

Unintended pregnancy and abortion by income, region, and the legal status of abortion: estimates from a comprehensive model for 1990–2019



Jonathan Bearak, Anna Popinchalk, Bela Ganatra, Ann-Beth Moller, Özge Tunçalp, Cynthia Beavin, Lorraine Kwok, Leontine Alkema



Summary

Background Unintended pregnancy and abortion estimates document trends in sexual and reproductive health and autonomy. These estimates inform and motivate investment in global health programmes and policies. Variability in the availability and reliability of data poses challenges for measuring and monitoring trends in unintended pregnancy and abortion. We developed a new statistical model that jointly estimated unintended pregnancy and abortion that aimed to better inform efforts towards global equity in sexual and reproductive health and rights.

Methods We developed a model that simultaneously estimated incidence of unintended pregnancy and abortion within a Bayesian framework. Data on pregnancy intentions and abortion were compiled from country-based surveys, official statistics, and published studies found through a literature search, and we obtained data on livebirths from the World Population Prospects. We analysed results by World Bank income groups, Sustainable Development Goal regional groupings, and the legal status of abortion.

Findings In 2015–19, there were 121.0 million unintended pregnancies annually (80% uncertainty interval [UI] 112.8–131.5), corresponding to a global rate of 64 unintended pregnancies (UI 60–70) per 1000 women aged 15–49 years. 61% (58–63) of unintended pregnancies ended in abortion (totalling 73.3 million abortions annually [66.7–82.0]), corresponding to a global abortion rate of 39 abortions (36–44) per 1000 women aged 15–49 years. Using World Bank income groups, we found an inverse relationship between unintended pregnancy and income, whereas abortion rates varied non-monotonically across groups. In countries where abortion was restricted, the proportion of unintended pregnancies ending in abortion had increased compared with the proportion for 1990–94, and the unintended pregnancy rates were higher than in countries where abortion was broadly legal.

Interpretation Between 1990–94 and 2015–19, the global unintended pregnancy rate has declined, whereas the proportion of unintended pregnancies ending in abortion has increased. As a result, the global average abortion rate in 2015–19 was roughly equal to the estimates for 1990–94. Our findings suggest that people in high-income countries have better access to sexual and reproductive health care than those in low-income countries. Our findings indicate that individuals seek abortion even in settings where it is restricted. These findings emphasise the importance of ensuring access to the full spectrum of sexual and reproductive health services, including contraception and abortion care, and for additional investment towards equity in health-care services.

Funding UK Aid from the UK Government, Dutch Ministry of Foreign Affairs, UNDP/UNFPA/UNICEF/WHO/World Bank Special Programme of Research, Development and Research Training in Human Reproduction (HRP), and The Bill & Melinda Gates Foundation.

Copyright © 2020 The Author(s). Published by Elsevier Ltd. This is an Open Access article under the CC BY-NC-ND 4.0 license

Introduction

With long-term global decreases in desired family size and changes in the age at which people want to start families,^{1–3} individuals increasingly spend more of their lives trying to avoid unintended pregnancies. Evidence suggests that rates of unintended pregnancy have declined worldwide,^{4,5} with increasing access to and use of contraception likely contributing to these trends. However, existing contraceptive methods are imperfect and some people who do not want to get pregnant might not want or be able to use these methods. As such, and

also because individuals with an intended pregnancy might be unable to continue a pregnancy, access to safe and legal abortion as well as contraception increases reproductive autonomy. Limits on access to services, in contrast, contribute to unintended pregnancy and, when access is limited, unsafe abortion.⁶

Despite global health commitments, such as the Sustainable Development Goals (SDGs)⁷ and the Global Strategy for Women's, Children's and Adolescent's Health (2016–30),⁸ the Guttmacher-Lancet Commission⁹ has documented continued gaps in sexual and

Lancet Glob Health 2020

Published Online

July 22, 2020

[https://doi.org/10.1016/S2214-109X\(20\)30315-6](https://doi.org/10.1016/S2214-109X(20)30315-6)

See Online/Comment

[https://doi.org/10.1016/S2214-109X\(20\)30342-9](https://doi.org/10.1016/S2214-109X(20)30342-9)

Guttmacher Institute,
New York, NY, USA
(J Bearak PhD, A Popinchalk MPH,
C Beavin BA, L Kwok BA); UNDP/
UNFPA/UNICEF/WHO/World
Bank Special Programme of
Research, Development and
Research Training in Human
Reproduction, Department of
Sexual and Reproductive
Health and Research, WHO,
Geneva, Switzerland
(B Ganatra MD, A-B Moller MPH,
Ö Tunçalp MD); and Department
of Biostatistics and
Epidemiology, University of
Massachusetts, Amherst, MA,
USA (L Alkema PhD)

Correspondence to:

Dr Jonathan Bearak, Guttmacher
Institute, New York, NY 10038,
USA

jbearak@guttmacher.org

Research in context

Evidence before this study

The scarcity and unreliability of data necessitated studies that use a model-based approach to estimate rates of abortion and unintended pregnancy. Sedgh and colleagues used a model-based approach to produce regional abortion estimates from 1990 to 2014. Bearak and colleagues then used these estimates and other data to estimate unintended pregnancy.

Sedgh and colleagues found that abortion rates between 1990–94 and 2010–14 declined in Europe and northern America, and remained similar elsewhere. As of 2010–14, they also found that abortion rates did not substantially differ between countries where abortion was legally available compared with those where it was restricted. Subsequently, Bearak and colleagues found that unintended pregnancy rates declined in all world regions, but that the evidence for a decline was comparatively weak in Latin America and northern America. They also found that women with unintended pregnancies were less likely to obtain an abortion in countries where access to abortion was restricted.

Added value of this study

We developed a new model that simultaneously estimated abortion and unintended pregnancy. Additionally, we built a new global database that incorporated data from 166 countries, compared with 92 countries and 105 countries from previous studies. Countries were invited to provide feedback on the data sources, methods and preliminary estimates as part of a WHO country consultation process. Our methods and comprehensive data input resulted in different estimates, and these estimates supersede those from previously published studies. Our analysis improves on previous research in several ways. Sedgh and colleagues

used information on married women's contraceptive needs and use of contraceptives to estimate abortion incidence only. Our analysis also incorporates information on these measures in unmarried women. Additionally, we extended their framework to simultaneously estimate unintended pregnancy, unintended births, and abortion. We also published a study protocol, which included new data classification processes. Finally, our study includes data up until 2018 and estimates up until 2019.

