of grade 9 (the last year of the preparatory level). Results of this exam determine whether a student can proceed to the secondary level on an academic track or will only be eligible for technical school. All systems except the Philippines have a total of 12 years of primary and secondary schooling; the Philippines is unusual in having only 10 years of schooling prior to university.

As discussed in the text, for four of these countries the DHS survey provides current status data on children's schooling only through the household rosters, the exception being Thailand where the data are drawn directly from birth histories. Apart from Thailand, therefore, only those children of school age who are still resident in the household can be linked to data on their mothers. In view of the potential difficulties of the DHS design, our analyses are limited to resident children of school age who are no older than 18. The issues are further discussed in Appendix C.

In Figures B.1 to B.5, the DHS current status data are used to show patterns of educational progress for each country.[31] The horizontal axes begin with the age at which children are meant to start grade 1 of primary school.[32] The children who are currently enrolled are divided into two groups: those whose age is appropriate to the grade (labeled "okay") and those who are over age either because of a late start or because of grade repetition

[29] In 1985, primary school in Kenya was expanded from 6 to 8 years. Because the DHS data were collected in 1993, all children age 18 at the time of the survey (the oldest children in our sample) would have been 10 in 1985; this ensures that they would have been full participants in the transition to 8 grades. A reduction in the years of primary schooling in Egypt from 6 to 5 years came in 1989, the year after the 1988 DHS was conducted, thus allowing us to use the old system to analyze the full sample of children. Recent changes in the Dominican Republic system have not been fully implemented and it appears that two parallel systems are currently in place. The traditional system had an intermediate phase of 2 years before full secondary whereas the reform plan has 4 years of secondary following 6 years of primary, with 2 additional years for university-bound students. The Thai system changed from 7 to 6 years of primary in 1978. Thus an 18-year-old in our sample would have been in grade 3 or 4 of primary in 1978, thus being able to complete primary under the new system.

[30] This is based on the ratio of the number of students enrolled in the first grade of secondary (1992) to the number of students in the last year of primary (1990). This figure is likely to be an overestimate. Data for 1991 are not yet available (UNESCO, 1994).

[31] These figures compare children of different ages at a particular point in time, and thus reflect both secular trends and life cycle changes. Although we would like to use the data to form a profile of school participation for the current cohort of school-age children, we know that patterns of school participation have been changing over the decade preceding the DHS surveys. As overall enrollment rates rise, we would expect to see the trends reflected in declining proportions of children never in school at younger ages. Interestingly, in our sample of countries this pattern is clearly apparent only in Egypt. Indeed, the picture for the Dominican Republic suggests a deteriorating situation, with 6 percent of 18-year-olds never having attended school but as many as 14 percent of 11-year-olds. This deterioration is confirmed by a recent World Bank (1995) assessment.

[32] School participation can begin before the first grade of primary in preprimary, nursery, or kindergarten. The prevalence of preschool attendance varies from country to country as does its content. Because little is known about preschool, it has been excluded here so that all the figures can be presented on a comparable basis.

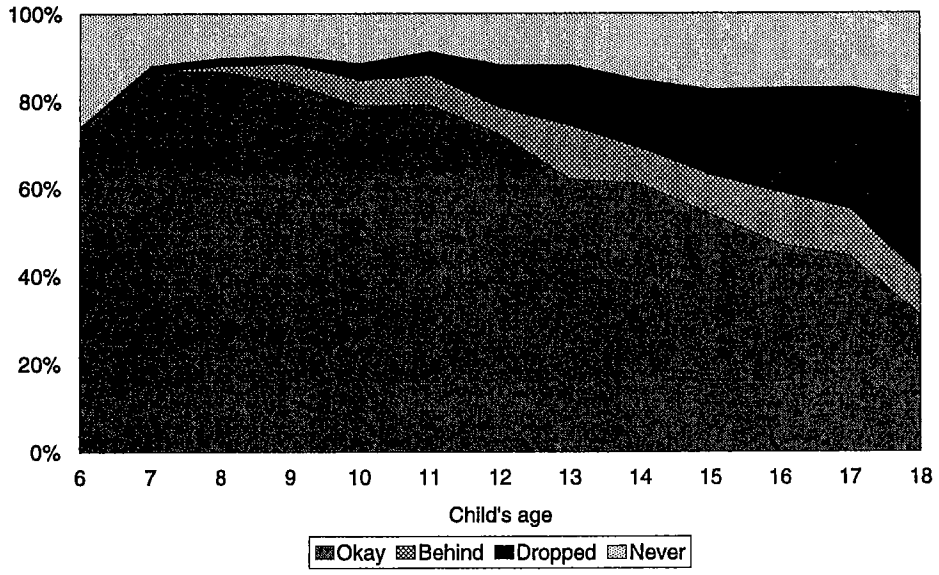
Table B.1 National education systems

National education systems, Demographic and Health Surveys, 1987-1993

	Dominican Republic 1991	Egypt 1988	Kenya 1993	Philippines 1993	Thailand 1987
PRIMARY					
Starting age	7	6	6	7	6
No. of grades	6	6	8	6	6
Promotion from grade-to-grade	Teachers' evaluations, internally administered	Local exams at end of grades 2, 4, 6	Automatic	Cumulative rating system. Pass grade = 75%, internally administered	External exams at grades 2, 4, 6
SECONDARY					
Entry requirement	Primary completion (certificado de suficiencia)	Passing score on locally administered grade 6 exam	Passing score on National KCPE exam	Primary Graduation Certificate	Entrance exam
No. of grades	Traditional plan: 2+4 Reform plan: 4+2	Preparatory: 3 Secondary: 3	4	4	Lower secondary: 3 Upper secondary: 3
Promotion from grade-to-grade	Teachers' evaluations, internally administered	Exam for basic education completed at end of grade 9; minimum score required for academic secondary	Automatic	Teachers' evaluations, internally administered	Certificates at grades 9 + 12 awarded by individual school
University placement	Secondary completion (Bachillerato)	National exam	National exam	National exam	Secondary completed
Total grades pre-university	12	12	12	10	12

