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### The Relationship of Abortion to Trends in Contraception and Fertility in Brazil, Colombia and Mexico

By Susheela Singh and Gilda Sedgh

National and regional estimates of the incidence of induced abortion in Brazil, Colombia and Mexico from the late 1970s to the early 1990s indicate a clear rise in the abortion rate in Brazil and increases in the abortion ratio in all three countries. Cross-sectional analysis showed no significant correlation between the abortion rate and contraceptive use, except in Mexico in the early 1990s, where a strong positive association was observed. Longitudinally, the abortion rate increased as contraceptive use increased in most regions of Brazil and Mexico throughout the study period, and in parts of Colombia until the mid-1980s. In Colombia and the most urban region of Mexico, the abortion rate declined as contraceptive use stabilized or increased. The abortion ratio was positively associated with contraceptive use over time in nearly every region of each country. The role of abortion in fertility decline was greatest in Brazil, where the general fertility rate would have been nearly 13% higher in the early 1990s if the abortion ratio had not increased from its level in the late 1970s. Abortion tended to have a greater impact on fertility in regions where contraceptive use was low. Overall, contraceptive use appears to have been a more important determinant of fertility than abortion, but abortion has played an important subsidiary role in determining fertility levels and trends in these countries.

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Over the past 30 years, fertility has declined substantially in almost every country in Latin America, and contraceptive use has risen dramatically. Abortion, however, remains a common practice among many women of reproductive age, even though it is still largely illegal in most countries in the **region**.<sup>1</sup>

A review article published in 1993 characterized induced abortion in Latin America as an epidemic, with 3-5 million performed each **year**.<sup>2</sup> Most of these occur clandestinely, under unsafe conditions, and they result in high levels of maternal morbidity

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and mortality. For example, induced abortion accounts for an estimated one in three maternal deaths in the region and 800,000 hospitalizations annually. The authors point out that in many countries, urgent hospital treatment for complications of unsafe clandestine abortion diverts scarce and costly health care resources.

Although few would deny the widespread use of induced abortion throughout much of Latin America, attempts at even approximating the incidence of abortion at the national, regional or state level are severely hampered by the clandestine nature of the practice. Few women who resort to abortion under such conditions are willing to admit to it, and no direct health surveillance systems are in place to collect data on the numbers involved.

Nevertheless, estimating abortion levels in Latin America is vital. The lack of complete and reliable data on abortion can lead many analysts and policymakers to conclude that all change in fertility results from contraceptive use, or from changes in the two other proximate determinants of fertility, postpartum infecundity and marriage. At best, analysts note the lack of information on abortion, but are unable to take it into account in explaining fertility **trends**.<sup>3</sup> Consequently, contraceptive use may be credited for too high a proportion of fertility decline if abortion is left out of the equation altogether. Conversely, where reliance on abortion is declining, contraceptive use may not be credited enough for reducing fertility.

Despite the difficulties in interpreting the relationship between abortion, contraceptive use and fertility, quantifying actual levels of abortion, even in approximate terms, is essential for evaluating women's access to and use of contraceptives and family planning services. Even if general measures of incidence cannot identify those subgroups with particularly high rates of induced abortion, the overall numbers can alert providers and planners to the need to increase effective method use and can help focus attention on barriers to that use, such as weaknesses in the quality of family planning services. (In Chile in the 1960s, for example, awareness of the severe public health consequences of high levels of unsafe abortion led the government to provide family planning **services**.<sup>4</sup>)

A number of unmeasurable factors, however, may complicate the analysis and interpretation of the relationship between abortion and contraceptive use. These include the lack of reliable information on contraceptive use among women who are sexually active but not in union and variations in rates of contraceptive failure (either method failures or failures caused by irregular or

incorrect use). In addition, women's motivation to achieve a small family or to time their births more precisely may simply outpace the rise in effective method use. Furthermore, an increase in sexual activity among unmarried persons may lead to an increase in unplanned pregnancies and in the demand for abortion. Thus, the level of abortion may remain stable or continue to rise even while contraceptive use rises or remains at a high level.

Despite the possibility of this somewhat counterintuitive situation in the short term, researchers have hypothesized that as an increasing proportion of couples practice contraception effectively or resort to sterilization, the incidence of induced abortion will eventually drop. The timing of such a decline, however, is difficult to predict, and the specific factors that would result in the transition from widespread reliance on pregnancy termination to widespread reliance on pregnancy prevention are not fully understood and differ among settings.

As early as the 1960s in Chile, Requena described what he saw as a "Latin American" pattern, in which the use of abortion to control fertility precedes contraceptive use, reaches a high level and eventually **declines**.<sup>5</sup> In the 1970s, Tietze and Bongaarts took these ideas further, proposing a theoretical framework to describe the underpinnings of this long-term process; in the absence of empirical data to test their hypotheses, they simulated two scenarios in which levels of contraception and of abortion might **interact**.<sup>6</sup>

The first scenario is one where abortion rates are low when contraceptive use begins to rise, and the incidence of abortion remains relatively low or rises only slightly during the transition to low fertility. The second scenario is one where levels of induced abortion are high or are increasing, contraceptive use is minimal and couples' motivation to have fewer children is intensifying; in this instance, reliance on induced abortion will rise considerably, even as contraceptive use begins to increase. In the long term, however, abortion is expected to decline as contraceptives become widely used.

A few studies (in **Korea**<sup>7</sup> and **Hungary**<sup>8</sup>) have provided some support for the second scenario. Yet for the majority of developing countries that are currently in the midst of the fertility transition, testing the Tietze-Bongaarts hypotheses is seriously hampered by the general unavailability of reliable abortion data, particularly for countries where the procedure is illegal.

In this article, we build on earlier work that estimated abortion levels in the region in recent **years**.<sup>9</sup> As in that earlier study, we indirectly project levels of abortion using a methodology that

relies on estimates of the number of women who are hospitalized for the treatment of complications related to induced abortion. Because good trend data on contraceptive use in the past two decades are now available, we can examine the changing relationship from the late 1970s until the early 1990s between induced abortion and contraceptive use in three large countries of Latin America: Brazil, Colombia and Mexico.

Specifically, we address the following questions: Have trends in abortion incidence and in contraceptive prevalence been interrelated? Has this relationship varied by country, or by region within countries? And how do contraceptive use and abortion, respectively, account for fertility levels and for changes in the fertility rate?

## DATA AND METHODOLOGY

### Data Sources

National, regional and state-level trend data on four basic measures were required for the analysis: population estimates; contraceptive prevalence rates; fertility rates; and the number of women hospitalized for the treatment of abortion complications. The specific years selected to represent each of the three time periods studied (the late 1970s, the 1980s and the early 1990s) correspond to the years in which nationally representative fertility surveys were conducted. Consequently, the time points selected for observation in each country were: 1980, 1986 and 1991 in Brazil; 1976, 1986 and 1990 in Colombia; and 1977, 1987 and 1992 in Mexico. Data sources are detailed in an Appendix (see page 13).

Measures of the proportion of women practicing family planning were weighted for method effectiveness, to control for changes in method mix over time and between geographic areas. To do this, we grouped methods into four categories of descending effectiveness: male and female sterilization; IUDs, injectables and the pill; condoms, diaphragms and spermicides; and rhythm, periodic abstinence, withdrawal and other traditional methods.

The weights are based on published failure rates.<sup>10\*</sup> (For each group of methods, the weight equals one minus the failure rate.)