Implications of all the available evidence

In contrast to declines in the global unintended pregnancy rate since 1990–94, the global abortion rate declined through 2000–04 before returning to levels last seen in the early 1990s, as the proportion of unintended pregnancies ending in abortion has increased. We also found substantial differences between low-income and high-income countries in the unintended pregnancy rate. This finding highlights global economic inequality in women's and couples' access to sexual and reproductive health services. For countries in our study that had restricted access to abortion, rates of unintended pregnancies were higher than in countries where abortion was broadly legal. The proportion of unintended pregnancies ending in abortion had increased since 1990–94 in countries where abortion was legally restricted. As such, individuals with unintended pregnancies relied on abortion services even in settings where abortion was restricted, potentially facing legal and physical risks for doing so. Our findings emphasise the need for continued investment in access to quality and comprehensive sexual and reproductive health care and, equally importantly, a commitment to upholding sexual and reproductive rights.

reproductive health and rights, including those related to access to contraception and safe quality abortion care. In this context, timely evidence for the incidence of unintended pregnancy and abortion can motivate investment and greater commitment to increase access to services and inform policies and programmes.

To strengthen this much needed evidence base, our study makes several contributions. We developed a new statistical model that jointly estimated unintended pregnancy and abortion. These outcomes contextualised one another, providing a more comprehensive understanding of unintended pregnancy and abortion. A study protocol was published to enhance transparency,¹⁰ and substantially more data were obtained (thereby covering more countries) than previous efforts.^{4,10–14} With this new approach, we developed estimates from 1990–2019.

This Article summarises how estimates of unintended pregnancy, abortion, and the percent of unintended pregnancies that end in abortion compare across World Bank income groups¹⁵ and SDG regions. We also compare

groups of countries where abortion is broadly legal to countries where it is not. This evidence can inform efforts towards global equity in sexual and reproductive health and rights.

Methods

This section presents a broad overview of methods reflecting space constraints, with a complete description of the methods elsewhere.¹⁶

We followed the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER)¹⁷ statement in developing the database, analysis, and presentation of the study.

Data for unintended pregnancy and abortion

Data for pregnancy intentions were compiled from country-based surveys and from studies found through a literature search. These surveys and studies are described in detail in the technical paper.¹⁶ In surveys done periodically, a pregnancy was considered unintended if it occurred sooner than desired or if it was not

wanted at all. We obtained data on abortion from published studies and official statistics. Official statistics might be incomplete because of various issues, including the legality of abortion, differing reporting requirements across countries, and under-reporting.¹⁸ Official statistics were determined to be complete through a data classification process outlined in the study protocol and, if incomplete, were treated as minima (minima inform the model that the true abortion rate is likely to be no less than the observed rate).^{10,16}

In total, 2415 datapoints were obtained for pregnancy intentions and abortions from 166 countries for the time period of 1990–2019. 516 observations were compiled on unintended fertility for 139 countries. For abortion data, we obtained 1899 observations from 105 countries, with 1019 observations treated as minima.

As some countries had data for one outcome but not the other, we had data for abortions or pregnancy intentions for 166 countries and territories. Of these 166 countries, we had point data for 150 countries; that is, for the other 16 countries, data were all minima, maxima (maxima inform the model that the true abortion rate is likely to be no more than the observed rate), or ranges.¹⁶ We had data for abortions and pregnancy intentions for 77 countries and, of these 77 countries, we had point data for both outcomes for 50 countries.

Modelling strategy

Our modelling strategy was informed by the proximate determinants of fertility.^{18,19} In brief, the incidence of

unintended pregnancy was defined in our model as a function of the number of women (disaggregated by marital status) with an unmet need for contraception, the number of women who used a contraceptive method who experienced a method or user failure, and the risk of pregnancy in each of these population groups (figure 1). Similarly, the incidence of intended pregnancies was defined as a function of the number of women (disaggregated by marital status) with no need for contraception and their risk of pregnancy. Abortion incidence was a function of group sizes, pregnancy rates, and propensities to have an abortion. Data for the sizes of these groups, and contraceptive method mix, were developed by the United Nations Population Division.^{19–23}

Pregnancy outcomes were abortions, livebirths, and fetal losses (ie, miscarriages and stillbirths; appendix p 1). We estimated fetal losses using an approach derived from life tables of pregnancy loss by gestational age in which there was, on average, one fetal loss for every ten abortions and one fetal loss for every five livebirths.^{18,19,24}

We used Bayesian hierarchical random walk models to produce estimates for 195 countries and territories (appendix p 2–3). For each country, resulting pregnancy and abortion estimates were based on: (1) available abortion and pregnancy data, (2) information on contraceptive needs and use by marital status, (3) model-based estimates of a series of parameters for variability, across countries and periods, in subgroup-specific pregnancy rates and probabilities that a pregnancy would end in

See Online for appendix

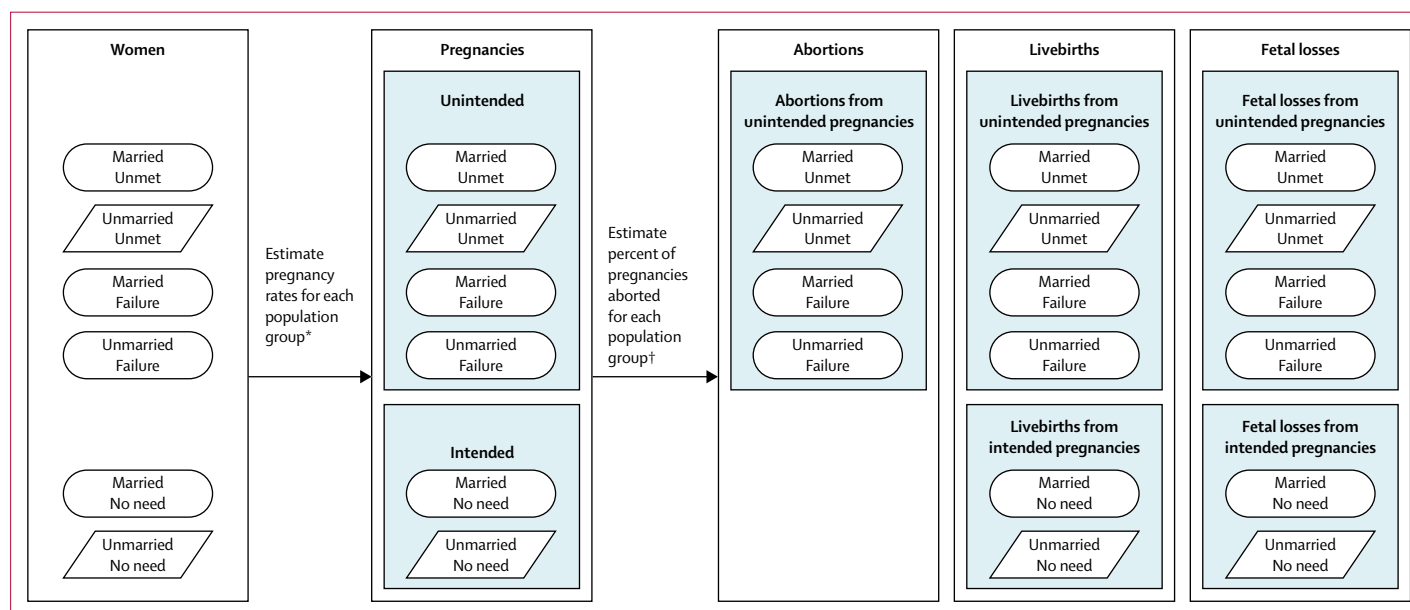


Figure 1: Process model for estimating rates of unintended pregnancy and abortion

