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The burden of unintended pregnancies in Brazil: a social and public health system cost analysis

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Background: Unintended pregnancy (UP) is an unmet medical need with consequences worldwide. We evaluate the costs of UP based on pregnancies in Brazil from for the year 2010.

Methods: The consequences of UP were evaluated using decision analysis based on pregnancy rates and outcomes as miscarriage, induced abortion, and live birth, which were factored into the analysis. The model discriminated between maternal and child outcomes and accounted for costs (in Brazilian currency [Real$, R$]) within the Brazilian public health service attributed to preterm birth, neonatal admission, cerebral palsy, and neonatal and maternal mortality. Event probabilities were obtained from local resources.

Results: We estimate that 1.8 million UPs resulted in 159,151 miscarriages, 48,769 induced abortions, 1.58 million live births, and 312 maternal deaths, including ten (3%) attributed to unsafe abortions. The total estimated costs attributed to UP are R$4.1 billion annually, including R$32 million (0.8%) and R$4.07 billion (99.2%) attributed to miscarriages and births and complications, respectively. Direct birth costs accounted for approximately R$1.22 billion (30.0%), with labor and delivery responsible for most costs (R$988 million; 24.3%) for the year 2010. The remainder of costs were for infant complications (R$2.84 billion; 72.3%) with hospital readmission during the first year accounting for approximately R$2.15 billion (52.9%). Based on the national cost, we estimate the cost per UP to be R$2,293.

Conclusion: Despite weaknesses in precise estimates in annual pregnancies and induced abortions, our estimates reflect the costs of UP for different pregnancy outcomes. The main costs associated with UP are in those carried to parturition. The health cost of abortion represents a small proportion of total costs as these are paid for outside of the public health system. Consequently, reductions in UP will generate not only cost savings, but reductions in woman and child morbidity and mortality.

Keywords: unintended pregnancy, public health, Brazil, abortion

Introduction

The construct of unintended pregnancies (UPs) is multifactorial and broadly encompasses pregnancies that are either unwanted or mistimed.[1] In many instances, UPs are likely to end by induced abortion; worldwide estimates suggest that 50% will be voluntarily terminated.[2] In 2008, it was estimated that 43.8 million abortions occurred worldwide, of which 86% occurred in low-/middle-income countries.[3] Furthermore, between 2003 and 2008, the number of induced abortions was found to have decreased in high-income countries but to have increased in low-/middle-income countries. During this same period of time, the proportion of unsafe abortions increased and they were believed to account for 13% of maternal deaths, with the majority of these concentrated in countries with restrictive laws on abortion.[4]

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Elective abortion in Brazil is considered non-legal, unless the pregnancy resulted from a rape, would cause a life-threatening condition to the mother, or the fetus has anencephaly or any other malformation that is incompatible with the extrauterine life. As a result, data on prevalence and associated costs of abortion are limited and remain a challenge to collect. However, it is recognized worldwide that direct health costs of UP and resulting abortions can significantly impact local health services and the families affected.[5]

Health system and societal costs can also arise from UPs that do not end in abortion and are carried to parturition. In the United States, the public health costs attributed to unintended births in a single year cost taxpayers $11.1 billion (2006).[6] Furthermore, previous studies have reported that UPs are more likely to result in preterm births and low-birth-weight babies, which would increase health costs for neonatal care and costs associated with long-term disabilities.[7] This is particularly relevant for UPs in adolescence, which are more likely to result in low-birth-weight births, which can increase health costs.[8]

Over the past few decades, Brazil, like many fast-emerging economies, has experienced a fertility transition noted by a dramatic reduction in the total fertility rate, which currently sits at 1.8 births per woman.[9,10] Furthermore, during the fertility transition, the rate of contraception has also increased.[11] Despite increased contraception use, the cumulative rate of spontaneous and induced abortion changed very little between 1996 and 2006, for which population survey estimates are available.[12,13] Furthermore, a survey of more than 1,000 women aged 10–24 years in a single postnatal unit in Brazil reported that more than 50% of all births were unintended, suggesting that possibly significant unmet contraception need still exists.[8] Similarly, for the whole country, the data from the last Demographic and Health Survey (DHS) performed in 2006 indicates that 55% of all births were unintended.[14]

