LEVELS AND TRENDS OF INFERTILITY AND CHILDLESSNESS

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Levels and Trends of Infertility and Childlessness

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PREFACE

The Demographic and Health Surveys (DHS) Program is one of the principal sources of international data on fertility, family planning, maternal and child health, nutrition, mortality, environmental health, HIV/AIDS, malaria, and provision of health services.

One of the objectives of The DHS Program is to provide policymakers and program managers in low- and middle-income countries with easily accessible data on levels and trends for a wide range of health and demographic indicators. DHS Comparative Reports provide such information, usually for a large number of countries in each report. These reports are largely descriptive, without multivariate methods, but when possible they include confidence intervals and/or statistical tests.

The topics in this series are selected by The DHS Program in consultation with the U.S. Agency for International Development.

It is hoped that the DHS Comparative Reports will be useful to researchers, policymakers, and survey specialists, particularly those engaged in work in low- and middle-income countries.

Sunita Kishor
Director, The DHS Program

ABSTRACT

Infertility is a significant reproductive health issue for couples worldwide. The effects of infertility are wide-ranging—from mental health issues such as anxiety and depression to social issues such as ostracization, intimate partner violence, and divorce. Although infertility affects both men and women, the woman in a couple is most often blamed for the inability to bear children. Despite its importance, infertility is understudied and there are no standard definitions for estimating prevalence.

This study aims to update estimates of childlessness, primary infertility, and secondary infertility in 16 USAID PRH focus countries and compare those estimates to previous estimates. Three of four rounds of DHS survey data were compared. Levels of infertility were calculated using a previously tested demographic approach that incorporates desire for a child into the definition to distinguish infertility from voluntary childlessness. In addition, this approach adjusts for incomplete information on contraceptive use arising from non-use of the contraceptive calendar. In most countries, childlessness, defined as never given birth, as measured among women in the 40-44 age group, was low and has decreased slightly, with an average of 1.9% in the first round of surveys and 1.7% in the most recent round. Estimates of primary infertility were low, with ranges from 0.9% in Kenya to 2.9% in Mali in the first round of surveys, and from 0.3% in Kenya to 3.8% in Senegal in the last round. Primary infertility estimates stayed relatively stable over time. Estimates of secondary infertility were higher, with ranges from 8.0% in Rwanda to 25.7% in India in the first round of surveys, and from 5.5% in Kenya to 36.8% in Bangladesh in the most recent round of surveys. Secondary infertility estimates also stayed stable in most countries, although consistent increases were seen in Bangladesh and Nepal, and consistent decreases in Kenya.

Concurrent trends in other health or environmental factors may be contributing to these trends in infertility, as well as increasing availability of assisted reproductive technologies in many parts of the world. Even with plateauing or decreasing levels of infertility, the impact of infertility on couples around the world is significant. Where secondary infertility is high or increasing, research into factors that account for these patterns needs to be undertaken to identify appropriate interventions. Further work into how to improve access to infertility care and management programs is required.

Key words: infertility, childlessness, measurement

ACRONYMS

ART	assisted reproductive technology
CI	confidence interval
DHS	Demographic and Health Survey
IVF	in vitro fertilization
LMIC	low- and middle-income countries
PI	prediction interval
PRH	Population and Reproductive Health
USAID	United States Agency for International Development
WHO	World Health Organization

1   INTRODUCTION

Infertility is an essential, but often neglected, component of reproductive health (Cui 2010). The ability to become pregnant and bear children is seen as central to a woman's identity in many societies. While infertility may be due to either the male or female partner in heterosexual relationships, the woman is frequently blamed for the infertility, especially where fertility testing is not a possibility (Bornstein et al. 2020; Inhorn and Patrizio 2015).

Individuals in relationships that experience infertility may experience psychological effects such as lower self-esteem, as well as lower marital and sexual satisfaction, than those not experiencing infertility (Keramat et al. 2014; Nyarko and Amu 2015). Women who have been diagnosed as infertile may have co-morbid depression or anxiety (Alhassan, Ziblim, and Muntaka 2014; Donkor, Naab, and Kussiwaah 2017). These effects may be stronger in pro-natalist societies where childbearing is expected and voluntary childlessness is not widely accepted (Ibisomi and Mudege 2014; Remennick 2000).

Some psychological effects may be related to the social implications of childlessness, especially for women. Childless women have frequently been stigmatized and have experienced social isolation within their communities (Bornstein et al. 2020; Rouchou 2013). Within married couples, infertility may lead to the withholding of basic necessities from the female partner (Dyer and Patel 2012). In addition, men who are unable to have children with their current wife may use infertility as grounds for seeking another wife or for divorce (Bornstein et al. 2020; Rouchou 2013; Rutstein and Shah 2004).

Between 48 million couples and 186 million individuals live with infertility globally, with half of these couples living in sub-Saharan Africa and South Asia (Mascarenhas et al. 2012b; Rutstein and Shah 2004). Infertility, which is a disease of the male or female reproductive system defined as the inability to achieve a pregnancy after a period of regular unprotected sexual intercourse (World Health Organization 2018), has been shown to be relatively stable in most countries (Mascarenhas et al. 2012b; Rutstein and Shah 2004). An analysis of trends from the late 1980s to 2000 showed that changes greater than 1% were seen in only a few countries in sub-Saharan Africa, and most of these were decreases (Rutstein and Shah 2004). A later assessment of infertility from 1990 to 2010 showed a similar pattern, with overall stability in primary infertility estimates and decreases in sub-Saharan Africa and South Asia (Mascarenhas et al. 2012b).

Secondary infertility, or the inability to achieve a pregnancy after a period of regular unprotected sexual intercourse when at least one prior pregnancy has been achieved (World Health Organization 2018), is generally higher than primary infertility in the same country (Larsen 2000; Polis et al. 2017; Rutstein and Shah 2004). Rutstein and Shah (2004) largely found declines in secondary infertility, with a few exceptions. Mascarenhas and colleagues (2012b) showed declines in secondary infertility estimates as well, although they were limited to sub-Saharan Africa.

Since these estimates are nearly 10 years old, an update to assess more recent trends would be beneficial to address the need for policies and programs that address infertility management and care. One of the challenges in comparing and updating trends in infertility is the different definitions and approaches to measurement (Gurunath et al. 2011). The clinical definition of infertility is the failure to achieve a pregnancy after 12 months or more of regular unprotected sexual intercourse (World Health Organization 2018). This is valuable at the individual level in order to provide timely intervention, further diagnostic

tests, and potential treatment (Olsen, Juul, and Basso 1998). However, nationally representative data that estimate this clinical definition are not readily available in low- and middle-income countries (LMICs). Although there has been some recent work that uses Demographic and Health Survey (DHS) data to estimate clinically defined infertility (Polis et al. 2017), most estimates of infertility in LMICs are based on demographic approaches. The demographic approaches typically use a 5-year period of regular unprotected sexual intercourse and no births (Larsen 2005; Mascarenhas et al. 2012a; Rutstein and Shah 2004). In addition, more recent definitions have included the measurement of a woman's desire for more children as a component of the exposure part of the infertility definition. There is debate in the literature about how inclusion of intent might affect estimates (Thoma et al. 2021). Mascarenhas and colleagues (2012b) showed that when using DHS data, not including intent had only a small influence on primary infertility estimates and resulted in an overestimation of secondary infertility estimates.

In this comparative report, we provide updated prevalence estimates and examine trends over the past 20 years in childlessness and primary and secondary infertility, and we apply a demographic approach to the measurement of infertility. We also use adjustment to account for bias from the different definitions of contraceptive use across multiple rounds of surveys.

2 DATA AND METHODS

2.1 Data

Data from 16 countries with DHS surveys were included in this analysis. The United States Agency for International Development (USAID) Population and Reproductive Health (PRH) priority countries with multiple rounds of survey data since 2000 were selected.[1] For all countries except India, this meant that four rounds of survey data were included. Only three rounds of survey data were available for India. The countries, as well as the DHS survey years included in this analysis, are listed in Table 1.

Table 1   DHS surveys included in analysis

Country	DHS survey years	Respondents	Number of respondents	Contraceptive calendar	Marriage and union calendar
Bangladesh	1999-2000	Ever-married women	10,544	Yes	Yes
Bangladesh	2004	Ever-married women	11,440	Yes	Yes
Bangladesh	2011	Ever-married women	17,842	Yes	No
Bangladesh	2017-18	Ever-married women	20,127	Yes	No
Ethiopia	2000	All women	15,367	No	No
Ethiopia	2005	All women	14,070	Yes	Yes
Ethiopia	2011	All women	16,515	Yes	No
Ethiopia	2016	All women	15,683	Yes	No
Ghana	1998	All women	4,843	No	No
Ghana	2003	All women	5,691	No	No
Ghana	2008	All women	4,916	Yes	No
Ghana	2014	All women	9,396	Yes	No
Haiti	2000	All women	10,159	No	No
Haiti	2005-06	All women	10,757	No	No
Haiti	2012	All women	14,287	No	No
Haiti	2016-17	All women	15,513	No	No
India	1998	Ever-married women	90,303	No	No
India	2005	All women	124,385	Yes	Yes
India	2015-16	All women	699,686	Yes	No
Kenya	1998	All women	7,881	Yes	Yes
Kenya	2003	All women	8,195	Yes	Yes
Kenya	2008	All women	8,444	Yes	No
Kenya	2014	All women	31,079	Yes	No
Malawi	2000	All women	13,220	No	No
Malawi	2004-05	All women	11,698	Yes	Yes
Malawi	2010	All women	23,020	Yes	No
Malawi	2015-16	All women	24,562	Yes	No
Mali	2001	All women	12,846	No	No
Mali	2006	All women	14,583	No	No
Mali	2012	All women	10,424	Yes	No
Mali	2018	All women	10,519	Yes	No

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[1] Afghanistan, DRC, Liberia, Madagascar, Mozambique, Pakistan, South Sudan, and Yemen are the USAID PRH priority countries not included in this analysis due to limited data or no recent data.

Table 1—*Continued*

Country	DHS survey years	Respondents	Number of respondents	Contraceptive calendar	Marriage and union calendar
Nepal	2001	Ever-married women	8,726	No	No
Nepal	2006	All women	10,793	Yes	No
Nepal	2011	All women	12,674	Yes	No
Nepal	2016	All women	12,862	Yes	No
Nigeria	2003	All women	7,620	No	No
Nigeria	2008	All women	33,385	Yes	No
Nigeria	2013	All women	38,948	Yes	No
Nigeria	2018	All women	41,821	Yes	No
Philippines	1998	All women	13,983	Yes	Yes
Philippines	2003	All women	13,633	Yes	Yes
Philippines	2013	All women	16,155	No	No
Philippines	2017	All women	25,074	No	No
Rwanda	2000	All women	10,421	No	No
Rwanda	2005	All women	11,321	No	No
Rwanda	2010	All women	13,671	Yes	No
Rwanda	2014-15	All women	13,497	Yes	No
Senegal	1997	All women	8,593	No	No
Senegal	2005	All women	14,602	No	No
Senegal	2012-13	All women	8,636	Yes	No
Senegal	2018	All women	9,414	Yes	No
Tanzania	1999	All women	4,029	No	No
Tanzania	2004-05	All women	10,329	Yes	Yes
Tanzania	2010	All women	10,139	Yes	No
Tanzania	2015-16	All women	13,266	Yes	No
Uganda	2000-01	All women	7,246	No	No
Uganda	2006	All women	8,531	Yes	No
Uganda	2011	All women	8,674	Yes	No
Uganda	2016	All women	18,506	Yes	No
Zambia	2001-02	All women	7,658	No	No
Zambia	2007	All women	7,146	Yes	No
Zambia	2013-14	All women	16,411	Yes	No
Zambia	2018-19	All women	13,683	Yes	No

2.2 Methods

2.2.1 Measures

Childlessness

Women age 20-49 were categorized as childless if they reported never having given birth and have been married for at least 5 years. Women who are not childless includes all women who have had at least one live birth, irrespective of the survival status of the child at the time of the survey.

For those surveys that used the marriage and union calendar, the calendar was used to define 5 continuous years of union. In surveys without the marriage and union calendar, the time since first union was used to

identify women who had been in only one union, with 5 or more years since first union.[2] Table 1 shows the surveys that used the marriage and union calendar.

Primary and secondary infertility

We use demographic definitions of infertility developed by Mascarenhas and colleagues (2012a). The algorithms for these definitions are shown in Figures 1 and 2. Demographers generally distinguish between infecundity, the inability to conceive after several years of exposure to pregnancy; infertility, the inability to bear any children, either due to infecundity, fetal death (miscarriage, induced abortion, or stillbirth) or use of contraception or lack of frequent sexual intercourse; and undesired infertility, which excludes induced abortion, use of contraception, and lack of or infrequent sexual intercourse (Rutstein and Shah 2004). Although the terms are often used interchangeably, in this report, we use the term infertility.

Primary infertility is defined as the absence of a live birth for women who never had a birth and who have been in a union for at least 5 years, during which neither partner used contraception, and where the female partner expresses a desire for a child at the time of the survey. The prevalence of primary infertility is calculated as the number of women age 20-49 in an infertile union divided by the number of women age 20-49 in fertile and infertile unions. Women in a fertile union have had at least one live birth and have been in a union for at least 5 years at the time of the survey. Women in infertile unions have been in a union for at least 5 years without using contraception at the time of the survey in countries with no contraceptive calendar and for 5 years in countries with a calendar and have had no live births (Figure 1). We selected the age group of 20-49 based on the reproductive lifespan of women and on the considerable (>20%) percentage of women first married by age 15 in at least one survey in five of the study countries.[3]

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[2] The one exception was the Senegal 1997 survey, in which the number of unions was not asked, so that all women with 5 or more years since first union were included. Mascarenhas et al (2012a) showed that including all women results in less than 5% error for infertility prevalence estimates.

[3] Bangladesh, Ethiopia, India, Mali, and Nigeria.

Figure 1   Definition of primary infertility, women age 20-49 using a 5-year exposure period (from Mascarenhas, 2012a)

Primary infertility prevalence is calculated as the number of infertile women (**A**) divided by the number of women who are both infertile and fertile (the sum of **A** plus **B**)

1. Union is defined as marriage or cohabitation

2. Desire for a child is defined as wanting a child, undecided, or declared infecund

For those surveys that used the marriage and union calendar, the calendar was used to define 5 continuous years of union. In surveys without the marriage and union calendar, time since first union was used to identify women who had been in only one union, with 5 or more years since first union. Table 1 shows the surveys that used the marriage and union calendar.

