

The Effects of Unintended Pregnancy on Infant, Child, and Parental Health: A Review of the Literature

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This article provides a critical review of studies assessing the effects of unintended pregnancy on the health of infants, children, and parents in developed and developing countries. A framework for determining and measuring the pathways between unintended pregnancy and future health outcomes is outlined. The review highlights persistent gaps in the literature, indicating a need for more studies in developing countries and for further research to assess the impact of unintended pregnancy on parental health and long-term health outcomes for children and families. The challenges in measuring and assessing these health impacts are also discussed, highlighting avenues in which further research efforts could substantially bolster existing knowledge. (STUDIES IN FAMILY PLANNING 2008; 39[1]: 18–38)

In the United States, nearly one-half of all pregnancies are unintended; 42 percent of these end in abortion (Finer and Henshaw 2006). Similarly, high levels of unintended pregnancy are found in developing countries. Recent data from the Demographic and Health Surveys (DHS) indicate that 14 to 62 percent of recent births were unintended, the highest levels being found in the Latin American–Caribbean and South–Southeast Asia regions (ORC Macro 2007).

Unintended pregnancy is a concern from both a human rights and a public health perspective. At the 1994 International Conference on Population and Development (ICPD) held in Cairo, the Programme of Action stated that “[a]ll couples and individuals have the basic right to decide freely and responsibly the number and spacing of their children and to have the information, education and means to do so” (ICPD 1994: Principle 8). A similar sentiment emerged from the Committee on Unintended Pregnancy of the Institute of Medicine. In 1995, the Committee concluded that “the consequences of unintended

pregnancy are serious, imposing appreciable burdens on children, women, men, and families” (Brown and Eisenberg 1995:1).

In light of the prevalence of unintended pregnancy and its potential impact on the health and well-being of families, this review is intended to provide a comprehensive and critical summary of studies assessing the consequences of unintended pregnancy on infant, child, and parental health. The measurement of and analytical challenges to studying the effects of pregnancy intention on health outcomes are discussed, and a conceptual framework is provided to illustrate the mechanisms through which unintended pregnancy may influence health outcomes. Our framework serves to structure the subsequent review of studies, highlighting the existing knowledge and persistent gaps in the literature. Promising directions for future research are highlighted.

Methods

This literature review summarizes peer-reviewed publications and published reports that were identified via PubMed and SCOPUS search engines through July 2007. In addition, publication references were cross-checked to ensure that all pertinent literature was identified and included. Searches were conducted using the terms “pregnancy intention,” “unintended pregnancy,” “unplanned pregnancy,” “unintended childbearing,” “unintended fertility,” “unintended births,” and “unwanted pregnan-

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cy.” Studies were identified that assessed the relationship between pregnancy intention and health outcomes, focusing specifically on investigations with at least one of the following criteria: (1) data were derived from a population-based sample; (2) the study employed a longitudinal design in which fertility preferences were ascertained prior to the health outcome; or (3) the study investigators employed multivariate analyses to control for potentially confounding variables in their analyses. Although we provide an overview of all of the studies found that met at least one of the criteria, we focus predominantly on studies that were considered to be more rigorous. Appendix Table A1 provides a summary of this subset of studies.

Measurement and Analytical Concerns

Assessing the relationship between pregnancy intention and its potential health consequences is fraught with a number of measurement and analytical concerns. We highlight some of the key challenges below; further discussion of these issues can be found elsewhere (see, for example, Lloyd and Montgomery 1996; Santelli et al. 2003; and Chalasani et al. 2007).

Contextual Influences on Unintended Pregnancy

The characterization of a pregnancy as “unintended,” as well as a family’s (or society’s) ability to respond to and to compensate for the potential repercussions of an unintended pregnancy, vary across social and cultural settings. At the societal level, the magnitude of the consequences of unintended childbearing is likely to differ according to the level of economic development, the stage of demographic transition, kinship and family norms, and social expenditure on families and children (Lloyd 1994; Chalasani et al. 2007). Because of this variation, comparing studies from different locations or temporal periods is difficult.

Anthropological ethnographies have contributed to our understanding of the meaning of unintended pregnancy at the family level. These studies provide insight into such issues as why pregnancies are deemed unintended, how unintended pregnancies and the children that result from these pregnancies are viewed and treated by the family and caregivers, and what the physical and mental manifestations of being unintended may be for both the child and the child’s family (Levine 1987; Scrimshaw and Scrimshaw 1990; Scheper-Hughes 1992). The greater level of detail provided in anthropological studies is needed in order to understand the role that socio-cultural context plays, both in the conceptualization and

measurement of unintended pregnancy and in assessing associated health outcomes.

Definition and Measurement of Unintended Pregnancy

As illustrated in Appendix Table A1, substantial variation exists in the way studies have measured pregnancy intention, in terms of the questions asked and the timing of these questions with respect to the pregnancy. Most surveys ask women to classify their pregnancies according to distinct response categories (wanted, unwanted, or mistimed), despite concerns that intentions may be better captured by a continuum, or range of feelings (Bachrach and Newcomer 1999; Luker 1999).¹ Moreover, the terms used to characterize pregnancy intention vary across settings and by study participants (Fischer et al. 1999; Barrett and Wellings 2002; Kendall et al. 2005).

Although most survey instruments ask women to make the distinction between mistimed pregnancies (wanted later) and unwanted pregnancies (not wanted at all), most studies combine these categories for analysis, usually because of limitations in sample size. The distinctions between and within these two pregnancy-intention classifications can be substantial, however, in terms of women’s characteristics, the extent of pregnancy mistiming, and the severity of the effects on children who are considered to be mistimed versus unwanted (Pulley et al. 2002; D’Angelo et al. 2004). The characterization of a pregnancy as mistimed versus unwanted is also likely to vary across study settings and populations. From an analytical perspective, studies that lump these two categories may blur the individual effects of these distinct classifications of pregnancy intention, thereby underestimating the true effect of “unwantedness,” and overestimating the effect of being “mistimed.”

Timing of Pregnancy-intention Measurements

Most studies rely on cross-sectional, retrospective reports of pregnancy intention by asking mothers to think back to their feelings at the time of conception or to report on their feelings regarding their most recent live birth. Retrospective reports are problematic, however, because women may rationalize an unwanted pregnancy as a wanted birth (McClelland 1983; Bankole and Westoff 1998; Williams and Abma 2000; Koenig et al. 2006). Evidence from panel studies in Morocco and India found that women were more likely to shift to a more positive response in retrospective reports of pregnancy intention, reclassifying a child from being “unwanted” to “wanted” (Bankole and Westoff 1998; Koenig et al. 2006). Other researchers contend, however, that parents may also shift from a “wanted” pregnancy to an “unwanted” one if the child’s

attributes differ from those that the parent was expecting (McClelland 1983; Rosenzweig and Wolpin 1993).

Given the inherently dynamic nature of childbearing decisions, prospective measurements also present challenges. Studies conducted in the United States have found that fertility preferences are relatively stable over time (Westoff and Ryder 1977; Schoen 1999); however, some women may experience changes in their personal situations or living conditions that influence fertility intentions (Williams et al. 1999). In developing country settings, particularly those in the midst of a rapid fertility transition, fertility preferences are considered to be less stable and more dependent on external influences such as family-composition preferences, child mortality, and partners' differential motivations for childbearing (Lloyd and Montgomery 1996; Bankole and Singh 1998; Montgomery and Cohen 1998; Gipson and Hindin 2007).

Participants in Studies of Unintended Pregnancy

More than one-fifth of the known pregnancies that occurred worldwide in 1999 were aborted (AGI 1999). The likelihood that a woman will have an abortion is highly dependent on her acceptance of induced abortion as a means of terminating an unintended pregnancy, the availability of abortion services, and her ability to access these abortion services (AGI 1999). These characteristics vary greatly across countries and even within countries; thus, unwanted pregnancies may be resolved in different ways, depending on the woman's characteristics and the setting. The variation in induced abortion across study settings complicates assessments of the consequences of unintended pregnancy because many of the existing study designs recruit women from antenatal care facilities or ask women to report their pregnancy intentions for recent live births (for example, Demographic and Health Surveys). In both cases, these samples are highly selective, omitting women who do not seek antenatal care and women who terminate their pregnancies.

A second limitation regarding the selection of study participants concerns the use of individuals' versus couples' reports. Historically, surveys have elicited fertility preferences from women because of the primary focus on women within family planning and reproductive health programs. Women have typically been asked to report their own preferences and, in some instances, to report on the perceived preferences of their partner (proxy reports). Despite the acknowledged influence that men have on reproductive decisionmaking (see Ezeh 1993; Lasee and Becker 1997; Bankole and Singh 1998; and Mason and Smith 2000), relatively few studies have collected and incorporated the fertility preferences of both partners.

In the few studies that do collect them, the health consequences associated with unintended pregnancy appear to be more pronounced among children who were considered unwanted by both parents, compared with those whom only one parent reported as unwanted (Frenzen and Hogan 1982; Sangi-Haghpeykar et al. 2005; Shapiro-Mendoza et al. 2005). Another study, however, found no effect on health outcomes when the mothers' proxy reports of fathers' pregnancy intentions were included (Korenman et al. 2002).

