
The Epidemiology of Abortion And Its Prevention in Chile

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ABSTRACT: Mortality by abortion has continuously decreased over the past fifty years in Chile. In fact, maternal death as a result of an induced abortion has become an exceptionally rare phenomenon in epidemiological terms (a risk of 1 in 4 million pregnant women of fertile age or 0.4 per 100,000 live births for abortion of any type, excluding ectopic pregnancy). After abortion became illegal in 1989, deaths related to abortion continued to decrease from 10.8 to 0.39 per 100,000 live births. This scientific fact challenges the common notion that less permissive abortion laws lead to greater mortality associated with abortion.

Regardless of the legal status of abortion, prevention of induced abortion remains a key objective in most of the western world,^[1,2] and Chile is not an exception to this rule. In fact, Chile has been the subject of an interesting series of epidemiological data and recent research — some of which conducted at our institute — which I will attempt to summarize in this editorial.

Mortality by abortion has continuously decreased over the past 50 years in Chile.^[3] In fact, maternal death as a result of an induced abortion has become an exceptionally rare phenomenon in epidemiological terms (a risk of 1 in 4 million pregnant women of fertile age or 0.4 per 100,000 live births for abortion of any type, excluding ectopic pregnancy). After abortion became illegal in 1989,^[4] deaths related to abortion continued to decrease from 10.8 to 0.39 per 100,000 live births (Figure 1). This scientific fact challenges the common notion that less permissive abortion laws lead to greater mortality associated with abortion.^[3,5-7]

Several factors likely contributed to this phenomenon observed in Chile. The most relevant factors that have been identified in recent studies appear to be the decrease in fertility (from 5.0 to 1.8 children per woman over this 50-year period), increased access to family planning methods starting in 1964,^[8] the increase in

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women's education (from an average of 3.5 to 12 years over this 50-year period), a progressive expansion of emergency obstetric care, early access to pregnancy management and post-abortion care.^[9,10] It should be noted that the increase in female education showed synergistic effects influencing other variables.^[10] Likewise, the evidence suggests that a dynamic *lex artis*, together with a prudential medical ethical practice applied on a case-by-case basis,^[11] have prevailed in Chilean obstetric medical practice, making it unnecessary to return to a particular law for extreme cases of vital maternal compromise. It could even be the case that such legislation would lead to regressive results, depending on the law's scope, interpretation and use, as has occurred historically with previous abortion laws.^[12,13] Of interest is a time series examining 100 years of official records^[3] that confirm that the global maternal mortality ratio increased during the first seven years of the first therapeutic abortion law of 1931, reaching a historical peak of 989.2 deaths per 100,000 live births in 1937, the highest in the history of Chilean maternal health during the 20th century (Figure 2).

According to official statistics, abortion-related morbidity has also decreased.^[9] For example, the number of hospital discharges in 1965 for abortion of any type (spontaneous or induced) was 56,130 (i.e., 18.6% of all live births that year), which corresponds to a third of the obstetric bed occupancy at that time.^[14] Currently, abortion-related discharges number approximately 30,000 each year (i.e., 12% of the total live births), which corresponds to 10% to 15% of the obstetric bed occupancy. Over the last decade (2001-2011), despite a steady rate of obstetric hospitalizations and deliveries (33% of the total hospital discharges for women), an important decrease in the rate of abortion-related hospital discharges has been observed (Figure 3).

Upon disaggregating the nine diagnostic codes of the O group for abortive causes or outcomes using the 10th revision of the *Statistical Classification of Diseases and Related Health Problems Diseases* (ICD-10), it can be observed that ectopic pregnancy (O00), molar pregnancy and other abnormal products of conception (O01, O02 and O08) and spontaneous abortion (O03) have remained at remarkably constant rates, representing 70% of the total abortion-related hospital discharges in the last year of the series. As highlighted by a recent review of the use of ICD-10 codes for the documentation of abortive outcomes,^[15] none of these codes has been related to illegal abortions. For example, code O02 is used (among others) to classify an anembryonic pregnancy^[16] that is terminated with curettage, which is frequent in Chile due to the high ultrasound and surgical obstetrical medicalization, especially within the private sector. It is a prevalent error^[17,18] to consider code O02 to be an estimate of illegal abortions, an assumption that would mistakenly inflate the numbers.