For those surveys that used the contraceptive calendar, the calendar was used to define the continuous absence of contraceptive for at least 5 years. In surveys without the calendar, no current contraceptive use was used as a proxy. Table 1 shows the surveys that used the contraceptive calendar.

Secondary infertility is defined as the absence of a live birth for women who desire a child and have been in a union for at least 5 years since their last live birth, during which they did not use any contraceptives. The prevalence of secondary infertility is calculated by the number of women age 20-49 in an infertile union divided by the combined number of women age 20-49 in infertile and fertile unions. Women in a fertile union have been in a union for at least 5 years and, at the time of the survey, successfully had at least one live birth. Women in infertile unions have been in a union for at least 5 years after their previous birth without using contraception and have not had another birth (Figure 2). Secondary infertility includes infertility after the first or higher order birth, as long as that birth was at least 5 years ago.

Figure 2   **Definition of secondary infertility, women age 20-49 using a 5-year exposure period (from Mascarenhas, 2012a)**
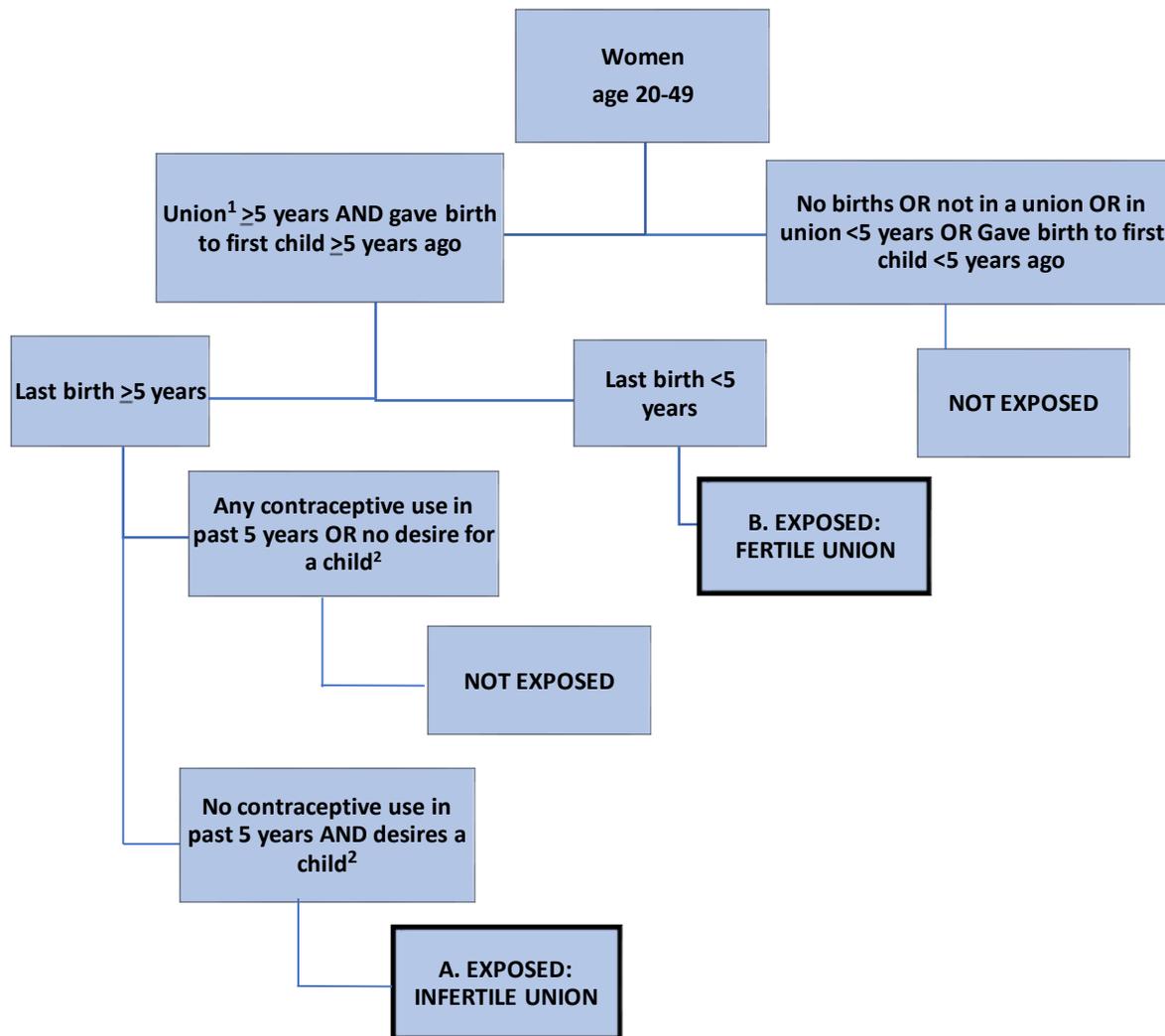
Secondary infertility prevalence is calculated as the number of infertile women (**A**) divided by the number of women who are both infertile and fertile (the sum of **A** plus **B**)

1. Union is defined as marriage or cohabitation

2. Desire for a child is defined as wanting a child, undecided, or declared infecund

2.2.2 Analysis

In the first step of the analysis, we calculated estimates of childlessness and primary and secondary infertility among women age 20 to 49 according to the definitions described above for all countries. Given the definitional requirement of being married or in union for 5 or more years, women who were age 20 would be the earliest anticipated to be able to be exposed to infertility. Using these estimates, we first calculated age-specific estimates for 5-year age groups from age 20 to 49. All estimates used sampling weights to account for the complex survey design.

We then calculated age-standardized estimates with 95% confidence intervals (CIs) using the World Health Organization (WHO) reference age groups (Ahmad et al. 2001) as well as sampling weights, for each country and survey. These estimates are available in Appendix 1.

As described in the previous section, the data collection approach for different components of the infertility definitions changed over the surveys, specifically for the definition of marriage, union status, and contraceptive use. Mascarenhas and colleagues (2012a) explored the effect of these different data collection approaches on infertility estimates. They found that while time since first union is an acceptable proxy for couple status for infertility prevalence estimates, using current contraceptive use as a proxy for contraceptive use over the 5-year exposure period in the definition of primary and secondary infertility has led to overestimates of infertility, especially among women over age 30. Measures with current contraceptive use overestimate both primary and secondary infertility (Mascarenhas et al. 2012a). However, all DHS surveys do not include the contraceptive calendar, which allows for assessment of contraceptive use over the exposure period.

To adjust for this bias, we followed a process similar to Mascarenhas and colleagues (2012b) in their analysis of infertility trends up to 2010. Data from all 41 surveys that used the contraceptive calendar (also referred to as "less-biased" estimates) were used to estimate linear regressions to correct the primary and secondary infertility estimates generated from the surveys that only assessed current contraceptive use (also referred to as the "biased" estimates). In the primary infertility linear regression equation, the dependent variable was the natural log of the less-biased estimate of infertility, and the independent variables were the natural log of the biased estimate and an indicator variable for women under age 30.

In the secondary infertility linear regression, the dependent variable was the natural log of the less-biased estimate of infertility, and the independent variables were the natural log of the biased estimate, age, square of age, and the prevalence of contraceptive use in the survey sample. Covariates were included based on the previous assessment of variables that bias the infertility estimates (Mascarenhas et al. 2012a; Mascarenhas et al. 2012b). Appendix 2 shows the coefficients and R^2 for each regression.

The *predict* command in Stata was then used to produce adjusted primary and secondary infertility estimates. The *stdf* command was used to generate the standard error of the prediction, which was used to calculate a 95% prediction interval (PI) for the predicted estimates. The prediction interval is the range of values likely to contain the value of the single prediction given the independent variables in the regression equation. As such, the PI is not directly comparable to the 95% CI for the unadjusted prevalence estimates derived for each survey. All age-standardized estimates presented in this report refer to the adjusted estimates.

We graphed the trends in prevalence estimates of age-standardized primary and secondary infertility over time, as well as calculated and plotted the absolute difference in prevalence estimates from the first and last surveys included in this study.

All analyses were conducted with Stata 16.

3   RESULTS

3.1   Childlessness

The total number of childless women in each survey was calculated as a part of calculating estimates of primary infertility. Lifetime childlessness, as opposed to not having a child yet, is best measured at the end of a women's reproductive years, or among women age 45-49. However, previous work has shown the common reporting challenges for this age group that would influence the determination of age and fertility (Goldman 1985; Pullum 2006; Pullum and Staveteig 2017; Rutstein et al. 1990). Therefore, we compared two groups of childless women, age 20-49, and age 40-44 (Rutstein and Shah 2004). Presenting rates of childlessness in women age 20-49 is recommended due to the sample size challenges with age-specific data (Vaessen 1984), while comparing two groups allows for an assessment of trends in childlessness (Rutstein and Shah 2004).

Table 2 presents the prevalence of childlessness among women in both groups.

Table 2   Trends in childlessness among women who have been married for at least 5 years

Country	Survey year	Childlessness					
		% of women	CI	N (weighted)	% of women	CI	N (weighted)
		Age 20-49			Age 40-44		
Bangladesh	1999-2000	2.0	[1.6, 2.3]	7,495	1.9	[1.1, 3.1]	960
Bangladesh	2004	2.0	[1.7, 2.4]	8,184	1.6	[1.0, 2.8]	998
Bangladesh	2011	2.1	[1.8, 2.4]	13,330	1.5	[1.0, 2.2]	1,938
Bangladesh	2017-18	2.4	[2.1, 2.7]	15,265	1.5	[1.0, 2.1]	2,119
Ethiopia	2000	2.9	[2.4, 3.5]	7,924	1.6	[0.8, 3.0]	1,006
Ethiopia	2005	1.5	[1.1, 1.9]	7,107	2.3	[1.4, 3.8]	868
Ethiopia	2011	2.6	[2.0, 3.1]	8,312	1.6	[0.8, 3.1]	1,046
Ethiopia	2016	2.1	[1.5, 2.6]	8,305	1.2	[0.6, 2.3]	1,010
Ghana	1998	2.9	[2.0, 3.7]	2,469	0.6	[0.1, 2.3]	415
Ghana	2003	2.5	[1.8, 3.3]	2,865	1.8	[0.9, 3.6]	473
Ghana	2008	2.2	[1.5, 2.9]	2,323	2.3	[1.1, 4.8]	392
Ghana	2014	2.4	[1.6, 3.2]	4,247	2.6	[1.5, 4.4]	834
Haiti	2000	2.9	[2.2, 3.6]	4,558	1.7	[0.8, 3.3]	758
Haiti	2005-06	5.5	[4.6, 6.3]	4,839	3.5	[2.2, 5.8]	760
Haiti	2012	4.3	[3.4, 5.2]	5,596	3.2	[2.0, 4.9]	969
Haiti	2016-17	2.4	[1.9, 3.0]	5,531	2.1	[1.3, 3.2]	1,043
India	1998-99	3.1	[2.9, 3.3]	67,127	2.0	[1.7, 2.4]	9,838
India	2005-06	3.0	[2.8, 3.2]	75,930	1.8	[1.5, 2.1]	11,562
India	2015-16	3.1	[3.0, 3.3]	413,938	2.0	[1.9, 2.2]	68,763
Kenya	1998	1.1	[0.7, 1.4]	3,574	1.5	[0.6, 3.4]	515
Kenya	2003	1.3	[0.8, 1.7]	3,546	0.9	[0.3, 2.3]	583
Kenya	2008-09	0.8	[0.5, 1.1]	3,814	1.7	[0.9, 3.4]	544
Kenya	2014	0.8	[0.6, 1.0]	14,126	1.3	[0.7, 2.5]	2,213
Malawi	2000	1.8	[1.4, 2.2]	6,884	1.6	[0.9, 2.7]	834
Malawi	2004	1.1	[0.8, 1.4]	5,547	1.1	[0.5, 2.5]	695
Malawi	2010	1.0	[0.8, 1.3]	12,214	1.0	[0.6, 1.8]	1,384
Malawi	2015-16	0.7	[0.5, 0.9]	12,347	0.8	[0.5, 1.5]	1,515

Continued...

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Table 2—*Continued*

Country	Survey year	% of women	CI	N (weighted)	% of women	CI	N (weighted)
				Childlessness			
			Age 20-49			Age 40-44	
Mali	2001	3.1	[2.7, 3.5]	8,613	2.3	[1.4, 3.8]	1,158
Mali	2006	3.5	[3.0, 3.9]	9,688	2.3	[1.6, 3.5]	1,298
Mali	2012-13	2.2	[1.8, 2.7]	6,980	2.9	[1.8, 4.6]	863
Mali	2018	2.3	[1.8, 2.7]	6,616	1.8	[1.0, 3.1]	812
Nepal	2001	2.0	[1.6, 2.4]	6,610	1.2	[0.6, 2.4]	927
Nepal	2006	1.6	[1.3, 2.0]	6,573	2.2	[1.3, 3.6]	973
Nepal	2011	2.1	[1.7, 2.6]	7,589	1.5	[0.9, 2.7]	1,160
Nepal	2016	2.5	[2.0, 2.9]	7,813	2.1	[1.2, 3.6]	1,230
Nigeria	2003	2.9	[2.1, 3.6]	4,068	5.1	[3.3, 7.8]	610
Nigeria	2008	2.3	[2.0, 2.5]	18,219	2.1	[1.6, 2.7]	2,723
Nigeria	2013	2.2	[2.0, 2.5]	21,693	2.6	[2.0, 3.3]	3,232
Nigeria	2018	2.0	[1.8, 2.3]	22,974	2.1	[1.5, 2.7]	3,492
Philippines	1998	2.0	[1.6, 2.4]	6,458	1.4	[0.8, 2.4]	1,221
Philippines	2003	3.0	[2.3, 3.6]	6,724	1.7	[1.1, 2.6]	1,292
Philippines	2013	3.2	[2.7, 3.7]	7,831	2.7	[2.0, 3.6]	1,622
Philippines	2017	3.6	[3.1, 4.1]	12,273	3.5	[2.6, 4.6]	2,478
Rwanda	2000	1.4	[1.0, 1.8]	3,830	0.8	[0.3, 1.9]	610
Rwanda	2005	0.9	[0.6, 1.2]	4,322	1.2	[0.6, 2.4]	722
Rwanda	2010	1.1	[0.8, 1.5]	5,180	1.1	[0.6, 2.2]	763
Rwanda	2014-15	0.9	[0.6, 1.3]	5,279	0.8	[0.4, 1.6]	880
Senegal	1997	2.4	[1.9, 2.9]	4,573	2.1	[1.2, 3.9]	697
Senegal	2005	3.9	[3.0, 4.8]	7,346	2.0	[1.2, 3.1]	1,117
Senegal	2012-13	2.5	[1.9, 3.1]	4,134	0.8	[0.4, 2.0]	614
Senegal	2018	3.9	[2.9, 4.8]	4,542	2.4	[1.2, 4.6]	768
Tanzania	1999	2.6	[1.7, 3.5]	2,002	2.0	[0.7, 5.3]	229
Tanzania	2004-05	1.9	[1.5, 2.4]	4,745	1.3	[0.6, 2.8]	680
Tanzania	2010	1.7	[1.3, 2.1]	5,013	1.4	[0.7, 2.7]	792
Tanzania	2015-16	1.2	[0.9, 1.5]	6,101	1.1	[0.6, 2.1]	1,023
Uganda	2000-01	2.4	[1.8, 3.0]	3,734	3.6	[2.1, 6.2]	405
Uganda	2006	1.6	[1.2, 2.1]	4,222	2.1	[1.1, 3.8]	533
Uganda	2011	1.0	[0.6, 1.4]	4,134	0.7	[0.2, 2.2]	535
Uganda	2016	0.9	[0.7, 1.2]	8,202	1.2	[0.6, 2.2]	1,187
Zambia	2001-02	2.0	[1.5, 2.5]	3,494	1.5	[0.7, 3.3]	447
Zambia	2007	1.6	[1.1, 2.1]	3,453	2.8	[1.4, 5.4]	384
Zambia	2013-14	1.0	[0.7, 1.2]	7,723	1.1	[0.6, 2.0]	1,075
Zambia	2018	0.8	[0.5, 1.0]	5,910	0.9	[0.4, 2.1]	906