Sources: Postlewaithe, T. Neville, ed. 1992. *The encyclopedia of comparative education and national systems of education.* Oxford: Pergamon Press.
Kurian, George Thomas, ed. 1988. *World education encyclopedia.* New York: Facts on File Publications.

Figure B.1 Children's educational progress by age, all children co-resident with mothers, Egypt 1988



Note: Preschool enrollment not included

("behind").[33] Students who have been to school but are not currently in school are labeled as "dropped."

In Figures B.1 and B.2, Egypt and Kenya are compared; both countries have a normal starting age of 6 for the primary level. The patterns reveal a striking contrast. In Kenya, starting ages are flexible with children continuing to enter primary until age 11.[34] Late entry is the major factor causing children to be behind grade for their age. With 8 grades of primary and automatic promotion from grade to grade, drop-out becomes significant only when children reach the end of primary and sit for the national KCPE exam. Given the limit on places in the first form of secondary, only the top-scoring 40 percent of Kenyan students can continue to secondary. On the positive side, relatively few students have never been to school.

In Egypt, a heavily bureaucratized school system enforces a strict age of entry. Students who have not gained a place in school by age 7 are therefore unlikely to have the opportunity to attend later. As a result, enrollment in primary is exceptionally high by age 7 (with 87 percent enrolled compared with 61 percent in Kenya at the same age) but begins to drop off by age 9. The percentages never enrolled are noticeably higher than in Kenya and drop-out begins to occur at a steady rate at age 10, when students sit for a series of standard exams at the end of grades 2, 4, 6, and (most important) grade 9. Relatively few students appear to be behind grade for their age, suggesting that those who are not able to keep up are more likely to drop out.

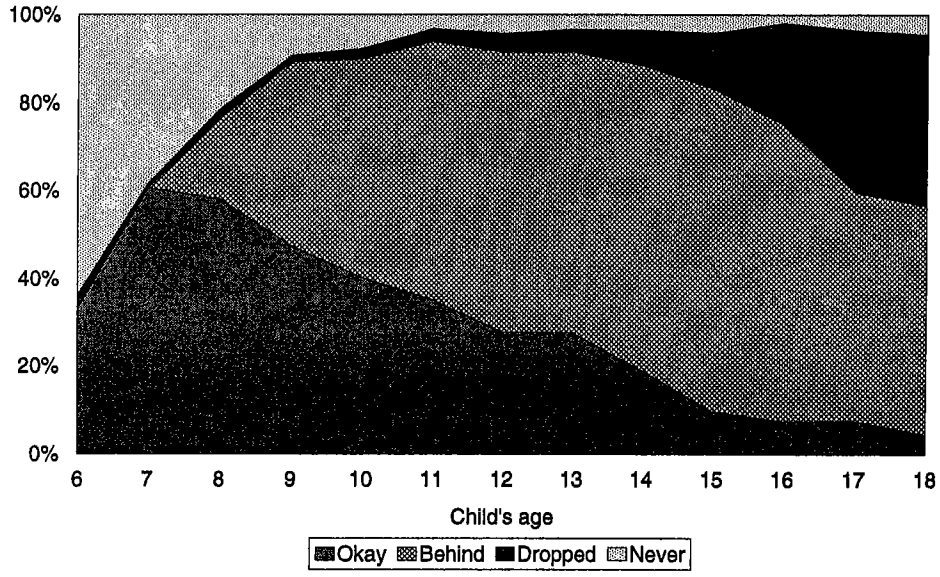
Figures B.3 and B.4 compare the Philippines and the Dominican Republic. In the Philippines, almost all children eventually enter school and most have entered by age 9. Most children are able to complete the 6 primary grades, but participation begins to fall off during the 4 years of secondary. Late entry and repetition do not appear to be important problems. By contrast, in the Dominican Republic, late entry is evidently common, with children behind grade representing almost half of all school attending students between ages 11 and 16.

Figure B.5 shows the Thailand data. In Thailand, most students start school by age 7-8 and those who remain in the system keep pace at the appropriate grade for their age. However, beginning at the end of primary school, the dropout rate increases markedly and continues increasing throughout secondary school.

[33]This follows the approach used by Lloyd and Blanc (1996) in their analyses of children's schooling in Africa. Children are classified as behind grade level if their number of grades completed is less than the number of years that would be completed if they started school within two years of the recommended starting age in the country according to UNESCO (1994) and attended continuously from that age onward. Specifically, a child is behind grade level if: competed years of education, current age - (recommended starting age + 2). The two year adjustment is due to the fact that children in any given grade may be observed at one of two ages (for example, a child starting school at age 6 will turn 7 during first grade) coupled with an additional adjustment to produce a conservative estimate of the proportion of children behind grade level given possible age and grade misreporting. Thus, in a country with a school starting age of 6, enrolled children who have completed grade 1 by age 8 would be classified as "at grade level."