After adjustment, the assigned weights were 1.00 for sterilization, 0.88 for the highly effective temporary methods, 0.70 for the moderately effective methods and 0.67 for all traditional methods. We assume that throughout the study period, women in all three countries experienced the same failure rates. It should be kept in mind, however, that contraceptive failure rates may vary by country, region or time period.

## ANALYTIC METHODOLOGY

Our approach is based largely on that used in the 1994 study of six countries in Latin **America**,<sup>11</sup> which included the three countries studied here. The earlier study, however, estimated abortion levels only for recent years and only at the national level. In this analysis, we estimate abortion levels for earlier periods and for regions within each country.

The methodology is based on official statistics on the number of women hospitalized for abortion complications. In addition, the data were adjusted to correct for underreporting and misreporting and to remove cases of spontaneous abortions; this adjusted number in each area and time period was then multiplied by a factor representing the expected number of total induced abortions for every one abortion that resulted in hospitalization. This last step is meant to take into account the unknown number of women having an abortion who did not need to be hospitalized or who needed to but did not receive such treatment.

•*Adjusting hospitalization data for incorrect coding.* The number of women hospitalized for complications of spontaneous or induced abortion is in many instances available only as the total number of all patients with diagnosis codes 630-**639**<sup>†</sup> from the Ninth Revision of the International Classification of Diseases (ICD-9). However, the first four codes in this series (630-633) do not describe abortion complications and constitute a misclassification. The earlier study indicated that nearly 10% of all patients diagnosed by codes 630-639 fell within the first four **codes**.<sup>12</sup> Thus, we subtracted this proportion from the total of hospitalized abortion complication cases.

In addition, an earlier analysis revealed that some women hospitalized with abortion complications were incorrectly classified with code 640 (threatened abortion); that study estimated the extent of such miscoding as 5.5% of all abortion **cases**.<sup>13</sup> Thus, codes 634-639 are assumed to have captured 94.5% of all cases; we therefore inflated the number of cases to account for the missing abortion complication cases by dividing by 0.945 (or multiplying by 1.058). Since these basic patterns of miscoding probably originate in the legal and medical context of the region as a whole, we anticipate that these proportions and levels of miscoding are unlikely to vary significantly across time periods, or across areas within countries, and we assume the miscoding levels to be the same in all study years and in all areas.

•*Adjusting hospitalization data for nonreporting and underreporting.* A substantial degree of underreporting of

abortion complications is known to exist in all three countries. In addition to some private-sector hospitals' failure to report hospitalized cases at all, public hospitals in some regions also generally underreport complications cases. Previous estimates of the level of underreporting in the early 1990s were based on the impressions of knowledgeable officials involved in the collection of each country's statistics, on information about the size of the private hospital system in each country and on interviews revealing that private hospitals do receive abortion complication **patients**.<sup>14</sup> As in that earlier project, we assumed in this study that in the early 1990s, the proportion of hospitalized cases that went unreported was 15% of all cases in Brazil, 17% in Colombia and 20% in Mexico.

Although we lack precise information on underreporting of complications in the late 1970s and mid-1980s, we assume increasingly poorer coverage further back in time, given the improvements in data collection in general, including hospital data collection. (Similarly, other studies have shown improvements over time in the recording of mortality data, both in coverage and in the quality of cause-of-death **information**.<sup>15</sup>) Thus, for the mid-1980s, we assume 20% underreporting in Colombia and 25% underreporting in Brazil and Mexico. For the earlier 1976-1980 period, we assume higher levels of underreporting of hospitalized abortion cases—25% in Colombia and 30% in Brazil and **Mexico**.<sup>‡</sup>

•*Estimating spontaneous abortions.* Hospital records in Latin America do not correctly distinguish between spontaneous and induced abortions, largely because abortion is illegal in these countries and reporting may result in criminal prosecution. Thus, many officials protect both the woman and the hospital by reporting the abortion as spontaneous. To distinguish between actual spontaneous abortions and induced abortions that were reported as spontaneous abortions, it is easiest to first establish the "true" level of spontaneous abortions. In the 1994 study, four different approaches were **used**,<sup>16</sup> here, we use the approach based on biological estimates of the likelihood that a conception will end in spontaneous abortion. (This method is more likely to produce estimates that are consistent over time periods and across areas of countries.)

Late spontaneous abortions (occurring at 13-22 weeks of gestation) are considered likely to need treatment in a hospital. Based on physiological patterns that are fairly constant across populations, we assume that the number of pregnancies ending in spontaneous abortions is equal to 3.4% of live births (a proportion estimated from life-table **data**<sup>17</sup>). However, in the

three study countries, not all women who experience a late spontaneous abortion will have access to hospitals. Therefore, we assume that access to hospitals among women experiencing late spontaneous abortions is similar to that observed among women giving birth; we use national and regional data from each country's Demographic and Health Survey (DHS) report on the proportion of deliveries attended by hospital personnel as a surrogate indicator of hospital access for the treatment of late spontaneous abortion. (For time periods for which no corresponding DHS data were available, we estimated the proportions of women with access to hospitals by projecting the observed trends in Colombia, the only country among the three for which multiple-year data for this measure were available.) We then subtracted the number of expected late spontaneous abortions from the total number of hospitalized abortion patients to obtain an estimate of the number of women hospitalized for induced abortion complications only.

•*Estimating the total number of induced abortions.* To produce indirect estimates of the total number of induced abortions in each country, we assumed that for each induced abortion patient who is hospitalized for treatment of abortion-related complications, a certain number of women will not develop complications that require hospitalization. Thus, multiplying the number of complication cases by that factor or number produces a rough estimate of the total induced abortions performed. For example, a factor (or multiplier) of one indicates that every woman having a clandestine induced abortion requires and obtains hospitalization, a factor of two indicates that for every two women having an induced abortion, one will be hospitalized, and so on.

The basic principle guiding the selection of a multiplier is that in settings where induced abortions are performed under dangerously unsanitary conditions, many women undergoing the procedure will experience complications. In such settings, the multiplier would be quite small. Conversely, where safe medical abortion procedures are used, few women would experience the types of complications that require hospital treatment, and the multiplier would be large.

The likelihood of treatment, however, is not simply a function of the seriousness of the complications; it also involves the woman's access to a hospital. These two considerations—the safety with which induced abortions are performed and the general availability of hospitals offering treatment—are likely to have opposing effects in determining a **multiplier**.<sup>§</sup> Given our uncertainty about the relative strength of each effect, we assumed

that they would cancel each other out, and that the multiplier would be the same across all states and regions of a country within a specific time **period**.<sup>\*\*</sup> There were, however, clear indications that access to safe abortion services had improved over the period 1976-1992, a development that would outweigh the effect of any small improvements in access to hospital care that also occurred during that period. Thus, we assumed that the multiplier would increase over time.

To develop plausible national multipliers for this study, we drew from a range of resources that provide evidence of the likely hospitalization rates among induced abortion patients. Based on the limited literature on hospitalization rates for induced abortion complications in the region from the 1960s **onwards**,<sup>18</sup> we selected a relatively low multiplier of 3.5 for all three countries for the period 1976-1980 (see table below), when the practice of induced abortion was probably less safe. For the period 1986-1987, by which time safety had substantially improved, we applied multipliers ranging from 4.5 to 5.0, and for the early 1990s, as improvements continued, between 5.0 and 5.5, even while the procedure remained illegal.