Among women age 20-49, in 11 of the 16 countries, childlessness has decreased from the first to the most recent survey. These decreases range from 0.3 percentage points in Kenya to 1.53 percentage points in Uganda. Only India had no change in rates of childlessness among women age 20-49. The remaining four countries experienced increasing rates of childlessness in women age 20-49. The Philippines had the largest increase (1.6 percentage points), while Bangladesh had the smallest increase of only 0.4 percentage points.

In the most recent survey data from each country, the highest proportion of women age 20-49 with no children was 3.9 percentage points in Senegal, while the lowest was 0.7 percentage points in Malawi.

Over all survey rounds of all 16 countries, childlessness rates are an average 0.3 percentage points higher among women age 20-49 than among women age 40-44.

Among women age 40-44, in 9 of the 16 countries, childlessness has decreased from the first survey to the most recent. These decreases range from 0.2 percentage points in Kenya to 3 percentage points in Nigeria. India and Rwanda had no change in rates of childlessness among women age 40-44. The remaining five countries saw increasing rates of childlessness in women age 40-44. Senegal had the smallest increase (0.3 percentage points), while Ghana and the Philippines had increases of 2 percentage points or more.

In the most recent survey data from each country, the highest proportion of women age 40-44 with no living children was 3.5 percentage points in the Philippines. The lowest was 0.8 percentage points in Malawi and Rwanda.

3.2 Primary infertility

Estimates of primary infertility were low, ranging from 0.9% in Kenya to 2.9% in Mali in the first round of surveys, and from 0.3% in Kenya to 3.8% in Senegal in the final round of surveys. Figure 3 shows the trend lines of primary infertility estimates for each of the 16 countries with the 95% PI. In most countries, the estimates remained relatively stable over the three or four time points. Only four countries had changes of 1 percentage point or more from one survey to the next: Ethiopia, Haiti, Mali, and Senegal.

Figure 3   Trends in adjusted age-standardized prevalence of primary infertility with 95% prediction intervals
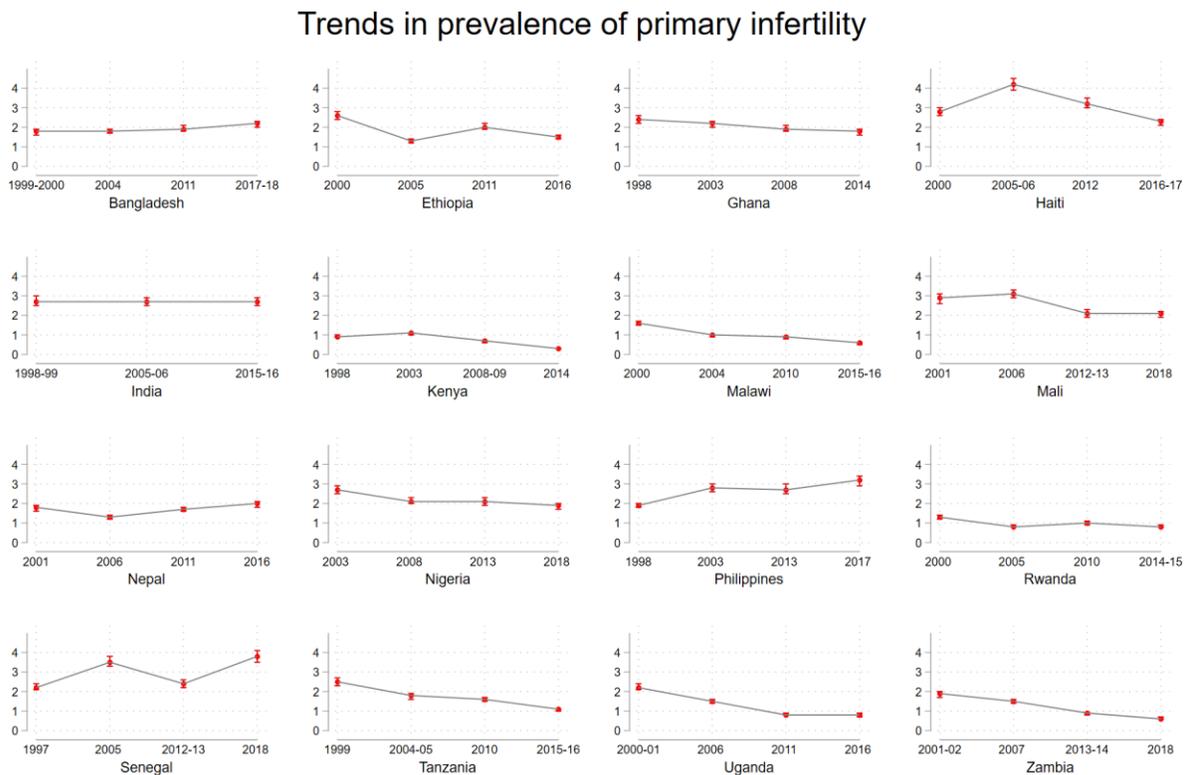
Figure 4 shows the trends in age-specific prevalence rates of primary infertility for women from age 20-49 in 5-year increments. Only prevalence estimates are provided in the graph to allow for ease of visualization. Confidence intervals for age-specific primary infertility estimates are provided for reference in table form

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in Appendix 3. In general, countries followed one of two patterns: (1) all age groups showed similar levels and trends of primary infertility over the different surveys, or (2) the youngest age group (age 20-24) had a higher level of primary infertility but a trend similar to the other age groups over the different surveys. Countries that followed the first pattern were Bangladesh, Kenya, Malawi, Nigeria, the Philippines, Rwanda, Tanzania, Uganda, and Zambia. Countries that followed the second pattern were Haiti, India, Nepal, and Senegal. It should be noted that estimates among women age 20-24 and age 40-49 may be less stable since in the younger group, fewer couples will have been married for 5 years, and in both groups, fewer may be seeking a child (Mascarenhas et al. 2012b). This is evident in the smaller numbers of women included in the denominator as exposed to primary infertility in these age groups (see Appendix 3.).

Figure 4   Trends in age-specific primary infertility
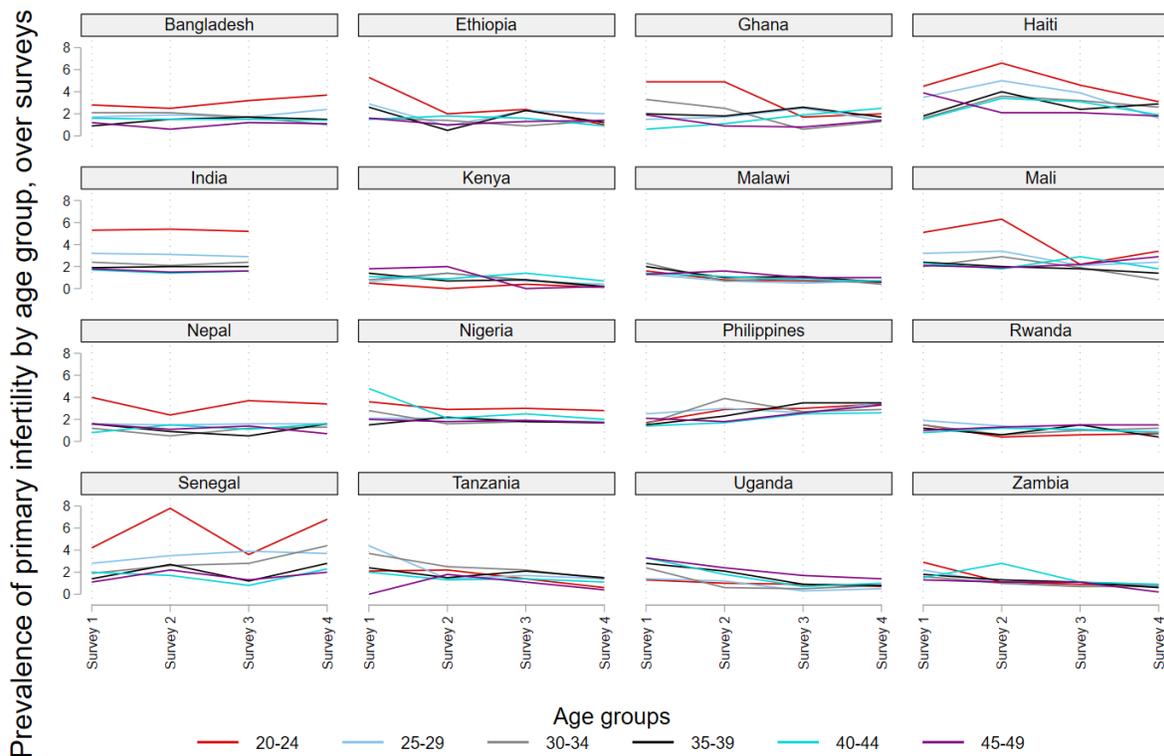
Figure 5 shows the percentage point change in primary infertility estimates from the first time point to the most recent. In all sub-Saharan African countries except Senegal, the estimate of primary infertility has decreased from the first time point to the most recent survey (see Figure 5). The smallest decrease was seen in Rwanda (0.5 percentage point difference), while the largest decrease was in Uganda and Tanzania (1.4 percentage point difference). In Senegal, there was a 1.6 percentage point increase from 1997 to 2018. Among Asian countries, all countries except India saw an increase in the estimate of primary infertility. The smallest increase was seen in Nepal (0.2 percentage points) and the largest in the Philippines (1.3 percentage points). In India, primary infertility was stable across all three time points, with no change. In Haiti, the only country in the Americas included in this analysis, the estimate of primary infertility decreased (0.5 percentage points) between the first time point and the most recent.

Figure 5   Percentage point change in adjusted age-standardized primary infertility from first DHS survey to the most recent DHS survey, by country
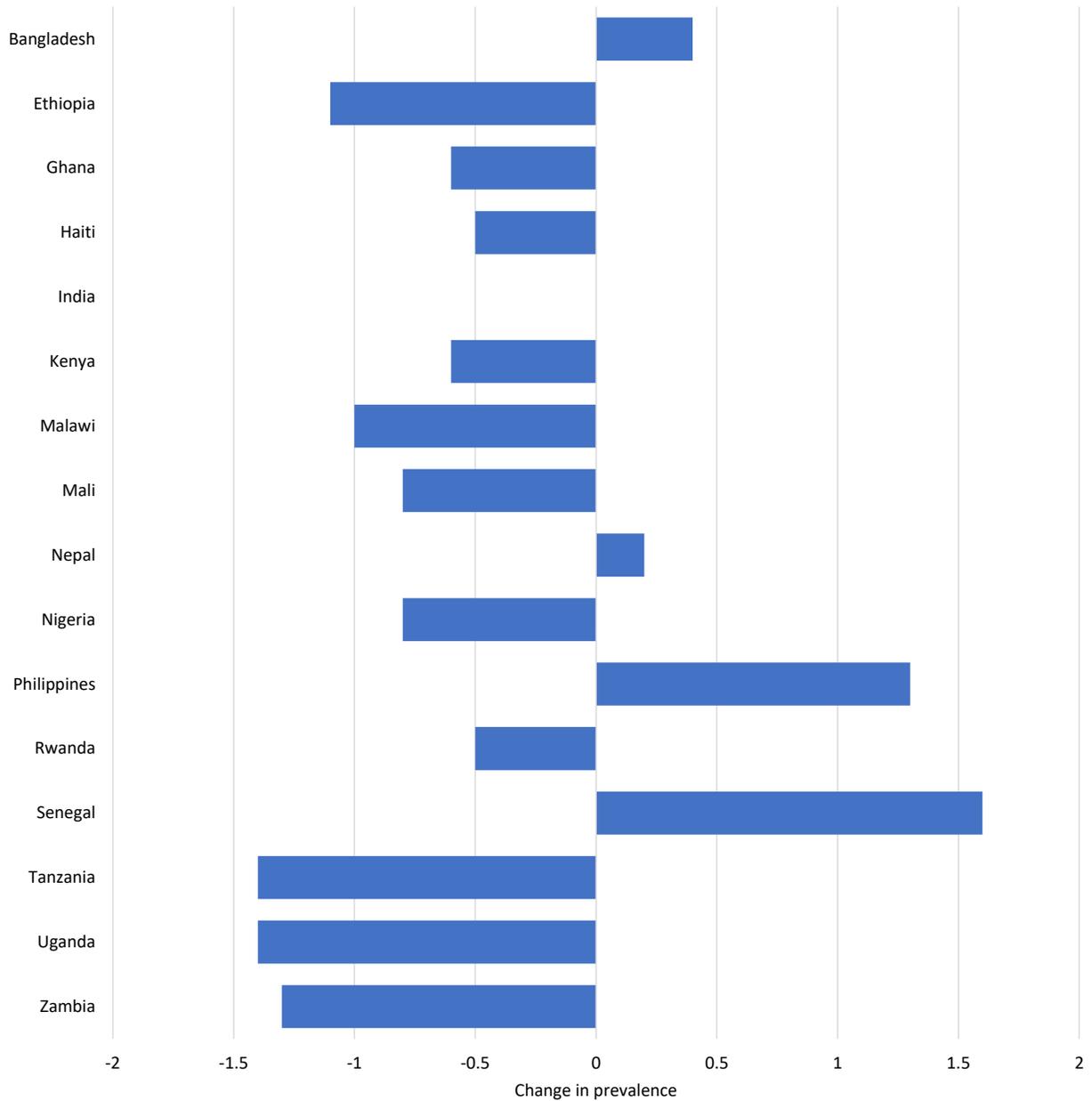
3.3   Secondary infertility

Figure 6 shows trend lines of secondary infertility estimates for each of the 16 countries with the 95% PI. In most countries, the estimates stayed relatively stable over the three or four time points. However, in a few countries, there were noticeable changes. For example, in Bangladesh, the trend line shows consistent increases at each time point. Nepal also had an increase in secondary infertility estimates over time. In Kenya, the estimated prevalence of secondary infertility steadily decreased from 1998 to 2014.