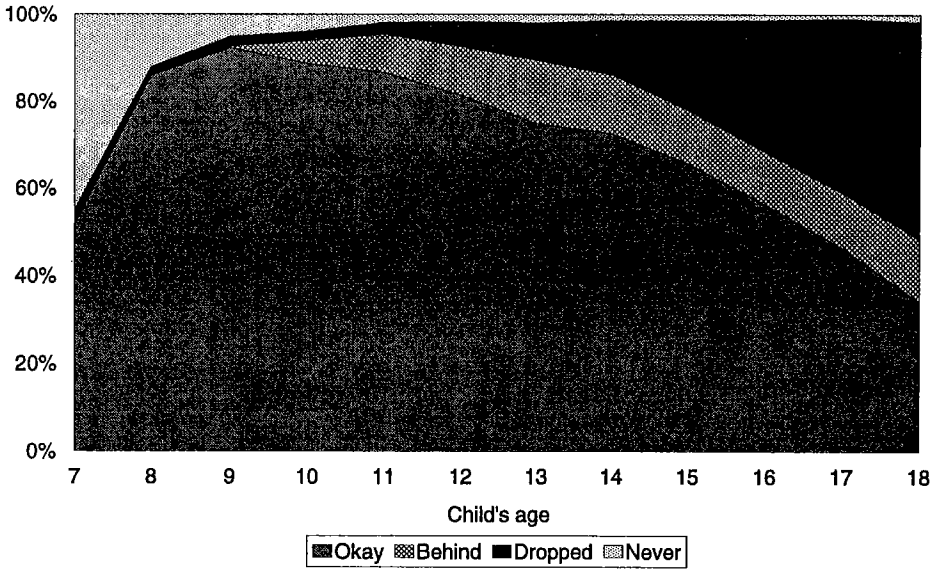
[34] In Kenya, the preschool sector is large and growing. One reason for the high enrollment in preschool may be that it is increasingly a requirement for admission to primary (Appleton, 1995). In our sample 40 percent of 6-year-olds in Kenya were in nursery, 25 percent of children age 7, 12 percent of children age 8, and 4 percent of children age 9.

Figure B.2 Children's educational progress by age, all children co-resident with mothers, Kenya 1993



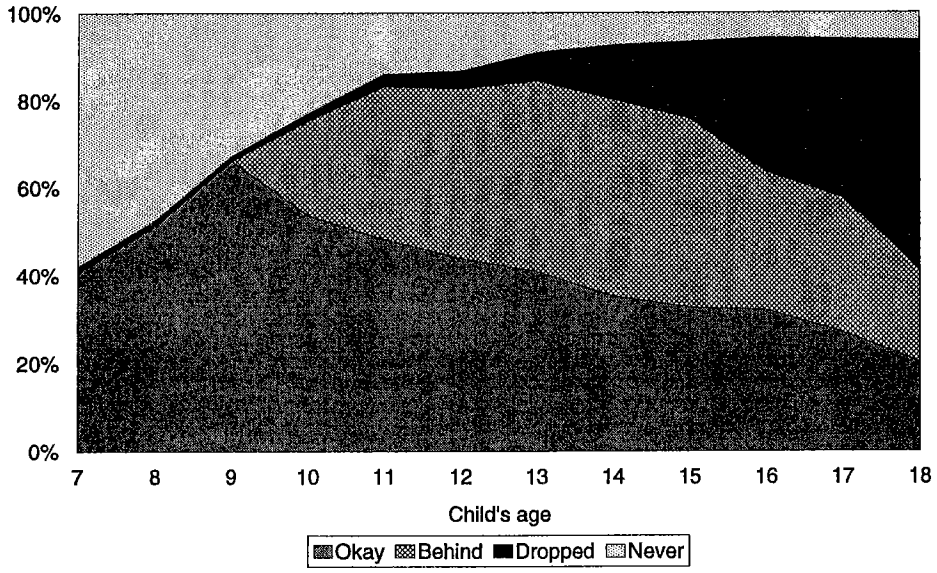
Note: Preschool enrollment not included

Figure B.3 Children's educational progress by age, all children co-resident with mothers, Philippines 1993