Unmet=unmet need for contraception. Failure=contraceptive failure. No need=no need for contraception. *A hierarchical time series model can be used to estimate pregnancy rates and propensities to have an abortion. This model enables sharing of information across countries and time. †To fit the model, use data for women and births from the United Nations Population Division, and use all data (by population group) for abortion and pregnancy intention. Fetal losses are calculated by the formula: 0.2 livebirths + 0.1 abortions.

abortion, and (4) birth rate estimates. Model assumptions, treatment of data (including accounting for random and systematic error across, and within, data classes), and model validation exercises are detailed in the technical paper.¹⁶

Reported estimates

We computed point estimates with 80% uncertainty intervals (UIs) using the medians and 10th and 90th percentiles of posterior distributions of model parameters. A higher probability of change corresponded to a greater certainty about the direction of change (ie, a greater or lesser rate of abortions or unintended pregnancies between two timepoints being compared). We did not perform null-hypothesis significance testing, for several reasons.²⁵ However, we present the posterior probabilities wherever below 90%.

We computed point estimates of outcomes of interest using the posterior medians for each country and for each grouping of countries separately for each 5 year period. We report annual estimates for 5 year time periods (ie, all rates, percentages, and numbers applied to each year in the 5 year time period or, in other words, they were the average across each 5 year span of time). For analyses in which countries were grouped by income and legality, we also considered the possibility that an estimate might not have been representative for most of the countries in that category. If large countries had estimates that differed substantially from other countries within the same group, this could obfuscate the relationship between income or legal status of abortion and rate of abortion or unintended pregnancy. Addressing this issue, we computed unweighted medians within groups of countries (appendix p 4). When comparing two groups of countries, if the weighting substantively affected the interpretation of the comparison, we explained how.

For results by SDG regional groupings, we presented major regions (except for Australia and New Zealand, which we distinguished from Oceania). Results for each subregion are in appendix p 5. For standardisation, we used each country's classifications from 2019 when reporting time trends by income group or the legal status of abortion.^{17,26} For results by World Bank income groups, we used country groups published in 2019.¹⁵

We used the 2019 classification for legal status and World Bank income group for all time periods in the analysis to minimise estimated trends being an artifact of countries shifting between categories during the analysis period or due to changes in the classification methods.

Additional groupings and indicators produced by our model that were beyond the scope of this Article are in the appendix (pp 7–9) and on the Guttmacher Institute and WHO websites.

Role of the funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

Incidence of unintended pregnancy

Global levels and trends

In 2015–19, there were on average 121·0 million unintended pregnancies each year (UI 112·8–131·5 million; appendix p 6), which corresponded to a global annual rate of 64 unintended pregnancies per 1000 women aged 15–49 years (60–70) (figure 2; appendix p 10). Among all pregnancies, 48% (46–51) were unintended (appendix p 7).

In 1990–94, the global annual unintended pregnancy rate was 79 pregnancies (UI 74–84) per 1000 women aged between 15–49 years (table 1). It declined by 12 points (7–15) between 1990–94 and 2000–04, to 67 unintended pregnancies (63–72; appendix p 5) per 1000 women. The estimated decline in the global unintended pregnancy rate was steepest before 2000 and the rate was 64 unintended pregnancies (60–70) per 1000 women in 2015–19. Because of global population growth, the annual number of unintended pregnancies increased by 13% (4–22) between 1990–94 and 2015–19, from 107·6 million (101·0–115·3) to 121·0 million (112·8–131·5), even as the rate declined, over the analysis period.

World Bank income groups

For World Bank income groups in 2015–19, the unintended pregnancy rates were negatively associated with income (figure 3). The average annual unintended pregnancy rate in high-income countries was 34 pregnancies per 1000 women aged 15–49 years (UI 32–37), compared with 66 pregnancies per 1000 women aged 15–49 years (61–73) in middle-income countries. In

For the Guttmacher institute website see gu.tt/GlobalAbortion
For the WHO website see <http://www.who.int/reproductivehealth/unintended-pregnancy-and-abortion>

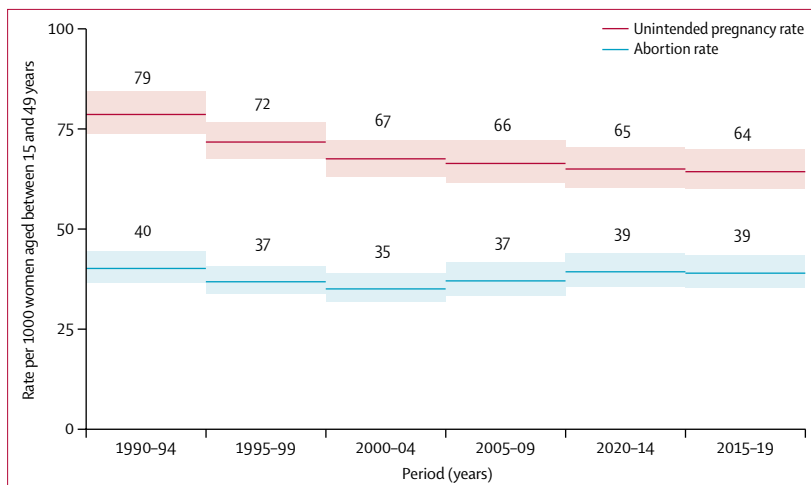


Figure 2: Global annual rates of unintended pregnancy and abortion per 1000 women aged between 15–49 years

Shaded areas indicate 80% uncertainty intervals.