Figure 6   Trends in adjusted age-standardized prevalence of secondary infertility with 95% prediction interval

Trends in prevalence of secondary infertility
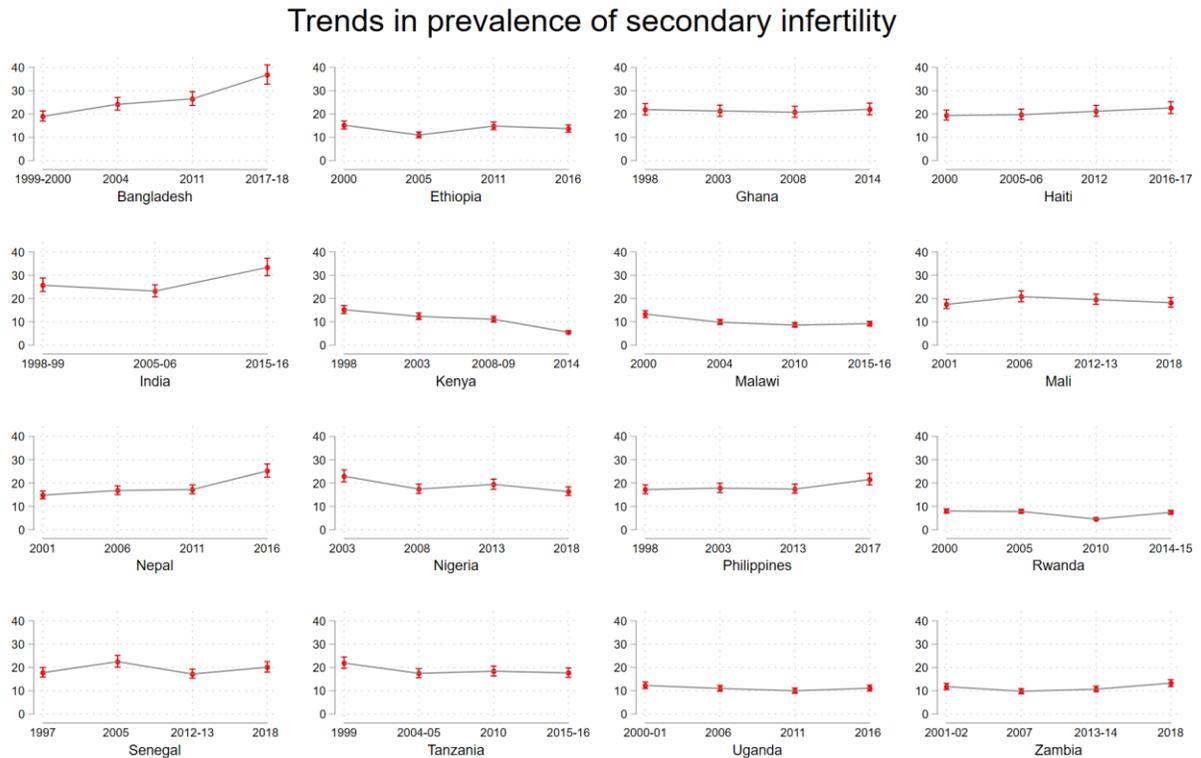
Figure 7 shows the age-specific estimates of secondary infertility among women age 20-49, by 5-year age groups. In all countries across all surveys, secondary infertility is highest among women age 45-49, with women age 40-44 having the second highest prevalence. As with primary infertility, only the estimates are shown in the graph for ease of visualization. For age-specific secondary infertility estimates with their confidence intervals and denominators, please see Appendix 4. Two main patterns can be observed over the surveys. The first is where the trend in the oldest groups of women follows the same pattern as the other age groups. Examples are Ethiopia, Haiti, Philippines, Rwanda, Senegal, Tanzania, Uganda, and Zambia. The second pattern included women in the oldest age group or two oldest age groups who showed a slightly different trend than the other age groups over the surveys. Examples of this pattern are Bangladesh, Ghana, Kenya, Malawi, Nepal, and Nigeria.

As with the age-specific primary infertility estimates, estimates of secondary infertility among women age 20-24 and age 40-49 may be less stable since in the younger group, fewer couples will have been married for 5 years and have already had one child, and in both groups, fewer couples may be seeking a child (Mascarenhas et al. 2012b).

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Figure 7   Trends in age-specific secondary infertility
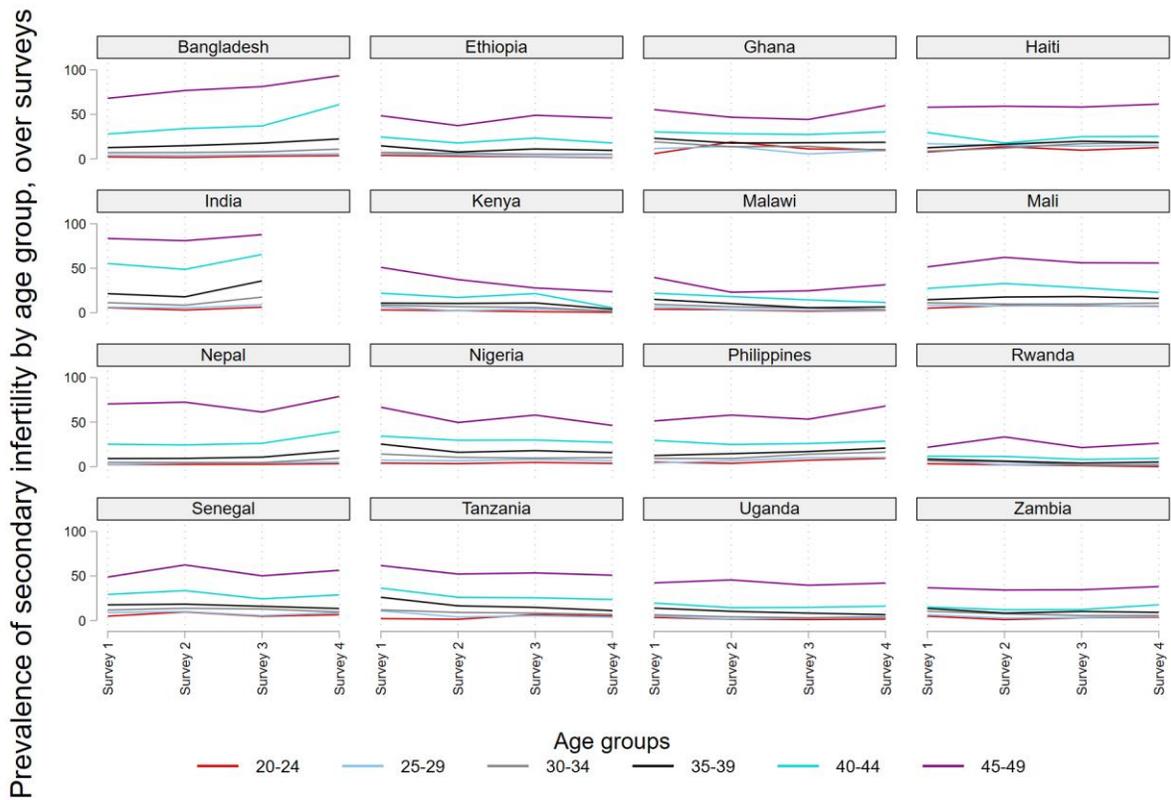
Figure 8 shows the percentage point change in secondary infertility estimates from the first time point to the most recent. The trends by geographic region are mixed. In four of the eleven sub-Saharan African countries, there was an increase in the estimate of secondary infertility. These increases ranged from 0.1 percentage points in Ghana to 2.3 percentage points in Senegal. The decreases seen in the other seven countries ranged from 0.6 percentage points in Rwanda to 9.7 percentage points in Kenya. All Asian countries had increases in the estimates of secondary infertility, which were relatively large, and ranged from 4.3 percentage points in the Philippines to 17.8 percentage points in Bangladesh.

Figure 8   Percentage point change in adjusted age-standardized secondary infertility from first DHS survey to the most recent DHS survey, by country

Change in prevalence
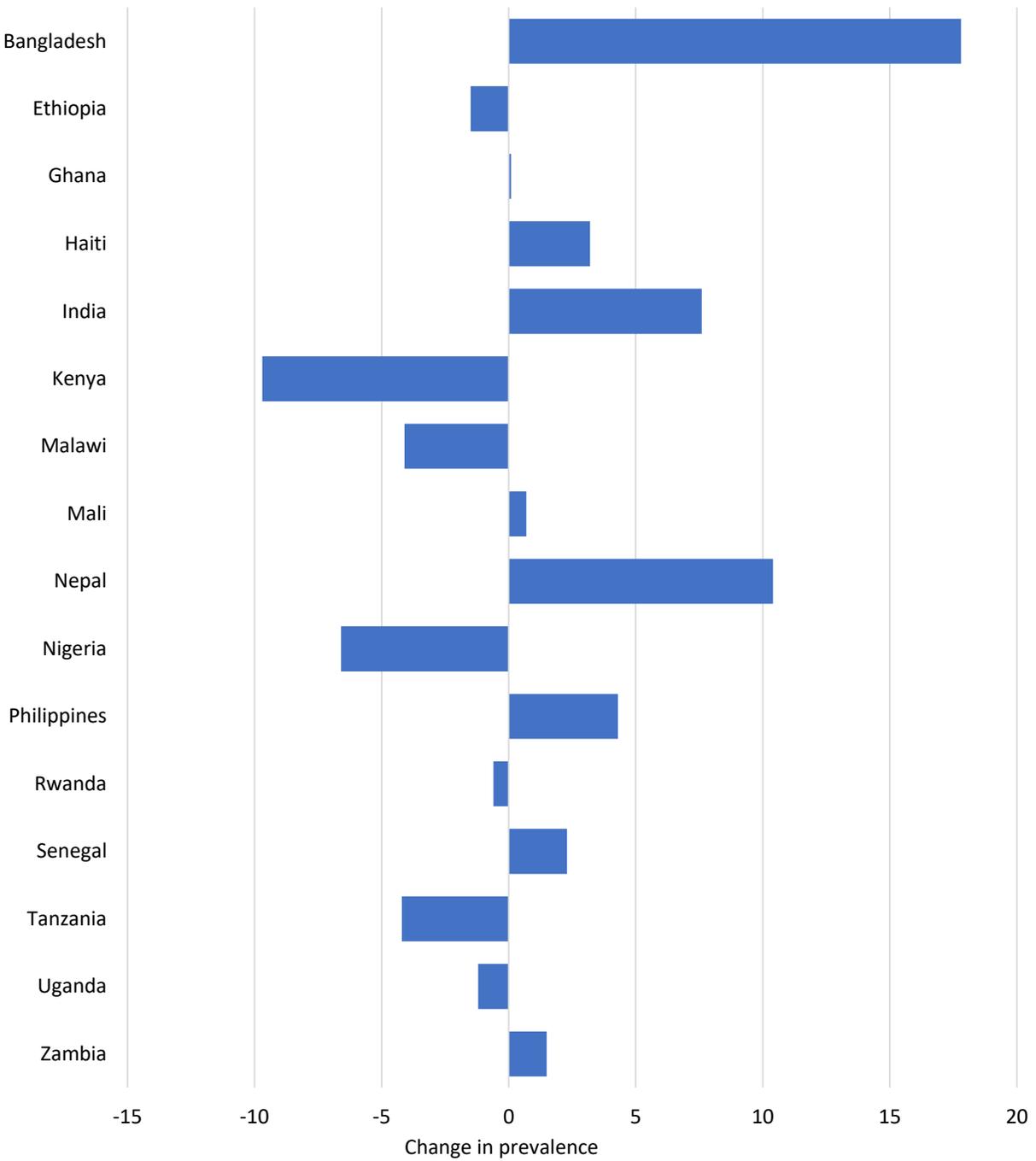
4   DISCUSSION

This report illustrates trends in childlessness, primary infertility, and secondary infertility in 16 countries over the past 20 years. Our analysis indicates that childlessness among married women is decreasing in many countries globally. This finding is congruent with previous research that assessed trends from before the time period included in our study. Using World Fertility Survey data, Vaessen (1984) found high levels of childlessness[4] among women age 40-44; 43% of the 28 countries in this analysis had a childlessness level over 4%. At the time, no countries were identified with less than 1% childlessness among women age 40-44, two with less than 2%, and only nine countries had less than 3%. There were similar levels among women age 25-49. In their analysis of DHS surveys from 1994-2000, Rutstein and Shah (2004) used a definition of childlessness that included having had no live births or having had all children die by the time of the survey and found lower levels of childlessness. Of the 47 countries, 29 (62%) had childlessness rates under 3%. In our analysis, which included only having had no live births among women married for 5 years or more, in 11 of the 16 (69%) countries, childlessness continued to decrease or plateaued over the time period. Of the most recent surveys, most (56%) countries had levels of childlessness under 2%, and nearly all (94%) had levels of childlessness under 3%.