Causal Inferences and Unobserved Heterogeneity Biases

Another issue that plagues this research is the problem of establishing causality between unintended pregnancy and subsequent health outcomes. Although a randomized, controlled trial is often considered the "gold standard" with respect to research designs, pregnancy intentions are not something that can be randomly assigned. Moreover, as noted above, women's and men's intentions are likely to change throughout a pregnancy and may be dependent on the birth outcome. Although longitudinal data may provide some inferences about the observed associations, causality is difficult if not impossible to show (Moffit 2005; Ní Bhrolcháin and Dyson 2007).

An additional concern is that both health outcomes and pregnancy intentions may be jointly determined by a single, often unobserved factor. A variety of study designs have attempted to control for both measured and unmeasured confounders between unintended pregnancy and health outcomes. Some of the earliest studies of this issue were conducted in Europe among women who were denied abortion in Sweden and in the Czech Republic (Forssman and Thuwe 1966; David 2006). In these studies, children who were born to these women (considered to be unintended) were matched with intended children with similar sociodemographic characteristics. Other study designs have used twin babies or compared unintended and intended children who are siblings in an attempt to control for measured and unmeasured family characteristics (Rosenzweig and Wolpin 1980; Joyce et al. 2000b; Chalasani et al. 2007). These approaches, however, generally do not provide an easy solution to sorting out causal associations under normal circumstances. Moreover, they rely on data abstracted from specific populations, or segments of the population, limiting the generalizability of the findings.

An important consideration in the measurement of unintended pregnancy is to determine who is affected when a pregnancy or birth is unintended. The effects of unintended pregnancy may extend beyond the index pregnancy or child to other siblings or to parents. In some

contexts, specific children may be considered unwanted according to their sex or birth order (for example, the youngest daughter), and may be particularly likely to suffer neglect or maltreatment (Das Gupta 1987). Although son preference may be the best-documented manifestation of this phenomenon, “differential care can proceed against any less desirable child, as moderated by family circumstances and existing family composition” (Levine 1987:282). In her ethnographic work, Scheper-Hughes (1984:535) describes the conflict that parents and particularly women, as caregivers, face amidst poverty and the increasing pressure of a growing family: essentially, being “cast in the role of family strategists, necessarily allocating scarce resources so that some of their children may be more or less favored for survival.”

In impoverished settings, not only the children but also the mother is likely to be malnourished, so that she has less energy to care for the demands of an increasingly large family (Graves 1976; Scrimshaw and Scrimshaw 1990). Other parental situations related to health could be exacerbated by the occurrence of an unintended pregnancy (for example, intimate partner violence), whereas other conditions (for example, anxiety and depression) may arise as a direct consequence of the unintended pregnancy.

An additional concern in the measurement of the consequences of unintended pregnancy is how the impact of being unintended may be influenced by family size. Desai (1995) analyzed DHS data from 1986–90 for 15 countries to assess siblings’ impact on younger children’s nutritional status (Desai 1995). Findings from this analysis indicated that unintended pregnancy and family size have independent effects on children’s health. Desai found a significant effect of family size among all planned and unplanned families; however, “the negative impact of family size was greater among families which had exceeded their desired size than among families that were planned” (page 208). Overall, Desai’s and others’ findings (for example, those of Lloyd 1994) highlight the importance of considering the potential interaction between family size and pregnancy intention and of accounting for contextual factors, an aspect that has received only limited attention in studies assessing the impact of unintended pregnancy on health outcomes.

Schematic Framework

Figure 1 illustrates the potential pathways by which pregnancy intention may influence health outcomes. A body of literature from both developed and developing country settings has shown that a variety of individual, family, community, and programmatic factors are associated

with the occurrence of an unintended pregnancy (for example, Brown and Eisenberg 1995; Adetunji 1998). Subsequently, an unintended pregnancy may lead to a range of health consequences with respect to maternal behavior during pregnancy, birth outcomes, maternal postpartum behaviors, and infant and child well-being.

As noted in this framework, the impacts of unintended pregnancy may affect health outcomes within one particular time period (for example, the prenatal period). The health impacts of unintended pregnancy may also be persistent and cumulative, extending into childhood.² Additionally, the framework includes the potential for deleterious health outcomes of unintended pregnancies for the index children, their siblings, and their parents.

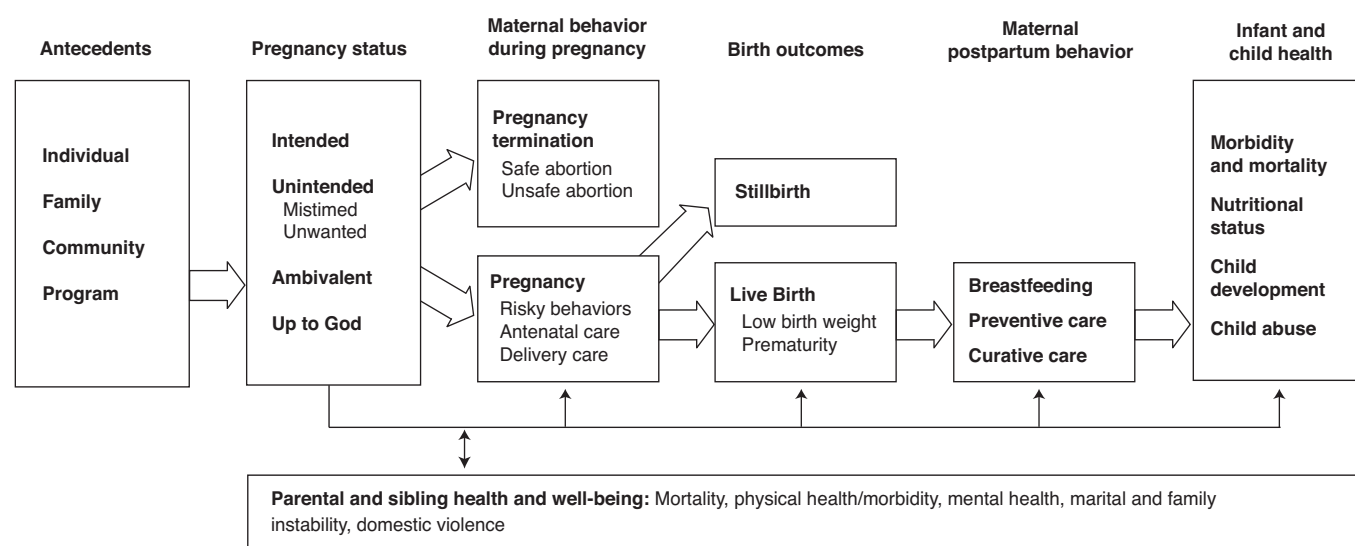
Consequences of Unintended Pregnancy: A Review of Studies

Maternal Behavior During Pregnancy

A few developed country studies have found a positive association between unintended pregnancies and maternal risk behaviors, including alcohol and illicit drug use, cigarette smoking, and caffeine intake (Weller et al. 1987; Altfeld et al. 1997; Than et al. 2005). Most studies, however, have found mixed or no effects (McCormick et al. 1987; Marsiglio and Mott 1988; Bitto et al. 1997; Hellerstedt et al. 1998; Kost et al. 1998b; Rubin and East 1999; Joyce et al. 2000a and 2000b; Korenman et al. 2002; Wells et al. 2006). Two population-based studies by Joyce and his colleagues (2000b) and Korenman and his colleagues (2002) analyzed data from the National Longitudinal Survey of Youth (NLSY) (1979–92), finding mixed effects of pregnancy intention on maternal behavior. The Joyce study first employed cross-sectional models to compare unintended with intended pregnancies and fixed-effects models to compare unintended and intended pregnancies from the same family to control for family-background variables that could confound the relationship between pregnancy intention and maternal behavior. Although significant associations were found between unintended (unwanted and mistimed) pregnancies and heavy smoking in the cross-sectional models with exogenous controls, these effects diminished in models that controlled for potentially endogenous variables and in the fixed-effects models.

Korenman and his colleagues (2002) used the same data from the NLSY; however, they incorporated the woman’s report of her partner’s fertility preference in the analyses. They found no significant effects of having an unintended pregnancy on maternal risk behavior among

Figure 1 Potential effects of unintended pregnancy on infant, child, and parental health outcomes



unmarried women. Among married women, they found significant effects for smoking during pregnancy when either the woman or her partner reported the pregnancy as unintended, but this relationship disappeared in the fixed-effects model.

Kost and her colleagues (1998b) explored the relationship between maternal risk behaviors and pregnancy intention in the 1988 National Maternal and Infant Health Survey and the 1988 National Survey of Family Growth. After adjusting for pregnancy intention, women's characteristics, and pregnancy experience, they found no significant effects for alcohol or vitamin use or for recommended weight gain. Significant effects of smoking behavior were limited to women reporting mistimed pregnancies; these women were 26 percent less likely to quit smoking during pregnancy, compared with women who had intended pregnancies.

The evidence from three large, rigorous studies conducted in the United States suggests that maternal risk behaviors are not strongly related to pregnancy intention, once family-background variables are controlled. Research from other countries is needed, however, to assess whether the effects of pregnancy intention on maternal risk behaviors vary by context.