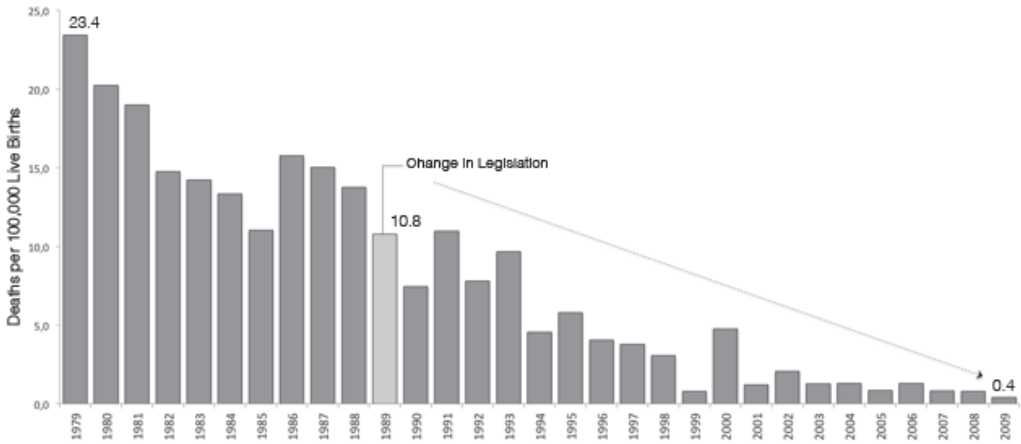


Figure 1. Maternal mortality ratio by abortion (deaths per 100,000 live births, excluding ectopic pregnancy) between 1979 and 2009 in Chile [3]. After 1989 (the year in which the health code authorizing therapeutic abortion endorsed by two physicians was repealed), the mortality ratio continued to decrease (96% in 20 years).

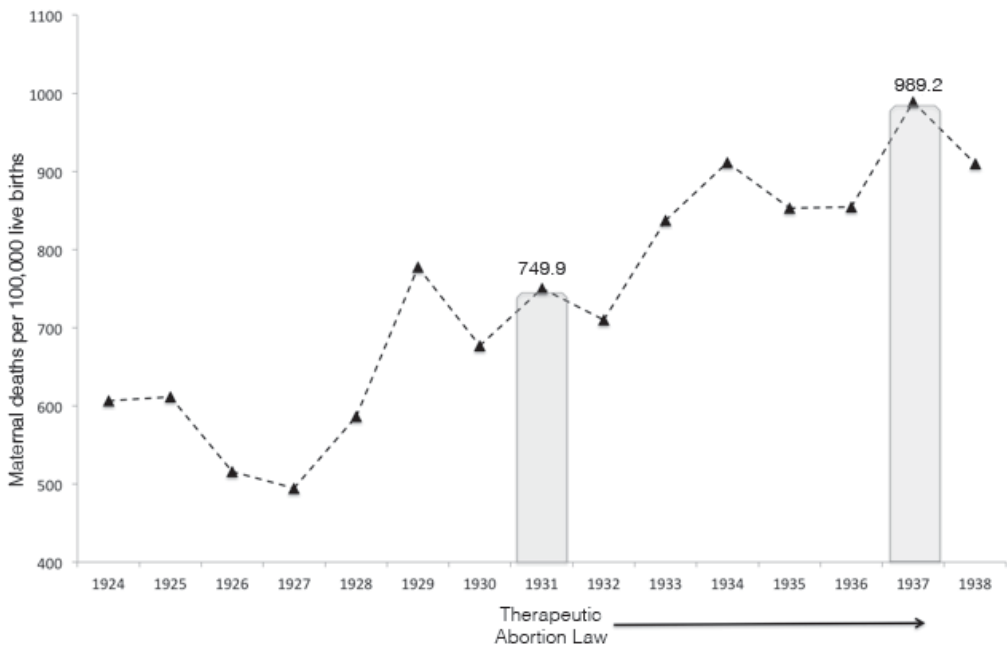


Figure 2. Maternal mortality ratio in Chile, 1924 – 1938.^[3]