Prevention of UP using publicly funded programs in high-income countries has proven to generate significant cost savings for health services and public services.[15] Previous economic studies evaluating the consequences of UP have mostly been performed in high-income countries where publicly funded fertility services and abortion legislation are different from those in low-/middle-income countries.[15] The aim of this study was to evaluate the cost consequences of UP in Brazil, an emerging economy with vastly different fertility planning services than most advanced economies and with restrictive abortion laws. To the best of our knowledge, this is the first published study that describes the economics of UP, and it is believed that this work can aid decision makers regarding access to contraceptives.

Methods

Model description

A model was developed to evaluate the humanistic burden and financial impact of UPs in Brazil. The analysis factored in costs and outcomes for 1 year post-delivery of UPs. Possible birth outcomes of UP included induced abortion, miscarriage, and ongoing pregnancy resulting in birth. All birth deliveries were assumed to have taken place in a hospital within the Brazil public health system as reported by DATASUS, the data system for the Ministry of Health in Brazil. Available data was further separated into vaginal (61.0%) and cesarean section (C-section) deliveries (38.4%).[16,17] Outcomes and resulting costs for infants were also followed. These included stillbirths and infant survival and complications from term and preterm deliveries. Complications included admission to a neonatal intensive care unit (ICU), hospitalization during the first year, and cerebral palsy. Data from DATASUS were used when possible to populate the model to reflect the reality of the public health care system. However, for parameters not identified in DATASUS, other relevant sources were used. A decision tree model was constructed in Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) from the perspective of the Brazilian public health system (Figure 1). The short-term horizon considered in the analysis precluded the need for discounting.

Data source and analysis

The total annual number of pregnancies was estimated using the reported number of live births for the year 2010 and adjusted with estimated percentages of induced abortion and miscarriage.[18] The percentages of induced abortions and miscarriage were derived from the population-based 2006 DHS and found to be 1.5% and 8.9%, respectively.[19] All induced abortions in the model were assumed to be from unintended pregnancies resulting in an adjusted abortion rate of 2.7%. The UP rate was estimated to represent 55% of all pregnancies.[20]

Maternal mortality rates of 20, ten, and 30 deaths per 100,000 births were used for miscarriage, vaginal delivery, and C-section delivery, respectively.[21–23] In addition, a case fatality rate of 100 deaths per 100,000 abortions was assumed.[24] For both delivery methods, it was estimated that 7.8% of all deliveries were preterm births and 0.85% were stillbirths.[25] The remainder of the deliveries was assumed to