Antenatal and Delivery Care

Numerous United States and European studies have found a significant positive association between pregnancy intention and delayed initiation of antenatal care and/or decreased number of antenatal care visits (Weller et al.

1987; Marsiglio and Mott 1988; Sable et al. 1990; Bitto et al. 1997; Delgado-Rodriguez et al. 1997; Kost et al. 1998b; Hulsey et al. 2000; Joyce et al. 2000a; Pagnini and Reichman 2000; Korenman et al. 2002; Sangi-Haghpeykar et al. 2005). Inconsistent or no effects were found in a few studies, however (Joyce and Grossman 1990; Altfeld et al. 1997; Joyce et al. 2000b). Comparisons among studies are complicated by the variety of ways in which antenatal care is measured: whether the woman sought any antenatal care, whether she initiated care before the first or second trimester, or whether she obtained a certain number of visits.

The three United States studies reviewed concerning maternal risk behaviors also considered pregnancy intention and antenatal care. Joyce and his colleagues' analysis (2000b) of NLSY data showed significant effects between intentions and antenatal care in cross-sectional models, but these effects diminished once observed family-background variables and fixed-effects models were used. Marginally significant effects were found indicating that women with unwanted pregnancies were more likely to receive later antenatal care (at six months' or longer gestation), compared with women who experienced wanted pregnancies. Korenman and his colleagues (2002) found more persistent effects on antenatal care. Using fixed-effects modeling, they found that unmarried women who had an unintended pregnancy (according to the woman or her partner) were nearly two times more likely than unmarried women with a wanted pregnancy to delay seeking antenatal care until after the first trimester. Among married women, the effects found for delayed ini-

tiation of antenatal care among women with unintended pregnancies diminished in the fixed-effects models, with a marginally significant association between unintended pregnancy and late initiation of antenatal care (after the first trimester).

The study by Kost and her colleagues (1998b) found that women with unintended (mistimed and unwanted) pregnancies were less likely to recognize their pregnancies within the first six weeks, and were significantly less likely than women with wanted pregnancies to obtain an antenatal care visit in the first eight weeks of pregnancy, after controlling for recognition of the pregnancy (odds ratio [OR] = 0.69 for mistimed; OR = 0.67 for unwanted). Despite delays for first antenatal care visits, no significant difference was found in the total number of antenatal care visits that women with unintended pregnancies received, compared with women having intended pregnancies. Kost and her colleagues highlighted the importance of controlling for women's recognition of pregnancy in assessing the impact of pregnancy intention on antenatal care adherence. The inability to distinguish a significant difference in the number of visits after controlling for recognition of the pregnancy suggests that women with unintended pregnancies may not seek antenatal care as early as do women with intended pregnancies, either because of late recognition of the pregnancy or because they delay in deciding whether to terminate the pregnancy. At least within the United States, however, women who continue with their pregnancies appear to be equally compliant in terms of seeking the adequate number of antenatal care visits.

Developing country studies on pregnancy intention and antenatal care have yielded inconsistent results. Some studies have found a positive association between unintended pregnancy and antenatal or delivery care (Eggleston 2000; Magadi et al. 2000), and others have found no association or mixed effects (Ni and Rossignol 1994; Gage 1998; Marston and Cleland 2003). Most of these studies were based on DHS data and, therefore, relied on women's retrospective recall of the timing of their antenatal care visits and on their retrospective assessments of pregnancy intention.

Two studies using DHS data from sub-Saharan Africa explored the relationship between pregnancy intention and initiation of antenatal care and total number of antenatal visits. Data from Kenya showed that women experiencing unwanted or mistimed births had, on average, fewer antenatal care visits and were more likely to delay the timing of the initial visit than women with wanted births (Magadi et al. 2000). In contrast, DHS data on premarital childbearing in Kenya and Namibia found no significant relationship between pregnancy intention

and initiation of antenatal care within the first trimester (Gage 1998).

In a more recent five-country DHS study by Marston and Cleland (2003), the effect of pregnancy intention was assessed for four health outcomes for births occurring three to five years prior to the survey, including receipt of antenatal care before the sixth month of gestation. In Peru and the Philippines, women experiencing unwanted pregnancies were significantly more likely to delay antenatal care (Peru: OR = 1.39; 95 percent confidence interval [CI]: 1.24–1.56; the Philippines: OR = 1.21; 95 percent CI: 1.01–1.46); Egyptian women with unwanted pregnancies were significantly less likely, however, to delay antenatal care (OR = 0.79; 95 percent CI: 0.66–0.95), compared with women with wanted pregnancies. Mistimed births were also associated with a significantly higher risk of late antenatal care in Kenya, Peru, and the Philippines. The authors subsequently compared the regression results from all births and from births of parity three and higher, finding that "birth order [had] a stronger and more pervasive influence than wantedness" (page 91). They argued that to assess adequately the effect of pregnancy intention on health outcomes, the interaction of birth order and family size must be considered.

Eggleston (2000) used retrospective, cross-sectional data from the 1994 Ecuador Demographic and Maternal Child Health Survey (ENDEMAIN) to assess the impact of mistimed and unwanted pregnancy on three measures of antenatal care: any antenatal care, initiation of antenatal care within the first trimester of pregnancy, and receipt of the recommended number of visits (four or more, according to World Health Organization guidelines). After controlling for sociodemographic characteristics, mothers with unwanted pregnancies were significantly less likely to have received antenatal care (OR = 0.68; 95 percent CI: 0.57–0.82), less likely to have initiated antenatal care in the first trimester (OR = 0.75; 95 percent CI: 0.60–0.92), and less likely to have received an adequate number of antenatal care visits, compared with women who reported wanted pregnancies (OR = 0.71; 95 percent CI: 0.57–0.89). No effects were found for mistimed pregnancies, however.

In general, findings from the developing country studies indicate that pregnancy intention affects both the initiation and the frequency of antenatal care visits, but as indicated by the five-country DHS study, the effects are likely to vary according to country context. Lessons learned from the United States studies, including the need to control for pregnancy recognition and to employ more sophisticated modeling, have yet to be widely incorporated. Moreover, most studies continue to rely on retrospective measures of pregnancy intention.

Birth Outcomes

An extensive literature exists on the effect of unintended pregnancy on birth outcomes in developed countries. Although some United States and European studies have found an increased risk of congenital anomalies, spontaneous abortion, premature delivery, and low birth weight among unwanted pregnancies (Blomberg 1980d; Sable et al. 1997; Kost et al. 1998a; Orr et al. 2000; Sable and Wilkinson 2000), other studies have found mixed results (Keeton and Hayward 2007; Mohllajee et al. 2007), or weak or nonsignificant associations (Matějček et al. 1978; Blomberg 1980a and 1980c; Laukaran and van den Berg 1980; Marsiglio and Mott 1988; Bitto et al. 1997; Joyce et al. 2000b; Ahluwalia et al. 2001; Korenman et al. 2002).

In the study by Joyce and his colleagues (2000b), the authors assessed the effect of pregnancy intention on low birth weight, finding only marginally significant effects in cross-sectional models for unwanted births after controlling for exogenous variables (for example, the child's sex and maternal race, education, and residence), and no significant effect in fixed-effects models. In their analysis comparing families with and without unintended births, small but significant effects of pregnancy intention on low birth weight were found for mistimed births. In the study by Korenman and his colleagues (2002), after controlling for covariates including maternal characteristics and birth order, the authors found no effect of pregnancy intention on birth weight. In another study, Kost and her colleagues (1998a) analyzed data from the National Maternal and Infant Health Survey (NMIHS) and the National Survey of Family Growth (NSFG) to assess the effect of pregnancy intention on birth outcomes and infant care. The authors constructed a summary variable of adverse birth outcomes: prematurity, low birth weight, and infant's small size for gestational age. Mothers with unwanted births had higher odds of having one or more adverse birth outcomes, after controlling for physical and socioeconomic characteristics. When the mother's behaviors during pregnancy, such as smoking, alcohol use, and antenatal care, were added to the model, however, the effect of pregnancy intention disappeared, indicating that the relationship between pregnancy intention and health outcomes is mediated by the antenatal maternal behaviors. Overall, these more rigorous United States studies point to weak or no effects of pregnancy intention on birth outcomes.

Findings for birth outcomes were mixed from the matched case-control studies in Europe (Czech Republic, Finland, and Sweden). In the Czech (Matějček et al. 1978; David 2006) and Swedish (Hook 1963; Blomberg 1980a and 1980c) studies, children born to women who applied

for and were refused therapeutic abortion were matched with "wanted" children and mothers of similar sociodemographic characteristics. These studies found no effect of being unwanted on birth outcomes. The Finnish study (Myhrman 1988) recruited women who sought antenatal care in two northern provinces and followed the children who resulted from unintended pregnancies (1966–82). Children born to mothers who considered their pregnancies to be unwanted were later matched with children from wanted pregnancies according to sociodemographic characteristics. This study, in contrast to the Czech and Swedish studies, found that children resulting from unwanted pregnancies were more likely to be of low birth weight and to be born prematurely than were children who were wanted.