	Unintended pregnancy rate per 1000 women aged between 15–49 years				Abortion rate per 1000 women aged between 15–49 years				Unintended pregnancies ending in abortion (%)			
	1990–94 (80% UI)	2015–19 (80% UI)	Change from 1990–94 to 2015–19 (80% UI)	Probability of change (%)	1990–94 (80% UI)	2015–19 (80% UI)	Change from 1990–94 to 2015–19 (80% UI)	Probability of change (%)	1990–94 (80% UI)	2015–19 (80% UI)	Change from 1990–94 to 2015–19 (80% UI)	Probability of change (%)
World	79 (74 to 84)	64 (60 to 70)	-18% (-24 to -11)	100%	40 (37 to 44)	39 (35 to 44)	-3% (-14 to 10)	62%	51 (48 to 54)	61 (58 to 63)	18% (12 to 26)	100%
Sub-Saharan Africa	103 (96 to 112)	91 (86 to 96)	-12% (-19 to -4)	97%	27 (20 to 34)	33 (29 to 38)	24% (-3 to 65)	87%	26 (21 to 31)	37 (34 to 40)	41% (18 to 76)	99%
West Asia and north Africa	126 (103 to 158)	86 (67 to 114)	-31% (-45 to -16)	99%	61 (40 to 91)	53 (34 to 78)	-14% (-40 to 21)	71%	48 (39 to 58)	61 (51 to 69)	25% (6 to 50)	96%
Central and south Asia	89 (76 to 107)	64 (59 to 70)	-28% (-40 to -15)	99%	40 (29 to 56)	46 (42 to 51)	15% (-17 to 60)	71%	45 (37 to 54)	72 (69 to 75)	59% (35 to 93)	100%
East and southeast Asia	60 (53 to 70)	58 (48 to 73)	-4% (-19 to 15)	61%	38 (35 to 42)	43 (34 to 54)	13% (-9 to 42)	74%	63 (54 to 70)	74 (65 to 80)	16% (7 to 29)	99%
Latin America	94 (88 to 100)	69 (61 to 79)	-27% (-35 to -16)	100%	35 (31 to 38)	32 (25 to 41)	-8% (-28 to 21)	66%	37 (34 to 40)	47 (41 to 53)	26% (9 to 45)	98%
Europe and northern America	67 (62 to 72)	35 (33 to 39)	-47% (-53 to -40)	100%	46 (42 to 50)	17 (15 to 20)	-63% (-67 to -56)	100%	69 (66 to 72)	49 (45 to 53)	-29% (-34 to -24)	100%
Australia and New Zealand	42 (36 to 48)	38 (32 to 45)	-9% (-21 to 5)	80%	19 (18 to 20)	15 (12 to 19)	-19% (-37 to 3)	87%	45 (39 to 53)	41 (33 to 50)	-11% (-27 to 7)	79%
Oceania (excluding Australia and New Zealand)	82 (61 to 116)	78 (58 to 113)	-4% (-21 to 16)	61%	22 (8 to 53)	34 (16 to 66)	51% (-8 to 161)	85%	28 (13 to 48)	44 (27 to 60)	54% (8 to 147)	95%

UI=uncertainty interval.

Table 1: Rates of unintended pregnancy and abortion, and proportion of unintended pregnancies ending in abortion, globally and for SDG regions between 1990–94 and 2015–19

low-income countries, the average annual unintended pregnancy rate was 93 pregnancies per 1000 women aged 15–49 years (88–100).

Since 1990–94, the unintended pregnancy rate declined among all income groups (appendix p 5). High-income and middle-income countries experienced a decline of 21% (UI 15–27 for high-income countries and 13–28 for middle-income countries), followed by a decline of 18% (12–24) in low-income countries.

SDG regional groupings

Annual average unintended pregnancy rates varied across SDG regions by nearly a factor of three (table 1; appendix p 10). Rates were 35 unintended pregnancies per 1000 women aged 15–49 years (UI 33–39) in Europe and northern America and 38 pregnancies per 1000 women aged 15–49 years (32–45) in Australia and New Zealand. Rates were nearest the global rate in east and southeast Asia (58 unintended pregnancies per 1000 women [48–73]), central and south Asia (64 pregnancies per 1000 women [59–70]), and Latin America (69 pregnancies per 1000 women [61–79]). The unintended pregnancy rate was 86 pregnancies per 1000 women (67–114) in west Asia and north Africa, and 91 pregnancies per 1000 women (86–96) in sub-Saharan Africa.

We found evidence of a decline in the unintended pregnancy rate throughout the SDG regions during the 30-year time period. The unintended pregnancy rate declined by 47% (UI 40–53) in Europe and northern America, and by 31% (16–45) in west Asia and north

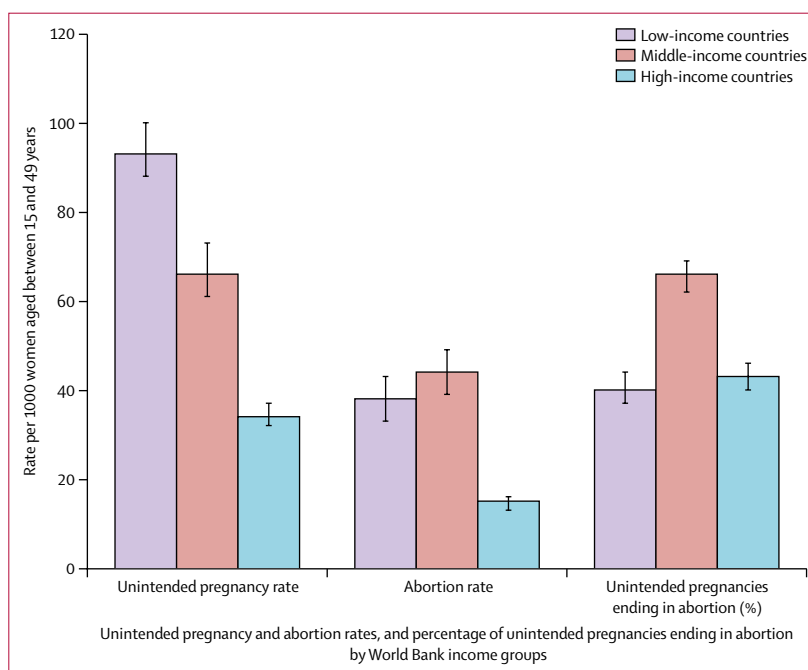


Figure 3: Unintended pregnancy and abortion rates, and percentage of unintended pregnancies ending in abortion by World Bank income group, 2015–19

Error bars indicate 80% UIs.

Africa. It declined by 28% (15–40) in central and south Asia and 27% (16–35) in Latin America. In sub-Saharan Africa, the rate declined by 12% (4–19).

Elsewhere, the unintended pregnancy rate declined from 1990–94 to 2015–19 by 4% (UI –15 to 19) in east and southeast Asia and 9% (–5 to 21) in Australia and New Zealand. However, in those two regions, the probabilities of change were 61% and 80% respectively.