In contrast, Figure 3 shows that the combined ratio of hospital discharges for other abortions (O05), unspecified abortion (O06), and failed attempted abortion (O07) had a significant downward trend of 2% per year or 1.73 per 1000 live births per year ($r=0.94$; $\beta=-1.73$; $p<0.001$). When these discharge codes are used, particularly 006, complications from illegal or clandestine abortions are frequently suspected.^[15] However, not all abortions classified as unspecified abortion necessarily correspond to secondary complications of induced abortions. In fact, this code is also used to account for abortions in which the physician has not determined another diagnosis or specific cause in the clinical registry (for example, “abortion, curettage” or simply “abortion” or “curettage” are common clinical registries classified under O06) and in which no pathology studies were conducted. Given this, it remains highly speculative to assume that all hospital discharges with abortive outcomes classified under code O06 reflect complications of induced abortions, as proposed by Molina et al. in a recent study.^[17]

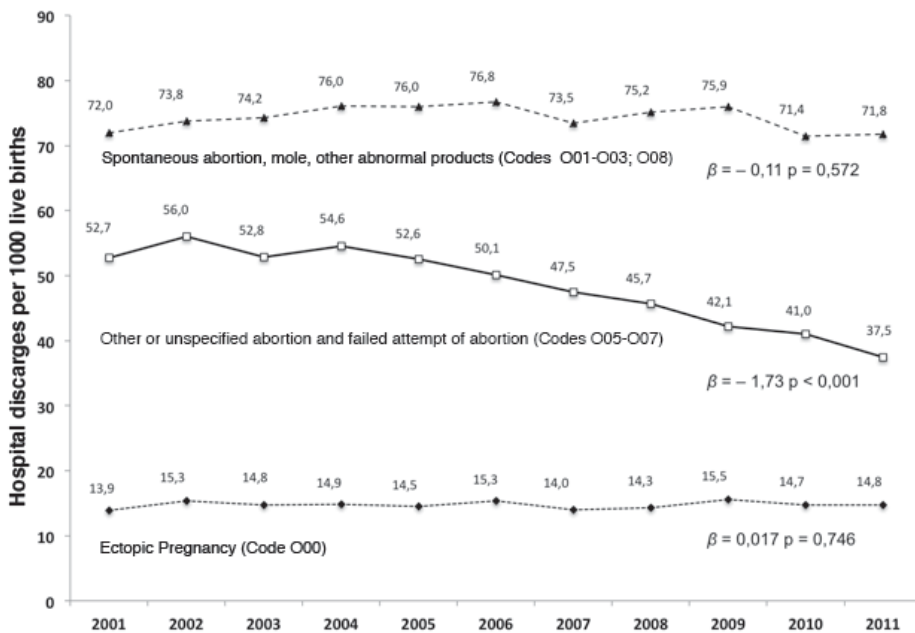


Figure 3. Abortion morbidity in Chile according to official statistics obtained from hospital discharge records by different types of abortion between 2001 and 2011. Complications of induced abortion are often suspected for discharge codes O05, O06 and O07 (solid line). The annual tendency was calculated using coefficients, estimated by simple regression. Source: Ministerio de Salud, Departamento de Estadísticas en Salud (DEIS).

Code O06 (unspecified abortion) accounts for 28.8% of the total number of hospital discharges of pregnancies with abortion outcomes (8,892 of a total of 30,860 for the last year for which statistics are available). Interestingly, the decrease in the number of discharges made using this code alone would account for nearly all of the reduction in abortion-related morbidity over the past decade, which is in excess of 15% globally. Given that the rate of other abortion outcomes of known cause has remained constant during this time period (Figure 3), this decrease does not appear to be simply an artifact of classification (i.e., an exchange of codes). We have also not detected a significant replacement of abortion codes with codes for hospitalizations for appendicitis or other common surgeries in the official statistics, which is part of an extensive urban myth in the national public opinion. It appears that there has been a real decrease in abortion-related morbidity that is both consistent and significant in epidemiological terms.

