HUMAN CAPITAL INITIATIVE

Measurement of Unmet Need for Family Planning

A COUNTERFACTUAL APPROACH

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ABSTRACT

Unmet need for family planning, which estimates the proportion of women who want to delay or limit childbearing but who are not using contraception, plays a fundamental role in family planning research, evaluation, and advocacy. While conceptually straightforward, its measurement is problematic and complex and has undergone multiple revisions over time. In its latest iteration, unmet need is calculated as the proportion of fecund and sexually active women of reproductive age who report wanting to either limit or space their next birth for at least two years but are not using any contraceptive method. While this revision is a significant simplification, its estimation still imposes a heavy data burden and suffers from a number of well-known methodological limitations, most notably its reliance on biased measures of women's stated fertility preferences and wantedness of births. In this study, we propose a counterfactual-based approach to estimating unmet need at the population level. Using data from 56 countries, we calculate unmet need in a population as the difference between: 1) the observed contraceptive prevalence rate in the population; and 2) the calculated contraceptive prevalence rate in a sub-sample of women who are identified to be from "ideal" family planning environments. Women from "ideal" environments are selected based on characteristics that indicate their contraceptive autonomy and decision-making over family planning use. We find significant differences between our approach and existing approaches to calculating unmet need, and we

observe significant variation across countries when comparing the different indicators. We argue that our measure of unmet need is preferable to existing indicators due to: 1) its independence from biases that are generated from the use of reported preference measures; 2) its exclusive reliance on measureable, observable variables; 3) the simplicity with which it can be derived; and 4) its flexibility to be both generalizable for cross-country comparisons as well as tailored for context-specific analyses.

INTRODUCTION

An estimated 40 percent of pregnancies, or 99 million pregnancies, each year are unintended (1–3), either because they are unwanted or mistimed at the time of conception (4). A large number of unintended pregnancies are causes for social concern because they contribute to high rates of induced abortion and increased maternal morbidity and mortality, which in turn place substantial health and economic burdens on women, their children, and their families (5–7). The use of contraception helps women and couples to meet their desired fertility and to avert unintended pregnancies and unwanted births (8,9). However, up to 215 million women, or 26 percent of sexually active women of reproductive age, are not using a contraceptive method even when they want to avoid becoming pregnant - these women account for an estimated 82 percent of all unintended pregnancies (3,10).

Unlike many domains in health, the provision of high-quality family planning services is not only measured by the achievement of good reproductive health outcomes but also considers the objective of helping women and couples maximize a complex and evolving set of preferences around future fertility and well-being. For this reason, the demand for (and use of) contraception differs from most other interventions in health; while one can assume that individuals have a demand for health interventions that reduce their risk of morbidity and mortality, the same cannot be said for the demand for contraception since women and couples may, in fact, seek to become pregnant at different points over their lifetimes (11). As a result, it has become incumbent on family planning and reproductive health programs to:

1. Demonstrate that a demand for contraception and family planning exists; and

2. Measure the extent to which this demand for contraception is met through contraceptive use.

The commitment to effectively quantify and meet demand for family planning has been enshrined in several global agendas, most recently (and notably) as a key target (target 3.7) in the 2030 Sustainable Development Goals (SDGs) (12). A key measure of progress to achieving target 3.7 of the SDGs is indicator 3.7.1, which is calculated as the proportion of women of reproductive age (15-49 years) who have their need, or demand, for family planning satisfied by using modern methods of contraception. To this end, the concept of unmet need, which aims to estimate the proportion of women who want to delay or stop childbearing but are not using contraception, plays a fundamental role in family planning research, evaluation, and advocacy and has received significant attention from academics in of reproductive health, human rights and reproductive justice, economics, and demography (11).

UNMET NEED: CURRENT DEFINITION AND MEASUREMENT CHALLENGES

Although the underlying concept of unmet need, the non-use of contraception among women stating a desire to avoid pregnancy, appears to be straightforward, its measurement is problematic

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and complex and has undergone multiple revisions in recent decades (11,13). In its latest iteration, unmet need is calculated as the proportion of fecund and sexually active women of reproductive age (WRA) who want to either limit or space their next birth for at least two years but are not using any contraceptive method (14). While this revision is a significant simplification from previous versions, its estimation still imposes a heavy data burden, where up to 15 items from survey responses are needed to capture a range of indicators related to: 1) a woman's potential exposure to the risk of pregnancy; 2) her sexual activity; 3) her physiological capacity to become pregnant (fecundity); and 4) the reliability of a woman's retrospective reporting of her preferences to space and limit births (11,13,14).

The current measure of unmet need is calculated as follows:

Unmet need

$$= \frac{\textit{WRA who want to limit/space births for 2+ years AND are not using contraception}}{\textit{Fecund and sexually active WRA (ages 15-49)}}$$

In this measure, the denominator aims to capture the population of women who would be at risk of pregnancy and includes women who: 1) are either married or are in a sexual union; 2) report being sexually active; and 3) are fecund, and are therefore at risk of becoming pregnant. Among this population, women are classified into: 1) current contraceptive users, comprised of women who either have a "met need for limiting births" or a "met need for spacing births," or 2) non-users of contraception, comprised of non-pregnant, currently pregnant, or postpartum amenorrheic women who are classified to either have an "unmet need for limiting births," an "unmet need for spacing births," or "no unmet need." The categorization of women into met need, unmet need, or no unmet need, and hence their relative contribution to the numerator, is a function of women's reported preferences to space or limit future births (in the case of women who are not pregnant or postpartum amenorrheic) or of women's retrospective preferences to space or limit their current (if pregnant) or most recent (if postpartum amenorrheic) birth. Figure 1 presents a flow diagram of the classification algorithm (14).