Country	1976-1980	1986-1987	1990-1992
Brazil	3.50	5.00	5.25
Colombia	3.50	5.00	5.50
Mexico	3.50	4.50	5.00

These multipliers assumed a faster rate of improvement in abortion services from the late 1970s to the mid-1980s, and a slower rate of change from 1986-1987 to 1990-1992. For the two later periods, we assigned slightly higher multipliers to Brazil and Colombia than to Mexico, taking into consideration the greater improvements in access to safe services that are believed to have occurred in those two **countries**.<sup>\*†</sup> Data sensitivity testing was carried out for the Northeast region of Brazil and for Bogotá in Colombia, two of the regions that showed the greatest change in access over time. Even assuming relatively smaller change (Northeast Brazil) or greater change (Bogotá, Colombia) in the resulting multipliers, shifts in the estimated abortion levels are still substantial, supporting the results and conclusions drawn from the estimates.

## TREND RESULTS

### Abortion Rates

At the national level, the estimated abortion rate (the annual number of abortions per 1,000 women aged 15-49) in the period 1976-1980 ranged from about 22 per 1,000 in Brazil and Mexico to 31 per 1,000 in Colombia (see Table 1). These levels are moderate compared with worldwide **experience**.<sup>19</sup> By the mid-



1980s, rates had increased slightly in all three countries, but from the mid-1980s to the early 1990s, the abortion rate continued to rise only in Brazil (to 39 per 1,000). In Mexico and Colombia, the rate dropped slightly over the same period (or stabilized, as these estimates have some margin of error).

Table 1. Abortion rate and abortion ratio, by year, according to country and region

Country and region	Abortion rate			Abortion ratio		
	1976-1980	1986	1991	1976-1980	1986	1991
<b>Brazil</b>	<b>22.4*</b>	<b>26.0</b>	<b>39.3</b>	<b>14.8*</b>	<b>19.3</b>	<b>31.2</b>
Rio de Janeiro	20.8	24.4	43.7	18.1	23.8	38.5
São Paulo	38.1	40.1	37.5	26.2	30.5	32.5
South	22.8	18.8	16.3	17.3	16.7	16.5
Central/Southeast	23.5	34.9	39.4	15.1	25.2	31.3
Northeast	14.1	22.6	59.1	8.1	14.1	37.9
North	8.5	5.6	23.7	5.0	4.3	19.3
<b>Colombia</b>	<b>31.4†</b>	<b>33.9</b>	<b>32.0‡</b>	<b>18.3†</b>	<b>23.2</b>	<b>24.8‡</b>
Atlantic	32.6	33.3	30.1	16.0	18.4	19.7
Pacific	28.9	21.7	18.1	16.3	17.9	15.7
Central	31.1	45.2	42.0	19.9	30.9	32.7
Eastern	18.6	36.1	34.2	10.8	23.3	26.2
Bogotá	48.7	27.0	30.7	32.7	22.3	26.8
<b>Mexico</b>	<b>22.1§</b>	<b>23.5**</b>	<b>22.0††</b>	<b>10.4§</b>	<b>15.2**</b>	<b>17.7††</b>
North	26.9	25.5	29.7	12.2	16.9	22.8
Northeast‡‡	28.8	20.2	25.7	13.6	16.0	22.3
East/Southeast	11.8	8.0	13.0	5.5	5.0	10.1
Central§§	13.5	17.5	20.3	5.7	10.4	15.3
Southwest and Fed. Dist.	32.1	41.0	25.1	16.8	26.5	21.9

\*1980. †1976. ‡1990. §1977. \*\*1987. ††1992. ‡‡Includes Monterrey. §§Includes Guadalajara. Notes: Abortion rate is annual number of abortions per 1,000 women aged 15-49. Abortion ratio is annual number of abortions per 100 pregnancies.

Within each country, these patterns varied by region. In Brazil, for example, the abortion rate increased by more than the average in the North and Northeast and in Rio de Janeiro, but did not change greatly in São Paulo. In the South, a region that is more developed than average and has a population of largely European origin, a small but steady decline occurred in the abortion rate after 1980, and by 1991 the rate had dropped to a level far below the national average.

In Colombia's Atlantic region, a small increase was followed by a small decline. In the Central and Eastern regions, the abortion rate showed a much more marked increase into the mid-1980s, while in the Pacific region and in Bogotá, it declined progressively after the mid-1970s. (The abortion rate declined precipitously in Bogotá between 1976 and 1986 and then increased slightly from 1986 to 1990, but this increase was nominal and probably represents the stabilization of the abortion rate in the late 1980s.)

In Mexico, the rise in the abortion rate between 1977 and 1987 was produced solely by change in the Southwest and Federal District region, which includes the large metropolitan area of Mexico City. While only this region experienced a large increase over the period, its size and population caused the national

average to increase slightly. All other regions except the Northeast maintained fairly stable abortion rates at a low-to-moderate level over the **decade**.<sup>21</sup> From the mid-1980s to the early 1990s, the large Southwest and Federal District region again stood apart in being the only one in which the abortion rate declined markedly; in all other regions, small increases occurred. The net effect at the national level was a fairly stable abortion rate between 1987 and 1992.

One of the central questions that we address here is whether the abortion rate has begun to decline in any of these three countries, either nationally or within specific regions. The abortion rate increased in some regions of every country, at least from the mid-1970s to the mid-1980s; in most of Brazil and Mexico, those increases continued into the early 1990s. However, there were substantial declines in abortion rates in the largest metropolitan areas of Colombia (Bogotá) and Mexico (the Southwest and Federal District).

This pattern suggests that some attributes of metropolitan areas are associated with being further along in the fertility transition, so that declines in abortion, or at least stabilization of the abortion rate, are likely to occur sooner. In Bogotá, for example, a higher level of contraceptive use since the mid-1970s (earlier than in other regions) may be an important factor in explaining these differential trends by level of urbanization. Other possible factors are the more rapid advancement in urban areas in women's education and in the quality of family planning services, and the concomitant greater improvements in contraceptive use.

Brazil, however, appears to be an exception to this pattern. The abortion rate was fairly stable throughout the study period in the metropolitan region of São Paulo, but it increased markedly in Rio de Janeiro, also a highly urbanized region. Although these increases were consistent with those occurring in all but one region of Brazil, they fail to show the general pattern of an earlier decline in metropolitan areas that was apparent in Colombia and Mexico.

### **ABORTION RATIOS**

The abortion ratio is the number of abortions per 100 pregnancies (excluding pregnancies that end in miscarriages). This ratio—the proportion of pregnancies that are resolved through abortion—can also be interpreted as the probability that a woman would choose an abortion if she were pregnant. As such, it is a very different measure from the abortion rate, which measures the incidence of abortion among all women of reproductive age, and does not necessarily follow the same pattern as the ratio. For example, the abortion ratio can increase while the abortion rate

remains steady or declines, if the overall level of childbearing falls. On the other hand, both the rate and ratio could decrease simultaneously—if, for example, the incidence of abortion falls and the level of childbearing remains relatively stable.

As Table 1 shows, national abortion ratios increased consistently over the period studied in all three countries. This upward trend reflects declines in the level of childbearing, combined with increasing or nearly stable abortion rates in many regions of these countries. Nationally, while abortion ratios ranged from 10-18 per 100 pregnancies in the mid-to-late-1970s in each country, they increased to 18-31 per 100 pregnancies by the early 1990s.