In terms of the plausibility of these findings, several factors could explain a decrease in the number of induced abortions and their associated complications over the last decade. For example, the use of drugs with abortive effects, such as misoprostol (which is increasingly accessible in the informal market),^[19,20] has been a factor mentioned in the literature.^[5,9,17,20] However, it is necessary to note that approximately half of the women that use this drug could experience bleeding and pelvic pain greater than that of a regular menstrual cycle and may consequently seek medical assistance. In addition, the rate of complications and failures can reach 30% or more with the use of self-administered misoprostol when taken in inadequate dosages or after more than nine weeks of gestation.^[21-23] Thus, one might predict that any significant increase in the illicit use of misoprostol at the population level would translate into an increase in abortion-related morbidity in hospital records, particularly in code O06 (unspecified abortion). Given that the opposite has been observed, it is unlikely that an increase in the use of this drug alone can explain the tendency observed in Figure 3.

A second factor that could explain the decrease in abortion-related morbidity is an increase in the prevalence or consistency of the use of contraceptive methods, including the growing access to emergency contraceptive in the health care network.

In a recent study of Chilean women with unplanned, vulnerable pregnancies at risk for abortion,^[24] 49.6% of the women were not using any contraceptive methods at the time of conception, while 23.1% reported using a hormonal method, 3.1% reported using some type of intrauterine device and 8.1% reported using a condom. No significant differences were observed between women who declared an intention to have an abortion and those who did not (Table I).

Table I
Baseline characteristics of a cohort^[24,28] of Chilean women
with unplanned pregnancies in vulnerable situation
based on their declarations of abortion intent

	Total population	Declares abortion intent		P value*
	(n = 3134)	No (n = 2648)	Yes (n = 486)	
Age (mean \pm SE)	22.7 \pm 6.2	22.7 \pm 6.2	22.9 \pm 6.5	0.363
Residence (%)				
Metropolitan Region	70.7	70.9	69.5	0.547
Other regions	29.3	29.1	30.5	0.547
Years of education (%)				
1 through 8	12.3	13.1	8.2	0.035
9 through 12	56.7	57.3	53.7	0.121
13 or more	25.0	23.6	32.7	<0.001
Undetermined	6.0	6.1	5.3	0.731
Gestational trimester (%)				
First	48.6	44.3	72.2	<0.001
Second	35.0	37.2	23.0	<0.001
Third	16.4	18.5	4.7	<0.001
Prevention method (%)				
None	49.6	49.8	48.1	0.464
Hormonal contraceptive	23.1	23.4	21.8	0.491
Intrauterine device (IUD)	3.1	3.2	2.3	0.698
Condom	8.1	7.7	10.5	0.228
Other	3.1	3.2	2.1	0.636
Unspecified	13.0	12.6	15.2	0.263

*P values were calculated using z-tests to compare 2 proportions, except for the mean ages, which were compared using an ANOVA test.

Although the rates of induced abortions in some countries with permissive laws, such as Spain, have increased in parallel with the increase in the global prevalence of contraceptive methods,^[25] a decrease in abortion-related morbidity at hospitals has been documented in Chile with the expansion of family planning programs.^[8,26] One interesting hypothesis is that the use of contraceptive methods could have become more consistent or efficient over time with less permissive abortion legislation. For example, a recent time series examining a panel of 41 countries, which used reports of gonorrhoea as a proxy for risky sexual behavior, showed that more permissive abortion laws are associated with an increase in the reported incidence of gonorrhoea, suggesting an increase in risky sexual behavior (e.g., unprotected sex) at the population level.^[27] According to the authors, economic theory predicts that abortion laws can affect sexual behavior by changing the marginal cost of engaging in risky sexual relations.^[27] Indeed, this cost is lower with more permissive laws. Thus, depending on their permissiveness, abortion laws could also change the marginal cost of engaging in risky sex without the use of a contraceptive.