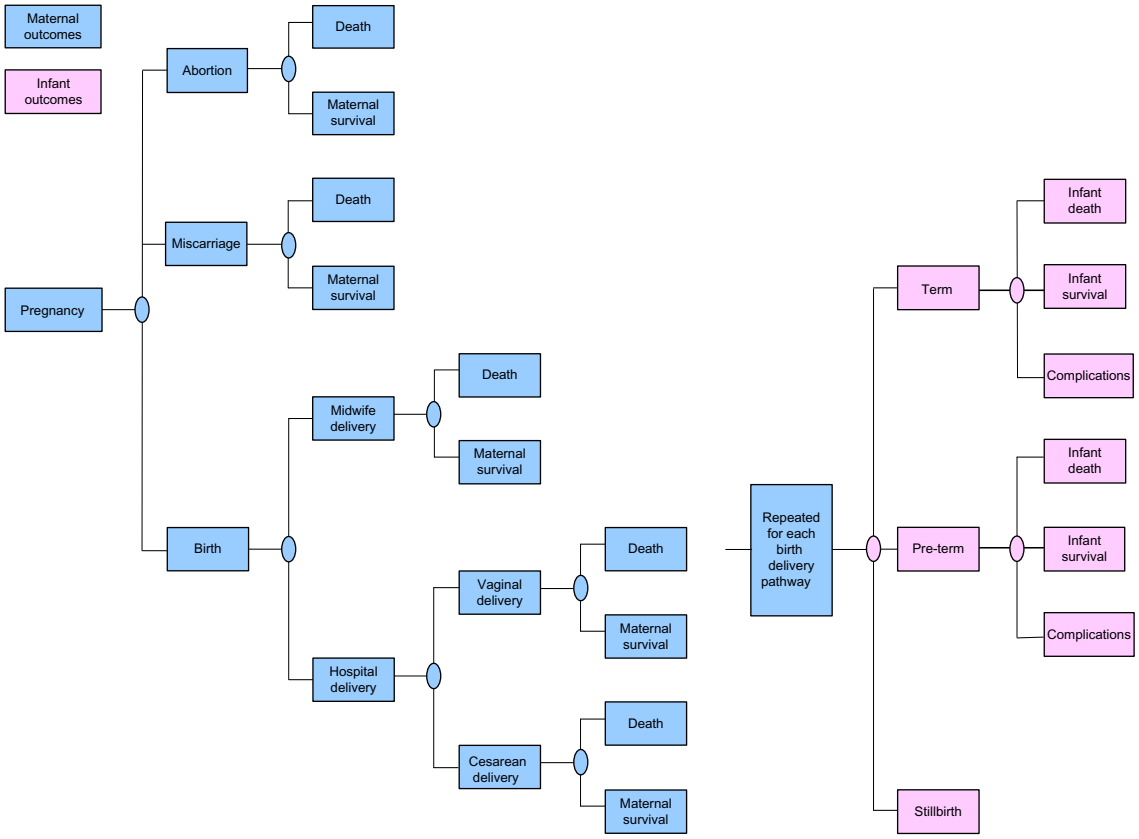

Figure 1 Unintended pregnancy decision model depicting the three main pregnancy outcomes.

be term births. Differential infant mortality rates were used for term and preterm births, with 8.5 per 1,000 live births for the former and 68 per 1,000 live births for the latter.[25,26] The model assessed infant complications, including admissions to neonatal ICU, hospitalization during the first year, and cerebral palsy. All preterm birth infants were assumed to require neonatal intensive care, compared to 7.6% of term birth infants.[27] For preterm infants, the average number of hospitalizations during the first year was 1.7, mostly from respiratory issues.[28] For term birth infants, hospitalization was calculated as a relative risk reduction.[29] Cerebral palsy occurred in 0.1% and 1.7% of term and preterm births, respectively.[30]

Cost resources

Resource use and unit costs were identified from published sources and the DHS in Brazil. In Brazil the public national health system (SUS) pays for around 70%–75% of all reproductive procedures. However, in this model, it is assumed that the costs are those from the public system, although, in approximately one-quarter of UPs, the costs are probably higher when related to women's care covered by insurance or privately.

Costs of elective abortion were not included in the analysis because these procedures rarely meet the legal requirements and would not be covered by the public health system. Costs of miscarriage were related to the following procedures: pelvic exam, blood test, ultrasound, and dilation and curettage. Separate vaginal and C-section delivery costs were used. The cost components for each method included antenatal care and labor and delivery.[31,32] Unit cost for hospitalization readmission during the first year was R$2,794.[33] This unit cost was also assumed for neonatal care admission, while cerebral palsy was estimated to be R$19,854.[33] Cost parameters are summarized in Table 1.