When regions are examined, abortion ratios rose in five of the six regions in Brazil (if the nominal dip in the middle of the study period in the North is discounted). The same pattern can be seen in three of the five Colombian regions, and in four of the five Mexican regions. In some regions where abortion rates either have begun to decline or have at least stabilized (i.e., southern Brazil, Bogotá and Colombia's Pacific region, and the Southwest and Federal District in Mexico), the abortion ratio has also begun to stabilize or decline since the 1980s (or in the case of Bogotá, since 1976). Yet, by the early 1990s, a substantial proportion of pregnancies in all three countries—nearly one-third in Brazil, one-quarter in Colombia and almost one-fifth in Mexico—ended in induced abortion.

### ABORTION AND FERTILITY DECLINE

Abortion clearly played a role in determining the *level* of fertility throughout the study period. However, its contribution to fertility *decline* depends not so much on the level of abortion as on the magnitude of the change in abortion compared with that of changes in fertility. To assess whether abortion contributed significantly to fertility decline in each of the three countries, we examined changes in the general fertility rate (GFR)—a fertility measure that is available for all three countries and that (unlike the crude birthrate) takes into account variations in the proportion of the total population that is accounted for by women of reproductive age.

Although the fertility transition was well underway by the mid-1970s in Brazil and **Colombia**,<sup>20</sup> fertility declined further in these two countries, with the GFR falling from about 130-140 live births per 1,000 women aged 15-49 in the late 1970s to fewer than 100 per 1,000 in the late 1990s (Table 2). However, in Mexico, which by the mid-1970s had only just begun its decline, the absolute decline in fertility was twice as large as in Brazil or Colombia. From the late 1970s to the early 1990s, Mexico's

proportional decline in GFR was also larger than in Brazil or Colombia (46% compared with 30-32%).

Table 2. Observed general fertility rate (GFR), by time period, hypothetical GFR if abortion rates or abortion ratios had not changed between earliest and latest periods, and percentage difference between observed and hypothetical GFRs, according to country and region

Country and region	Observed GFR			Hypothetical GFR		% difference in GFR	
	1976-1980	1986	1991	If no rate change	If no ratio change	If no rate change	If no ratio change
<b>Brazil</b>	129*	108	87	96	99	11	13
Rio de Janeiro	94	78	70	83	83	18	19
São Paulo	107	91	78	78	82	0	5
South	109	94	82	78	82	-4	0
Central/Southeast	132	104	87	96	98	10	13
Northeast	159	137	97	122	123	26	27
North	161	125	99	108	109	9	10
<b>Colombia</b>	140†	112	97‡	97	102	0	5
Atlantic	171	148	123	122	126	-1	3
Pacific	148	100	97	91	97	-6	0
Central	125	101	86	92	95	7	11
Eastern	155	119	96	105	107	9	12
Bogotá	100	94	84	74	80	-12	-5
<b>Mexico</b>	191§	132**	102††	102	107	0	5
North	194	126	101	103	109	2	8
Northeast	184	106	89	87	95	-2	6
East/Southeast	203	151	115	116	118	1	3
Central	223	151	112	116	119	3	6
Southwest and Fed. Dist.	160	114	90	86	93	-4	4

\*1980. †1976. ‡1990. §1977. \*\*1987. ††1992. Note: Contribution of abortion to fertility decline is based on the assumption that each abortion prevents 0.56 births.\*§

The contribution of induced abortion to fertility decline may be expressed as the percentage by which the GFR would have differed from its observed level in 1991 in two scenarios: if the abortion rate had not changed from its 1976-1980 level (that is, if women of reproductive age had continued to have the same probability of obtaining an abortion over time), or if the abortion ratio had not changed (that is, if women, once pregnant, continued to have the same likelihood of choosing to resolve the pregnancy by abortion over time). In both cases, we assume that each abortion averts 0.56 **births**.\*§

At the national level, trends in either measure—abortion rates or ratios—indicate that abortion had the largest impact in Brazil. As Table 2 shows, Brazil's GFR in 1991 would have been 11% higher had the abortion rate remained at its 1980 level (a projected rate of 96 live births per 1,000 women, instead of the observed 1991 rate of 87 births per 1,000). Further, the 1991 GFR would have been 13% higher if the abortion ratio had remained at its 1980 level.

Clearly, abortion had an important effect on fertility at the regional level in Brazil as well. For example, had there been no change in the abortion rate, the GFR would have been 9-10% higher in two regions and 18-26% higher in two others, with the

Northeast being the region most affected by abortion. The situation would have been roughly the same had the abortion ratio remained unchanged. However, in southern Brazil and São Paulo, real abortion rates fell slightly during most or all of the study period. In São Paulo, the abortion ratio rose from 1980 to 1991; if it had remained at its 1980 level, the GFR would have been 5% higher than the observed GFR. Thus, abortion contributed relatively little to fertility decline in these two regions.

Abortion appears to have been a much less important factor in fertility change in Colombia than in Brazil. The Colombian GFR would hardly have changed had abortion rates remained at the late-1970s level, and the GFR would have been only 5% higher had the abortion ratio remained at its 1976 level. Abortion contributed significantly to fertility decline in the Central and Eastern regions, however. The GFR in 1990 would have been 11-12% higher in these regions had the abortion ratio remained at its 1976 level. In the other regions, abortion did not contribute substantively to fertility decline. The negative values suggest that in these regions, the pregnancy rate fell even faster than did the GFR, as an ongoing decline in fertility was accompanied by a decline in the abortion rate.

In Mexico, as in Colombia, abortion was only moderately important in explaining fertility decline. The large fertility declines in each region were probably caused mainly by rising contraceptive use and by other factors, not by an increased probability of resolving unwanted pregnancies through abortion. Had the abortion ratio remained unchanged since 1977, for example, the GFR in 1991 would have been only 3-8% higher in any of the regions (see Table 2).

Two points concerning this analysis should be kept in mind. First, the role of abortion in fertility *change* should not be confused with the role of abortion in explaining the *level* of fertility. In Colombia and Mexico, abortion continued to be an important determinant of the level of fertility, even though abortion was not important in explaining fertility change, since the abortion rate and ratio changed so little.

Second, the projected declines in the GFRs are open to different interpretations. For example, the analysis implies that in Bogotá, had the abortion rate remained unchanged at its 1976 level, fertility would have been 12% *lower* in 1991 than it actually was. Increasing, and increasingly more effective, contraceptive use probably explained the concurrent declines in abortion and fertility. However, the number of abortions in recent years in Bogotá might possibly have been underestimated, if access to safe abortions increased even more rapidly than we took into account

when developing the multipliers for this analysis. In that situation, the abortion rate would be somewhat higher, and abortion's role in explaining the trend in fertility would also be greater.

We also examine here trends in the average number of births, abortions and pregnancies per woman; Table 3 presents these measures for each of the three countries. In Brazil, the number of abortions per woman rose substantially, from roughly 0.8 in 1980 to about 1.4 in 1991; this rise in reliance on abortion appears to have contributed to the decline in the number of births, from 4.5 per woman to about 3.0. By comparison, in Colombia and Mexico, the number of abortions per woman hardly changed over the period, suggesting that the steady decline in family size was largely caused by increases in contraceptive use.