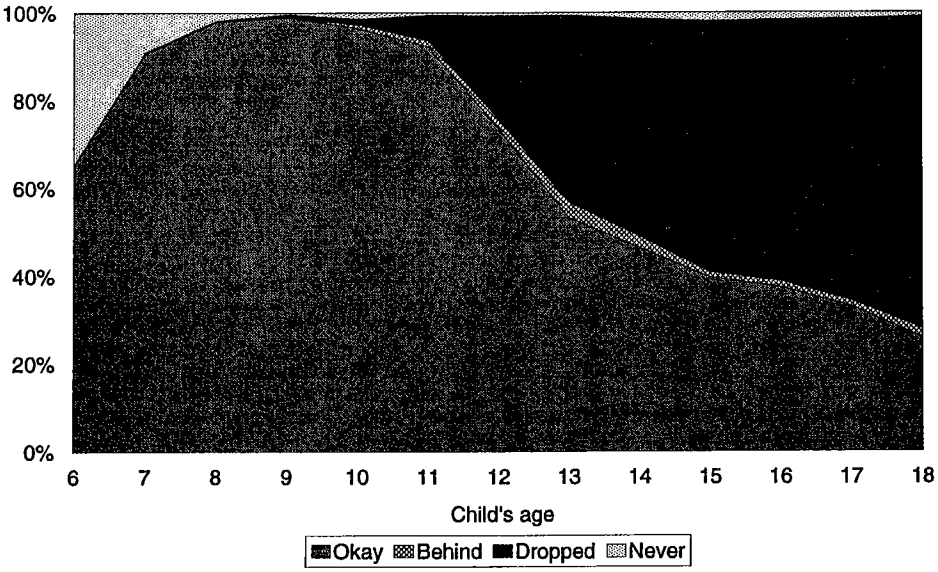
Note: Preschool enrollment not included

Figure B.4 Children's educational progress by age, all children co-resident with mothers, Dominican Republic 1991



Note: Preschool enrollment not included

Figure B.5 Children's educational progress by age, all children co-resident with mothers, Thailand 1987



Note: Preschool enrollment not included

Appendix C

Issues in Linking Data on Children's Schooling

In all study countries except Thailand, data on children's schooling are available only in the DHS household rosters. When such data are to be linked to information taken from mothers, as in this study, there are selectivity biases that require investigation.

The main difficulty is that children who no longer reside with their mothers cannot be linked. In settings where child fostering is prevalent, or where marriage dissolution causes children to live with relatives other than their mothers, these are particular concerns. There is a general concern in that the older the child in question, the more likely he or she is to have moved away.

As discussed in the text, these issues were confronted in deciding on an upper age cut-off for the children whose schooling levels were to be investigated. We settled on age 18 as the appropriate age, this following an examination of the DHS household roster data on children's residence. In the study countries, the percentages of children still residing with their mothers as of this age exceeds 60 percent. Moreover, an examination of schooling data for all resident children aged 18 and younger, and a comparison to the data derived from the subset of children who still reside with their mothers, showed no important differences.

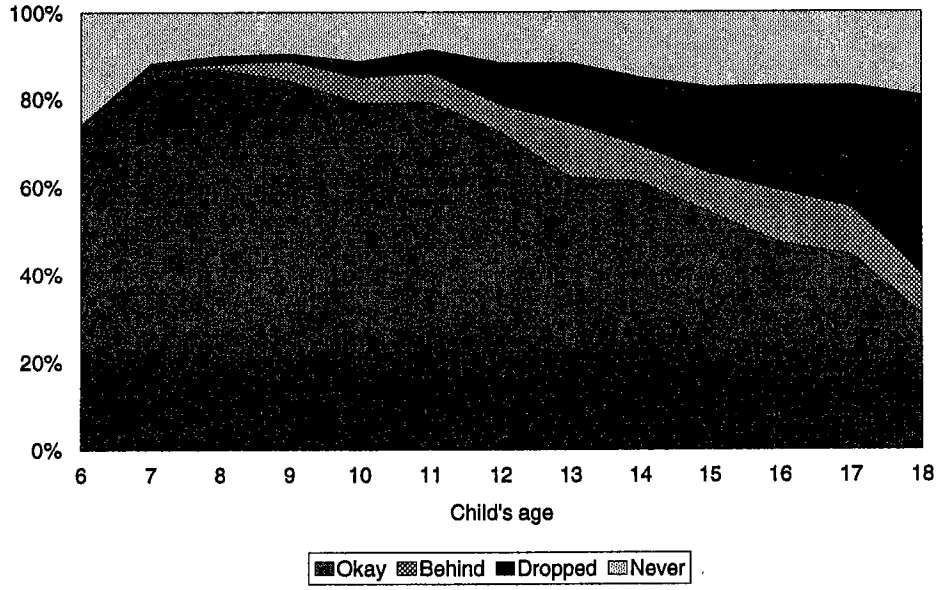
This point is illustrated in Figures C.1 to C.4, which are analogous to those presented for the subset of linked children in Appendix B, but which show the distribution of school status for all children in the household. A country-by-country comparison of these figures to their counterparts based on the linked children shows that the differences are very small. Indeed, no systematic difference can be detected. We are therefore reasonably satisfied that no serious selectivity bias contaminates the schooling data for linked children.

Further difficulties arise in matching information derived from birth histories for resident children to the schooling data collected in the DHS household roster. No unique identifier exists for children that would allow their records in the birth history and household rosters to be directly joined. It was therefore necessary to devise an algorithm to search for matches. From the birth history, information was extracted on the child's sex and age, together with the *wline* variable that identifies, or should identify, the location of the mother's record in the household roster. All household members whose parents live in the household should have listed the line number of their parents. In principle, therefore, all resident children of the interviewed woman should list *wline* as their mother's line number. Each such child should then be recorded in the household roster as having the same sex and age as derived from the birth history.

That at least is the principle in matching, but in practice there is much variation in the extent to which data from the birth history and household roster agree. Age is recorded in years in the household roster, whereas finer detail is available in the birth history; moreover, a child's age would not typically be reported by that child's mother in the household roster. Some children described by the mother as living with her do not appear at all in the household roster; other children of the same sex and age may appear in the roster, yet do not list *wline* as the line number of their mothers.