Results

Based on the modeled parameters we estimate 1.79 million annual UPs and 1.47 million annual planned pregnancies. We estimate annual maternal deaths of 351, of which 49 (14%) are attributed to abortions and 302 to complications from miscarriages and deliveries. The number of infant deaths within the 12 months following birth was estimated at 32,864. The model estimates preterm deliveries attributed to UP as 122,523. The number of estimated neonatal

Table 1 Cost variables included in the economic model

Outcomes	Costs[a]	Reference
Abortion	R$0	
Miscarriage	R$206.81	34
Birth		
Vaginal delivery		
Antenatal care	R$152.74	31
Labor and delivery	R$562.82	32
Cesarean delivery		
Antenatal care	R$152.74	31
Labor and delivery	R$784.90	32
Infant complications		
Neonatal care	R$2,793.92	33
Infant hospitalization during first year	R$2,793.92	33
Cerebral palsy	R$19,853.94	33

Note: [a]Exchange rate: US$1= almost R$2.

Table 3 Annual costs of unintended pregnancy in Brazil based on different pregnancy outcomes

Pregnancy outcomes	Annual cost[a]	Percentage of annual costs
Miscarriage costs	R$32,913,992	0.8% (of total)
Birth costs	R$4,066,926,567	99.2% (of total)
Birth delivery-related costs	R$1,221,010,848	30.0%[b]
Antenatal care	R$232,727,755	5.7%
Labor and delivery	R$988,283,092	24.3%
Infant complications	R$2,845,915,719	70.0%[b]
Neonatal care admission	R$627,601,523	15.4%
Hospital readmission in 1st year	R$2,149,858,847	52.9%
Cerebral palsy	R$68,455,349	1.7%
Sum all costs annual unintended pregnancies	R$4,099,840,559	100%

Notes: [a]Exchange rate: US$1= almost R$2; [b]percentage of subcategory for abortion, miscarriage, and birth costs.

admissions for the year 2010 associated with UP was 224,631 which included all preterm deliveries and 7.6% of all term deliveries. The disaggregated values for different pregnancy outcomes attributed to UP are described in Table 2.

The direct costs associated with UP are categorized by miscarriages and births. Costs are disaggregated to relevant cost components (Table 3). Costs of abortions are not reimbursed in the public health system and are not included in the analysis. The total costs attributed to UP are estimated to be R$4.1 billion annually, of which approximately R$32.9 million (0.8%) was attributed to miscarriage and R$4.07 billion (99.2%) to births and resulting complications.

Table 2 Annual unintended pregnancy outcomes in Brazil

Pregnancy outcomes	Number of cases
Unintended pregnancies	1,788,212
Live births	1,580,292
Miscarriages	159,151
Induced abortions	48,769
Planned pregnancies	1,463,083
Live births	1,332,868
Miscarriages	130,214
Delivery type	
Vaginal births	935,059
Cesarean births	588,627
Infant complications	
Preterm deliveries	122,523
Neonatal care admission	224,631
Hospital readmissions within year after birth	769,477
Cerebral palsy cases	3,448
Total maternal deaths	351
Unsafe abortion	49
Miscarriage	32
Birth	270
Infant deaths within the first year (includes neonatal period)	32,864

From the direct birth-related costs, antenatal care accounted for approximately R$233 million (5.7%) of birth costs, with labor and delivery costs responsible for R$988 million (24.3%). The remainder of birth costs were attributed to infant complications, estimated to be R$2.8 billion (70.0%), with neonatal costs accountable for approximately R$628 million (15.4%) and hospital readmission in the first year costs of R$2.1 billion (52.9%) of all birth costs annually. Based on the national cost estimates and the number of annual UPs, we estimate the cost per UP to be R$2,293.

Discussion

Our analysis estimates the costs and outcomes associated with unintended pregnancies to derive a cost per UP of R$2,293. The cost per UP factors in a range of health-related costs attributed to those resulting in abortion and resulting live births for those carried to parturition. This figure is broadly aligned with previous analyses in the United States of $1,609 per UP after factoring in the purchasing power parity between the two countries.[35] It is also worth noting that the estimates provided here are likely an underestimate of all costs. For example, the analysis described here focused on the costs that occur within the public health systems. Consequently, costs of elective abortions paid for by individuals are not represented in this analysis. Furthermore, because elective abortion is illegal in Brazil except in extreme and rare cases, hidden costs from elective abortions may filter into the public health system. For instance, costs associated with post-abortive care are likely to be classified as miscarriages when reported to national authorities. Additionally, the long-term societal costs that arise from UP and reduced educational attainment and lost productivity of young mothers has not been accounted for in our analysis.[36–39]