This finding contrasts with trends in the United States and other high-income countries, where rising levels of childlessness can be linked to other demographic factors such as delayed marriage and childbearing (Livingston, Parker, and Rohal 2015; Schmidt et al. 2012). In sub-Saharan Africa and South Asia, age at first marriage, while increasing, is still low, with a median age at first union of between age 18 and 21 (Tabutin and Schoumaker 2020). A similar trend is observed in the median age at first birth; although slightly increasing, it is still often less than age 20 in sub-Saharan Africa (Tabutin and Schoumaker 2020).

Childlessness is typically categorized as either voluntary or involuntary (Bloom and Pebley 1982). In our application of a more specific definition of infertility, which included desire for a child and non-use of contraception as criteria, we attempted to separate these two categories of childlessness, where involuntary childlessness is categorized as infertility.

Our findings indicated that primary infertility is plateauing or decreasing in most countries. Earlier studies of DHS surveys from 1986-2000 have also shown decreases in primary infertility, although with a slightly different definition of infertility, with 67% of 27 countries showing decreases among women age 25-49 (Rutstein and Shah 2004). Mascarenhas and colleagues (2012b), who used the same definition of infertility as in our study, found relatively steady rates of primary infertility between 1990 and 2010 in 190 countries, with declines in sub-Saharan Africa. However, Mascarenhas and colleagues also found declines in South Asia. In this analysis, all Asian countries had increases in primary infertility, except for India, which had a steady primary infertility rate.

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[4] Measured as the proportion of currently married women, in the married state for at least 5 years, without fertile pregnancies.

Trends in secondary infertility did not show any clear pattern. In sub-Saharan African countries, the prevalence of secondary infertility stayed about the same, with some countries (Kenya, Malawi, Nigeria, Tanzania) showing decreases. Secondary infertility appears to be increasing in some Asian countries, with large increases seen in Bangladesh, India, and Nepal. Rutstein and Shah (2004) showed general declines in secondary infertility, while more recent analysis of trends saw declines persisting in sub-Saharan Africa but plateauing in all other parts of the world (Mascarenhas et al. 2012b). Within sub-Saharan Africa, the patterns of primary and secondary infertility are similar to previous findings, with West African countries showing higher prevalence compared to the Eastern and Southern African countries (Ericksen and Brunette 1996; Larsen 2000).

While this analysis is focused on trends and not causes of infertility, there may be simultaneous trends in other factors such as ageing, chronic health conditions, diet, environment, genetics, and infections, which may contribute to infertility trends (Thoma et al. 2021). For example, smoking, which has been estimated to be associated with up to 13% of infertility cases (Penzias et al. 2018), has been decreasing globally (World Health Organization 2015). In addition, a 2017 meta-analysis suggested that sperm count in men around the world declined significantly between 1973 and 2011 (Levine et al. 2017).

Using the most recent data from these 16 countries, the average prevalence of primary infertility is 1.7%, down from 2.1% from the first survey in each country. The average prevalence of secondary infertility is 18.4%, up from 17.1% in the first survey in each country. The decrease in primary infertility may be due in part to increased availability of assisted reproductive technology (ART) in many parts of the world (Chiware et al. 2021; Dyer et al. 2019). In sub-Saharan Africa, 21 of 54 countries have at least one in-vitro fertilization (IVF) unit, with twelve in Nigeria, eight in Ghana, four in Uganda, three in Kenya, and one in Ethiopia and Tanzania (Ombelet and Onofre 2019). Of the Asian countries in this analysis, IVF is primarily available in India, Bangladesh, and Nepal. In India, in the capital city of Delhi alone, there are reported to be at least 125 IVF clinics (Malhotra et al. 2013), and there are 10 tertiary IVF clinics in Bangladesh (Fatima et al. 2015). Haiti opened its first IVF clinic in 2011 (Haiti Libre 2012). Despite these dramatic increases in access to ART services, there are still many barriers to ART (Inhorn and Patrizio 2015). A recent systematic landscape analysis showed that ART is being offered in LMICs, but it remains costly. No studies identified where ART was effective, affordable, and accessible to those most in need of the services (Chiware et al. 2021).

There are multiple aspects of this study that represent both strengths and limitations. First, this study used a demographic approach to measuring infertility, with a 5-year period with no births as the definition, which makes estimates more comparable with other studies. However, as described in the introduction, there are other approaches to measuring infertility that are better aligned with clinical and epidemiological approaches that assess 12- or 24-month periods, such as time-to-pregnancy measures (Polis et al. 2017). The WHO estimates that using a 2-year time frame would result in prevalence values 2.5 times larger (World Health Organization 2021). These measures require consistent contraceptive calendar data, which were not available for all our surveys.

The definition of infertility used in this study has strengths and limitations as well. While using a criterion that a woman desire a(nother) child excludes voluntarily childless women, it may also exclude women who have been trying to have a child for an extended period of time without success, who have abandoned hope, and would respond negatively to this question. In this case, women would be excluded from the numerator

and the denominator, which leads to an underestimate of infertility. The question of desire for a child is asked for only that point in time and does not reflect temporal changes in the desire for a child. The definition also does not include measurement of frequency or timing of sexual intercourse, and assumes that women who are in a union, not using contraception, and who desire a child are having regular, unprotected sexual intercourse. This assumption may be violated in cases of lack of intercourse, periodic abstinence, or induced abortion.

Using DHS survey data comes with limitations as well. In some contexts, responses on sensitive topics such as contraceptive use may not be accurate (Ahmed, Schellstede, and Williamson 1987; Guyavarch and Coleman 2006). We used data from the contraceptive calendar, which has a 5-year recall period, to adjust the prevalence of primary and secondary infertility. Contraceptive calendar data may be misreported, particularly among women who use condoms or traditional methods (Callahan and Becker 2012).

Accurate estimates of infertility depend on other types of data, such as women's reported birthdate/age, women's reported age at first union, and reported birthdate/age of the last child in the birth history. While most DHS surveys have low levels of incomplete data, there are some instances where many or most women in certain countries do not know their birthdate (month and/or year). For example, in recent surveys in Bangladesh, incomplete reporting of woman's age can be as high as 94% and incomplete reporting of women's reported age at first union as high as 67% (Pullum and Staveteig 2017). Incomplete reporting of children's birthdate tends to be much lower, at 4.6% on average (Pullum and Staveteig 2017). However, these inaccuracies would only seriously impact the infertility estimates if they show evidence of systematic bias.

Finally, our definition of infertility focuses on the woman, her contraceptive non-use, and desire for children, with no inclusion of the male partner's perspective. The male partner may want a(nother) child, while the woman does not, or vice versa, although this definition does not take this into account. Future conceptualizations of infertility should include male partner perspectives.

In conclusion, this report describes levels and trends in childlessness and infertility in select USAID PRH priority countries using a demographic definition. In general, levels of primary infertility show stable or decreasing trends, while in some countries, secondary infertility is increasing, particularly in Bangladesh, Nepal, and India. Future research should examine these trends more closely and identify the drivers of these trends. In particular, additional research into the availability and accessibility of ART in these countries would be beneficial in order to understand to what degree ART availability played a role in these fertility trends. Where secondary infertility is high or increasing, research into factors that account for these patterns needs to be undertaken to identify appropriate interventions.

Although the levels of childlessness and primary infertility are low and trends show a decline, the emotional and financial toll for couples who do experience them can be huge. It is important to examine the consequences of primary and secondary infertility and the coping mechanisms couples adopt to formulate evidence-based programs and policies for infertility care and management.

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APPENDIX 1

Appendix Table 1   Unadjusted age-standardized primary and secondary infertility estimates and 95% confidence intervals (CI), women age 20-49

Country	Primary infertility (%)				Secondary infertility (%)			
Bangladesh	1999-2000 1.8 [1.4, 2.1]	2004 1.7 [1.4, 2.0]	2011 1.9 [1.6, 2.2]	2017-18 1.9 [1.7, 2.2]	1999-2000 18.2 [16.5, 20.0]	2004 20.5 [18.8, 22.2]	2011 22.6 [20.9, 24.3]	2017-18 29.6 [28.2, 31.0]
Ethiopia	2000 2.7 [2.2, 3.2]	2005 1.3 [0.9, 1.6]	2011 1.8 [1.4, 2.3]	2016 1.3 [0.9, 1.7]	2000 16.1 [14.8, 17.4]	2005 11.7 [10.4, 12.9]	2011 14.1 [12.6, 15.6]	2016 12.2 [10.7, 13.7]
Ghana	1998 2.5 [1.7, 3.2]	2003 2.3 [1.5, 3.0]	2008 1.7 [1.1, 2.4]	2014 1.7 [1.2, 2.2]	1998 22.7 [20.7, 24.6]	2003 22.2 [19.3, 25.1]	2008 18.9 [16.6, 21.2]	2014 21.3 [19.2, 23.4]
Haiti	2000 2.8 [2.1, 3.5]	2005-06 4.2 [3.5, 5.0]	2012 3.3 [2.6, 4.0]	2016-17 2.3 [1.8, 2.9]	2000 20.7 [18.5, 22.9]	2005-06 21.1 [19.1, 23.1]	2012 22.6 [20.5, 24.7]	2016-17 23.8 [21.7, 25.9]
India	1998-99 2.8 [2.7, 3.0]	2005-06 2.7 [2.5, 2.9]	2015-16 2.7 [2.6, 2.8]		1998-99 27.7 [26.9, 28.4]	2005-06 24.6 [23.7, 25.5]	2015-16 33.9 [33.4, 34.3]	
Kenya	1998 1.0 [0.6, 1.4]	2003 1.0 [0.7, 1.4]	2008-09 0.7 [0.4, 1.0]	2014 0.3 [0.1, 0.4]	1998 15.6 [13.5, 17.7]	2003 11.6 [9.6, 13.5]	2008-09 11.1 [9.1, 13.0]	2014 5.6 [4.7, 6.5]
Malawi	2000 1.7 [1.3, 2.0]	2004 1.0 [0.7, 1.3]	2010 0.8 [0.6, 1.1]	2015-16 0.6 [0.4, 0.8]	2000 15.0 [13.6, 16.3]	2004 10.1 [8.8, 11.5]	2010 8.4 [7.4, 9.3]	2015-16 8.9 [7.8, 10.0]
Mali	2001 2.9 [2.5, 3.3]	2006 3.2 [2.7, 3.6]	2012-13 2.2 [1.7, 2.6]	2018 2.1 [1.7, 2.5]	2001 18.2 [17.0, 19.5]	2006 21.2 [19.2, 23.1]	2012-13 19.7 [18.3, 21.1]	2018 18.4 [16.9, 19.9]
Nepal	2001 1.9 [1.5, 2.3]	2006 1.4 [1.0, 1.7]	2011 1.6 [1.3, 2.0]	2016 1.8 [1.4, 2.2]	2001 16.8 [15.4, 18.1]	2006 17.3 [15.4, 19.1]	2011 16.3 [13.9, 18.6]	2016 23.1 [20.7, 25.6]
Nigeria	2003 2.8 [2.1, 3.5]	2008 2.1 [1.9, 2.4]	2013 2.2 [1.9, 2.4]	2018 2.0 [1.7, 2.2]	2003 23.2 [21.2, 25.1]	2008 17.7 [17.0, 18.5]	2013 19.6 [18.7, 20.4]	2018 16.8 [16.1, 17.6]
Philippines	1998 1.8 [1.4, 2.2]	2003 2.7 [2.0, 3.3]	2013 2.8 [2.4, 3.3]	2017 3.2 [2.7, 3.7]	1998 17.0 [15.4, 18.5]	2003 17.7 [16.2, 19.2]	2013 19.8 [18.3, 21.2]	2017 23.7 [21.9, 25.5]

Continued...

Appendix Table 1—*Continued*

Country	Primary infertility (%)				Secondary infertility (%)			
Rwanda	**2000**	**2005**	**2010**	**2014-15**	**2000**	**2005**	**2010**	**2014-15**
	1.4 [0.9, 1.8]	0.9 [0.6, 1.2]	1.1 [0.8, 1.4]	0.9 [0.6, 1.2]	9.3 [7.9, 10.6]	9.2 [8.1, 10.3]	5.8 [4.7, 6.8]	6.6 [5.4, 7.8]
Senegal	**1997**	**2005**	**2012-13**	**2018**	**1997**	**2005**	**2012-13**	**2018**
	2.3 [1.8, 2.9]	3.6 [2.7, 4.4]	2.4 [1.8, 3.0]	3.8 [2.9, 4.7]	18.7 [17.2, 20.2]	22.8 [21.3, 24.4]	17.5 [15.6, 19.3]	18.9 [17.3, 20.5]
Tanzania	**1999**	**2004-05**	**2010**	**2015-16**	**1999**	**2004-05**	**2010**	**2015-16**
	2.5 [1.6, 3.4]	1.8 [1.3, 2.2]	1.7 [1.2, 2.1]	1.1 [0.8, 1.4]	22.8 [20.0, 25.7]	16.5 [15.0, 18.0]	17.4 [15.7, 19.1]	15.3 [13.9, 16.7]
Uganda	**2000-01**	**2006**	**2011**	**2016**	**2000-01**	**2006**	**2011**	**2016**
	2.3 [1.8, 2.9]	1.5 [1.0, 1.9]	0.8 [0.4, 1.1]	0.8 [0.6, 1.1]	13.8 [11.9, 15.8]	11.5 [10.0, 12.9]	10.3 [8.9, 11.8]	11.0 [9.8, 12.1]
Zambia	**2001-02**	**2007**	**2013-14**	**2018**	**2001-02**	**2007**	**2013-14**	**2018**
	1.9 [1.4, 2.4]	1.4 [0.9, 1.8]	0.9 [0.7, 1.2]	0.7 [0.4, 0.9]	13.5 [11.9, 15.2]	10.0 [8.5, 11.5]	10.5 [9.2, 11.7]	12.0 [10.5, 13.4]

APPENDIX 2

Appendix Table 2.1   Predictive variables in linear regression to predict adjusted primary infertility prevalence

Adjusted R^2=0.9935

Predictor	Coefficient
Constant	0.137 (0.137, 0.138)
Natural log of biased prevalence estimate (calculated using current contraceptive use as a proxy for past use)	1.0464 (1.0462, 1.0466)
Indicator variable equal to 1 for ages < 30 and equal to 0 for ages ≥ 30	-0.0013 (-0.0015, -0.0011)

Appendix Table 2.2   Predictive variables in linear regression to predict adjusted secondary infertility prevalence