A third factor to consider as a major determinant in the decrease in abortion-related morbidity, has been the emergence and gradual expansion of community preventive programs in Chile (e.g., Fundación Chile Unido, Fundación San José, Proyecto Esperanza, Fundación Maternitas, ISFEM, etc.). These programs identify the specific situation leading to vulnerability in unplanned pregnancies at risk for abortion and offer immediate support to the mother to find a solution. Recently, the preliminary results from one of the most extensive programs in terms of coverage (i.e., a cohort of 3,134 Chilean women with unplanned, vulnerable pregnancies) were presented in parallel discussion sessions of the United Nations' Millennium goals.^[28] As observed in Figure 5, based on the mother's declared intentions regarding abortion, the program achieved a live birth rate (with or without adoption) ranging between 69% and 85% depending on the risk group and whether the mother abandons or continues the program.

Research to identify specific situations associated with increased vulnerability appears to be key in the design of preventative strategies. In a sub-cohort of the previously mentioned study^[28] (the 486 women who initially declared an intention to abort), the following six factors explained more than 92% of the motivation to abort (Table II): coercion from their parents, a partner or from a third party with or without domestic violence (44.4%); interference with life expectations (22.8%); the desire to hide the pregnancy from parents or partner due to fear of their reaction (20.4%); repeated sexual abuse, rape and incest (2.1%); partner abandonment (1.9%); and psychological or emotional problems (1.9%). Without accounting for the fact that this is a high-risk sample, which is probably biased by self-selection and may not accurately represent the national reality, these results suggest that social problems that escape the spectrum of usual

medical actions are associated with increased abortion risk. In addition, these findings indicate that preventive programs within the community can be highly effective in reducing abortion incidence.

Another situation that also confers an increased risk for abortion is the presence of congenital diseases (3.1% of live births, approximately 7,400 births per year),^[29] the diagnoses of which can be made at increasingly early time points. For example, in European countries with permissive abortion laws,^[30] the rate of induced abortion in cases of trisomy 21 (i.e., the cause of Down syndrome) is between 76% and 96% of all diagnosed cases. Because of the fact that these countries typically have health coverage for screening for more than 70% of the population,^[30] there has been an enormous decrease in the number of births of children with this condition.^[31] Studies suggest that the implementation of systematic genetic diagnosis programs increase the interruption of pregnancy.^[32,33] Figure 5 compares the birth rates of children with Trisomy 21 in Chile^[29] and other selected countries.^[31,34] Chile and Ireland have a

Table II
Specific vulnerability situations in a cohort of 3,134 Chilean women
with unplanned pregnancies at risk for abortion^[28]

	Total population (n = 3134)	Declares abortion intent		P value †
		No (n = 2648)	Yes (n = 486)	
Coercion ^a (%)	10.1	3.7	44.4	<0.001
Sexual abuse ^b (%)	1.9	1.8	2.1	0.897
Hiding pregnancy due to fear ^c (%)	14.1	12.9	20.4	0.001
Life expectations ^d (%)	5.5	2.3	22.8	<0.001
Psychological problems ^e (%)	31.4	36.9	1.9	<0.001
Abandonment by the couple (%)	7.0	7.9	1.9	0.009
Abandonment or expel from home (%)	17.0	20.1	0.4	<0.001
Assistance to give in adoption (%)	8.0	9.4	-	-
Doubts about pregnancy (%)	1.2	1.4	-	-
Other causes (%)	4.0	3.5	6.2	0.245

^aCoercion to abort from the father, mother, both parents or partner;
^bRape, incest or repeated sexual abuse; ^cHiding the pregnancy due to a fear of a parent's or partner's reaction; ^dNot wanting to interfere with their life, including not interrupting studies, fear of being a single mother, socioeconomic reasons and course of life; ^eIncluding substance or alcohol abuse; † z- test.