Incidence of abortion and percent of unintended pregnancies ending in abortion

Global levels and trends

In 2015–19, there were 73·3 million (UI 66·7–82·0) abortions each year on average (appendix p 6), which corresponded to a global annual rate of 39 abortions (35–44) per 1000 women aged 15–49 years. These estimates reflect that 61% (58–63) of unintended pregnancies ended in abortion.

The global abortion rate was similar in 2015–19, compared with 1990–94. However, there was evidence of a decline through 2000–04 (with a probability of change of 97%) and then an increase (probability of change of 92%; figure 2). The proportion of unintended pregnancies that ended in abortion increased 18% (UI 12–26) over the 30-year period from 51% (48–54) to 61% (58–63) in 2015–19 (table 1).

World Bank income groups

Whereas unintended pregnancy rates decreased monotonically across income groups in 2015–19, abortion rates varied across income groups in a more nuanced way (figure 3), being highest in middle-income countries, and lowest in high-income countries. In middle-income countries, the annual average abortion rate was 44 abortions per 1000 women aged between 15 and 49 years (UI 39–49), by contrast with 38 abortions per 1000 women aged between 15 and 49 years (33–43) in low-income countries and 15 abortions per 1000 women aged

between 15 and 49 years (13–16) in high-income countries. The corresponding percentages of unintended pregnancies ending in abortion were 66% (62–69) in middle-income compared with 40% (37–44) in low-income countries and 43% (40–46) in high-income countries.

From 1990–94 to 2015–19, high-income countries had a 31% (UI 24–37) decline in the abortion rate and a 12% (6–18) decline in the percent of unintended pregnancies ending in abortion (appendix p 8). Abortion rates in low-income and middle-income countries were similar in 2015–19 compared with 1990–94. However, we found evidence that the proportion of unintended pregnancies ending in abortion increased between these two periods by 22% (15–31) in middle-income countries and by 26% (11–46) in low-income countries.

SDG regional groupings

Abortion rates varied across SDG regions by approximately a factor of three (table 1; appendix p 10), similar to the spread across regions in unintended pregnancy rates, in 2015–19. By contrast, the proportion of unintended pregnancies ending in abortion differed by up to a factor of approximately two (table 1).

Comparing 1990–94 with 2015–19, there was the most evidence of a trend in Europe and northern America, where the annual average abortion rate declined by 63% (UI 56 to 67; table 1). We also found evidence that the average annual abortion rate declined in west Asia and north Africa by 14% (–21 to 40), and in Australia and New Zealand by 19% (–3 to 37). However, the probability of change for west Asia and north Africa was only 71% and for Australia and New Zealand was only 87%. In sub-Saharan Africa, the abortion rate has been roughly level since 1995 (although there was some evidence of an increase relative to 1990–94 [probability 87%]). In central

	Unintended pregnancy rate per 1000 women aged between 15–49 years				Abortion rate per 1000 women aged between 15–49 years				Unintended pregnancies ending in abortion (%)			
	1990–94 (80% UI)	2015–19 (80% UI)	Change from 1990–94 to 2015–19 (80% UI)	Probability of change (%)	1990–94 (80% UI)	2015–19 (80% UI)	Change from 1990–94 to 2015–19 (80% UI)	Probability of change (%)	1990–94 (80% UI)	2015–19 (80% UI)	Change from 1990–94 to 2015–19 (80% UI)	Probability of change (%)
Abortion broadly legal	72 (66 to 80)	58 (53 to 66)	–19% (–28 to –9)	99%	44 (39 to 49)	40 (36 to 47)	–8% (–20 to 9)	73%	61 (56 to 65)	70 (65 to 73)	15% (8 to 23)	100%
Abortion broadly legal (excluding India and China)	76 (72 to 80)	50 (46 to 54)	–34% (–39 to –29)	100%	46 (43 to 50)	26 (24 to 30)	–43% (–49 to –36)	100%	61 (59 to 63)	53 (50 to 56)	–13% (–18 to –8)	100%
Abortion restricted	91 (86 to 97)	73 (68 to 79)	–20% (–25 to –14)	100%	33 (28 to 38)	36 (32 to 42)	12% (–4 to 30)	82%	36 (32 to 39)	50 (46 to 53)	39% (27 to 53)	100%
Abortion prohibited altogether	110 (100 to 123)	80 (70 to 91)	–27% (–35 to –19)	100%	35 (27 to 48)	40 (31 to 51)	11% (–14 to 40)	70%	32 (27 to 39)	50 (44 to 55)	52% (30 to 78)	100%
Abortion permitted to save the woman's life	86 (80 to 93)	70 (63 to 77)	–19% (–26 to –12)	100%	31 (27 to 38)	36 (30 to 43)	15% (–3 to 35)	85%	36 (33 to 41)	52 (48 to 56)	41% (28 to 57)	100%
Abortion permitted to preserve health	92 (86 to 99)	75 (70 to 81)	–18% (–24 to –12)	100%	33 (28 to 38)	36 (31 to 41)	8% (–8 to 27)	73%	36 (32 to 39)	47 (44 to 51)	32% (20 to 47)	100%

UI=uncertainty interval.

Table 2: Rates of unintended pregnancy and abortion, and proportion of unintended pregnancies ending in abortion, by legal status of abortion for years 2015–19