In the only developing country study, ENDEMAIN data in Ecuador were used to examine the association between unwanted pregnancy and the risk of low birth weight (Eggleston et al. 2001). After controlling for pregnancy and delivery characteristics and sociodemographic characteristics, low birth weight ($\leq 2,500$ grams) was found to be significantly more frequent among births that were considered unwanted (OR = 1.64; 95 percent CI: 1.22–2.20); this association was not found for mistimed births, however. An important caveat to this study is that birth weight was determined by means of the mother's self-report and intentions were measured based on cross-sectional retrospective reports.

Maternal Postpartum Behavior

Breastfeeding

Nearly all United States and European studies assessing the effect of pregnancy intention on breastfeeding have concluded that children who are born from unintended pregnancies are less likely to be breastfed or are more likely to be breastfed for a shorter duration, compared with children whose birth was intended (Matějček et al. 1978; Kost et al. 1998a; Joyce et al. 2000b; Korenman et al. 2002; Taylor and Cabral 2002). Only one exception to this finding was observed, in an analysis of primiparous women aged 19–27 who participated in the 1979 National Longitudinal Survey of Labor Market Experience of Youth (Marsiglio and Mott 1988). Even in studies in which fixed-effects models were employed to compare unwanted with wanted siblings within the same family, unwanted siblings were significantly less likely to be breastfed, after controlling for other sociodemographic characteristics (Joyce et al. 2000b; Korenman et al. 2002). Using couple data concerning pregnancy intention, Korenman and his colleagues found that both married and unmarried wom-

en with unintended pregnancies were much less likely to breastfeed, compared with women whose pregnancies were intended.

In an analysis of DHS data from 18 countries, Hromi-Fiedler and Pérez-Escamilla (2006) assessed whether women with unintended pregnancies were less likely to engage in prolonged breastfeeding (for 13 to 36 months). In the within-country analyses, they found a negative effect of unintended pregnancy on prolonged breastfeeding in only three of the 18 countries; in the pooled data analysis, however, they found that women with unintended pregnancies were 10 percent less likely to continue breastfeeding beyond the first year of life (OR = 0.90; 95 percent CI: 0.85–0.96). A handful of other developing country studies found that women with unplanned pregnancies were less likely to breastfeed and to continue breastfeeding, compared with women with planned pregnancies (Pérez-Escamilla et al. 1999; Berra et al. 2001; Chinebuah and Pérez-Escamilla 2001). Again, these studies generally rely on cross-sectional data with retrospective self-reports on pregnancy intention and breastfeeding duration. Differences in the classifications of pregnancy-intention groups (for example, “unplanned” versus “unintended”) further complicate the comparison of these studies.

Preventive and Curative Care

No effects were found in the few studies assessing the association between pregnancy intention and well-baby care, child immunization, or curative care in the United States and Europe (Matějček et al. 1978; Marsiglio and Mott 1988; Rosenzweig and Wolpin 1993; Kost et al. 1998a; Hulsey et al. 2000). Marsiglio and Mott (1988) focused on young primiparous women who participated in the NLSY, finding no significant effects of pregnancy intention on breastfeeding or well-baby care in multivariate models. For Kost and her colleagues (1998a), the analysis of the infant care variables revealed that, after controlling for physical and socioeconomic characteristics, birth outcome, and pregnancy behaviors, mothers who considered their pregnancies to be unwanted were no less likely than mothers with wanted pregnancies to seek well-baby care within three months.

Published studies from developing countries in this area are limited. The five-country DHS analysis by Marston and Cleland (2003) found significantly higher risks of incomplete child vaccination by one year of age for mistimed births in Egypt (OR = 1.40; 95 percent CI: 1.08–1.82) and for unwanted births in Kenya (OR = 1.60; 95 percent CI: 1.12–2.28) and Peru (OR = 1.24; 95 percent CI: 1.09–1.41). Similar to their findings on antenatal care, the authors found that higher-order births were more disadvantaged with respect to health outcomes; they found no

difference in outcomes by sex of the child, however. No significant effects were found for the other two countries in the analysis, Bolivia and the Philippines.

Two studies by Jensen and Ahlburg assessed the effect of pregnancy intention on the incidence and treatment of acute respiratory infection and diarrhea. In their study using DHS data from 11 countries and one Indian state, the authors found that unwanted children were more likely than wanted children to become ill; once they were ill, however, unwanted and wanted children were equally likely to be taken for treatment (Jensen and Ahlburg 1999). Their later study, conducted with data from the 1991 Indonesia DHS, found that unwanted children were more likely to become ill and less likely to receive treatment, compared with wanted children (Jensen and Ahlburg 2002).

Overall, studies conducted in the United States indicate no effect of unintended pregnancy on preventive and curative care, whereas findings from developing countries find mixed effects. Children resulting from unintended pregnancies may be disadvantaged with respect to vaccinations, illness, and curative care; these effects seem to be highly context specific, however.

Infant and Child Health

Infant and Child Mortality

Some of the earliest evidence on the effects of pregnancy intention on child mortality—most notably, elevated mortality risk for female offspring—comes from societies characterized by a strong preference for sons. Excess female mortality during early childhood has been reported in a number of South Asian countries in terms of absolute mortality differences (D’Souza and Chen 1980; Dyson and Moore 1983; Koenig and D’Souza 1986) and relative differences, after adjusting for the biological survival advantage of females (Hill 1995). Further support for selective mortality among female offspring comes from a study conducted in the Punjab, India, which found that sex bias in survival was not generalized; rather, it was pronounced only among higher-order female births (Das Gupta 1987). More recent evidence has documented the continued differential treatment of sons and daughters, as well as the increased use of sex-selective abortion in some regions of the world (Arnold et al. 2002; Hesketh and Xing 2006). In a band of countries from East Asia through South Asia to the Middle East and North Africa, discrimination against females—through sex-selective abortion, female infanticide, abandonment of newborn girls, and neglect of daughters through differential allocation of food and care-seeking behavior—has resulted

in severely imbalanced sex ratios (Li 2004; Yount 2004; Hesketh and Xing 2006).

Evidence of the direct relationship between unintended childbearing and childhood mortality is derived from studies from both the developed and developing world. Two longitudinal studies in the United States (1959–66) followed a cohort of married, pregnant women in San Francisco who were enrolled in a particular health maintenance organization. Although the authors used limited control variables, the results indicated adverse outcomes for births that occurred to women who felt “negative” about their pregnancies, including increased risk of neonatal mortality (Bustan and Coker 1994: RR = 2.4; CI: 1.5–4.0; Laukaran and van den Berg 1980: RR = 1.80 [$p = 0.003$] and RR = 1.78 [$p = 0.002$]). The findings from these studies should be interpreted cautiously; the analytical models do not control for the mother’s health status, nor is an attempt made in these studies to explain the intervening mechanisms that may have led to higher mortality rates for children from unwanted pregnancies. These findings, particularly among a “low-risk” cohort of women with health insurance who received early prenatal care, warrant further investigation into the potential association between unintended pregnancy and infant death.

Several developing country studies have assessed the direct effects of pregnancy intention on child mortality. Frenzen and Hogan (1982) analyzed data collected through the Northern Thailand Fertility Study in the Chiang Mai and Chiang Rai provinces (1976–77). Ever-married women aged 15–44 ($N = 1,921$) and husbands ($N = 1,615$) provided information on pregnancy and contraceptive history and on individual and family-level sociodemographic characteristics. Births reported as wanted by one or neither parent experienced significantly higher risks of infant mortality (OR = 1.15), after controlling for a substantial number of sociodemographic characteristics. As a consequence, however, of the cross-sectional design of this study and the simultaneous ascertainment of both infant death and pregnancy intention, these findings may be affected by recall bias and also should be interpreted cautiously.

Montgomery and his colleagues (1997b) analyzed retrospective DHS data from five developing countries to assess the effects of unintended fertility (births considered to be either unwanted or mistimed at the time of conception) and excess fertility (when a woman’s parity at the time of the survey exceeded her reported ideal family size). The multivariate models controlled for children’s characteristics, parents’ characteristics, and cluster characteristics (for example, access to health-care facilities, size of cluster, and so forth). The authors found

that in three of the countries (Egypt, the Philippines, and Thailand), babies born to women who reported excess fertility at the time of the DHS survey experienced higher neonatal and postneonatal mortality. The retrospective measure of unintended fertility, in contrast, showed weak or inconsistent effects on mortality.

Surveillance data from rural Bangladesh were used to investigate the relationship between pregnancy intention and childhood mortality among a sample of 9,869 births that occurred over the 1982–93 period (Montgomery et al. 1997a). The authors found no significant relationship between pregnancy wantedness and childhood mortality. The authors noted, however, that focusing on an intermediate outcome of child mortality (that is, postneonatal mortality) might have affected the results by separating the effect of birth interval from the effect of pregnancy wantedness on mortality.

Chalasani and colleagues (2007) address this concern by assessing the impact of child wantedness on neonatal, postneonatal, and early childhood death in their analysis of longitudinal surveillance data from the Maternal-Child Health Extension Project (1982–2002) in rural Bangladesh. Fixed-effects models were used to compare unwanted and wanted siblings within families. The authors assessed the effects of (1) sex-specific unwantedness, based on mother’s prospective reports of a specific preference for a male or female child, and (2) general unwantedness, based on whether the woman wanted another child at all. They find higher odds of neonatal (OR = 1.30) and postneonatal (OR = 2.08) mortality among children who were unwanted because they were the “wrong” sex. The additional negative effect of being “excess quantity” was apparent in the neonatal case (OR = 1.72). Lastly, the authors conducted a natural experiment analysis on a subset of women who indicated a desire for additional children of one sex but not the other, assuming that desire for a child of a specific sex was not conditional on the number or sex composition of existing children. The natural experiment analysis, however, found no significant effect on any of the mortality outcomes.