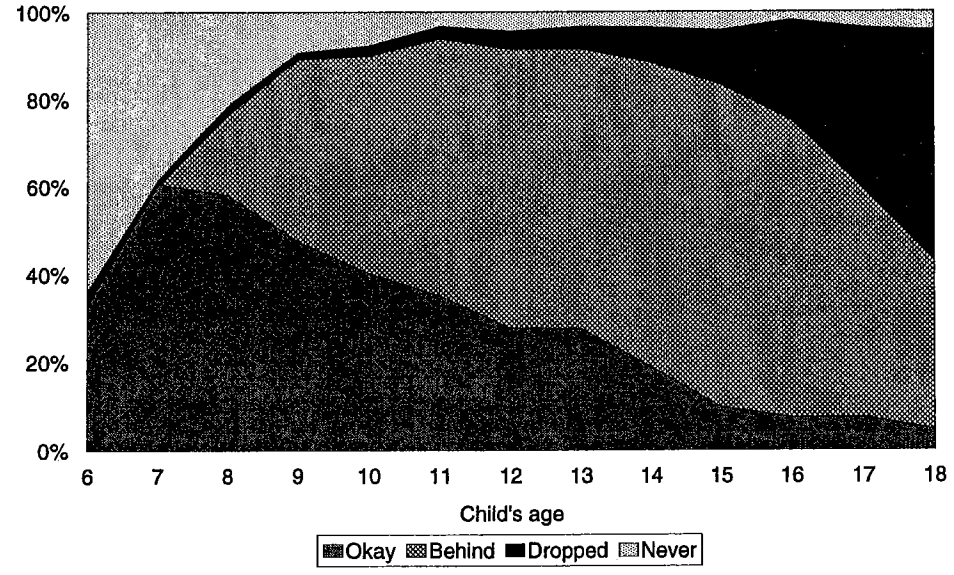
In view of these difficulties, a matching rule was adopted that declared as "matched" those children whose age in the household roster was within 2 years of the age derived from the birth history. A secondary or residual category of "matched" children was also established, defined to include those who did not list *wline* as their mother's line number, yet who were of the same sex and age as (otherwise unmatched) children. An analysis was then conducted of the differences between the various categories of matched and unmatched children; this did not reveal any systematic patterns that could threaten the schooling analyses.

Figure C.1 Children's educational progress by age, all children in sampled households, Egypt 1988



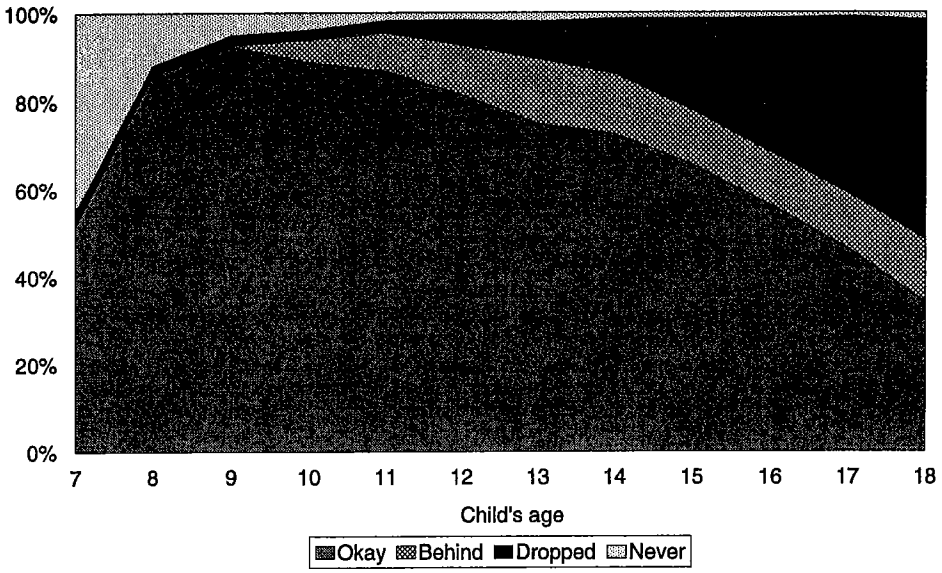
Note: Preschool enrollment not included

Figure C.2 Children's educational progress by age, all children in sampled households, Kenya 1993