Adjusted R^2=0.9854

Predictor	Coefficient
Constant	0.20 (0.19, 0.20)
Natural log of biased prevalence estimate (calculated using current contraceptive use as a proxy for past use)	1.152 (1.152, 1.153)
Age (years)	0.0021681 (0.0020097, 0.0023265)
Square of age (years)	-0.000027 (-0.000029, -0.000025)
Prevalence of contraceptive use in the survey sample	-0.2004 (-0.2014, -0.1994)

APPENDIX 3

Appendix Table 3   Age-specific primary infertility

Country	Age group	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)
Bangladesh	20-24	1999-2000	2.8	[2.0, 3.8]	1,300	2004	2.5	[1.7, 3.5]	1,498	2011	3.2	[2.5, 4.2]	2,160	2017-18	3.7	[2.9, 4.7]	1,939
	25-29	1999-2000	1.7	[1.2, 2.5]	1,777	2004	1.9	[1.3, 2.7]	1,804	2011	1.7	[1.3, 2.3]	3,049	2017-18	2.4	[1.9, 3.1]	3,156
	30-34	1999-2000	2.1	[1.5, 2.9]	1,548	2004	2.1	[1.4, 3.0]	1,639	2011	1.7	[1.2, 2.4]	2,521	2017-18	1.0	[0.7, 1.4]	3,226
	35-39	1999-2000	0.9	[0.5, 1.7]	1,173	2004	1.5	[0.9, 2.4]	1,316	2011	1.7	[1.1, 2.7]	2,129	2017-18	1.5	[1.0, 2.0]	2,738
	40-44	1999-2000	1.6	[0.9, 2.7]	956	2004	1.5	[0.8, 2.7]	996	2011	1.5	[1.0, 2.2]	1,937	2017-18	1.4	[1.0, 2.1]	2,117
	45-49	1999-2000	1.2	[0.6, 2.5]	713	2004	0.6	[0.3, 1.4]	864	2011	1.2	[0.8, 1.9]	1,511	2017-18	1.1	[0.7, 1.7]	2,010
Ethiopia	20-24	2000	5.3	[3.7, 7.6]	900	2005	2.0	[1.0, 3.7]	754	2011	2.4	[1.4, 4.2]	880	2016	1.0	[0.4, 2.4]	816
	25-29	2000	2.9	[1.9, 4.4]	1,762	2005	0.9	[0.5, 1.7]	1,642	2011	2.3	[1.5, 3.5]	2,137	2016	2.0	[1.0, 3.7]	1,869
	30-34	2000	1.6	[0.9, 2.8]	1,533	2005	1.4	[0.8, 2.4]	1,360	2011	0.9	[0.4, 2.0]	1,637	2016	1.4	[0.8, 2.4]	1,768
	35-39	2000	2.6	[1.6, 4.2]	1,428	2005	0.5	[0.2, 1.1]	1,252	2011	2.3	[1.3, 4.0]	1,577	2016	1.2	[0.4, 3.1]	1,538
	40-44	2000	1.5	[0.8, 3.0]	1,005	2005	1.8	[0.9, 3.5]	864	2011	1.6	[0.8, 3.1]	1,046	2016	0.9	[0.4, 1.8]	1,007
	45-49	2000	1.6	[0.8, 3.1]	878	2005	1.0	[0.5, 2.2]	757	2011	1.3	[0.6, 2.8]	778	2016	1.4	[0.6, 3.4]	701
Ghana	20-24	1998	4.9	[2.6, 9.3]	216	2003	4.9	[2.4, 9.7]	205	2008	1.7	[0.5, 5.7]	176	2014	2.0	[0.8, 4.8]	257
	25-29	1998	1.5	[0.7, 3.1]	516	2003	1.7	[0.9, 3.1]	600	2008	2.5	[1.3, 4.8]	448	2014	1.4	[0.7, 3.1]	727
	30-34	1998	3.3	[2.0, 5.6]	535	2003	2.5	[1.5, 4.2]	663	2008	0.6	[0.2, 1.8]	504	2014	1.3	[0.7, 2.3]	922
	35-39	1998	2.0	[1.1, 3.8]	528	2003	1.8	[1.0, 3.2]	625	2008	2.6	[1.4, 4.8]	522	2014	1.7	[1.0, 2.9]	992
	40-44	1998	0.6	[0.1, 2.3]	415	2003	1.1	[0.5, 2.6]	471	2008	1.9	[0.9, 4.1]	391	2014	2.5	[1.4, 4.3]	833
	45-49	1998	1.9	[0.9, 4.4]	333	2003	0.9	[0.3, 2.7]	408	2008	0.8	[0.2, 3.4]	334	2014	1.4	[0.7, 3.0]	633
Haiti	20-24	2000	4.5	[2.6, 7.7]	349	2005-06	6.6	[4.4, 9.7]	452	2012	4.6	[2.6, 8.1]	385	2016-17	3.1	[1.4, 6.4]	339
	25-29	2000	3.5	[1.5, 7.6]	830	2005-06	5.0	[3.5, 7.0]	1,008	2012	3.9	[2.6, 5.8]	1,053	2016-17	1.6	[0.9, 2.6]	936
	30-34	2000	1.6	[0.8, 3.1]	900	2005-06	3.6	[2.4, 5.6]	910	2012	3.2	[2.1, 4.9]	1,199	2016-17	2.6	[1.7, 4.0]	1,205
	35-39	2000	1.8	[1.1, 3.0]	956	2005-06	4.0	[2.7, 5.9]	956	2012	2.4	[1.6, 3.5]	1,147	2016-17	2.9	[1.9, 4.5]	1,245
	40-44	2000	1.5	[0.7, 3.1]	757	2005-06	3.4	[2.0, 5.6]	759	2012	3.1	[2.0, 4.8]	968	2016-17	1.9	[1.2, 3.1]	1,041
	45-49	2000	3.9	[1.3, 11.0]	746	2005-06	2.1	[1.2, 3.4]	761	2012	2.1	[1.2, 3.6]	895	2016-17	1.8	[1.0, 3.2]	919
India	20-24	1998-99	5.3	[4.7, 5.9]	7,662	2005-06	5.4	[4.8, 6.1]	6,867	2015-16	5.2	[4.8, 5.6]	25,948				
	25-29	1998-99	3.2	[2.9, 3.6]	15,094	2005-06	3.1	[2.8, 3.5]	14,591	2015-16	2.9	[2.8, 3.1]	77,277				
	30-34	1998-99	2.4	[2.1, 2.7]	14,610	2005-06	2.1	[1.8, 2.4]	15,463	2015-16	2.4	[2.2, 2.5]	84,909				
	35-39	1998-99	1.9	[1.6, 2.2]	12,682	2005-06	2.0	[1.7, 2.3]	14,423	2015-16	2.0	[1.8, 2.1]	82,142				
	40-44	1998-99	1.7	[1.4, 2.1]	9,806	2005-06	1.4	[1.1, 1.7]	11,521	2015-16	1.6	[1.4, 1.7]	68,455				
	45-49	1998-99	1.8	[1.5, 2.2]	7,253	2005-06	1.5	[1.2, 1.9]	8,314	2015-16	1.6	[1.5, 1.8]	62,515				

Continued…

Appendix Table 3—*Continued*

Country	Age group	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)
Kenya	20-24	1998	0.5	[0.1, 2.0]	307	2003	0.0	[.0, .0]	306	2008-09	0.4	[0.2, 1.2]	392	2014	0.1	[0.0, 0.3]	1,120
	25-29	1998	0.6	[0.3, 1.5]	809	2003	1.4	[0.8, 2.6]	808	2008-09	0.7	[0.2, 1.8]	824	2014	0.4	[0.2, 0.8]	3,492
	30-34	1998	0.8	[0.3, 2.0]	755	2003	1.4	[0.8, 2.7]	802	2008-09	0.8	[0.3, 1.9]	885	2014	0.1	[0.1, 0.3]	3,339
	35-39	1998	1.4	[0.8, 2.6]	818	2003	0.7	[0.3, 2.0]	648	2008-09	0.8	[0.3, 1.9]	726	2014	0.2	[0.1, 0.5]	2,948
	40-44	1998	1.1	[0.4, 2.7]	514	2003	0.9	[0.3, 2.3]	583	2008-09	1.4	[0.7, 3.0]	541	2014	0.7	[0.2, 2.1]	2,201
	45-49	1998	1.8	[0.8, 4.3]	384	2003	2.0	[0.8, 4.8]	366	2008-09	0.0	[0.0, 0.0]	472	2014	0.2	[0.0, 0.6]	1,660
Malawi	20-24	2000	1.6	[0.9, 2.9]	997	2004	0.8	[0.4, 1.9]	948	2010	0.7	[0.3, 1.6]	1,667	2015-16	0.6	[0.2, 1.5]	1,608
	25-29	2000	1.3	[0.9, 1.9]	1,803	2004	0.7	[0.4, 1.5]	1,482	2010	0.5	[0.3, 0.8]	3,330	2015-16	0.7	[0.4, 1.2]	2,823
	30-34	2000	2.3	[1.5, 3.4]	1,278	2004	0.7	[0.3, 1.5]	1,111	2010	1.0	[0.6, 1.7]	2,619	2015-16	0.4	[0.2, 0.7]	2,847
	35-39	2000	2.0	[1.3, 3.1]	1,159	2004	1.0	[0.6, 1.9]	855	2010	1.1	[0.7, 1.9]	2,071	2015-16	0.6	[0.3, 1.0]	2,317
	40-44	2000	1.4	[0.7, 2.5]	832	2004	1.1	[0.5, 2.5]	695	2010	0.8	[0.4, 1.5]	1,381	2015-16	0.7	[0.4, 1.3]	1,512
	45-49	2000	1.3	[0.6, 3.0]	691	2004	1.6	[0.9, 2.9]	537	2010	1.0	[0.5, 1.8]	1,185	2015-16	1.0	[0.4, 2.2]	1,126
Mali	20-24	2001	5.1	[3.7, 6.9]	1,298	2006	6.3	[4.4, 8.8]	1,487	2012-13	2.2	[1.4, 3.5]	889	2018	3.4	[2.2, 5.2]	797
	25-29	2001	3.2	[2.4, 4.3]	1,911	2006	3.4	[2.6, 4.4]	2,266	2012-13	2.1	[1.5, 2.9]	1,692	2018	2.4	[1.7, 3.4]	1,539
	30-34	2001	2.0	[1.4, 2.9]	1,799	2006	2.9	[2.1, 4.1]	1,838	2012-13	1.9	[1.3, 2.9]	1,527	2018	0.8	[0.4, 1.5]	1,408
	35-39	2001	2.4	[1.6, 3.6]	1,515	2006	2.0	[1.4, 2.9]	1,671	2012-13	1.8	[1.2, 2.7]	1,273	2018	1.4	[0.9, 2.2]	1,213
	40-44	2001	2.3	[1.4, 3.7]	1,157	2006	1.8	[1.2, 2.8]	1,293	2012-13	2.9	[1.8, 4.6]	862	2018	1.8	[1.0, 3.1]	812
	45-49	2001	2.1	[1.3, 3.2]	885	2006	1.9	[1.0, 3.4]	1,052	2012-13	2.2	[1.2, 3.9]	620	2018	2.9	[1.7, 4.8]	559
Nepal	20-24	2001	4.0	[2.8, 5.7]	958	2006	2.4	[1.5, 3.8]	924	2011	3.7	[2.4, 5.6]	801	2016	3.4	[2.2, 5.3]	707
	25-29	2001	1.6	[1.1, 2.4]	1,495	2006	1.5	[1.0, 2.4]	1,521	2011	1.6	[1.0, 2.4]	1,684	2016	1.6	[1.0, 2.6]	1,646
	30-34	2001	1.2	[0.7, 2.0]	1,382	2006	0.5	[0.3, 1.1]	1,238	2011	1.2	[0.6, 2.4]	1,574	2016	1.3	[0.9, 2.1]	1,669
	35-39	2001	1.6	[0.9, 2.6]	1,105	2006	0.9	[0.5, 1.8]	1,146	2011	0.5	[0.2, 1.0]	1,454	2016	1.6	[1.0, 2.5]	1,500
	40-44	2001	0.8	[0.4, 2.0]	924	2006	1.5	[0.9, 2.5]	967	2011	1.1	[0.5, 2.1]	1,154	2016	1.6	[0.8, 3.2]	1,225
	45-49	2001	1.6	[0.9, 2.9]	742	2006	1.1	[0.6, 2.2]	758	2011	1.4	[0.7, 2.9]	825	2016	0.7	[0.3, 1.6]	1,018
Nigeria	20-24	2003	3.6	[2.0, 6.5]	426	2008	2.9	[2.2, 3.8]	2,009	2013	3.0	[2.2, 3.9]	2,130	2018	2.8	[2.1, 3.7]	2,263
	25-29	2003	2.1	[1.3, 3.3]	880	2008	2.1	[1.7, 2.7]	4,112	2013	1.9	[1.5, 2.4]	4,529	2018	1.8	[1.4, 2.3]	4,738
	30-34	2003	2.8	[1.7, 4.7]	780	2008	1.6	[1.2, 2.1]	3,757	2013	1.8	[1.4, 2.4]	4,323	2018	1.7	[1.3, 2.2]	4,750
	35-39	2003	1.5	[0.8, 2.9]	737	2008	2.2	[1.7, 2.8]	3,498	2013	1.8	[1.4, 2.3]	4,183	2018	1.7	[1.2, 2.3]	4,587
	40-44	2003	4.8	[3.0, 7.4]	609	2008	2.1	[1.6, 2.7]	2,723	2013	2.5	[1.9, 3.2]	3,230	2018	2.0	[1.5, 2.7]	3,490
	45-49	2003	2.0	[1.1, 3.8]	533	2008	1.8	[1.4, 2.5]	2,508	2013	1.9	[1.4, 2.6]	2,996	2018	1.7	[1.3, 2.3]	3,095