Overall, the existing evidence for child mortality suggests a disadvantage for unintended children. The study by Chalasani and colleagues, indicating that unwanted infants may be significantly more likely to die in the neonatal or postneonatal periods than wanted infants, is remarkable in light of its rigor in incorporating prospective measures of pregnancy intention, employing longitudinal data, and using fixed-effects analyses of siblings’ outcomes. Future studies are needed, however, to assess this relationship in other settings and to explore further the mechanisms through which unintended pregnancy may result in the increased risk of infant mortality.

Nutritional Status

Studies focusing on nutritional status are generally conducted in developing countries, where malnutrition remains a major problem. Stunting can be caused by chronic malnutrition or repeated illness, or both, and is typically measured by comparing the child's height-for-age to international standards. Marston and Cleland (2003) found that stunting was 15 percent more likely for children born as a result of unwanted pregnancies in Peru (OR = 1.15; 95 percent CI: 1.02–1.29) but significantly less likely for children born as a result of both mistimed and unwanted births in Egypt (mistimed OR = 0.81; 95 percent CI: 0.68–0.96; unwanted OR = 0.84; 95 percent CI: 0.71–0.99). In the DHS analysis by Montgomery and his colleagues (1997a), excess and unwanted fertility were found to be associated with significantly lower height-for-age in only one of the five countries studied, the Dominican Republic. A recent study using data from the 1998 Bolivia DHS also found that children aged 12–35 months who were considered to be either mistimed or unwanted were approximately 30 percent more likely to be stunted, compared with wanted children (Shapiro-Mendoza et al. 2005).

Child Development

All of the identified studies assessing the impact of pregnancy intention on child development before the age of five have been conducted in the United States. An additional set of studies have looked at long-term effects of pregnancy intention on development in later childhood, adolescence, and early adulthood; these studies are not reviewed here (Forssman and Thuwe 1966 and 1981; Myhrman 1988; Axinn et al. 1998; Barber et al. 1999; Joyce et al. 2000b; David 2006).

Baydar (1995) analyzed data from a sample of 1,327 mothers and their children (younger than two) who participated in the National Longitudinal Survey of Youth. Children's resources and developmental outcomes (for example, motor and social development, vocabulary, attachment) were assessed at two time points (1986 and 1988) according to their wantedness status. Although the bivariate results indicated disadvantages for unwanted and mistimed children, these effects mostly diminished once family-environment characteristics were included in the model. The only significant finding from the multivariate models was that children resulting from mistimed pregnancies experienced less favorable (that is, nonauthoritarian) parenting styles, compared with those resulting from wanted pregnancies.

Hummer and his colleagues (2004) and Crissey (2005), using nationally representative data from the 1988 National Maternal and Infant Health Survey and the 1991

Longitudinal Follow-Up, found mixed effects of pregnancy intention on maternal reports of child health, activity level, and overall development. Because of the scarcity of studies that have assessed child development as associated with pregnancy intention, further research in this area is warranted and would benefit from the inclusion of objective measures of child development and sufficient control of potentially confounding variables in the causal pathway.

Child Abuse and Violence

Assessments of the impact of pregnancy intention on subsequent child abuse and violence are limited; only a handful of studies have been conducted in the United States, Europe, and Japan, and no studies identified from developing country settings have examined this relationship. The developed country studies suggest a positive association between unintended pregnancy and child abuse (Hunter et al. 1978; Zuravin 1987 and 1991; Sidebotham et al. 2003; Goto et al. 2005 and 2006), with one exception (Zuravin 1988).

The only population-based study, conducted by Sidebotham and his colleagues (2003), analyzed data from the Avon Longitudinal Study of Parents and Children in the United Kingdom for 14,256 children. In addition to information on hospital admission, infant health and development, and child characteristics, the pregnancy intention of the mother was ascertained at 12 weeks' gestation. Children from the cohort who were registered with the child protection agency by the age of six ($n = 115$) were nearly three times more likely than others to have resulted from a pregnancy that the mother considered to be unintended (OR = 2.92; 95 percent CI: 1.83–4.64), after controlling for birth weight, child health, developmental problems, and reported positive attributes of the child.

Because the existing studies on the relationship between pregnancy intention and subsequent child abuse are extremely limited in number and geographic focus, additional population-based, longitudinal studies from other countries are needed to foster a better understanding of this association.

Parental Health and Well-being

Maternal Mortality

Each year an estimated 529,000 maternal deaths occur throughout the world (Ronsmans and Graham 2006). Many factors contribute to maternal mortality, including poor maternal nutrition, deficient health systems, and a lack of skilled providers. The highest risk of death is with-

in impoverished developing country settings, where one in six women will die as a result of pregnancy or childbirth (Ronsmans and Graham 2006). Although very few studies (for example, Ni and Rossignol 1994 and Czeizel et al. 1999) have directly investigated whether unintended pregnancies increase the risk of maternal mortality, an association is suggested by the following observations. First, every pregnancy brings increased exposure to the risk of maternal death; thus, every unintended pregnancy, but particularly those in high-maternal-mortality settings, subjects the woman to a life-threatening event not of her choosing. Second, unintended pregnancies are more likely to be of higher parity and/or to be experienced by very young or older women, for whom the risks of maternal death are inherently greater (Campbell and Graham 2006). A recent analysis by the Guttmacher Institute and UNFPA found that by averting the 52 million unintended pregnancies that occur worldwide each year, 22 million induced abortions, 1.4 million infant deaths, and 142,000 maternal deaths could also be prevented (Singh et al. 2003).

Unsafe Abortion

According to estimates from the Guttmacher Institute, 210 million pregnancies occurred worldwide in 1999, of which 22 percent were terminated by means of induced abortion (AGI 1999). Although induced abortion is a relatively common means of terminating an unintended pregnancy, one in four of the world's women live in countries that ban the procedure or permit it only to save the woman's life.

Differences in legal status, accessibility, and provision of abortion and postabortion services result in substantial variation in the risks of abortion to maternal health in different settings. In the United States, induced abortion results in an estimated 50 deaths per 100,000 procedures, compared with 100–1,000 deaths per 100,000 procedures in developing countries (the number varies depending on the safety of procedure used, the severity of complications, and the woman's access to postabortion care) (Ahman and Shah 2004). According to estimates from 1995, 26 million legal and 20 million illegal abortions were performed worldwide; nearly all unsafe abortions occurred in developing countries (Henshaw et al. 1999; Ahman and Shah 2004).

An estimated 74,000 women die every year from unsafe abortion (UNFPA 2007); these procedures account for 13 percent of all maternal deaths worldwide and are responsible for an estimated five million person-years of productive life lost due to death and illness (Singh et al. 2003; Ahman and Shah 2004; Grimes et al. 2006).

Morbidity is a far more common consequence of unsafe abortion, manifested both in short-term and potentially long-term complications. An estimated 20–30 percent of unsafe abortions result in reproductive tract infections, of which 20–40 percent result in infection of the upper reproductive tract and infertility (Ahman and Shah 2004). Long-term complications include infertility, chronic infections, and risks to subsequent pregnancies. An estimated 2 percent of women of reproductive age become infertile as a result of unsafe abortion, and 5 percent suffer from chronic infections (Ahman and Shah 2004).

Maternal Mental Health

Evidence suggests a link between unintended childbearing and a significantly increased risk of maternal depression (Najman et al. 1991; Barber et al. 1999; Lara et al. 2006; Nakku et al. 2006; Lau and Keung 2007), of anxiety (Najman et al. 1991), and of a decline in psychological well-being or psychosocial conditions (Laukaran and van den Berg 1980; Hardee et al. 2004). The evidence, however, especially from developing countries, is limited.

Barber and her colleagues (1999) used longitudinal data from the National Survey of Families and Households to examine maternal depression, happiness, and overall perception of health. After controlling for maternal characteristics, total number of children in the family, and presence in the household of a child aged 5–18, mothers who had experienced any unwanted births reported higher levels of depression and lower levels of happiness; no effects on physical health were found, however. The authors also found that mothers who had experienced unwanted births were more likely to spank or slap their children and to have spent less leisure time with them, compared with other mothers. These negative outcomes were significantly exacerbated by the mother's mental health status: mothers with unwanted births who were also depressed were even more likely to have negative outcomes.

Najman and colleagues (1991) found significantly higher rates of anxiety and depression among a sample of Australian mothers when measured at three timepoints—before, shortly after, and six months after the birth of a child from an unwanted pregnancy—after controlling for mother's age, income, marital status, and parity. No measure was available for the mental health status of mothers prior to the pregnancy, however, indicating that these conditions may have preceded the unwanted pregnancy.