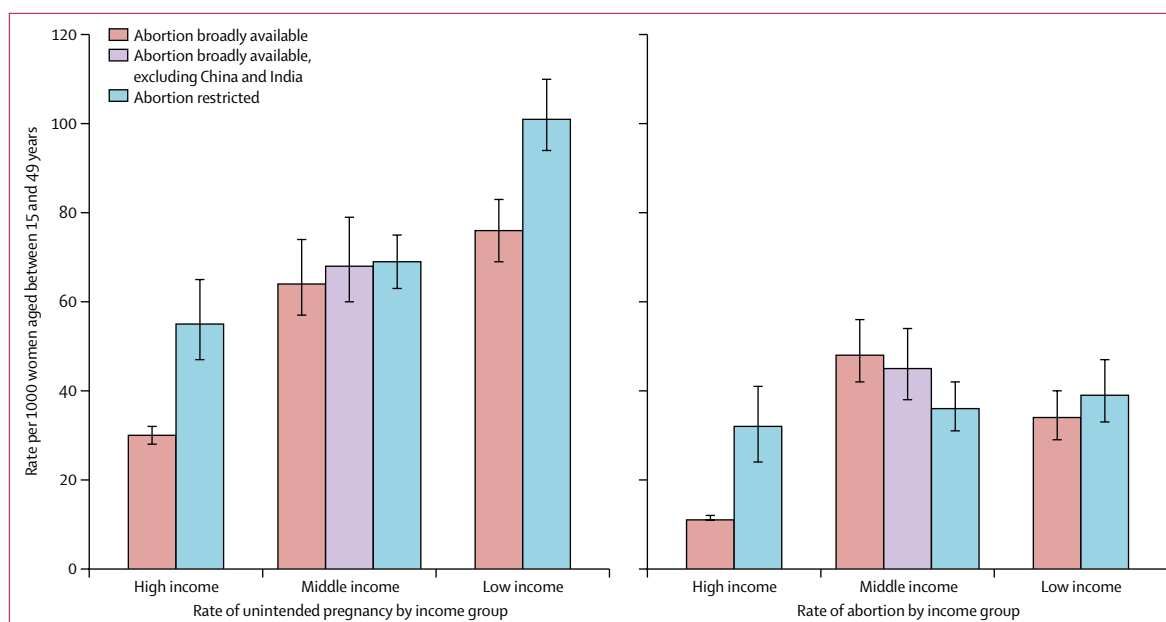


Figure 4: Rates of unintended pregnancy and abortion for World Bank income groups and legal status of abortion, 2015–19

and south Asia, we found evidence of a decrease in the average annual abortion rate followed by an increase: from 40 abortions per 1000 women (29–56) in 1990–94, to 35 abortions (28–44) in 2004–05, to 46 abortions (42–51) in 2015–19. However, the probability of change for the initial decrease was only 78%, in contrast to 94%, for the subsequent increase.

Most regions saw an increase in the percent of unintended pregnancies ending in abortion during the 30-year time period (table 1). The percent of unintended pregnancies ending in abortion increased by 59% (UI 35–93) in central and south Asia, and by 41% (18–76) in sub-Saharan Africa. Elsewhere, we found evidence that the percent of unintended pregnancies ending in abortion increased by 16% (7–29) in east and southeast Asia, and by 26% (9–45) in Latin America. A clear exception to this general pattern was found in Europe and northern America. There, the percent of unintended pregnancies ending in abortion declined by 29% (24–34) from 1990–94 to 2015–19.

Legal status of abortion

Results for 2015–19

We grouped countries where abortion is prohibited altogether, permitted only to save a woman's life or to preserve physical or mental health (referred to hereafter as where abortion is restricted), and where abortion is available on request or on broad socioeconomic grounds (referred to hereafter as broadly legal; table 2). In these comparisons, we report averages across countries where abortion is broadly legal, as well as in countries in this category except for China and India. There is evidence that these countries were atypical

within this category, but skewed the estimates because of their large populations. Therefore the estimated averages when including these countries did not reflect the majority of countries within these categories (appendix p 4).

We found that unintended pregnancy rates were generally higher in settings where abortion is restricted than in settings where it is broadly legal (table 2). Where abortion is restricted, the annual average unintended pregnancy rate was 73 (UI 68–79) per 1000 women in 2015–19 (table 2). The abortion rate for countries where abortion is restricted was 36 (32–42), and the abortion rate was similar regardless of the type of legal restriction (table 2). For countries where abortion is broadly legal, the rates were 58 (53–66) for unintended pregnancy and 40 (36–47) for abortion. The unintended pregnancy rate was 50 (46–54) and the abortion rate was 26 (24–30) for countries where abortion is broadly legal, excluding India and China.

We found that around half of unintended pregnancies ended in abortion—whether abortion is restricted or broadly legal—excluding India and China (table 2). Among all countries where abortion is broadly legal, 70% (UI 65–73) of unintended pregnancies ended in abortion.

Results by income and legal status of abortion, 2015–19

Within any World Bank income group, rates of unintended pregnancy were higher in countries with restrictive abortion laws (figure 4). High-income countries where abortion is broadly legal had the lowest annual average rate of unintended pregnancy at 30 (UI 28–32) pregnancies per 1000 women aged between 15 and 49 years. The highest rate was 101 unintended pregnancies (94–110) per

1000 women aged between 15–49 years in low-income countries with restrictive abortion laws.

In high-income countries where abortion is broadly legal, the annual rate of abortion was 11 abortions (UI 11–12) per 1000 women aged between 15 and 49 years (figure 4). The abortion rate in high-income countries with restrictive laws, and middle-income and low-income countries regardless of legal status, was higher than that of high-income countries where abortion is broadly legal, and ranged from 32 abortions (24–41) to 48 abortions (42–56) per 1000 women aged between 15–49 years.

The proportion of unintended pregnancies ending in abortion was similar for high-income countries where abortion is broadly legal (38% [UI 35–40]), and low-income countries where abortion is legally restricted (39% [34–43]). Among other income and legality groupings, the proportion of unintended pregnancies ending in abortion varied with no clear pattern, from 44% (40–49) in low-income countries where abortion is broadly legal, to 76% (70–80) in middle-income countries where abortion is broadly legal.

Trends by the legal status of abortion

From 1990–95 to 2015–19, the abortion rate declined by 43% (UI 36 to 49) in settings where abortion is broadly legal, excluding China and India. The abortion rate increased by 12% (–4 to 30) in countries that highly restrict access to abortion, although the probability of change was only 82% (appendix p 4).

The percent of unintended pregnancies ending in abortion was not always similar in countries where abortion is legally restricted compared with countries where abortion is broadly legal. In countries that restricted abortion, the percent of unintended pregnancies ending in abortion increased in every 5 year period in our analysis. The cumulative increase between 1990–94 and 2015–19 was 39% (UI 27–53; table 2). By contrast, in countries where abortion is broadly legal, excluding China and India, there was a 13% (8–18) decrease in the percent of unintended pregnancies ending in abortion.

Discussion

Over the 30 year period analysed there had been a decline in the unintended pregnancy rate, which shows that more people than ever, as a proportion of the population who are at reproductive age, were able to limit or space their childbearing.²⁷ Despite this decline, approximately half of all pregnancies were unintended. By contrast to declines in the global unintended pregnancy rate, the global abortion rate was roughly equal in 2015–19 and 1990–94. Declines in the global unintended pregnancy rate slowed after 2000–04, after which the proportion of unintended pregnancies ending in abortion began to increase. It is possible that increases in individuals' motivation to avoid an unintended birth, as well as greater access to services, contributed to both trends.

The substantial decline in the rate of unintended pregnancies is noteworthy because increased availability of contraception and access to family planning services cannot guarantee a decline in unintended pregnancies. Although family planning programmes have led to an increase in the prevalence of contraceptive use, changes in fertility preferences, as well as the shift from permanent methods, could both lead to increased rates of unintended pregnancy.