Our analysis highlights that considerable cost savings can be achieved by reducing UP, which are thought to represent 55% of all pregnancies in Brazil.[20] The analysis accounted for both untimed and unwanted births to estimate the UP rate and associated costs, in which live births resulting from unwanted pregnancies represented the largest share of health costs, representing 99% of all costs. This is also attributed to the fact that abortion is a relatively inexpensive procedure that is paid for outside of the health service. Because a substantial proportion of pregnancies are attributed to mistimed pregnancies, ie, pregnancies that would have occurred at some point in the future, but occurred sooner due to mistimed pregnancy, the actual cost savings to be realized by reducing UP is less than described here and would mostly be associated with averting those pregnancies considered to be unwanted. To put the potential cost savings into perspective, an analysis conducted for the state of California, USA estimated that preventing many UP in a single year will offer savings of $1.1 billion up to 2 years of age of the child, and that every dollar spent on averting UP offers $2.76 of saving in 2 years and $5.33 at 5 years post-delivery.[15] A national-level analysis that focused on the federally financed Medicaid program in the United States noted that taxpayer savings of $4.7–$6.2 billion could be achieved by reducing unintended pregnancies.[40] Based on the cost savings attributed to UP, it is anticipated that future health researchers can build on the research described here to better understand the cost savings that may be achieved through improved contraceptive use.

The analysis sought to incorporate a broad range of costs associated with UP to illustrate that costs extend beyond the point of delivery. For instance, UPs often occur in adolescent and young adults and can be predictive of low birth weight, preterm birth, and neonatal admission.[8,41–43] The precise mechanism by which UP influences preterm birth is likely to be multifactorial. However, some studies have observed that women with UPs are less likely to receive adequate prenatal care[44] and are also more likely to smoke and drink alcohol during pregnancy, which contributes to adverse outcomes.[44,45] It is important to highlight these costs because it suggests that UPs place unnecessary demand on health services that are often stretched to capacity. Since UP, for the most part, can be avoided, this illustrates the health service benefits and health service capacity that could be released by reducing UP.

Much of the humanistic burden attributed to UP relates to maternal mortality and morbidity of women who pursue unsafe abortions. In our analysis, we estimate 49 annual deaths from abortions representing 13% of the estimated maternal deaths. It has been suggested that access to improved contraceptive services could prevent maternal mortality by 25%–35%.[46] Furthermore, estimates from the World Health Organization reported that unsafe abortion disables approximately 5 million women each year, suggesting reductions in morbidity could also be achieved through improved contraception use.[4]

Empirical evidence and clinical guidelines agree that the most effective approach to preventing UP is through education and contraceptive use, of which long-acting contraceptive (LARC) methods are the most effective intervention.[47–51] In particular, among adolescents, prevailing evidence suggests that education and contraception are the main interventions for reducing UP.[49]

In advanced economies, the percentage of women using LARC methods has been steadily increasing. A recent study noted that the proportion of women using LARC methods has increased from 2.4% of women aged 15–44 years since 2002 to 8.5% of women in 2009.[52] In the United States, the American College of Obstetricians and Gynecologists (ACOG) advocates use of intrauterine contraceptives (both copper-intrauterine device and the levonorgestrel-releasing intrauterine system) and implants as first-line therapy for adolescent women because they contribute to reduce the number of UPs.[48] LARC has also proven to be cost-saving compared with combined oral contraceptives in the United Kingdom. Investigators reported that this finding was influenced almost entirely by the lower failure rates associated with LARC.[50,53] An analysis conducted in the United States also noted that cost savings could be achieved by switching women from oral contraceptives to LARCs, and approximately 50% of costs of UP were attributed to contraceptive adherence.[54]