Country and year	Pregnancies	Births	Abortions
<b>Brazil</b>			
1980	5.3	4.5	0.8
1986	4.7	3.8	0.9
1991	4.4	3.0	1.4
<b>Colombia</b>			
1976	6.0	4.9	1.1
1986	5.1	3.9	1.2
1990	4.5	3.4	1.1
<b>Mexico</b>			
1977	7.5	6.7	0.8
1987	5.4	4.6	0.8
1992	4.3	3.6	0.8
<small>Note: For each measure, the average number was calculated by multiplying the annual rate per 1,000 women by 35 years (for ages 15-49) and then dividing by 1,000.</small>			

### ABORTION AND CONTRACEPTION

One central question that we sought to answer is whether abortion levels rose or fell as contraceptive use increased. To test the theory that abortion incidence increases before ultimately declining with rising contraceptive use, we explored the relationship between these two factors using two different analytic methods. First, we examined the correlation between contraception and abortion at each point in time across geographic areas; second, we analyzed the time trend in abortion relative to the time trend in contraceptive use at the national and regional levels.

Four measures of contraceptive use were examined—current use of any method among women in union; current use of a modern method among women in union; current use of any method among all women of reproductive age; and current use of a modern method among all women of reproductive age. All four measures were weighted for the effectiveness of the method. The

two contraceptive use measures based on all women of reproductive age, regardless of union status, are more consistent with the abortion measures, which were also estimated for all women.

We included both the abortion rate and the abortion ratio in the analyses. Should the abortion rate remain stable over time, we expect the association between contraceptive use (rising over time in these three countries) and the abortion ratio to be positive, since the rise in contraceptive practice will lower the pregnancy rate. A negative relationship between contraceptive use and the abortion ratio would indicate that the abortion rate had declined even faster than the fertility rate.

### CROSS-SECTIONAL RELATIONSHIPS

We calculated simple correlation coefficients using each country's 23-32 administrative units (states in Brazil and Mexico, and departments in Colombia) as the units of analysis. However, information on both contraceptive use and abortion was available at the state or departmental level for only one of the three study years in each country—in 1986 for Brazil, in 1990 for Colombia and in 1992 for Mexico.

The results indicated no significant association between the abortion rate and contraceptive use for Colombia in 1990, or for Brazil in 1986. For Mexico in 1992, however, there was a significant, positive association ( $p=.01$ ) between contraceptive use and abortion incidence, with correlation coefficients ranging from .41 to .44 across the four contraceptive use measures. These results suggest that in Brazil and Colombia, greater state-level variation exists in the pattern of change and in the strength of two important proximate determinants of fertility—contraception and abortion. Mexico, however, appears to exhibit a more uniform pattern across states, whereby whenever contraceptive use is high, the abortion rate also is high.

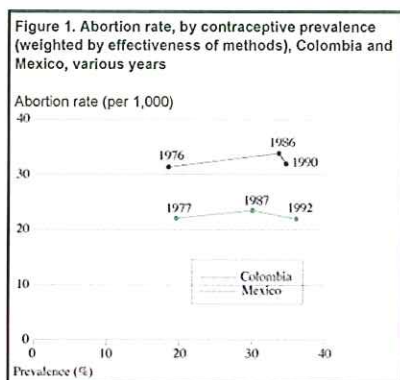
We also calculated correlations between the abortion ratio and the four measures of contraceptive use, with states or departments as the unit of analysis. These analyses revealed positive and significant relationships between the abortion ratio and contraceptive use in both Colombia ( $p=0.05$ ) and Mexico ( $p=0.001$ ). Notably, however, this association was not significant in **Brazil**.<sup>†\*</sup> In addition, analyses that pooled all regions in all three countries in 1986 and separately for the 1990s showed no significant correlation between abortion and contraception.

### TRENDS OVER TIME

The goal of the second approach—examining time trends in contraceptive use and abortion at the national and regional

levels—is to explore whether common patterns persisted over time. For example, did reliance on abortion typically continue to rise as contraceptive use rose? Or did the practice of abortion decline as contraceptive use increased, and if so, what was the timing of the decline?

Figure 1 plots the abortion rate against the level of contraceptive use for the two countries for which data were available in all three years—Colombia and Mexico. As the figure shows, the abortion rate remained more or less stable as contraceptive use increased from the mid-1970s to the early 1990s. In Colombia, the increase in contraceptive use from the mid-1980s to the early 1990s was minimal, but in Mexico, contraceptive prevalence increased greatly over that interval.



Although national-level contraceptive use data are unavailable for Brazil for all three study years,<sup>††</sup> the partial regional data that were available suggest that nationally, contraceptive use rose substantially between 1980 and 1986, and that use most likely continued to rise through the early 1990s, even as the national abortion rate in Brazil increased steadily between 1980 and 1991.

Figure 2 graphs the abortion rate against the contraceptive prevalence rate for three points in time in all five regions of Colombia. The abortion rate clearly rose from 1976 through 1986 in the Central and Eastern regions, even as contraceptive use rose sharply over that period. The abortion rate declined, however, in the Pacific region and especially in Bogotá, while contraceptive use increased over the study interval. From 1986 to 1990, the abortion rate declined in four of the five regions as contraceptive use stabilized (Central and Atlantic regions) or continued to increase (Eastern and Pacific regions). If the small increase in the abortion rate from 1986 to 1990 in Bogotá is discounted as a short-term fluctuation (or as the result of underestimating Bogotá's abortion rate in 1986), then the abortion rate can be considered to have stabilized in Bogotá even as levels of contraceptive use plateaued.

Figure 2. Abortion rate, by contraceptive prevalence (weighted for effectiveness of methods), regions of Colombia, 1976, 1986 and 1990



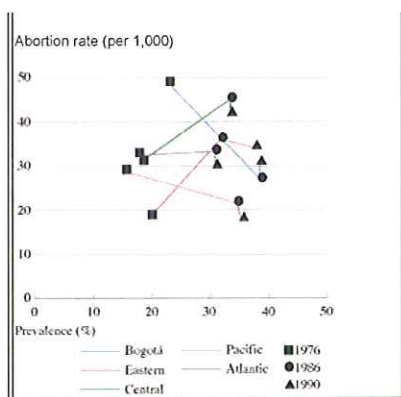
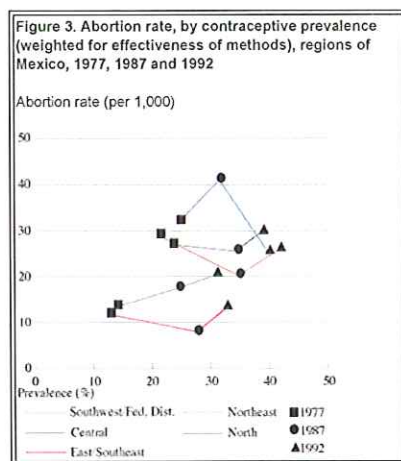


Figure 3 plots the same measures for the five regions of Mexico. The abortion rate in the Southwest and Federal District (which includes Mexico City) increased from 1977 to 1987, and then declined from 1987-1992 as contraceptive use increased throughout the period. In only one region (the Central region, which includes the metropolitan area of Guadalajara) did abortion rise moderately and steadily with contraceptive use. Neither pattern advanced in our hypothesis characterizes the remaining three regions (North, Northeast, and the East and Southeast), where the abortion rate actually fell from 1977 to 1987 before rising through 1992. This initial dip in the abortion rate may reflect errors in the abortion estimates or perhaps an unusual development in these regions.