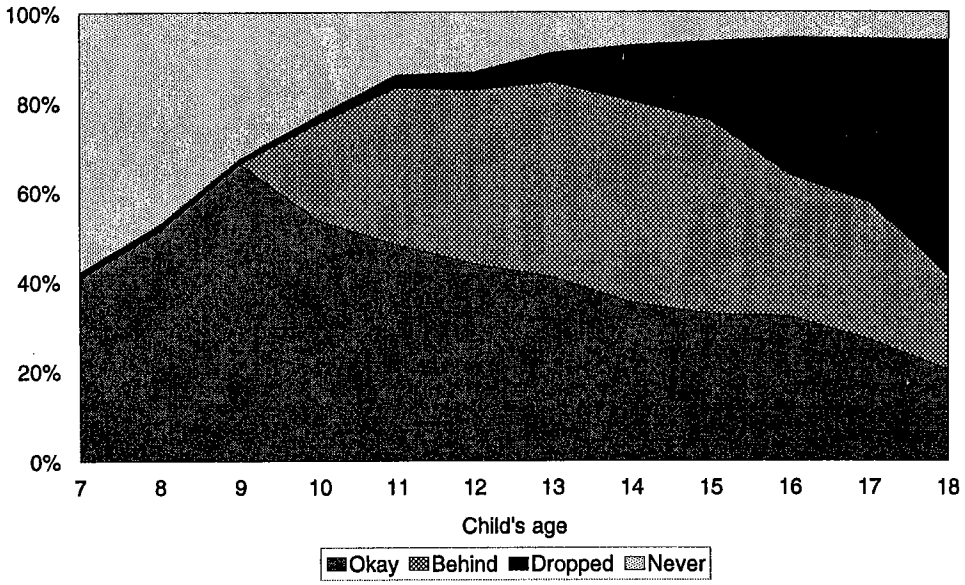
Note: Preschool enrollment not included

Figure C.3 Children's educational progress by age, all children in sampled households, Philippines 1993



Note: Preschool enrollment not included

Figure C.4 Children's educational progress by age, all children in sampled households, Dominican Republic 1991



Note: Presechool enrollment not included

Appendix D

Summary of DHS-I, DHS-II, and DHS-III Surveys, 1985-1997

Region and Country	Date of Fieldwork	Implementing Organization	Respondents	Sample Size	Male/Husband Survey	Supplemental Studies, Modules, and Additional Questions
SUB-SAHARAN AFRICA						
DHS-I						
Botswana	Aug-Dec 1988	Central Statistics Office	AW 15-49	4,368		AIDS, PC, adolescent fertility
Burundi	Apr-Jul 1987	Département de la Population, Ministère de l'Intérieur	AW 15-49	3,970	542 Husbands	CA, SAI, adult mortality
Ghana	Feb-May 1988	Ghana Statistical Service	AW 15-49	4,488	943 Husbands	CA, SM, WE
Kenya	Dec-May 1988/89	National Council for Population and Development	AW 15-49	7,150	1,133 Husbands	
Liberia	Feb-Jul 1986	Bureau of Statistics, Ministry of Planning and Economic Affairs	AW 15-49	5,239		TBH, employment status
Mali	Mar-Aug 1987	Institut du Sahel, USED/CERPOD	AW 15-49	3,200	970 Men 20-55	CA, VC, childhood physical handicaps
Ondo State, Nigeria	Sep-Jan 1986/87	Ministry of Health, Ondo State	AW 15-49	4,213		CA, TBH
Senegal	Apr-Jul 1986	Direction de la Statistique, Ministère de l'Economie et des Finances	AW 15-49	4,415		CA, CD
Sudan	Nov-May 1989/90	Department of Statistics, Ministry of Economic and National Planning	EMW 15-49	5,860		FC, M, MM
Togo	Jun-Nov 1988	Unité de Recherche Démographique, Université du Benin	AW 15-49	3,360		CA, SAI, marriage history
Uganda	Sep-Feb 1988/89	Ministry of Health	AW 15-49	4,730		CA, SAI
Zimbabwe	Sep-Jan 1988/89	Central Statistical Office	AW 15-49	4,201		AIDS, CA, PC, SAI, WE
DHS-II						
Burkina Faso	Dec-Mar 1992/93	Institut National de la Statistique et de la Démographie	AW 15-49	6,354	1,845 Men 18+	AIDS, CA, MA, SAI
Cameroon	Apr-Sep 1991	Direction Nationale du Deuxième Recensement Général de la Population et de l'Habitat	AW 15-49	3,871	814 Husbands	CA, CD, SAI
Madagascar	May-Nov 1992	Centre National de Recherches sur l'Environement	AW 15-49	6,260		CA, MM, SAI
Malawi	Sep-Nov 1992	National Statistical Office	AW 15-49	4,850	1,151 Men 20-54	AIDS, CA, MA, MM, SAI
Namibia	Jul-Nov 1992	Ministry of Health and Social Services, Central Statistical Office	AW 15-49	5,421		CA, CD, MA, MM
Niger	Mar-Jun 1992	Direction de la Statistique et des Comtes Nationaux	AW 15-49	6,503	1,570 Husbands	CA, MA, MM, SAI
Nigeria	Apr-Oct 1990	Federal Office of Statistics	AW 15-49	8,781		CA, SAI
Rwanda	Jun-Oct 1992	Office National de la Population	AW 15-49	6,551	598 Husbands	CA
Senegal	Nov-Aug 1992/93	Direction de la Prévision et de la Statistique	AW 15-49	6,310	1,436 Men 20+	AIDS, CA, MA, MM, SAI
Tanzania	Oct-Mar 1991/92	Bureau of Statistics, Planning Commission	AW 15-49	9,238	2,114 Men 15-60	AIDS, CA, MA, SAI
Zambia	Jan-May 1992	University of Zambia	AW 15-49	7,060		AIDS, CA, MA