Despite the positive benefits of LARC, use in Brazil lags behind that of other countries. A survey conducted in 2008 in Northern Brazil reported that only 1% of women attending a post-abortion clinic elected for an intrauterine device, despite 93% of women having knowledge of the product.[55] Several barriers have been identified, which often limit uptake of LARC methods.[56] These include health care provider lack of knowledge of risks, myths, misconceptions, and lack of training for insertion of the various devices. Also, misinformation and fear of pain at insertion among women can limit demand for LARC methods. Furthermore, LARC can often involve considerable up-front expense, although evidence does suggest that these methods are cost-effective compared with alternative contraceptive methods. Because of the expense, reimbursement can influence the rate of uptake.

Even recognizing the importance of abortion, and especially induced and unsafe abortion, for maternal mortality

and morbidity in Brazil, there are no reliable and available data confirming a pandemic of such conditions as commonly reported by media and gray literature. Data extracted from the 2006 Brazilian DHS indicated that only 1.5% self-reported induced abortions among all pregnancies for the whole period of the survey.[14,19] A probable contribution for this scenario is the high prevalence of and easy access to contraceptive use among women in reproductive age in the country during the last 2 decades. Although all induced abortions are technically classified as unsafe, this is not the impression of the majority of obstetricians working in the field. There is a general belief that complications due to unsafe induced abortions are less and less frequent and that there was recently a marked drop in their occurrence. With no direct information to confirm this, one indirect point of evidence is the decrease in the proportional contribution of abortion as cause of maternal mortality in the country. In fact, official Brazilian data confirm that it was 16.4% in 1990 (representing the third cause of maternal mortality), while only 8.9% in 2000 and 9.0% in 2010 (the fifth cause, behind even the indirect obstetric causes).[20] In the meantime, there was a spread of the use of misoprostol as an agent for inducing abortion, not only in health facilities for situations where abortion is allowed, but mainly for situations not legally permitted, wherein the women obtain misoprostol in the black market and self-administer it vaginally. This is believed to be the current most common way of inducing medical abortion and also to be associated with the low rates of severe complications due to abortion, especially infection and hemorrhage, in Brazil.

There are also at least two possible limitations for the external validity of the current cost estimates. The first refers to the assumption that all miscarriages are really diagnosed and "treated" with dilation and curettage. However, it is possible that a proportion of individuals will never reach health facilities and receive no intervention. The second refers to another assumption that all medical abortions are unsafe. Currently, in Brazil, the majority of medical abortions are performed by the woman through self-administration of misoprostol acquired off-label or in the black market. With these procedures, the rate of complications due to medical abortions has dropped significantly during the last decade, with some of these cases arriving at hospitals already as complete abortions that need no complementary procedures. Although insufficient data are available to support this scenario, this would probably impact strongly on the estimates of post-abortion care, taking into account the correspondent reduced morbidity and mortality.

The cost consequences of live births attributed to UP in adolescents can extend beyond the observed costs of increased prenatal care, preterm births, and abortions. Studies have noted that adolescent women are more likely to dropout from school following pregnancy. Furthermore, others have suggested that future generations will follow the reproductive pattern of their parents, which could perpetuate the likelihood of UP in the offspring of these mothers.[57] As reported, education has been shown to break the association of adolescent fertility across generations, suggesting the longer-term benefits to be achieved by reducing UP.

Conclusion

Our analysis illustrates the cost consequences associated with UP in Brazil. In the past 2 decades, Brazil has made considerable progress toward reducing abortion rates, but, despite these efforts, the humanistic and direct economic costs associated with UP remain high.[58] To achieve economic savings from reducing the UP rate will require education, training of providers, and improved access to effective contraceptive measures. It is believed that the research described herein can inform the burden of UP and the benefits of improved fertility planning.

Implications

The cost consequences associated with UP in Brazil could be investigated in other settings using the same methodology used in this report. It is important to estimate the cost associated to UP to initiate actions to reduce the high rate observed in many countries.

Disclosure

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