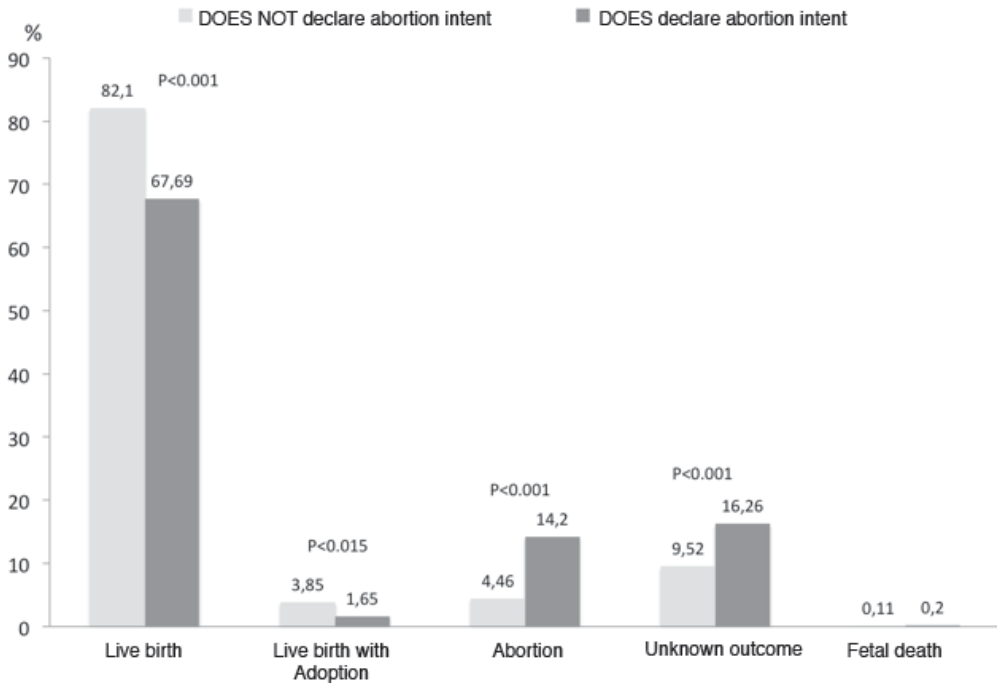


Figure 4. Outcomes of a support program and community support (Fundación Chile Unido) in a cohort of 3,134 Chilean women with unplanned pregnancies in vulnerable situations who were grouped according to their declared intention of having an abortion (no = 2,648; yes = 486). The unknown outcome corresponds to women with whom contact was lost before 20 weeks of gestation.

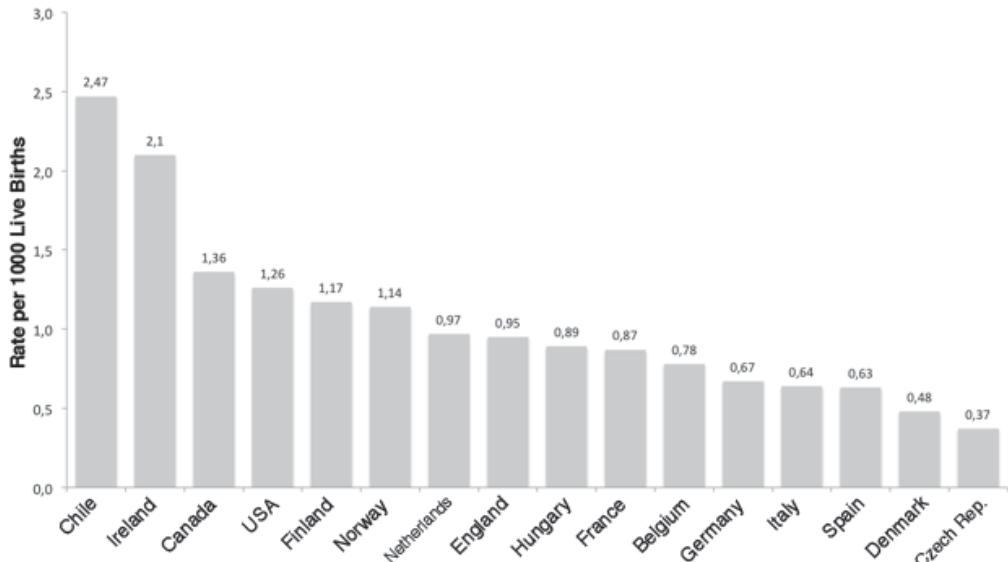


Figure 5. Birth rates of children with trisomy 21 (Down syndrome) in Chile, Canada, United States, and 13 European countries.^[29,31,34]