For World Bank income groups, our findings indicated an inverse relation between income and unintended pregnancy, resulting in substantial differences between low-income and high-income countries. For 2015–19, low-income countries had the highest unintended pregnancy rate and the lowest proportion of unintended pregnancies ending in abortion. These findings could relate to global economic inequalities that influence people's ability to access sexual and reproductive health services, including contraception services and abortion care. However, this evidence is descriptive and we caution against interpreting these patterns as though they show a causal effect of income.

We generally found evidence of a decline in the average annual unintended pregnancy rate throughout SDG regions. The trends in abortion rates were more nuanced, which can be explained by how the proportion of unintended pregnancies ending in abortion generally increased throughout the 30 year period. This trend could reflect increases in access to abortion, such as through the spread of medication abortion, or a stronger motivation to avoid unintended births. The one exception is the substantial decline in the unintended pregnancy and abortion rates in Europe and northern America.

We found no evidence that abortion rates were lower in settings where abortion was restricted. The gradation in type of restrictions also made little difference on the abortion rate due to unintended pregnancy rates being substantially higher in countries where abortion was restricted. This finding means that some women in these restrictive settings must take legal and physical risks to seek abortion care, corroborating findings in earlier studies^{28–31} that show that women with unintended pregnancies rely on abortion even in settings where abortion is restricted.

Moreover, we found that China and India, which comprised 62% of women who were at reproductive age in countries where abortion was broadly legal, skewed the averages in countries where abortion was broadly legal. Averaging among all other countries where abortion is broadly legal, abortion rates were higher among countries where abortion was restricted. These countries could differ for several reasons, including differences in fertility preferences, and access to and use of contraception.

We also found that the proportion of unintended pregnancies ending in abortion increased in countries where abortion was legally restricted. This finding points to the need for research to understand how individuals

obtain abortions, particularly in legally restrictive settings, the safety of abortions in these settings,³² and the consequences of unsafe abortion on health and wellbeing. Other aspects of people's wellbeing, including their experience of mistreatment and stigma,^{33,34} also warrant further study.

High-income countries where abortion is broadly legal had the lowest unintended pregnancy rate, abortion rate, and proportion of unintended pregnancies ending in abortion. Among middle-income and low-income countries, there was not a clear relationship between legal restrictions and abortion rates, or the proportion of unintended pregnancies ending in abortion. These findings could reflect differences in the quality and capacity of national health systems in low-income and middle-income countries, and show the need for additional investment in sexual and reproductive health care. Research is also needed for obstacles people face (eg, social and economic obstacles) to exercising their reproductive autonomy, and the policies and programmes that can most effectively ensure all peoples' sexual and reproductive health and rights.

This study has several limitations. We presented estimates for broad regions and groupings of countries, which masked variation across countries and population groups. We contextualised abortion within the context of unintended pregnancy, but abortions can also occur following intended pregnancies. In addition, abortion data are relatively sparse and have high UIs in countries with restrictive laws compared with countries that do not, and data for unplanned birth rates are relatively sparse in countries with liberal laws compared with countries with restrictive laws.

The increasing availability of medication abortion (ie, misoprostol with or without mifepristone) poses challenges for measuring abortion incidence in many countries as use of these drugs occurs both inside and outside of formal health systems, meaning that it is likely that abortions are occurring outside of the health sector that we could not capture. Also, although marital status as well as contraceptive needs and use are key proximate determinants of pregnancy, these determinants alone do not explain all differences between time periods or between countries. These limitations, which were evident in the wide UIs for settings in which outcome data were limited, reflect the continued need for—and investment in—abortion research, especially in regions and countries with little available data.

There were also many strengths to our estimation approach. To the best of our knowledge, we incorporated more data into our model than any of the previously published estimates of global trends in abortion and unintended pregnancy, and we took advantage of newly available estimates of unmet need among unmarried women. In addition, we used, for the first time, a comprehensive model that jointly estimated unintended pregnancy and abortion.

Our estimated numbers of abortions and unintended pregnancies were higher than previous estimates. However, previous unintended pregnancy estimates were within our UIs. Other studies previously estimated that 111.7 million unintended pregnancies⁴ and 59.3 million abortions¹¹ occurred annually between 2010–14, whereas our estimates for the same period were 118.0 million unintended pregnancies (UI 109.5–128.0) and 71.4 million abortions (64.6–79.7).

Similarly to Sedgh and colleagues,¹² we estimated that the global abortion rate declined for approximately 15 years after 1990–94. However, whereas they found little evidence of an increase thereafter, we found that, by 2015–19, the abortion rate returned to a similar rate to that estimated for 1990–94. This change was largely due to differences in the model-based estimates for Asia, although there are smaller differences (in either direction) in other regions.

Previous studies defined women of reproductive age as being between the ages of 15–44 years. Our study used the ages of 15–49 years to be consistent with the UN family planning indicators and the data used in our study.

One reason that our findings differed from previous studies was that our statistical model closely corresponded to our theoretical framework, in contrast to earlier studies. Family planning indicators were used in our study to predict unintended pregnancy, but Sedgh and colleagues used these indicators to estimate abortion. Their statistical model had to assume no differences across countries within subregions in the proportion of unintended pregnancies ending in abortion because it could not use data for the proportion of births that were unintended. Bearak and colleagues⁴ previously produced estimates of unintended pregnancies informed by this theoretical framework but, in their study, the unknowns to be modelled were the proportions of births unintended; the abortion estimates from Sedgh and colleagues were treated as fixed. As a result, the pregnancy intention data did not inform the previously published abortion estimates, and uncertainty in the abortion estimates were ignored when modelling unintended births.

Finally, we built a substantially larger database than previous studies. Previous studies obtained abortion data for 92 countries and intention data from 105 countries.^{4,11} In our study, we obtained abortion data for 104 countries and intention data from 139 countries. Our joint estimation approach and database constituted a substantially more comprehensive effort.

Conclusion

The Guttmacher-*Lancet* Commission recommended a comprehensive package of essential sexual and reproductive health and rights services, including contraception and safe abortion care, for inclusion in national health systems.⁹ Our findings emphasise that unintended pregnancy and abortion are experiences that

are shared by many people globally, regardless of region, income group, and legal status. Our findings highlight the need for continued commitment and investment to ensure access to the full spectrum of quality comprehensive sexual and reproductive health care. Fulfilling these commitments will not only result in better outcomes for all, but are also necessary to achieve the targets for the Global Strategy for Women's, Children's and Adolescent's Health (2016–30)⁸ as well as the SDGs, and universal health coverage.

Contributors

JB and LA contributed to the conceptualisation of the estimation approach. JB developed the statistical model and did the data analysis with input from LA and AP. AP compiled and managed the data, with contributions from CB and LK. BG, OT, and A-BM led the country consultation. JB prepared the first draft of the manuscript, with assistance from AP, and subsequent drafts were revised by AP with inputs from all coauthors. All coauthors convened periodically for technical exchanges about the estimation approach.