DHS-III						
Benin	Jun-Aug 1996	Institut National de la Statistique	AW 15-49	5,491	1,535 Men 20-64	AIDS, CA, MA, MM, SAI
Central African Republic	Sep-Mar 1994/95	Direction des Statistiques Démographiques et Sociales	AW 15-49	5,884	1,729 Men 15-59	AIDS, CA, CD, MA, MM, SAI
Comoros	Mar-May 1996	Centre National de Documentation et de la Recherche Scientifique	AW 15-49	3,050	795 Men 15-64	CA, MA
Côte d'Ivoire	Jun-Nov 1994	Institut National de la Statistique	AW 15-49	8,099	2,552 Men 12-49	CA, MA, SAI
Eritrea	Sep-Jan 1995/96	National Statistics Office	AW 15-49	5,054	1,114 Men 15-59	AIDS, CA, MA, MM, SAI
Ghana	Sep-Dec 1993	Ghana Statistical Service	AW 15-49	4,562	1,302 Men 15-59	CA, MA
Kenya	Feb-Aug 1993	National Council for Population and Development	AW 15-49	7,540	2,336 Men 15-54	AIDS, CA, MA, SAI
Madagascar	Sep-Dec 1997	Institut National de la Statistique, Direction de la Démographie et des Statistiques Sociales	AW 15-49	7,060		AIDS, CA, MA
Malawi (KAP)[a]	Jun-Oct 1996	National Statistical Office	AW 15-49	2,683	2,658 Men 15-54	AIDS
Mali	Nov-Apr 1995/96	CPS/MSSPA et DNSI	AW 15-49	9,704	2,474 Men 15-59	AIDS, CA, MA, MM, SAI
Mozambique	Mar-Jul 1997	Instituto Nacional de Estatística/ Ministéro de Saúde	AW 15-49	8,779	2,335 Men 15-64	CA, MA, MM, SAI
Senegal (Interim)	Jan-Apr 1997	Division de Statistiques Démographiques, Direction de la Prévision et de la Statistique	AW 15-49	8,593	4,306 Men 20+	AIDS
Tanzania (KAP)[a]	Jul-Sep 1994	Bureau of Statistics, Planning Commission	AW 15-49	4,225	2,097 Men 15-59	AIDS, PC
Tanzania (In-depth)	Jun-Oct 1995	Bureau of Statistics, Planning Commission	AW 15-49	2,130		Adult and childhood mortality estimation
Tanzania	Jul-Nov 1996	Bureau of Statistics, Planning Commission	AW 15-49	8,120	2,256 Men 15-59	AIDS, CA, MA, MM
Uganda	Mar-Aug 1995	Statistics Department, Ministry of Finance and Economic Planning	AW 15-49	7,070	1,996 Men 15-59	AIDS, CA, MA, MM, SAI
Uganda (In-depth)	Oct-Jan 1995/96	Institute of Statistics and Applied Economics, Makerere University	AW 20-44	1,750	1,356 Partners	Negotiating reproductive outcomes
Zambia	Jul-Jan 1996/97	Central Statistics Office	AW 15-49	8,021	1,849 Men 15-59	AIDS, CA, MA, MM
Zimbabwe	Jul-Nov 1994	Central Statistical Office	AW 15-49	6,128	2,141 Men 15-54	AIDS, CA, MA, MM, PC, SAI
NEAR EAST/NORTH AFRICA						
DHS-I						
Egypt	Oct-Jan 1988/89	National Population Council	EMW 15-49	8,911		CA, CD, MM, PC, SAI, WE, WS
Morocco	May-Jul 1987	Ministère de la Santé Publique	EMW 15-49	5,982		CA, CD, S
Tunisia	Jun-Oct 1988	Office National de la Famille et de la Population	EMW 15-49	4,184		CA, S, SAI
DHS-II						
Egypt	Nov-Dec 1992	National Population Council	EMW 15-49	9,864	2,466 Husbands	CA, MA, PC, SM
Jordan	Oct-Dec 1990	Department of Statistics, Ministry of Health	EMW 15-49	6,461		CA, SAI
Morocco	Jan-Apr 1992	Ministère de la Santé Publique	AW 15-49	9,256	1,336 Men 20-70	CA, MA, MM, SAI
Yemen	Nov-Jan 1991/92	Central Statistical Organization	EMW 15-49	5,687		CA, CD, SAI