In the only developing country study identified, Hardee and her colleagues (2004) assessed psychosocial well-being in Indonesia among women with and without unintended pregnancies. Women were grouped into three clusters, according to their scores on five scales of

psychosocial well-being. After controlling for sociodemographic variables, the authors found that women who had reported ever experiencing an unintended pregnancy were nearly three times more likely to be in the low well-being than in the high well-being cluster (OR = 2.8; 95 percent CI: 1.5–5.1)

In light of the paucity of studies investigating the impact of unintended pregnancy on psychosocial health and well-being, and their limitations in terms of establishing causality, the existing research should only be considered to be suggestive of such an impact.

Childrearing and Domestic Violence

Some studies have found unwanted pregnancy to be associated with increased risks of negative childrearing outcomes and parenting difficulty (Goto et al. 2005 and 2006), and physical abuse and violence (Gazmararian et al. 1995; Goodwin et al. 2000; Lau 2005), although the studies are few and are unable to determine causality as a result of their design or the inclusion of limited control variables. Goto et al. (2006) surveyed women in Japan during their pregnancies and at six weeks postpartum to determine whether unintended pregnancy was associated with childrearing outcomes. Although their multivariate analyses indicated that mothers of unintended children were more likely to report lower mother-to-child attachment, increased negative feelings of mothers, and a lower level of participation by fathers in childrearing, their sample size was relatively small, especially for the follow-up (N = 140), and likely to be highly select.

The relationship between pregnancy intention and physical violence was assessed in two studies using US data from the Pregnancy Risk Assessment Monitoring System (PRAMS). In the Gazmararian et al. (1995) and Goodwin et al. (2000) studies, the authors found higher odds of physical abuse among women who reported retrospectively that their most recent pregnancy was unintended. Several limitations of both studies are noted by the authors, however, including their inability to establish the direction of causality between pregnancy intention and physical abuse, as well as the exclusion of women with non-live birth outcomes.

In a study of Chinese women in Hong Kong, Lau (2005) found that women with unplanned pregnancies experienced higher risks of physical and sexual abuse than those having planned pregnancies. Women with unplanned pregnancies were more than two times more likely than those whose pregnancies were planned to experience sexual coercion, after controlling for socioeconomic, demographic, and cultural variables (OR: 2.13; 95 percent CI: 1.18–3.84). Like the studies of maternal mental

health, this study does not control for any history of domestic violence that may have preceded the pregnancy. Moreover, because of the study's cross-sectional design, determining the causal pathway between violence and unintended pregnancy is not possible; domestic violence may have precipitated an unintended pregnancy or may have resulted from an unintended pregnancy.

Conclusions

The existing evidence on the impact of unintended pregnancy on child and parental health outcomes is mixed and is limited by an insufficient number of studies for some outcomes and by the aforementioned measurement and analytical concerns. Differences in the measurement and classification of pregnancy intention further complicate the comparison of studies. Among the studies that incorporated both mistimed and unwanted pregnancies/births, the impact of pregnancy intention on health consequences was inconsistent, with some studies finding unwanted pregnancies particularly disadvantaged (for example, Eggleston 2000) and others finding significant negative effects only for mistimed pregnancies (for example, Gage 1998 and Kost et al. 1998b). These inconsistencies point to the need for improved understanding and measurement of pregnancy intention across study settings. In addition, the broader acknowledgment and incorporation of the degrees of "unintendedness" into analytic models would better represent the heterogeneity of this concept and the severity of associated health outcomes.

Despite a considerable number of studies (often conducted in the United States) on some outcomes, evidence for other outcomes is limited or nonexistent. That so few studies are available from developing country settings is particularly striking, considering that the financial, social, and physical costs of unintended pregnancy are likely to be greater in resource-poor settings. The scarcity of studies on this topic is surprising, given that the prevention of unintended pregnancy has been a major rationale for the funding and provision of family planning, both in the United States and internationally.

The evidence of the impact of unintended pregnancy on abortion-related morbidity and mortality points to the need for primary and secondary prevention efforts. Primary prevention, through the increased provision and use of effective contraceptive methods, can reduce levels of unintended pregnancy. In the event of an unintended pregnancy, secondary prevention efforts can help to ensure safe abortion and postabortion services to prevent

ongoing illness and death for the estimated 46 million women around the world who have abortions each year (AGI 1999).

Among studies that have assessed antenatal care, breastfeeding behavior, and child nutrition, the evidence is relatively consistent, showing a negative effect of unintended pregnancy. The developed country studies found more pronounced effects on the timing, rather than the frequency, of antenatal care and found persistent negative effects on the breastfeeding of children who resulted from unintended pregnancies. For developing countries, the evidence of these outcomes is more limited, yet what evidence there is suggests that the effects of pregnancy intention on antenatal care may be even more severe than it is in developed countries, and that unintended pregnancy also may affect negatively the breastfeeding and nutritional status of children who resulted from unwanted pregnancies.

For other outcomes, such as maternal risk behaviors, pregnancy outcomes, and curative care, developed country studies failed to find a significant association with pregnancy intention; the paucity of studies from developing countries precludes an overall assessment of such an impact. The few existing studies suggest that the children who result from unintended pregnancies may, in fact, be disadvantaged with respect to low birth weight and incomplete vaccinations; additional investigation is needed to substantiate or contradict these findings.

Although studies conducted in developed countries are limited, findings from rigorous developing country studies suggest that children who are the result of unintended pregnancies are at an increased risk of infant mortality, compared with children resulting from intended pregnancies. Consistent evidence shows higher levels of mortality and malnutrition for female children as a result of son preference. Differentiation of the effects of being unintended versus the effect of the child's sex could help to broaden the understanding of differential treatment and underinvestment in children, particularly within developing country settings.

The scarcity of studies on the effects of unintended pregnancy on the physical and mental health of men and women also must be noted. Beyond maternal and abortion-related mortality, relatively few studies have assessed the effects of unintended pregnancy on women's health and well-being. The studies that have been

conducted indicate a positive association between unintended pregnancy and depression, anxiety, and abuse. Several of these studies are cross-sectional, however, and do not include baseline measures of psychosocial well-being. An additional concern is the absence of studies designed to assess the potential consequences to fathers of unintended pregnancies. Because the role of fathers is that of principal or sole wage earner in many contexts throughout the world, the pressure to provide adequately for a family increases with the number of children in the household. Research is needed to assess whether unintended pregnancy results in adverse physical and mental health outcomes for both men and women.

Although they are not reviewed here, a few studies have attempted to measure the long-term social and health impacts on older children, adolescents, and adults that result from unintended pregnancies. As Lloyd and Montgomery (1996) point out in their discussion of the methodological limitations of research on unintended childbearing, the potential long-term and cumulative consequences of unwantedness necessitate longitudinal study designs and a focus on health outcomes beyond the early childhood years. Efforts by Axinn and his colleagues (1998) and Barber and her colleagues (1999) corroborate this argument; their findings of the impact of pregnancy intention into late adolescence and early adulthood suggest that future work in this area is warranted.

In their design and analysis, future studies should incorporate strategies to isolate and to estimate accurately the independent effects of being "unintended" on children's health outcomes. Longitudinal cohort studies provide an opportunity to assess such temporal associations and could provide a means of assessing the cumulative effects of unintended pregnancy. The use of hierarchical models or matched sibling analyses could allow for the comparison of both wanted and unwanted siblings, thereby controlling for both observable and unobservable family-level characteristics.

Although this literature review identifies specific gaps in existing knowledge of the effects of unintended pregnancy, the most recent studies also indicate a shift toward more rigorous methodologies and research designs. Future research in this area must continue to evolve by overcoming methodological limitations and by embracing a broader view of the potential impacts of unintended pregnancy for children and their families.