higher rate of births with Down syndrome (2.47 per 1000 live births, approximately 600 new cases per year), suggesting that less permissive abortion legislation may contribute to preventing the abortion of these children.^[35] However, in the case of serious and lethal diseases such as anencephaly (0.03% of live births, approximately 65 to 75 cases per year) or renal agenesis (0.02%, approximately 40 to 50 cases per year), access to perinatal palliative care programs offered by specialized obstetric teams provides an efficient alternative solution to the problem of induced abortion.^[36-38] Pilot programs of this type have been successfully implemented in Santiago.^[39] It is necessary to expand their reach to the national level to promote maternal and perinatal health and to prevent induced abortions.

Another factor that is relevant in the epidemiology and prevention of abortion is to have empirically plausible estimations of abortion figures, especially for the design of proportional preventive strategies. A study conducted in 1990 that was based on a subjective opinion survey with expansion factors reported inflated data, suggesting that approximately 160,000 illegal abortions were performed every year in Chile.^[40] However, a review of the methodology of that study found it lacking reproducibility and subject to biases of selection, recall, and ideology of the interviewed individuals, especially in the calculation of an expansion factor that multiplies the number of discharges by abortion observed in health institutions.^[41] Other examples from countries that have modified their abortion legislation also suggest large estimation errors. For example, in the Federal District of Mexico, it was estimated that more than 194,875 abortions were performed every year prior to the restrictive legislation. After more than 5 years following the new law, the number of induced abortions has not reached 20,000 in any year.^[15] In Uruguay, 33,000 abortions per year were estimated pre-legislation,^[42] but after the first full year of complete statistics post-legislation, the total number of induced abortions was only 6,676.^[43] Even assuming some under reporting of legal abortions in these countries, these numbers show that such methods fail to provide empirically plausible estimations of abortion figures.^[44]

Although the number of illegal abortions cannot be known precisely, it is possible to conduct objective and reproducible epidemiologic approximations that are independent of the operator. Table III presents the results obtained using a recently described residual method^[41] that estimates the number of induced abortions using the number of live births, the probability of viable conception and clinical abortion^[45,46] and the number of hospital discharges for several complications. The greater the excess of hospital discharges for a given abortion method and the lower the rate of complications for this abortion method, the greater the estimate of induced abortions will be. For example, considering 30% to 40% failure rates for self-administered misoprostol,^[21-23] it is estimated that between 13,553 and 18,071 illegal abortions occur each year on average. This number would correspond to approximately 16.1% of all hospitalizations for abortion in Chile (Table III).

Table III
Estimation of the number of expected abortions obtained by combining statistics from hospital discharge reports from 2001 to 2008, live births and reciprocal probabilities of viable conceptions and abortions^[45,46] for different percentile rates of complications, adapted from Koch et al^[9]

Year	Observed live Births†	Hospitalizations by abortion‡	Expected clinical abortions ^b	Abortion excess‡	Inducted abortions according to complications rate				
					(%) ^c	50%	40%	30%	20%
2001	248,651	34,479	29,319	5,160	15.0	10,321	12,901	17,201	25,802
2002	241,027	34,968	28,420	6,548	18.7	13,097	16,371	21,828	32,742
2003	236,223	33,497	27,853	5,644	16.8	11,288	14,110	18,813	28,219
2004	232,588	33,835	27,425	6,410	18.9	12,821	16,026	21,368	32,052
2005	232,092	33,184	27,366	5,818	17.5	11,636	14,545	19,393	29,090
2006	233,104	33,145	27,485	5,660	17.1	11,319	14,149	18,865	28,298
2007	242,054	32,532	28,541	3,991	12.3	7,983	9,978	13,304	19,957
2008	248,366	33,423	29,285	4,138	12.4	8,276	10,345	13,794	20,690
Mean	239,263	33,633	28,212	5,421	16.1	10,843	13,553	18,071	27,106

†: Based on data of live births that was corrected by the Instituto Nacional de Estadísticas (INE) (2010) “Estadísticas Vitales, Informe Anual 2008.” ‡Data published by the Ministerio de Salud (Ministry of Health) of Chile. ^bEstimations were performed by applying the probabilities of viable conception and clinical abortion [45,46]. The probabilities used were 0.67 for live birth and 0.079 for clinical abortion ‡: Estimated as the difference between hospital discharges for observed and expected abortions. ^cEstimated proportion of hospital discharges related to induced abortions. Absolute total number of estimated induced abortions when different rates of complications are applied, from 20% (2 of every 10) to 50% (5 of every 10) of the excess residual of hospital discharges for abortion.