Declaration of interests

We declare no competing interests.

Acknowledgments

The authors alone are responsible for the views expressed in this Article, and they do not necessarily represent the views, decisions, or policies of the institutions with which they are affiliated.

References

- Bongaarts J, Mensch BS, Blanc AK. Trends in the age at reproductive transitions in the developing world: the role of education. *Popul Stud* 2017; **71**: 139–54.
- Darroch JE. Trends in contraceptive use. *Contraception* 2013; **87**: 259–63.
- Bongaarts J. Can family planning programs reduce high desired family size in sub-Saharan Africa? *Int Perspect Sex Reprod Health* 2011; **37**: 209–16.
- Bearak J, Popinchalk A, Alkema L, Sedgh G. Global, regional, and subregional trends in unintended pregnancy and its outcomes from 1990 to 2014: estimates from a Bayesian hierarchical model. *Lancet Glob Health* 2018; **6**: e380–89.
- Sedgh G, Singh S, Hussain R. Intended and unintended pregnancies worldwide in 2012 and recent trends. *Stud Fam Plann* 2014; **45**: 301–14.
- Ganatra B, Gerds C, Rossier C, et al. Global, regional, and subregional classification of abortions by safety, 2010–14: estimates from a Bayesian hierarchical model. *Lancet* 2017; **390**: 2372–81.
- United Nations. Transforming our world: the 2030 agenda for sustainable development. New York, NY: United Nations, 2015.
- Every Woman, Every Child. Global strategy for women's, children's and adolescent's health. Every Woman Every Child. Every Woman Every Child. June 24, 2016. <https://www.everywomaneverychild.org/global-strategy/> (accessed Sept 18, 2017).
- Starrs AM, Ezech AC, Barker G, et al. Accelerate progress—sexual and reproductive health and rights for all: report of the Guttmacher–Lancet Commission. *Lancet* 2018; **391**: 2642–92.
- Bearak JM, Popinchalk A, Sedgh G, et al. Pregnancies, abortions, and pregnancy intentions: a protocol for modeling and reporting global, regional and country estimates. *Reprod Health* 2019; **16**: 36.
- Sedgh G, Bearak J, Singh S, et al. Abortion incidence between 1990 and 2014: global, regional, and subregional levels and trends. *Lancet* 2016; **388**: 258–67.
- Sedgh G, Singh S, Shah IH, Ahman E, Henshaw SK, Bankole A. Induced abortion: incidence and trends worldwide from 1995 to 2008. *Lancet* 2012; **379**: 625–32.
- Henshaw SK, Singh S, Haas T. The incidence of abortion worldwide. *Int Fam Plan Perspect Dig* 1999; **25**: S30–38.
- Sedgh G, Henshaw S, Singh S, Ahman E, Shah IH. Induced abortion: estimated rates and trends worldwide. *Lancet* 2007; **370**: 1338–45.
- The World Bank. World Bank country and lending groups. 2019. <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups> (accessed Feb 12, 2020).
- Bearak J, Popinchalk A, Ganatra B, et al. Global estimation of unintended pregnancy and abortion using a Bayesian hierarchical random walk model. 2020. <https://arxiv.org/abs/2007.09246> (accessed July 21, 2020).
- Stevens GA, Alkema L, Black RE, et al. Guidelines for Accurate and Transparent Health Estimates Reporting: the GATHER statement. *PLoS Med* 2016; **13**: e1002056.
- Bongaarts J. A framework for analyzing the proximate determinants of fertility. *Popul Dev Rev* 1978; **4**: 105.
- Bongaarts J. Modeling the fertility impact of the proximate determinants: time for a tune-up. *Demogr Res* 2015; **33**: 535–60.
- UN. Estimates and projections of family planning indicators 2020. New York: United Nations. https://www.un.org/en/development/desa/population/theme/family-planning/cp_model.asp (accessed April 22, 2019).
- UN. World contraceptive use 2019. 2019. <https://www.un.org/en/development/desa/population/publications/dataset/contraception/wcu2019.asp> (accessed July 16, 2020).
- Kantorova V. National, regional and global estimates and projections of the number of women aged 15 to 49 who are married or in a union, 1970–2030. New York: United Nations Population Division, 2013.
- United Nations. World marriage data 2017. New York: Nations, Department of Economic and Social Affairs, Population Division, 2017. http://www.un.org/en/development/desa/population/publications/pdf/marriage/Metadata_World-Marriage-Data-2017.pdf (accessed Nov 5, 2018).
- Dellicour S, Aol G, Ouma P, et al. Weekly miscarriage rates in a community-based prospective cohort study in rural western Kenya. *BMJ Open* 2016; **6**: e011088.
- WHO. The global abortion policies database. <https://abortion-policies.srhr.org/> (accessed Nov 22, 2019).
- Center for Reproductive Rights. The world's abortion laws. 2019. <https://reproductiverights.org/worldabortionlaws> (accessed July 16, 2020).
- USAID. Desired number of children: 2000–2008. 2010. <https://www.dhsprogram.com/pubs/pdf/CR25/CR25.pdf> (accessed July 16, 2020).
- Sedgh G, Sylla AH, Philbin J, Keogh S, Ndiaye S. Estimates of the incidence of induced abortion and consequences of unsafe abortion in Senegal. *Int Perspect Sex Reprod Health* 2015; **41**: 11.
- Chae S, Kayembe PK, Philbin J, Mabika C, Bankole A. The incidence of induced abortion in Kinshasa, Democratic Republic of Congo, 2016. *PLoS One* 2017; **12**: e0184389.
- Polis CB, Mhango C, Philbin J, Chimwaza W, Chipeta E, Msusa A. Incidence of induced abortion in Malawi, 2015. *PLoS One* 2017; **12**: e0173639.
- Sully EA, Madziyire MG, Riley T, et al. Abortion in Zimbabwe: a national study of the incidence of induced abortion, unintended pregnancy and post-abortion care in 2016. *PLoS One* 2018; **13**: e0205239.
- Singh S, Remez L, Sedgh G, Kwok L, Onda T. Abortion worldwide 2017: uneven progress and unequal access. New York: Guttmacher Institute, 2018.
- Gerds C, Raifman S, Daskilewicz K, Momberg M, Roberts S, Harries J. Women's experiences seeking informal sector abortion services in Cape Town, South Africa: a descriptive study. *BMC Womens Health* 2017; **17**: 95.
- Jayaweera RT, Ngui FM, Hall KS, Gerds C. Women's experiences with unplanned pregnancy and abortion in Kenya: a qualitative study. *PLoS One* 2018; **13**: e0191412.