Appendix

Table A1 Measures of pregnancy intention employed in selected studies

Study	Measure of pregnancy intention
Barber et al. (1999)	"Thinking back to shortly before your recent pregnancy began, did you really want to have a(nother) child sometime, or would you rather not have had any(more)?" Unwanted birth: Mother reported they did not want any additional children. Wanted birth: Mother reported that they wanted at least one (more) child. Any unwanted births: Assessed across study waves if mother had any unwanted births. Mother had more children than she wanted: Compared actual with preferred childbearing, "If you could start life over again, knowing that things would turn out just about the way they have for you and your husband, what number of children would you want to have when your family is complete?"
Baydar (1995)	Wanted pregnancy: One for which the mother had planned or one that she had not planned, but nevertheless had wanted. Mistimed pregnancy: One that occurred at a time the woman would rather have postponed childbearing, whether or not she was practicing contraception. Unwanted pregnancy: One that a woman would have preferred not to have had at any time. (Measured before birth and within 90 days postpartum.)
Bustan and Coker (1994)	"How do you feel about having a baby now?" (asked during first trimester). Unwanted pregnancy: If the woman indicated that she or her husband was unhappy, resentful, or upset about the pregnancy or did not want the pregnancy, or that the pregnancy was mistimed. Accepted pregnancy: If the woman indicated that she and her husband were happy about the pregnancy or stated that they had wanted, accepted, or planned the pregnancy.
Chalasani et al. (2007)	"Do you want any more children?" (overall wantedness). "How many children (of each sex) do you want?" (sex-specific wantedness), asked via periodic surveys before birth of the child.
Eggleston (2000)	"At the time you became pregnant, did you want to become pregnant, did you want to wait until later, or did you not want this pregnancy?"
Frenzen and Hogan (1982)	Was birth wanted by both parents, by only one parent, or by neither parent? (Question not specified).
Gage (1998)	DHS question: "At the time you became pregnant, did you want to become pregnant then, did you want to wait until later, or did you want no (more) children at all?" (Asked of all women who had had a live birth in the preceding five years.)
Hromi-Fiedler and Pérez-Escamilla (2006)	DHS question: Combined mistimed and unwanted into "unintended."
Jensen and Ahlburg (1999)	DHS question: Compared unwanted with wanted/mistimed.
Jensen and Ahlburg (2002)	DHS question: Compared unwanted with wanted/mistimed.
Joyce et al. (2000b)	Same as Baydar (1995). (Women were asked a series of four questions before the birth [29 percent], or within one year of child's birth.) (For approximately 11 percent of the children in the sample, child outcomes were not linked to pregnancy intention questions and were classified as "not determined.")
Korenman et al. (2002)	Same as Baydar (1995). (Mistimed and unwanted pregnancies were combined into one category [unintended] for multivariate analyses.)
Kost et al. (1998a) and (1998b)	Intended births: Births occurring to women who had wanted to become pregnant when they did. Mistimed births: Births occurring to women who had not wanted to conceive at that time but who had wanted to have a child in the future. Unwanted births: Births occurring to women who had not wanted to have any, or any more, children. National Survey of Family Growth measure asks whether, just before the woman became pregnant, she had wanted to become pregnant, would have preferred the pregnancy to occur earlier or later, or had not wanted to be pregnant at all. National Maternal and Infant Health Survey measure asks whether the woman had wanted to become pregnant at the time she conceived, would have preferred it to happen later, or had not wanted to become pregnant ever again.
Laukaran and van den Berg (1980)	"How do you feel about having a baby now?" (asked during first trimester). Wanted pregnancy: Woman gave strong favorable response (delighted, pleased, excited, wanted it, very happy, glad). Unwanted pregnancy: Woman gave strong negative response (unhappy, resentful, upset, did not want).
Magadi et al. (2000)	DHS question
Marsiglio and Mott (1988)	"Was the reason you were not/stopped using any contraceptive methods because you yourself wanted to become pregnant?" If no, "Just before you became pregnant, did you want to become pregnant when you did?" If no, "Did you want a baby, but not at that time, or did you want none at all?" Wanted pregnancy: "Yes" to initial question, or "yes/didn't matter" to second item.
Marston and Cleland (2003)	DHS question
Montgomery et al. (1997a)	DHS question
Montgomery et al. (1997b)	"Do you want any more children?" (overall wantedness). "How many children (of each sex) do you want?" (sex-specific wantedness, asked via periodic surveys before birth of child).
Najman et al. (1991)	Unwanted pregnancy: Women reported negatively to following two items: "How well do the following statements describe how you felt when you found out you were pregnant?" (Likert-scale range: 1–5 for four possible responses: I felt overjoyed, I would have preferred not to become pregnant, I felt unhappy, I felt it was the worst thing that could have happened to me.) "Choose one of the following: I planned to get pregnant at this time. I meant to avoid pregnancy at this time. I wanted to get pregnant at this time. My method of family planning failed."

Table A2 Summary of studies on the health effects of unintended pregnancy

Study	Sample	Outcomes	Significant findings	Comments
Barber et al. (1999)	882 white, married mothers and their children from 1961 Detroit birth records; Intergenerational Panel Study of Mothers and Children (IPSMC); 2,162 white women aged 19+ with at least one child younger than 18 who participated in National Survey of Families and Households (NSFH) (Wave 1) in 1987–88	IPSMC: Parent–child relationships (affection, social support, financial support) NSFH: Mother's health (depression, happiness, overall health), mother–child interaction (leisure time spent with children, frequency of spanking children)	IPSMC: Family-level: unwanted childbearing negatively related to mother–child affection in early adulthood. Women with excess childbearing had significant declines in relationships and gave less social support to adult children. No effect on financial support. NSFH: Mothers with unwanted births had higher levels of depression, lower levels of happiness, less involvement in children's leisure, and were more likely to use physical punishment than other mothers. No effect on physical health.	IPSMC controls: sex of child, mother's age, birth order, total number of children in the family in 1977, parental education, family income, and mother's participation in the labor force. NSFH controls: total number of children in the family, mother's age, mother's education, parental income, whether mother was working outside the home, and whether household included a child aged 5–18.
Baydar (1995)	1,327 mothers with children younger than two in 1986 who participated in the National Longitudinal Survey of Youth (NLSY)	Developmental resources, child developmental outcomes	Mistimed children were more likely to experience authoritarian parenting. No other effects found.	Controls: maternal sociodemographic characteristics, maternal self-esteem, and child's characteristics (sex, age, birth order, low-birth-weight status, at risk of having birth defects).
Bustan and Coker (1994)	8,823 married HMO patients enrolled (1959–66), San Francisco	Fetal, neonatal, and postneonatal death	Unwanted pregnancies had higher neonatal death rate. No effects for fetal or postneonatal death.	Limited controls: mother's age, race, parity, and husband's education only. Excluded couples who had contradictory feelings about the pregnancy.
Chalasani et al. (2007)	21,920 children (n = 3,283 for fixed-effects models; 1,008 sets of siblings) from Maternal-Child Health Extension Project, Bangladesh (1982–2002)	Neonatal, postneonatal, and early childhood mortality	Higher odds of neonatal and postneonatal mortality among children born to mothers who wanted a child of the opposite sex. Higher odds of neonatal and postneonatal mortality among children born to mothers who did not want a child. Children who were “up to God” or not wanted attained less schooling than wanted children.	Controls: sex and birth year of child, birth order, maternal age, parental education, religion, and thana (county). Prospective measurement of overall and sex-specific wantedness. Pregnancy intentions: wanted, “up to God,” and unwanted. Used fixed-effects models of sets of siblings.
Eggleston (2000)	3,988 women aged 15–49, 1994 Ecuador Demographic and Maternal-Child Health Survey	More than 1 antenatal care visit, initiated antenatal care in first trimester, 4+ antenatal care visits	Women with unwanted pregnancies were less likely to: obtain antenatal care, initiate care in first trimester, receive 4+ visits. No effect for mistimed pregnancies.	Controls: maternal age, parity, education, socioeconomic status, geographic region, marital status, and previous use of family planning methods.
Frenzen and Hogan (1982)	1,921 ever-married women (aged 15–44) and 1,615 husbands; Northern Thailand Fertility Study (1976–77)	Infant mortality	Higher odds of infant mortality among births wanted by only one or neither parent.	Controls: social class, maternal education, district development, parents' feelings toward wealth transfer in family, health information, maternal age, parity, birth interval, and year of birth.
Gage (1998)	Women aged 15–49 who participated in 1993 Kenya DHS (n = 3,700) or 1992 Namibia DHS (n = 2,294) and who had a live birth within the past five years	First antenatal care visit at less than three months' gestation, institutional delivery	No effects on initiation of antenatal care. Mistimed births in Kenya were less likely to have institutional delivery.	Controls: education, urban residence, presence of child younger than three, distance to nearest health facility, ethnic group, premarital status, and maternal age.
Hromi-Fiedler and Pérez-Escamilla (2006)	41,353 women who had a live child aged 13–36 months; 18 DHS Surveys (1995–2000)	Mother reported breastfeeding child aged between 13 and 36 months	Women with unintended pregnancies in three countries were less likely to breastfeed for more than 12 months. In pooled analysis, women with unintended pregnancies were less likely to breastfeed for more than 12 months.	Controls: child's age (months), sex, place of residence, maternal employment, parity, maternal age, pregnancy status of the respondent at time of interview, maternal education, and marital status.
Jensen and Ahlburg (1999)	DHS data from 11 countries and one Indian state	Child ill with fever or diarrhea at less than 2 weeks, modern treatment for fever or diarrhea, number of vaccinations received	Wanted children had lower incidence of acute respiratory infection (all countries) and lower incidence of diarrhea (seven countries). No consistent effects on treatment. Wanted children had higher levels of vaccination in countries where vaccination levels are low.	Controls: child's sex and age, maternal education and age, father's education, assets, household facilities, and areal prevalence of disease at cluster level. Assessed children born in the survey window who have at least one surviving sibling. Estimated effects on children and family.
Jensen and Ahlburg (2002)	14,393 children born to women who participated in 1991 Indonesian DHS	Child ill with fever/cough or diarrhea, use of curative care	Unwanted children had higher incidence of illness and lower levels of curative care.	Controls: sex and age of child, number of siblings, maternal age, education of mother and father, household assets and condition, residence, and province mean.