Another more simple and accessible method involves indirect epidemiological standardization and the combination of rates for known populations. In Table IV, the rates observed in Spain for the first five years of complete statistics have been used as a standard^[41] after being corrected for the differences in global fertility and age of the Chilean female population exposed to abortion risk in the year 2010. For each estimate, 95% confidence intervals are provided. On average, it is estimated that 18,240 induced abortions occur each year, with a rate of 4.65 per 1000 women of fertile age. Both methods led to similar results, rely on available information of vital statistics with objective estimators and avoid the use of amplifiers of unknown validity.^[44]

Lastly, it should be highlighted that changes in the legal status of abortion are not focused on preventing this procedure occur, but rather only on facilitating its access depending on the permissiveness of the type of legislation.^[6,7,9] Legislative changes also do not solve the problems that lead to the specific vulnerability that motivate the intent of abortion, such as coercion or fear. Furthermore, repeated abortions have become a problem in several countries with permissive laws, such as Spain,^[44] France,^[47] The Netherlands^[48] and Nepal^[49] Even self-provoked

abortions that are performed secretly, as shown in recent studies, are not completely prevented in countries with legal abortion on request, particularly with the growing availability of misoprostol.^[50]

Table IV
Estimation of induced abortions for the Chilean population
using the standard rates observed in Spain for the
first five years of complete statistics^[41]

Model ^a	Standard rate (Spain) ^b	Fertile population (Chile) ^c	Correction factor Fertility ^d	Correction factor Age ^e	Induced abortions (crude)	Induced abortions (adjusted) ^f	Rate per 1,000 women	CI 95% [†]	
								Lower	Upper
1 (1987)	2.0193	3,923,514	1.2199	0.0331	7,923	9,927	2.53	2.48	2.58
2 (1988)	3.1066	3,923,514	1.2408	0.0297	12,189	15,486	3.94	3.88	4.01
3 (1989)	3.6086	3,923,514	1.2670	0.0262	14,158	18,309	4.67	4.59	4.73
4 (1990)	4.3547	3,923,514	1.2880	0.0227	17,086	22,394	5.71	5.63	5.78
5 (1991)	4.8572	3,923,514	1.3037	0.0195	19,057	25,216	6.43	6.34	6.50
Mean	3.6035	3,923,514	1.2639	0.0262	14,138	18,240	4.65	4.581	4.716

^aRefers to the year of the official rate published by the Instituto Nacional de Estadísticas of Spain that was used as the standard. ^bRate for every 1000 women of fertile age. ^cThe fertile population estimated for 2010 was based on the 2002 census. ^dCalculated as the reciprocal of the difference in the rate of global fertility between Chile in 2010 and Spain between 1987 and 1991. ^eCalculated as a proportional factor of the difference between the female population of fertile age of Spain and Chile. ^fAn estimate of the absolute number of abortions after adjusting for fertility and age. [†] Confidence intervals of 95% for the rates of induced abortions per 1000 women of fertile age.

In Chile, the first line of prevention of induced abortions has historically been focused on family planning through the supply and access of contraceptive methods designed to prevent unplanned pregnancies. When this fails or is insufficient, a more recent second line of prevention has been the emergence of support programs for vulnerable women with unplanned pregnancies at risk for abortion, which are conducted by the community or by local obstetric teams in the case of serious congenital diseases. Expanding the coverage of these preventive programs, as well as monitoring their effectiveness, is necessary to prevent clandestine abortions and to continue to decrease their incidence in the Chilean female population.

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