Appendix Table 3—*Continued*

Country	Age group	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)
Philippines	20-24	1998	1.7	[0.8, 3.6]	324	2003	2.9	[1.1, 7.3]	293	2013	3.0	[1.7, 5.2]	371	2017	3.4	[1.9, 5.8]	635
	25-29	1998	2.5	[1.7, 3.8]	1,073	2003	3.0	[2.0, 4.4]	1,046	2013	2.6	[1.8, 3.7]	1,121	2017	3.5	[2.5, 5.1]	1,961
	30-34	1998	1.6	[1.1, 2.4]	1,536	2003	3.9	[3.0, 5.1]	1,450	2013	2.7	[2.0, 3.7]	1,634	2017	2.9	[2.1, 4.2]	2,408
	35-39	1998	1.5	[1.0, 2.4]	1,568	2003	2.3	[1.7, 3.3]	1,571	2013	3.5	[2.7, 4.5]	1,675	2017	3.5	[2.7, 4.6]	2,721
	40-44	1998	1.4	[0.8, 2.4]	1,221	2003	1.7	[1.1, 2.6]	1,291	2013	2.5	[1.8, 3.4]	1,619	2017	2.6	[1.9, 3.5]	2,465
	45-49	1998	2.1	[1.3, 3.4]	1,001	2003	1.8	[1.1, 2.8]	1,135	2013	2.6	[1.9, 3.5]	1,503	2017	3.3	[2.3, 4.6]	2,386
Rwanda	20-24	2000	1.5	[0.6, 3.8]	264	2005	0.4	[0.1, 2.9]	257	2010	0.6	[0.1, 4.0]	177	2014-15	0.7	[0.1, 4.7]	126
	25-29	2000	1.9	[1.1, 3.2]	805	2005	1.4	[0.8, 2.6]	908	2010	1.0	[0.5, 1.8]	1,103	2014-15	0.9	[0.5, 1.8]	931
	30-34	2000	1.5	[0.8, 2.9]	830	2005	0.6	[0.3, 1.3]	1,039	2010	1.0	[0.6, 1.7]	1,314	2014-15	1.2	[0.7, 1.9]	1,479
	35-39	2000	1.2	[0.6, 2.6]	757	2005	0.6	[0.3, 1.5]	793	2010	1.5	[1.0, 2.4]	1,086	2014-15	0.4	[0.2, 1.0]	1,197
	40-44	2000	0.8	[0.3, 1.9]	610	2005	1.2	[0.6, 2.4]	722	2010	1.1	[0.6, 2.2]	763	2014-15	0.8	[0.4, 1.6]	880
	45-49	2000	1.0	[0.4, 2.7]	405	2005	1.3	[0.6, 2.8]	554	2010	1.5	[0.8, 2.8]	683	2014-15	1.5	[0.8, 2.9]	583
Senegal	20-24	1997	4.2	[2.6, 6.7]	554	2005	7.8	[5.0, 12.0]	953	2012-13	3.6	[2.2, 5.9]	487	2018	6.8	[3.9, 11.5]	425
	25-29	1997	2.8	[1.9, 4.2]	973	2005	3.5	[2.7, 4.7]	1,608	2012-13	3.9	[2.6, 5.8]	1,026	2018	3.7	[2.5, 5.3]	998
	30-34	1997	1.9	[1.1, 3.3]	1,004	2005	2.6	[1.7, 4.1]	1,573	2012-13	2.8	[1.6, 5.0]	960	2018	4.4	[2.8, 6.9]	1,127
	35-39	1997	1.4	[0.8, 2.4]	1,009	2005	2.7	[1.8, 4.1]	1,404	2012-13	1.2	[0.7, 2.3]	821	2018	2.8	[1.7, 4.6]	942
	40-44	1997	2.0	[1.1, 3.8]	696	2005	1.7	[1.0, 2.7]	1,114	2012-13	0.8	[0.3, 1.8]	613	2018	2.3	[1.1, 4.5]	767
	45-49	1997	1.1	[0.5, 2.6]	492	2005	2.2	[1.1, 4.6]	912	2012-13	1.3	[0.6, 3.0]	462	2018	2.0	[1.0, 4.3]	570
Tanzania	20-24	1999	2.1	[0.8, 5.6]	220	2004-05	2.2	[1.1, 4.2]	495	2010	1.4	[0.6, 3.2]	470	2015-16	0.6	[0.2, 1.7]	490
	25-29	1999	4.4	[2.6, 7.3]	529	2004-05	1.4	[0.7, 2.6]	1,078	2010	1.7	[0.9, 3.0]	1,053	2015-16	1.4	[0.8, 2.4]	1,239
	30-34	1999	3.7	[2.0, 6.9]	399	2004-05	2.5	[1.6, 3.9]	1,084	2010	2.2	[1.4, 3.5]	1,061	2015-16	1.4	[0.8, 2.5]	1,301
	35-39	1999	2.4	[0.9, 6.4]	396	2004-05	1.5	[0.8, 2.6]	837	2010	2.1	[1.2, 3.4]	1,009	2015-16	1.5	[0.7, 3.1]	1,297
	40-44	1999	2.0	[0.7, 5.3]	229	2004-05	1.3	[0.6, 2.8]	680	2010	1.4	[0.7, 2.7]	792	2015-16	1.1	[0.6, 2.1]	1,023
	45-49	1999	0.0	[00.0, 0.2]	218	2004-05	1.8	[0.8, 3.8]	541	2010	1.1	[0.5, 2.4]	625	2015-16	0.4	[0.1, 1.2]	770
Uganda	20-24	2000-01	1.3	[0.6, 2.8]	561	2006	1.0	[0.4, 2.4]	547	2011	0.9	[0.3, 2.7]	443	2016	0.7	[0.3, 1.6]	993
	25-29	2000-01	1.4	[0.8, 2.4]	891	2006	1.2	[0.6, 2.2]	1,014	2011	0.3	[0.1, 1.0]	1,097	2016	0.5	[0.3, 0.9]	1,904
	30-34	2000-01	2.4	[1.4, 4.1]	735	2006	0.6	[0.3, 1.4]	983	2011	0.5	[0.2, 1.3]	853	2016	0.8	[0.4, 1.4]	1,941
	35-39	2000-01	2.8	[1.6, 4.9]	601	2006	2.1	[1.1, 3.7]	747	2011	0.9	[0.4, 1.9]	771	2016	0.8	[0.4, 1.5]	1,549
	40-44	2000-01	3.3	[1.8, 5.8]	404	2006	1.8	[0.9, 3.6]	531	2011	0.7	[0.2, 2.2]	535	2016	1.0	[0.5, 2.0]	1,185
	45-49	2000-01	3.3	[1.7, 6.2]	278	2006	2.4	[1.3, 4.6]	433	2011	1.7	[0.7, 4.2]	359	2016	1.4	[0.8, 2.5]	816
Zambia	20-24	2001-02	2.9	[1.7, 4.9]	503	2007	1.1	[0.4, 2.9]	414	2013-14	0.9	[0.4, 2.3]	658	2018	0.8	[0.3, 1.9]	560
	25-29	2001-02	2.2	[1.4, 3.5]	913	2007	1.0	[0.5, 2.1]	895	2013-14	0.7	[0.4, 1.4]	1,800	2018	0.8	[0.4, 1.7]	1,191
	30-34	2001-02	1.6	[0.9, 2.9]	730	2007	1.0	[0.4, 2.1]	773	2013-14	0.7	[0.4, 1.3]	1,823	2018	0.7	[0.3, 1.6]	1,288
	35-39	2001-02	1.8	[1.0, 3.3]	603	2007	1.3	[0.6, 2.8]	565	2013-14	1.1	[0.6, 1.9]	1,478	2018	0.6	[0.2, 1.3]	1,209
	40-44	2001-02	1.5	[0.7, 3.3]	447	2007	2.8	[1.4, 5.4]	384	2013-14	1.1	[0.6, 2.0]	1,075	2018	0.9	[0.4, 2.1]	906
	45-49	2001-02	1.3	[0.5, 3.6]	326	2007	1.1	[0.4, 3.0]	332	2013-14	1.1	[0.6, 2.2]	742	2018	0.2	[0.1, 0.9]	657

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APPENDIX 4

Appendix Table 4   Age-specific secondary infertility estimates

Country	Age group	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)
Bangladesh	20-24	1999-2000	2.3	[1.4, 3.9]	676	2004	1.7	[1.0, 2.9]	790	2011	3.0	[2.0, 4.5]	919	2017-18	3.7	[2.5, 5.7]	727
	25-29	1999-2000	4.2	[3.1, 5.5]	1,160	2004	3.9	[2.7, 5.4]	1,162	2011	4.7	[3.6, 6.1]	1,674	2017-18	5.8	[4.7, 7.1]	1,691
	30-34	1999-2000	7.1	[5.4, 9.4]	819	2004	7.2	[5.4, 9.4]	839	2011	8.0	[6.3, 10.1]	1,056	2017-18	11.0	[9.2, 13.2]	1,325
	35-39	1999-2000	12.7	[9.8, 16.4]	410	2004	14.8	[11.4, 19.0]	424	2011	17.7	[13.9, 22.2]	541	2017-18	22.4	[18.9, 26.4]	620
	40-44	1999-2000	28.0	[22.0, 35.0]	184	2004	34.0	[26.8, 42.0]	187	2011	37.0	[30.4, 44.2]	274	2017-18	61.0	[54.5, 67.1]	284
	45-49	1999-2000	68.0	[58.4, 76.3]	134	2004	76.8	[69.5, 82.8]	209	2011	81.2	[73.5, 87.0]	196	2017-18	93.4	[89.7, 95.8]	380
Ethiopia	20-24	2000	4.1	[2.2, 7.5]	396	2005	3.0	[1.5, 5.7]	376	2011	2.5	[0.9, 7.0]	424	2016	1.4	[0.5, 4.1]	393
	25-29	2000	6.4	[4.9, 8.5]	1,384	2005	4.4	[3.2, 5.9]	1,358	2011	3.0	[2.0, 4.5]	1,619	2016	2.0	[1.2, 3.3]	1,433
	30-34	2000	7.3	[5.6, 9.5]	1,351	2005	6.3	[4.8, 8.4]	1,190	2011	5.3	[3.7, 7.5]	1,360	2016	5.2	[3.8, 7.1]	1,419
	35-39	2000	14.7	[12.2, 17.6]	1,206	2005	7.8	[6.1, 10.0]	1,012	2011	11.2	[8.9, 14.1]	1,231	2016	9.6	[7.5, 12.2]	1,191
	40-44	2000	24.6	[20.8, 29.0]	715	2005	17.9	[14.5, 22.0]	576	2011	23.4	[18.9, 28.5]	673	2016	17.9	[14.3, 22.2]	594
	45-49	2000	48.5	[43.5, 53.5]	525	2005	37.4	[32.0, 43.2]	376	2011	49.0	[41.9, 56.2]	368	2016	45.9	[38.1, 53.9]	338
Ghana	20-24	1998	5.9	[3.0, 11.3]	110	2003	19.0	[10.2, 32.6]	86	2008	11.3	[6.0, 20.4]	89	2014	10.3	[5.1, 19.7]	135
	25-29	1998	11.7	[9.0, 15.3]	414	2003	14.0	[10.9, 17.7]	477	2008	5.6	[3.6, 8.7]	345	2014	9.5	[7.0, 12.7]	563
	30-34	1998	19.2	[15.6, 23.3]	455	2003	13.7	[11.1, 16.9]	591	2008	14.1	[10.8, 18.2]	415	2014	9.4	[7.1, 12.2]	802
	35-39	1998	23.2	[19.2, 27.7]	427	2003	17.8	[14.4, 21.9]	503	2008	18.2	[14.2, 22.9]	399	2014	18.7	[15.6, 22.3]	812
	40-44	1998	30.3	[24.6, 36.6]	291	2003	28.3	[23.4, 33.9]	314	2008	27.5	[21.6, 34.2]	238	2014	30.4	[26.2, 35.1]	509
	45-49	1998	55.4	[47.5, 63.0]	168	2003	46.8	[39.8, 53.9]	226	2008	44.3	[35.8, 53.2]	140	2014	59.9	[53.2, 66.3]	295
Haiti	20-24	2000	7.7	[4.4, 13.1]	185	2005-06	13.8	[8.2, 22.3]	192	2012	9.8	[4.9, 18.5]	164	2016-17	12.8	[7.8, 20.2]	164
	25-29	2000	17.1	[11.6, 24.5]	639	2005-06	15.2	[11.8, 19.5]	674	2012	14.3	[11.1, 18.2]	717	2016-17	15.3	[12.4, 18.9]	626
	30-34	2000	8.7	[5.9, 12.6]	726	2005-06	12.1	[8.8, 16.3]	669	2012	17.2	[13.9, 21.0]	834	2016-17	18.3	[15.0, 22.1]	832
	35-39	2000	12.5	[9.3, 16.6]	703	2005-06	16.4	[13.0, 20.4]	681	2012	19.9	[16.3, 24.1]	744	2016-17	18.5	[14.9, 22.8]	759
	40-44	2000	29.7	[23.1, 37.3]	477	2005-06	17.9	[14.0, 22.6]	418	2012	25.0	[20.2, 30.5]	480	2016-17	25.3	[21.1, 30.0]	510
	45-49	2000	58.0	[51.6, 64.1]	371	2005-06	59.2	[52.9, 65.1]	329	2012	58.2	[51.8, 64.4]	325	2016-17	61.5	[54.9, 67.7]	314
India	20-24	1998-99	5.7	[4.9, 6.5]	4,169	2005-06	3.1	[2.5, 3.9]	2,932	2015-16	6.3	[5.4, 7.2]	8,712				
	25-29	1998-99	6.3	[5.7, 6.9]	9,617	2005-06	5.4	[4.9, 6.1]	8,227	2015-16	9.0	[8.6, 9.4]	40,703				
	30-34	1998-99	11.4	[10.5, 12.4]	6,649	2005-06	8.5	[7.6, 9.4]	6,099	2015-16	17.6	[16.9, 18.4]	34,296				
	35-39	1998-99	21.5	[19.8, 23.3]	3,375	2005-06	17.9	[16.1, 19.9]	3,117	2015-16	35.8	[34.7, 36.9]	19,877				
	40-44	1998-99	55.3	[52.3, 58.1]	1,714	2005-06	48.7	[45.1, 52.3]	1,435	2015-16	65.5	[64.1, 66.8]	10,516				
	45-49	1998-99	83.4	[80.7, 85.7]	1,213	2005-06	80.9	[77.2, 84.1]	962	2015-16	87.7	[86.8, 88.6]	8,872				

Continued...