(continued)

Table A2 (continued)

Study	Sample	Outcomes	Significant findings	Comments
Joyce et al. (2000b)	Children born to 3,038 women who had had at least two births and who participated in the NLSY (1979–92)	Initiated antenatal care at more than six months, smoked more than pack a day, low birth weight, ever breastfed, cognitive development, social development	Cross-sectional models (model A): Unwanted and mistimed pregnancies associated with late antenatal care, heavy smoking, lower likelihood of breastfeeding, and negative effects on child development. Fixed-effect, within-mother models (models A and B): Unwanted children less likely to be breastfed; marginal effects on late antenatal care; no effects on child development. Between-family models (model A): Families with unwanted or mistimed pregnancies associated with heavy smoking, lower likelihood of breastfeeding, negative effects on child development (model B): Mistimed pregnancies less likely to result in low-birth-weight child; marginally less likely to be breastfed; negative effects on child development.	Model A (exogenous) controls: child's sex, region, urban residence, mother's race/ethnicity, and characteristics of mother's household when she was 14 years old. Model B (exogenous and potentially endogenous controls): Model A + child's birth order, number of siblings at time of birth, mother's religious attendance, year of child's birth, mother's marital status, Aid to Families with Dependent Children participation in year following the birth, mother's education, age at birth, family income in year following birth, mother's 1980 Armed Forces Qualifications Test (AFQT) score, 1979 self-efficacy (Rotter) score, and 1980 self-esteem score.
Korenman et al. (2002)	Children born to 5,514 married and 2,614 unmarried women who participated in the NLSY (1979–92)	Initiation of antenatal care after first trimester and after second trimester, smoked at all or more than one pack a day during pregnancy, ever breastfed, low birth weight	Cross-sectional models: Unmarried women more likely to initiate antenatal care after first trimester. Married women with unintended pregnancy more likely to initiate antenatal care after first trimester; more likely to smoke; and less likely to breastfeed. Fixed-effects, within-mother models: Unmarried women more likely to initiate antenatal care after first trimester and less likely to breastfeed; marginal effects on antenatal care and breastfeeding for married women.	Controls: undetermined pregnancy intention, region and urban residence, mother's race and ethnicity, child's sex, birth order, year of birth, characteristics of mother's household at age 14, mother's score on the AFQT (1980), and timing of pregnancy-intention report. Mother proxy-reported the father's intention.
Kost et al. (1998a)	9,122 births reported in the 1988 National Maternal and Infant Health Survey and 2,548 births reported in the 1988 National Survey of Family Growth	Any of following: birth < 37 weeks, birth weight < 2,500 grams, > 42 weeks' gestational age weighing < 2,500 grams; well-baby care in first three months, first six months; ever breastfed	No effects on birth outcome when adjusted for pregnancy behaviors. No effect found on well-baby care. Children from unwanted pregnancies less likely to be breastfed (NMIHS). No effect found for NSFG.	Controls: mother's health and sociodemographic characteristics, socioeconomic characteristics, and pregnancy behaviors. Births occurring before 25 weeks' gestation were omitted from small-for-gestational-age analyses. NSFG: self-reported behaviors; NMIHS: self-reported behaviors and infant's birth certificate. Excluded multiple live births.
Kost et al. (1998b)	9,122 births reported in the 1988 National Maternal and Infant Health Survey and 2,586 births reported in the 1988 National Survey of Family Growth	Recognized pregnancy in six weeks, received antenatal care in eight weeks, made recommended number of visits, quit smoking, stopped or reduced use of alcohol, took vitamins, gained weight within five pounds of advice	Mistimed and unwanted pregnancies less likely to receive antenatal care in first eight weeks (NMIHS). No effect on number of antenatal care visits. Women with mistimed pregnancies less likely to quit smoking (NMIHS). No effect for alcohol use, vitamin use, or adequate weight gain.	Controls: maternal age and race/ethnicity, marital status, mother's education, poverty status, received public assistance, worked during pregnancy, number of previous live births, prior negative pregnancy experience, and recognized pregnancy in first six weeks. NMIHS: self-reported behaviors and infant's birth certificate. Excluded multiple live births.
Laukaran and van den Berg (1980)	7,901 live births to married, pregnant Caucasian patients enrolled from 1959 to 1966 in Child Health and Development Study through Kaiser HMO, San Francisco	Perinatal death, congenital anomalies, postpartum hemorrhage or infection, antenatal visit for accidental injury, three or more doses of analgesics, psychosocial conditions, birth outcomes and obstetric complications	Unwanted status associated with increased risk of perinatal death, congenital anomalies, postpartum hemorrhage or infection, antenatal visit for accidental injury, three or more doses of analgesics, and psychosocial conditions. No significant differences in birth weight, duration of gestation, length of labor, or antenatal and intrapartum obstetric complications.	Controls were employed using two models: husband's occupation and parity, and mother's age and parity. Included random-effects models to control for woman-level and community variance.
Magadi et al. (2000)	5,104 births occurring within previous five years to women aged 15–49 who participated in the 1993 Kenya DHS and who received antenatal care	Frequency and timing of antenatal care visits	Women with unwanted or mistimed pregnancies had fewer antenatal visits and delayed first visit.	Controls: maternal sociodemographic variables, preceding birth interval, age at first birth, ideal number of children, use of family planning methods, distance and time to nearest health facility, and birth order.

(continued)

Table A2 (continued)

Study	Sample	Outcomes	Significant findings	Comments
Marsiglio and Mott (1988)	Mothers of firstborn children from 1979 NLSY, reinterviewed in 1984 at age 19–27 (n = 6,015 women)	Antenatal care at less than three months, never smoked during pregnancy, one or no alcoholic drinks per month during pregnancy, ever breastfed, well-baby care at less than one month, weight gain of ≤ 15 or ≥ 50 pounds, low or high birth weight (less than 5.5 pounds; more than nine pounds)	Women with wanted pregnancies more likely to seek early antenatal care, to gain more than 50 pounds during pregnancy, and to have a baby weighing more than nine pounds. No significant effects for alcohol use, smoking, insufficient weight gain, low birth weight, breastfeeding, or well-baby care.	Controls: race/ethnicity, residence at age 14, education of respondent's mother, and age at birth. Restricted to relatively young mothers who did not quickly repeat the childbearing process.
Marston and Cleland (2003)	Women who had live births within five years of marriage and who participated in DHS surveys: Bolivia (1998), Egypt (1995), Kenya (1998), Peru (1996), Philippines (1998)	Received antenatal care at less than six months of pregnancy, supervised delivery, received full vaccination, stunting	Antenatal care: Women with mistimed pregnancies were less likely to receive antenatal care in the first six months of pregnancy (Kenya, Peru, Philippines). Women with unwanted pregnancies were less likely (Peru, Philippines) and more likely (Egypt) to receive antenatal care in the first six months of pregnancy. Supervised delivery: Women with unwanted pregnancies were more likely (Egypt) and less likely (Peru) to have a supervised delivery. Full vaccination by one year: Children who resulted from mistimed pregnancies were more likely to have their full vaccinations (Egypt). Children who resulted from unwanted pregnancies were less likely to have their full vaccinations (Kenya, Peru). Stunting: Children who resulted from mistimed pregnancies were less likely to be stunted (Egypt). Children who resulted from unwanted pregnancies were less likely to be stunted (Egypt) and more likely to be stunted (Peru).	Controls: birth order, maternal education, household wealth, type of residence, ethnic group, language, and region (sex/age of child added for postnatal outcomes). For multiple births, only firstborn child is included. Vaccination and growth data are available only for those children who survived one year.
Montgomery et al. (1997a)	9,869 children from demographic surveillance households in rural Bangladesh (1982–93)	Child survival 0–5 years	Unwantedness was not associated with child mortality.	Controls: child sex, birth order, parity, mother's education, father's education, family background (house size, assets, religion), thana (county), and time period.
Montgomery et al. (1997b)	DHS data from Dominican Republic (1991), Egypt (1988), Kenya (1993), Philippines (1993), and Thailand (1987)	Child survival 0–5 years, nutritional status	Excess fertility was associated with higher mortality (Egypt, Philippines, Thailand); excess and unwanted fertility was negatively associated with height-for-age (Dominican Republic only). Child-specific variables of excess fertility had weak or inconsistent effects.	Controls: child characteristics (sex, age, birth interval, birth order, parity, twin, premature, antenatal care, tetanus vaccination), parents' characteristics (mother's age at birth, mother's schooling, union status, spouse's schooling, standard of living index, index squared), and cluster characteristics (cluster size, distance to and number of hospital/health center[s], number of health services provided at health centers, community has health worker/trained midwife/mobile health clinic).
Najman et al. (1991)	6,642 pregnant women enrolled at first antenatal-care visit and followed postpartum (1981–84; Mater-University of Queensland Study of Pregnancy)	Anxiety, depression	Anxiety and depression were associated with unwanted pregnancy.	Controls: mother's age, income, marital status, and parity. Lack of measurement of mental health prior to pregnancy.

Notes

- 1 The exception among the reviewed studies is the measure employed by Bustan and Coker (1994) and Laukaran and van den Berg (1980), in which women were asked, "How do you feel about having a baby now?" The participants' responses were noted and coded in seven distinct categories, ranging from "strongly favorable" (for example, delighted, pleased) to a "negative response" (for example, unhappy, resentful).
- 2 Health outcomes for children until age five are addressed in this review; however, some evidence suggests that the cumulative effects of unintended pregnancy may persist into adolescence and early adulthood (Hook 1963; Blomberg 1980b; Myhrman 1988; David 1992; Axinn et al. 1998; Barber et al. 1999).

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