DHS-III						
Egypt	Nov-Jan 1995/96	National Population Council	EMW 15-49	14,779		CA, FC, MA, WS
Jordan	Jun-Oct 1997	Department of Statistics	EMW 15-49	5,548		AIDS, CA, MA, MM
Morocco (Panel)	Apr-May 1995	Ministère de la Santé Publique	AW 15-49	4,753		
ASIA						
DHS-I						
Indonesia	Sep-Dec 1987	Central Bureau of Statistics, National Family Planning Coordinating Board	EMW 15-49	11,884		PC, SM
Nepal (In-depth)	Feb-Apr 1987	New Era	CMW 15-49	1,623		KAP-gap survey
Sri Lanka	Jan-Mar 1987	Department of Census and Statistics, Ministry of Plan Implementation	EMW 15-49	5,865		CA, NFP
Thailand	Mar-Jun 1987	Institute of Population Studies Chulalongkorn University	EMW 15-49	6,775		CA, S, SAI
DHS-II						
Indonesia	May-Jul 1991	Central Bureau of Statistics, NFPCB/MOH	EMW 15-49	22,909		PC, SM
Pakistan	Dec-May 1990/91	National Institute of Population Studies	EMW 15-49	6,611	1,354 Husbands	CA
DHS-III						
Bangladesh	Nov-Mar 1993/94	Mitra & Associates/NIPORT	EMW 10-49	9,640	3,284 Husbands	PC, SAI, SM
Bangladesh	Nov-Mar 1996/97	Mitra & Associates/NIPORT	EMW 10-49	9,127	3,346 EMM	CA, MA, SM
Indonesia	Jul-Nov 1994	Central Bureau of Statistics/ NFPCB/MOH	EMW 15-49	28,168		MM, PC, SAI, SM
Kazakstan	May-Aug 1995	Institute of Nutrition, National Academy of Sciences	AW 15-49	3,771		CA, MA
Kyrgyz Republic	Aug-Nov 1997	Institue of Obstetrics and Pediatrics	AW 15-49	3,848		CA, MA, anemia testing
Nepal	Jan-Jun 1996	Ministry of Health/New ERA	EMW 15-49	8,429		CA, MA, MM
Philippines	Apr-Jun 1993	National Statistics Office	AW 15-49	15,029		MM, SAI
Turkey	Aug-Oct 1993	General Directorate of MCH/FP Ministry of Health	EMW <50	6,519		CA, MA
Uzbekistan	Jun-Oct 1996	Research Institute of Obstetrics and Gynecology	AW 15-49	4,415		CA, MA
LATIN AMERICA/CARIBBEAN						
DHS-I						
Bolivia	Feb-Jul 1989	Instituto Nacional de Estadística	AW 15-49	7,923		CA, CD, MM, PC, S, WE
Bolivia (In-depth)	Feb-Jul 1989	Instituto Nacional de Estadística	AW 15-49	7,923		Health
Brazil	May-Aug 1986	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-44	5,892		CA, S, SM, abortion, young adult use of contraception
Colombia	Oct-Dec 1986	Corporación Centro Regional de Población, Ministerio de Salud	AW 15-49	5,329		CA, PC, S, SAI, SM
Dominican Republic	Sep-Dec 1986	Consejo Nacional de Población y Familia	AW 15-49	7,649		CA, NFP, S, SAI, family planning communication

Dominican Republic (Experimental)	Sep-Dec 1986	Consejo Nacional de Población y Familia	AW 15-49	3,885		S, SAI
Ecuador	Jan-Mar 1987	Centro de Estudios de Población y Paternidad Responsable	AW 15-49	4,713		CD, SAI, employment
El Salvador	May-Jun 1985	Asociación Demográfica Salvadoreña	AW 15-49	5,207		CA, S, TBH
Guatemala	Oct-Dec 1987	Instituto de Nutrición de Centro América y Panamá	AW 15-44	5,160		CA, S, SAI
Mexico	Feb-May 1987	Dirección General de Planificación Familiar, Secretaría de Salud	AW 15-49	9,310		NFP, S, employment
Peru	Sep-Dec 1986	Instituto Nacional de Estadística	AW 15-49	4,999		NFP, employment,
Peru (Experimental)	Sep-Dec 1986	Instituto Nacional de Estadística	AW 15-49	2,534		
Trinidad and Tobago	May-Aug 1987	Family Planning Association of Trinidad and Tobago	AW 15-49	3,806		CA, NFP, breastfeeding
DHS-II						
Brazil (NE)	Sep-Dec 1991	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-49	6,222	1,266 Husbands	AIDS, PC
Colombia	May-Aug 1990	PROFAMILIA	AW 15-49	8,644		AIDS
Dominican Republic	Jul-Nov 1991	Instituto de Estudios de Población y Desarrollo (PROFAMILIA), Oficina Nacional de Planificación	AW 15-49	7,320		CA, MA, S, SAI
Paraguay	May-Aug 1990	Centro Paraguayo de Estudios de Población	AW 15-49	5,827		CA, SAI
Peru	Oct-Mar 1991/92	Instituto Nacional de Estadística e Informática	AW 15-49	15,882		CA, MA, MM, SAI
DHS-III						
Bolivia	Nov-May 1993/94	Instituto Nacional de Estadística	AW 15-49	8,603[b]		AIDS, CA, CD, MA, MM, S, SAI
Brazil	Mar-Jun 1996	Sociedade Civil Bem-Estar Familiar no Brasil	AW 15-49	12,612	2,949 Men 15-59	AIDS, CA, MA, MM, PC, S
Colombia	Mar-Jun 1995	PROFAMILIA	AW 15-49	11,140		AIDS, CA, MA, PC
Dominican Republic	Aug-Dec 1996	CESDEM/PROFAMILIA	AW 15-49	8,422	2,279 Men 15-64	CA, MA
Guatemala	Jun-Dec 1995	Instituto Nacional de Estadística	AW 15-49	12,403		AIDS, CA, MA, MM, S
Haiti	Jul-Jan 1994/95	Institut Haitien de l'Enfance	AW 15-49	5,356	1,610 Men 15-59	AIDS, CA, CD, MA, SAI
Peru	Aug-Nov 1996	Instituto Nacional de Estadística e Informática	AW 15-49	28,951	2,487 Men 15-59	CA, MA, MM

[a] No health or birth history section in questionnaire.
[b] Household questionnaire was administered in 26,144 households.

AIDS	acquired immune deficiency syndrome
AW	all women
CA	child anthropometry
CD	causes of death (verbal reports of symptoms)
CMW	currently married women
EMW	ever-married women
FC	female circumcision
M	migration
MA	maternal anthropometry
MM	maternal mortality
NFP	natural family planning
PC	pill compliance
S	sterilization
SAI	service availability information
SM	social marketing
TBH	truncated birth history
VC	value of children
WE	women's employment
WS	women's status

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