### IMPACT ON FERTILITY

We hypothesized that fertility would be highest when both abortion and contraceptive use are at their lowest levels. Because abortion is predicted to eventually decline as effective contraceptive use reaches very high levels and as fertility subsequently falls, fertility would probably not be at its lowest point as long as both abortion and contraception are high, but might be lowest when contraceptive prevalence is very high and abortion rates are in a middle range. These hypotheses, however, do not allow for significant differences in contraceptive failure rates across areas or over time. As mentioned earlier, we assumed

the same uniform failure rates for all areas in all three time-periods studied.

We tested the above hypotheses by categorizing levels of abortion and contraceptive use separately as low, low-medium, medium-high and high. We then calculated the average GFR for regions with each possible combination of the four levels (see Table 4, page 12). The results show a strong relationship between contraceptive use and fertility: The GFR drops from 164 births per 1,000 women of reproductive age to 94 births per 1,000 as contraceptive prevalence rises, from low (25% or fewer of all women of reproductive age) to high (38% or more), across all levels of abortion prevalence.

**Table 4. Average GFR, by level of contraceptive prevalence, according to level of abortion rate, Brazil, Colombia and Mexico, 1976-1992**

Abortion rate (per 1,000 women per year)	Contraceptive prevalence				
	Total	Low ( $\leq 25.0\%$ )	Low-medium (25.0-32.9%)	Medium-high (33.0-37.9%)	High ( $\geq 38.0\%$ )
<b>Total</b>	<b>124</b>	<b>164</b>	<b>127</b>	<b>103</b>	<b>94</b>
Low ( $\leq 20.1$ )	147	178	133	97	110
Low-medium (20.1-30.0)	119	175	124	110	90
Medium-high (30.1-40.4)	121	152	130	102	88
High ( $\geq 40.5$ )	100	100	114	95	*

\*No data. Notes: Contraceptive prevalence rates are for all women aged 15-49 and are weighted for effectiveness of each method. The units of analysis are regions, for all three study years and for all three countries combined. Complete data are not available for all regions in all time periods.

The level of abortion also has an impact on fertility: The GFR falls from 147 births per 1,000 women to 100 births per 1,000, as abortion rates rise from low (20 or fewer abortions per 1,000 women of reproductive age) to high (40.5 or more abortions per 1,000 women) across all contraceptive prevalence levels. The relationship between abortion and fertility is most consistent and strongest in areas where contraceptive use is low.

Fertility does not decline much, however, as levels of abortion and contraceptive use move from medium-high to high. Instead, as was suggested above, fertility is lowest when contraceptive use is high but abortion is only medium-high. Moreover, a high degree of reliance on either abortion or contraceptive use alone is associated with low fertility, regardless of the extent of reliance on the other factor.

We also explored whether these associations would be different or stronger in any one country. We collapsed the four contraceptive and abortion prevalence groups into two, because of the small number of cases in each country. This less-detailed breakdown revealed no inconsistencies or reversals of the relationships in any country (not shown). However, it was still evident that in each country, if contraceptive use levels are high, the prevalence of abortion makes relatively little difference to the GFR. However, if contraceptive prevalence is low, abortion makes a substantial difference.

Factors other than abortion and contraception may also influence the observed relationship, however. Differences in the effectiveness of contraceptive use, beyond that controlled for by standard weighting for failure rates, could account for some of the inconsistencies. The small number of cases on which these averages are based, and the fact that the levels and patterns of relationships vary by country and within countries, also contribute to inconsistencies when all three countries are combined.

## DISCUSSION

According to demographic experience and theory, as couples become increasingly motivated to restrict their family size, they seek all available means to achieve their family size **goals**.<sup>21</sup> This theory seems to have been borne out in Latin America, at least in the three countries studied here—Brazil, Colombia and Mexico. Their experience fits the second of the two hypotheses advanced by Tietze and Bongaarts in the mid-**1970s**:<sup>22</sup> Declines in abortion would be slow in arriving, because when the fertility transition began in Latin America in the 1960s, contraceptive prevalence was low and the incidence of abortion was either rising or already high in many **areas**.<sup>23</sup>

Although our analysis does not cover the 1960s, we can surmise from the high fertility in these countries in that period (typically 6-7 children per woman) that voluntary restriction of fertility was minimal. Moreover, abortion rates were probably relatively low before the fertility transition began, but rose during the 1960s and early 1970s to the moderate levels we found during the mid-1970s. This suggests that in the early stages of the demographic transition, abortion probably played an important role in fertility decline in all three countries.

The results of these analyses broadly support the hypothesis that abortion rates can rise as contraceptive use increases, but that they ultimately begin to stabilize and then decline. However, these patterns varied considerably both among countries and within countries. In Colombia and Mexico, the level of abortion stabilized after contraceptive use began to rise, whereas in Brazil, abortion continued to rise through the early 1990s, as contraceptive use also climbed.

There was even wider variation by region. In the large metropolitan regions of Colombia and Mexico, for example, the abortion rate declined—from the mid-1970s in Bogotá and from the mid-1980s in the region containing Mexico City. In contrast, the abortion rate in São Paulo remained steady and the rate in Rio de Janeiro increased sharply, following the overall pattern of

Brazil. Most other regions of Brazil and Mexico experienced an ongoing rise in the abortion rate, with increases continuing up to the early 1990s. In Colombia, however, most regions saw declines in the abortion rate after the mid-1980s (albeit small ones), suggesting that a national culture of effective contraceptive use was beginning to take hold.

Our estimates of abortion trends are highly dependent on the multipliers used, which in turn are based on assumptions about the proportion of abortions that lead to hospitalizations in each country in different time **periods**.<sup>14</sup> Yet even if we had used slightly higher multipliers, the basic trends would not have changed appreciably, because the observed declines in abortion rates were so large. The overall trend in abortion would also not have differed if the multipliers had been uniformly too low, although the impact of abortion on fertility at any one point in time might have been greater than our results indicated.

The high degree of variation within countries in both the level of contraceptive use and the level of abortion suggests that individual regions are undergoing their fertility transition at different paces, and that the role of abortion in the transition varies geographically. Thus, the cross-sectional correlations between contraceptive use and the abortion rate are often weak. Nevertheless, the comparison of trends in contraception and abortion over time supports earlier **hypotheses**.<sup>24</sup>

Our analysis shows that the marked rise in the level of abortion in Brazil accounted for a substantial amount of the national fertility decline during the 1980s, as it did for most regions of Brazil. (Even in Brazil, however, in absolute terms, contraceptive use is responsible for a greater part of fertility control than is abortion.) In contrast, abortion was a much less important factor in fertility change overall in Colombia and Mexico. In some regions of Colombia and Mexico, however, abortion played at least a small, and occasionally moderate, role in fertility decline.

The weakness of the cross-sectional relationships between contraceptive use and abortion levels, and the wide variation among regions in this relationship over time, suggest that levels of unwanted pregnancy and of abortion are influenced by factors beyond the level of contraceptive use, such as the extent of incorrect use of effective methods and of the use of less-effective traditional methods. Some of these factors depend at least in part on the quality and reach of existing family planning services. In addition, factors that affect access to abortion services may change independently and influence the level of abortion in any given area (for example, should an effective and inexpensive

abortifacient become easy for women to obtain, or should governments zealously enforce the law).