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Appendix Table 4—_Continued_

Country	Age group	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)
Kenya	20-24	1998	3.3	[1.3, 7.8]	193	2003	2.4	[1.0, 5.6]	172	2008-09	1.3	[0.6, 3.0]	250	2014	0.6	[0.3, 1.5]	708
	25-29	1998	6.9	[4.8, 9.9]	647	2003	2.2	[1.4, 3.6]	659	2008-09	4.3	[2.4, 7.5]	656	2014	2.0	[1.3, 3.0]	2,645
	30-34	1998	8.6	[6.4, 11.5]	583	2003	6.9	[5.1, 9.4]	601	2008-09	6.1	[4.1, 8.9]	687	2014	1.8	[1.3, 2.7]	2,372
	35-39	1998	10.9	[8.1, 14.6]	480	2003	10.5	[7.7, 14.2]	438	2008-09	11.1	[8.3, 14.7]	508	2014	4.1	[3.0, 5.5]	1,768
	40-44	1998	22.0	[16.1, 29.3]	224	2003	17.2	[13.0, 22.3]	268	2008-09	21.6	[14.9, 30.2]	255	2014	5.7	[4.2, 7.9]	894
	45-49	1998	51.0	[39.3, 62.7]	117	2003	37.3	[27.0, 48.9]	107	2008-09	27.9	[19.8, 37.8]	131	2014	23.6	[18.4, 29.7]	314
Malawi	20-24	2000	4.1	[2.7, 6.3]	595	2004	3.4	[1.9, 6.2]	551	2010	1.8	[0.9, 3.5]	1,027	2015-16	2.7	[1.7, 4.3]	918
	25-29	2000	6.7	[5.3, 8.4]	1,552	2004	3.7	[2.6, 5.3]	1,281	2010	2.8	[1.9, 4.1]	2,866	2015-16	3.0	[2.1, 4.1]	2,287
	30-34	2000	9.5	[7.9, 11.5]	1,119	2004	6.7	[4.9, 9.0]	984	2010	5.5	[4.3, 6.9]	2,239	2015-16	3.5	[2.7, 4.5]	2,193
	35-39	2000	15.1	[12.7, 17.8]	917	2004	10.3	[7.7, 13.6]	659	2010	5.7	[4.4, 7.3]	1,572	2015-16	6.6	[5.1, 8.4]	1,457
	40-44	2000	22.0	[18.1, 26.5]	502	2004	18.2	[14.2, 23.0]	409	2010	14.5	[11.6, 18.0]	763	2015-16	11.6	[8.9, 15.0]	659
	45-49	2000	39.7	[33.9, 45.7]	326	2004	23.1	[17.2, 30.3]	207	2010	24.7	[20.2, 29.7]	425	2015-16	31.5	[25.9, 37.8]	314
Mali	20-24	2001	5.2	[3.7, 7.3]	750	2006	8.1	[4.8, 13.3]	896	2012-13	7.9	[5.5, 11.1]	566	2018	7.3	[5.2, 10.3]	496
	25-29	2001	8.7	[7.0, 10.9]	1,643	2006	7.6	[6.0, 9.6]	1,947	2012-13	8.4	[6.9, 10.1]	1,479	2018	6.8	[5.4, 8.6]	1,336
	30-34	2001	11.3	[9.6, 13.2]	1,672	2006	9.8	[8.1, 11.9]	1,694	2012-13	9.8	[8.1, 11.9]	1,392	2018	10.9	[8.9, 13.4]	1,277
	35-39	2001	14.7	[12.5, 17.2]	1,372	2006	17.7	[15.4, 20.4]	1,489	2012-13	18.2	[15.5, 21.2]	1,106	2018	16.1	[13.6, 19.1]	1,042
	40-44	2001	27.4	[23.9, 31.2]	900	2006	32.9	[27.2, 39.1]	972	2012-13	28.1	[24.1, 32.4]	612	2018	22.8	[19.4, 26.6]	570
	45-49	2001	51.5	[46.0, 57.0]	485	2006	62.3	[57.6, 66.7]	627	2012-13	56.1	[49.5, 62.5]	329	2018	55.9	[49.8, 61.9]	299
Nepal	20-24	2001	2.4	[1.3, 4.6]	407	2006	2.5	[1.1, 5.4]	367	2011	2.6	[1.3, 5.2]	316	2016	3.4	[1.7, 6.8]	258
	25-29	2001	2.4	[1.6, 3.6]	1,064	2006	4.1	[2.8, 5.9]	999	2011	4.1	[2.8, 6.1]	952	2016	5.3	[3.7, 7.6]	915
	30-34	2001	4.8	[3.5, 6.5]	848	2006	4.7	[3.1, 6.9]	604	2011	4.6	[3.0, 7.1]	612	2016	9.4	[7.1, 12.5]	604
	35-39	2001	9.1	[6.7, 12.3]	516	2006	9.3	[6.5, 13.0]	382	2011	10.7	[7.2, 15.8]	335	2016	18.0	[13.4, 23.8]	264
	40-44	2001	25.2	[20.4, 30.7]	317	2006	24.4	[18.7, 31.2]	206	2011	26.2	[18.5, 35.7]	180	2016	39.4	[28.6, 51.4]	141
	45-49	2001	70.4	[64.1, 75.9]	269	2006	72.4	[63.1, 80.1]	180	2011	61.3	[48.2, 72.8]	113	2016	78.8	[66.2, 87.6]	100
Nigeria	20-24	2003	4.0	[1.8, 8.6]	242	2008	3.4	[2.4, 4.6]	1,173	2013	4.8	[3.6, 6.5]	1,190	2018	3.7	[2.7, 4.9]	1,244
	25-29	2003	7.4	[5.2, 10.4]	735	2008	6.7	[5.9, 7.7]	3,468	2013	8.2	[7.1, 9.5]	3,801	2018	6.7	[5.8, 7.9]	4,025
	30-34	2003	14.2	[11.3, 17.7]	713	2008	10.5	[9.5, 11.7]	3,389	2013	9.6	[8.5, 10.7]	3,888	2018	10.2	[9.2, 11.3]	4,242
	35-39	2003	25.3	[21.4, 29.7]	654	2008	16.1	[14.7, 17.6]	3,014	2013	18.0	[16.5, 19.7]	3,569	2018	15.8	[14.5, 17.1]	3,800
	40-44	2003	34.3	[28.7, 40.3]	422	2008	29.6	[27.4, 32.0]	1,973	2013	29.9	[27.6, 32.2]	2,235	2018	27.2	[25.1, 29.5]	2,260
	45-49	2003	66.7	[59.6, 73.0]	270	2008	49.6	[46.7, 52.5]	1,323	2013	57.9	[54.7, 61.0]	1,500	2018	46.3	[43.0, 49.8]	1,231
Philippines	20-24	1998	5.2	[2.3, 11.3]	159	2003	3.7	[1.5, 8.8]	130	2013	7.3	[4.4, 12.1]	163	2017	9.3	[5.1, 16.5]	272
	25-29	1998	4.1	[2.8, 6.1]	744	2003	6.7	[4.8, 9.2]	666	2013	10.1	[8.0, 12.6]	702	2017	10.4	[8.4, 12.8]	1,271
	30-34	1998	9.2	[7.4, 11.4]	1,046	2003	9.1	[7.3, 11.2]	936	2013	14.0	[12.0, 16.3]	1,005	2017	16.3	[13.6, 19.3]	1,529
	35-39	1998	12.5	[10.2, 15.1]	935	2003	14.6	[11.9, 17.9]	809	2013	17.0	[14.6, 19.8]	882	2017	20.9	[17.4, 24.8]	1,420
	40-44	1998	29.5	[25.0, 34.5]	508	2003	24.9	[20.9, 29.4]	471	2013	26.0	[22.4, 30.0]	573	2017	28.6	[23.7, 34.2]	864
	45-49	1998	51.3	[44.7, 57.9]	263	2003	57.9	[51.8, 63.7]	293	2013	53.3	[47.6, 58.9]	323	2017	68.0	[61.3, 74.1]	464

Appendix Table 4—*Continued*

Country	Age group	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)	Year	%	CI	N (weighted)
Rwanda	20-24	2000	3.3	[1.0, 10.1]	106	2005	2.1	[0.5, 8.1]	121	2010-11	1.2	[0.2, 7.8]	90	2014-15	0.0	[..0, ..0]	55
	25-29	2000	7.0	[5.2, 9.5]	594	2005	2.2	[1.3, 3.8]	739	2010-11	2.0	[1.2, 3.2]	792	2014-15	2.6	[1.6, 4.3]	651
	30-34	2000	6.7	[5.0, 8.9]	741	2005	5.7	[4.4, 7.4]	949	2010-11	1.7	[1.1, 2.7]	1,088	2014-15	1.4	[0.8, 2.3]	1,079
	35-39	2000	8.5	[6.6, 10.8]	686	2005	6.2	[4.6, 8.3]	731	2010-11	4.0	[2.9, 5.7]	826	2014-15	5.2	[3.9, 7.0]	793
	40-44	2000	11.8	[9.2, 15.1]	484	2005	11.5	[9.1, 14.5]	592	2010-11	8.1	[6.0, 10.9]	528	2014-15	9.3	[6.7, 12.9]	419
	45-49	2000	21.7	[16.3, 28.4]	193	2005	33.4	[28.3, 39.0]	320	2010-11	21.4	[16.8, 26.8]	286	2014-15	26.3	[19.8, 34.0]	152
Senegal	20-24	1997	4.9	[2.9, 8.0]	338	2005	9.6	[6.8, 13.3]	509	2012-13	4.8	[1.9, 11.8]	255	2018	6.5	[3.1, 13.1]	225
	25-29	1997	8.9	[7.0, 11.3]	828	2005	10.1	[8.3, 12.3]	1,281	2012-13	5.6	[4.0, 7.9]	817	2018	8.7	[6.0, 12.4]	801
	30-34	1997	11.8	[9.7, 14.4]	951	2005	13.8	[11.7, 16.2]	1,413	2012-13	12.9	[10.2, 16.3]	860	2018	9.6	[7.4, 12.2]	978
	35-39	1997	17.6	[14.5, 21.2]	914	2005	18.4	[15.9, 21.3]	1,235	2012-13	16.0	[13.0, 19.6]	719	2018	13.5	[10.9, 16.6]	800
	40-44	1997	29.3	[25.6, 33.2]	550	2005	33.6	[29.9, 37.6]	821	2012-13	24.3	[19.7, 29.5]	482	2018	28.8	[23.8, 34.3]	546
	45-49	1997	48.8	[41.8, 55.9]	306	2005	62.4	[55.9, 68.5]	453	2012-13	50.2	[42.4, 57.9]	266	2018	56.4	[48.1, 64.4]	305
Tanzania	20-24	1999	2.2	[0.7, 6.7]	124	2004-05	1.4	[0.4, 4.3]	243	2009-10	6.7	[3.6, 12.2]	272	2015-16	5.1	[2.8, 9.1]	288
	25-29	1999	10.8	[7.3, 15.8]	438	2004-05	4.0	[2.7, 5.9]	884	2009-10	5.3	[3.4, 8.0]	885	2015-16	3.8	[2.6, 5.4]	1,009
	30-34	1999	11.9	[8.7, 16.1]	354	2004-05	9.1	[7.0, 11.7]	947	2009-10	8.3	[6.4, 10.8]	892	2015-16	6.8	[5.0, 9.2]	1,091
	35-39	1999	26.1	[20.0, 33.3]	328	2004-05	16.5	[13.0, 20.6]	706	2009-10	14.8	[11.7, 18.6]	836	2015-16	11.2	[8.9, 14.0]	1,009
	40-44	1999	36.4	[28.3, 45.3]	169	2004-05	26.1	[21.1, 31.8]	460	2009-10	25.5	[20.8, 30.8]	541	2015-16	23.6	[19.8, 28.0]	669
	45-49	1999	61.7	[48.2, 73.5]	127	2004-05	52.2	[45.7, 58.5]	271	2009-10	53.5	[45.7, 61.2]	294	2015-16	50.9	[43.5, 58.2]	341
Uganda	20-24	2000-01	3.5	[1.5, 8.1]	347	2006	1.4	[0.6, 3.4]	341	2011	1.1	[0.4, 3.1]	294	2016	1.6	[0.7, 3.3]	634
	25-29	2000-01	5.0	[3.5, 7.3]	781	2006	1.5	[0.9, 2.8]	890	2011	2.8	[1.7, 4.4]	950	2016	3.2	[2.3, 4.3]	1,612
	30-34	2000-01	6.4	[4.8, 8.5]	646	2006	4.1	[2.8, 5.9]	890	2011	3.1	[2.0, 4.8]	755	2016	4.2	[3.3, 5.5]	1,640
	35-39	2000-01	13.9	[10.6, 17.9]	476	2006	10.3	[8.1, 13.1]	635	2011	8.3	[6.2, 11.0]	634	2016	6.6	[5.2, 8.3]	1,176
	40-44	2000-01	19.6	[14.9, 25.5]	250	2006	14.5	[11.0, 18.9]	343	2011	14.8	[11.1, 19.4]	331	2016	16.1	[13.4, 19.3]	690
	45-49	2000-01	42.3	[34.0, 51.0]	128	2006	45.6	[37.8, 53.6]	191	2011	39.6	[31.4, 48.4]	157	2016	42.0	[35.7, 48.5]	281
Zambia	20-24	2001-02	4.9	[2.8, 8.3]	308	2007	1.0	[0.3, 3.3]	255	2013-14	3.1	[1.4, 6.7]	425	2018-19	3.7	[2.2, 6.2]	335
	25-29	2001-02	6.4	[4.6, 8.9]	808	2007	2.8	[1.8, 4.3]	779	2013-14	3.3	[2.3, 4.8]	1,568	2018-19	4.5	[2.9, 7.1]	1,036
	30-34	2001-02	10.4	[8.2, 13.0]	653	2007	7.6	[5.7, 10.0]	686	2013-14	5.6	[4.3, 7.3]	1,592	2018-19	5.6	[4.3, 7.2]	1,101
	35-39	2001-02	13.6	[10.6, 17.4]	514	2007	8.3	[6.1, 11.3]	456	2013-14	10.2	[8.2, 12.7]	1,183	2018-19	9.2	[7.0, 12.1]	906
	40-44	2001-02	15.1	[11.2, 20.0]	295	2007	12.2	[8.4, 17.3]	242	2013-14	12.3	[9.6, 15.6]	668	2018-19	17.7	[13.2, 23.3]	516
	45-49	2001-02	36.8	[28.9, 45.4]	141	2007	34.2	[25.5, 44.1]	120	2013-14	34.5	[27.8, 41.9]	242	2018-19	38.1	[31.1, 45.7]	226