What might explain Brazil's steady increase in abortion into the early 1990s? And why does abortion appear to have played a larger role in fertility decline in Brazil than in the other two countries studied? One likely contributing factor was the rapid rise in the use of the over-the-counter drug misoprostol as an abortifacient in the early 1990s, a phenomenon that within Latin America was largely confined to **Brazil**.<sup>25</sup> Another important factor is the poorer quality of family planning services in Brazil, where there is no government-supported family planning program and contraceptive services are mostly unavailable through the public sector. As a result, poor women in most regions of Brazil still lack access to a wide range of methods. Most users of reversible methods rely on the pill and obtain it without a prescription from pharmacies, which may not provide adequate information and counseling about correct use and side effects.

In contrast, the government of Mexico has actively supported family planning, and in Colombia, the very strong private nonprofit organization, Profamilia, provides widespread access to high-quality services. In Brazil, inadequate counseling and limited choice of methods may lead to incorrect use and method discontinuation and, consequently, to higher levels of unwanted pregnancy and abortion. The fact that the abortion rate has stabilized in the Brazilian region of São Paulo may reflect that state's well-organized system of family planning services **delivery**.<sup>26</sup> Our analysis thus supports the view that the access to and quality of family planning services may affect trends in the abortion rate.

The apparent ongoing rise in reliance on abortion in Brazil is nevertheless difficult to explain in the context of a rapid increase in female sterilization in that country. For example, the proportion of women in union who were protected by female sterilization rose from 27% (among 15-44-year-olds) in 1986 to 40% (among 15-49-year-olds) in **1996**.<sup>27</sup> The increased reliance on sterilization, along with an increase in the use of reversible methods, might result in an eventual decline in the abortion rate in Brazil.

That this has not yet happened may be due to a combination of factors. The motivation to have smaller families might be stronger in Brazil than in the two other countries. (The TFR is already slightly lower in Brazil than in Colombia or Mexico—2.6 lifetime births per woman vs. 3.0 and 3.2, **respectively**.<sup>28</sup>) In addition, some reproductive factors common to all three countries could be

more influential in Brazil than in Colombia or Mexico. For example, while the proportion of unmarried young women who are sexually active is probably increasing in Latin America as a whole, that proportion probably rose more rapidly in Brazil than in Colombia. DHS surveys conducted in the mid-1980s and early 1990s in Colombia and Northeast Brazil show that while the proportion of unmarried women aged 20-24 who had ever had sex rose in both countries, increases were somewhat larger in Northeast Brazil than in Colombia—a rise from 8.3% in 1986 to 17.0% in 1991 in Northeast Brazil, compared with an increase from 9.1% in 1986 to 14.1% in 1990 in Colombia. And at the same time, the proportion of 20-24-year old women who were unmarried increased rapidly in Northeast **Brazil**.<sup>29</sup> (No comparable data are available for Mexico.) Given the low levels of contraceptive use among unmarried women, this documented increase in sexual activity (which itself is likely to be underreported) could provide another reason why abortion rates are higher in Brazil.

Finally, it is possible that we overestimated the incidence of abortion in the Northeast in 1986 and 1991. If access to hospital care improved more rapidly in this region than throughout Brazil, then the multiplier for this region should be lower than what was used, and the estimated abortion rates for 1986 and 1991 would also be lower.

The program and policy implications arising from this study are clear: High-quality family planning services that offer a wide range of contraceptive choices and in-depth counseling to all women, including rural women, poor women, adolescents and sexually active single women, should be made more available in all three countries, but particularly in Brazil. It is also clear, based on the observation of other countries in which family planning services are widely available, that the practice of abortion is unlikely to disappear altogether in Latin America, even as effective contraceptive practice continues to rise.

#### **APPENDIX: DATA SOURCES**

In this section, we list the sources of the data used to make our estimates. Except where otherwise noted, the sources given are for national, regional and state-level data.

##### **BRAZIL**

**\*Population:** For 1980, 1986 and 1991, census data and census projections were used.

**\*Contraceptive use:** For 1980, family planning survey data provided information on nine states and three **regions**.<sup>30</sup> For 1986, data from both the DHS and a government statistical office

survey were **used**.<sup>31</sup> For 1991, DHS data provided information on the Northeast region and on the states in this **region**.<sup>32</sup>

**\*Fertility:** For 1980, 1986 and 1991, estimates of crude birthrates, made by the Instituto Brasileiro de Geografia e Estatística (IBGE), were **used**.<sup>33</sup>

**\*Hospitalizations for abortion complications:** For 1980, national estimates are from an unpublished **source**;<sup>34</sup> regional estimates were imputed by distributing the national total across regions, using the regional distribution observed in 1984-1985 (the nearest period for which hospitalization data were available by region). For 1986 and 1991, all data are from unpublished tabulations by the government agency, Departamento de Informática do Sistema Unificado de Saúde (DATASUS). For 1986, data are for the largest public hospital system only (Instituto Nacional de Assistência Médica da Previdência Social, or INAMPS); totals for all hospital systems combined were imputed based on information about the proportion of all obstetric and gynecologic hospital beds in each state that belonged to **INAMPS**.<sup>35</sup> For 1991, data are from several public hospital systems, but not from private-sector hospitals.

## COLOMBIA

**\*Population:** For 1976, 1986 and 1990, census data and census projections were used.

**\*Contraceptive use:** For 1976, national and regional estimates are from the World Fertility Survey (**WFS**).<sup>36</sup> For 1986, national and regional estimates are from the **DHS**,<sup>37</sup> and for 1990, data at all levels (national, regional, sub-regional and state level) are from the **DHS**.<sup>38</sup>

**\*Fertility:** For 1976, national and regional estimates are based on age-specific fertility rates (ASFRs) from the WFS. For 1986 and 1990, all estimates are based on ASFRs from the DHS.

**\*Hospitalizations for abortion complications:** For 1976, 1986 and 1990, all data are from special tabulations of data files of the Ministry of Health. These data are mainly for public hospitals.

## MEXICO

**\*Population:** For 1977, 1987 and 1992, census data and census projections were used.

**\*Contraceptive use:** For 1977, national and regional estimates are from the **WFS**.<sup>39</sup> For 1987, national and regional estimates are from DHS **data**.<sup>40</sup> For 1992, national, regional and state-level

data are from the 1992 Mexico Fertility Survey (Encuesta Nacional de la Dinámica Demográfica, or **ENADID**).<sup>41</sup>

\***Fertility:** For 1977 and 1987, national and regional estimates are based on ASFRs from the WFS and DHS, respectively. For 1992, all estimates are based on ASFRs from the ENADID.

\***Hospitalizations for abortion complications:** For 1977, a national estimate only is available, and only for the largest public-sector system, Instituto Mexicano del Seguro Social (IMSS); for 1987, national, regional and state-level data are available, but only for the two largest public-sector hospital systems (IMSS and the Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado, or **ISSSTE**).<sup>42</sup> For both 1977 and 1987, the total number of hospitalized abortion cases was estimated, assuming that reporting hospital systems in those years received the same proportion of the total abortion cases as in 1992. In addition, for 1977, regional estimates were imputed by distributing the national total across regions, using the regional distribution observed in 1991. For 1992, national, regional and state-level data were available for all public-sector systems, but not for private-sector **hospitals**.<sup>43</sup>

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## RÉSUMÉ

Les estimations nationales et régionales relatives à l'incidence de l'avortement provoqué au Brésil, en Colombie et au Mexique, entre la fin des années 70 et le début des années 90, indiquent une augmentation nette du taux d'avortement au Brésil, ainsi qu'un nombre d'avortements par naissance également en hausse dans les trois pays. L'analyse transversale ne révèle aucune corrélation significative entre les taux d'avortement et la pratique contraceptive, sauf au Mexique, où une nette association positive a été observée au début des années 90. Dans la nette association positive longitudinale, le taux d'avortement a suivi l'accroissement de la pratique contraceptive dans la plupart des régions de Colombie jusqu'au milieu des années 80. En Colombie et dans la région la plus urbanisée du Mexique, les taux d'avortement se sont réduits à mesure de la stabilisation ou de l'augmentation de la pratique contraceptive. Le nombre d'avortements par naissance présente une association temporelle positive avec la pratique contraceptive dans presque toutes les régions des trois pays observés. Le rôle de l'avortement dans le déclin de la fécondité est apparu le plus important au Brésil, où l'indice général de fécondité aurait été de près de 13% supérieur au début des années 1990 si le nombre d'avortements par naissance n'avait pas augmenté depuis le début de la période d'observation. Selon les tendances observées, l'avortement semble avoir eu une plus grande incidence sur la fécondité dans les régions caractérisées par une pratique faible de la contraception. Dans l'ensemble, la pratique contraceptive semble avoir été un déterminant de fécondité plus important que l'avortement, mais l'avortement a joué un rôle accessoire important dans la détermination des niveaux et des tendances de la fécondité dans les pays observés.

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\*To take into account method failures that might result in pregnancy terminations, we averaged the published failure rates for methods in Colombia and Brazil, and then multiplied that average by 1.5 to include failures leading to abortions, on the assumption that one-third of all failures result in induced abortion. (Mexico was excluded from the calculation because estimates of failure rates there were considered unreliable.)

†The codes are defined as follows: Code 630—molar pregnancy or hydatidiform mole; Code 631—other abnormal product of conception; Code 632—missed abortion, early fetal death (at 22 or fewer weeks of gestation) with retention of a dead fetus, or retained products of conception, not following either a spontaneous or an induced

abortion, Code 633—ectopic pregnancy, including tubal pregnancy, Code 634—spontaneous abortion, Code 635—legally induced abortion, Code 636—illegally induced abortion, Code 637—unspecified abortion, Code 638—failed attempted abortion, and Code 639—complications following abortion and ectopic or molar pregnancy.

<sup>††</sup>The more complex organization of hospitals in Mexico and Brazil, each of which has many more separately operated hospital systems than Colombia, underlies our assumption that underreporting was somewhat greater in the past in Brazil and in Mexico than was the case in Colombia. However, we believe that reporting was slightly better for Brazil than for the other two countries in the early 1990s, as a result of Brazil's organized and effective effort (beginning in the late 1990s) to expand and improve the reporting of hospital data.

<sup>†††</sup>For example, in urban areas, abortion services are likely to be more accessible and safer, which would result in a higher multiplier (i.e., a smaller proportion of women obtaining abortions would require hospitalization). However, in those same urban areas, women's access to hospital care is also likely to be better, if a higher proportion of women who need hospital care obtain it, the multiplier will be reduced.

<sup>††††</sup>We also developed a set of multipliers based on the assumption that improvements in access to safe abortion outweigh increases in the use of hospital services as areas become more urbanized. This situation would result in higher-than-average multipliers for more urban areas and in lower-than-average multipliers for more rural areas in each country in a specific time period. A comparison of the two sets of estimates, one based on multipliers that vary by area according to the percentage urban and the other based on uniform multipliers in each country and time period, showed similar results in the abortion levels and trends over time in each of the countries and in their regions, suggesting that the estimates were quite stable.

<sup>†††††</sup>A few exceptions were made for areas within Brazil and Colombia that were known to have extremely safe or unsafe services. For Brazil in 1986, a multiplier of 5.25 was assigned to the more urban and developed regions (Rio de Janeiro, São Paulo, the South and the Central and Southeast regions), while one of 4.5 was assigned to more rural, less well-served areas (the North and Northeast). For Brazil in 1991, a multiplier of 5.75 was assigned to the metropolitan regions of Rio de Janeiro and São Paulo, one of 5.5 to the urban South and Central and Southeast regions, and one of 4.75 to the North and Northeast. For Colombia in 1986, three of the four Pacific departments (Cauca, Chocó and Nariño) with limited access to safe abortion services were assigned a multiplier of 4.5, the fourth department, Valle, a more urban and developed area, was assigned the same multiplier as that of all other areas (5.0), and the Pacific region was assigned the weighted average of the multipliers in its four states (4.8). For Colombia in 1990, because of Bogotá's far higher-than-average access to safe services, we assigned the Bogotá region a multiplier of 6.0; the first three Pacific states were again assigned relatively low multipliers (4.75), while the fourth, Valle was given a multiplier of 6.0. However, because Valle represents 60% of the region's population, the approximate weighted average in the region was the same as the multiplier for all other areas (5.5).

<sup>††††††</sup>The moderate decline in the abortion rate in the Northeast region (which includes the metropolitan area of Monterrey) from 1977 to 1987 is difficult to explain, especially since it was followed by an increase between 1987 and 1992. Data errors in either 1977 or 1987 in the numbers of hospitalizations or in the adjustment and estimation process for this region are likely explanations for this unexpected dip in the abortion rate. The number of abortions in the North and Northeast regions may also have been underestimated, because while some Mexican women living in border areas travel to the United States to obtain abortions, the extent of this behavior is unknown.

<sup>†††††††</sup>In general, the average number of births averted per induced abortion is calculated as follows:  $b = [0.4 \times (1 + u)]$ , where  $b$  = births averted,  $u$  = the percentage of women practicing contraception and 0.4 represents the accepted number of births averted biologically by each induced abortion. (See: J. Bongaarts and R. G. Potter, *Fertility, Biology and Behavior: An Analysis of the Proximate Determinants*, Academic Press, New York, 1983, p. 65.) The proportion of all women using contraceptives in the 1990s was approximately 40% in all three countries. Because this is a very rough approximation of the number of births averted, we applied the national average contraceptive prevalence rate at all geographic levels.

<sup>††††††††</sup>Our confidence in the general reliability of the data was supported by the strong negative relationship in all three countries between contraceptive use and both the pregnancy rate and the fertility measures ( $p < .01$  or less).

<sup>†††††††††</sup>In São Paulo, for which data are available only for 1980 and 1986, the abortion rate remained virtually unchanged over that interval, and in the South, the abortion rate dropped slightly, while contraceptive use increased in both regions during that period. In both regions, the abortion rate decreased from 1986 to 1991. Although corresponding contraceptive use data are unavailable, prevalence likely continued to increase in both regions over the period or remained at its relatively high level. We lack data on trends in contraceptive use in the other three regions (Rio de Janeiro, the North and Central/Southeast) where the abortion rate rose throughout the study period, although contraceptive use probably increased in these regions also.

<sup>††††††††††</sup>For example, had we assigned higher multipliers to the metropolitan areas of Colombia and Mexico in the 1980s and 1990s, the observed declines in the abortion rate would have been smaller. If we assumed for Bogotá a multiplier of six in 1986 and a multiplier of seven in 1990 (instead of five and six, respectively), the abortion rates in the three study years would be 49, 32 and 36 per 1,000 women of reproductive age, instead of 49, 27 and 31 per 1,000. Moreover, if the multipliers assigned in the more recent periods were too low—which would mean that more unreported safe abortions were being performed than we estimated—multipliers in those same areas were also probably too low in the earliest study year; thus, adjustment may have increased the estimated rates throughout the study period.