Over the years, a number of methodological limitations and concerns related to the measurement and estimation of the components of unmet need in survey data have been highlighted by scholars and practitioners alike. Key issues include:

1. The reliability of women's reported or assumed sexual activity, which serves as an indicator of exposure to the risk of pregnancy. For example, currently married women are assumed to be sexually active and exposed to the risk of pregnancy even if they report not using contraception because their partners are away or because they have no or infrequent sex. Including these women in the calculation of unmet need may therefore result in an overestimation of the measure (13,14). On the other hand, excluding unmarried but (potentially) sexually active women who demand contraception from the calculation would underestimate unmet need.

2. The inclusion of pregnant and postpartum amenorrheic women, many of whom might soon demand contraception following their transition out of their temporary state of insusceptibility to pregnancy. The length of postpartum amenorrhea, during which time a woman is free from the risk of pregnancy, continues to be a source of debate, and sensitivity analyses show that varying the length of time during which postpartum amenorrhea is a reliable signal of inability to conceive has significant impacts on the range of estimates of unmet need (13).

Figure 1: Current Methodology for Unmet Need Classification, DHS
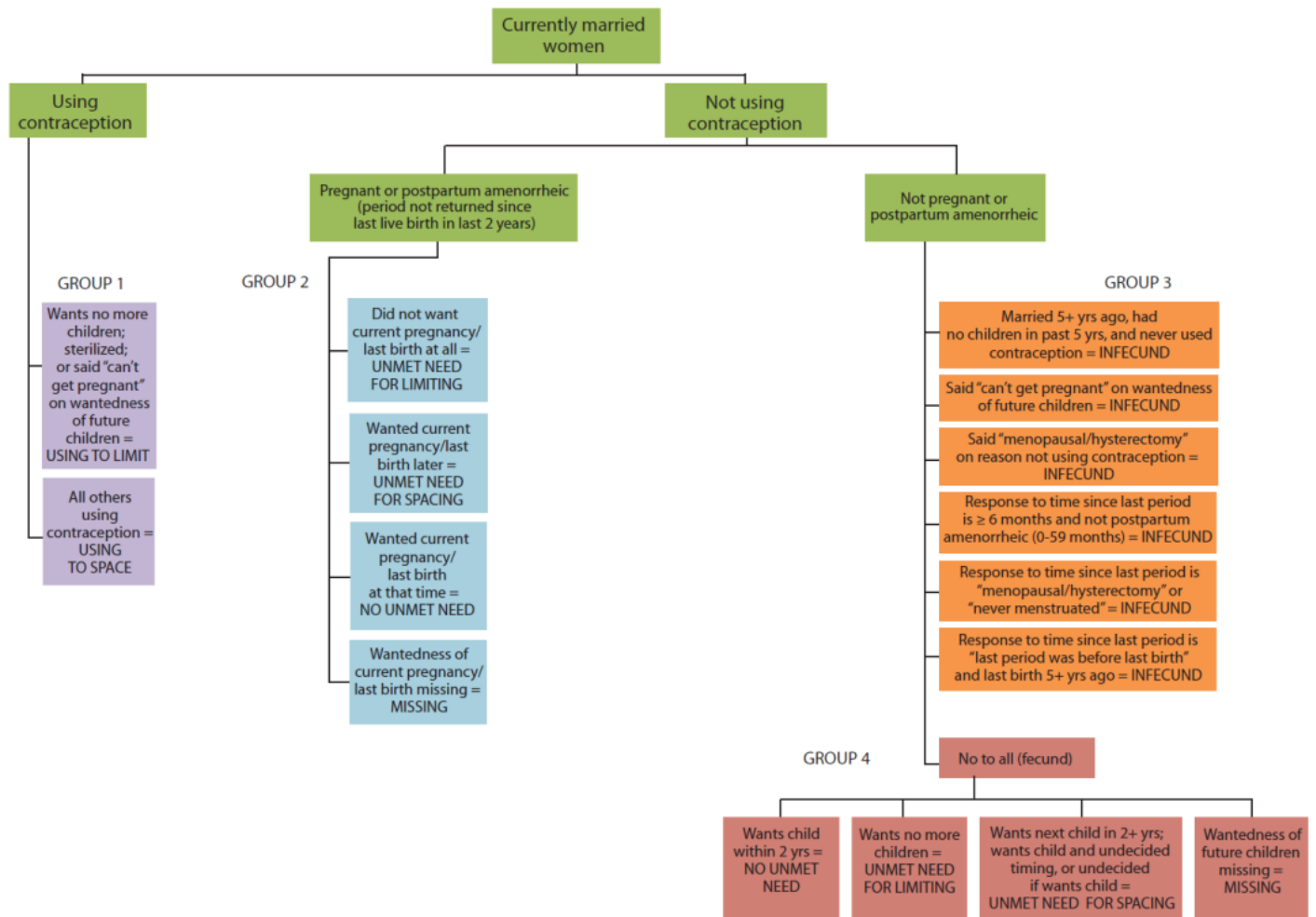
Source: United States Agency for International Development Demographic and Health Surveys Program, 2012.

3. The identification and exclusion of infecund women, whose contraceptive use or non-use are independent from their risk of pregnancy. To this end, the measurement of fecundity from behavioral responses, and in the absence of biological indicators, is challenging and relies on questionable assumptions. Specifically, the revised algorithm assumes that women are infecund if they satisfy at least one of three criteria: (1) they first married five or more years ago, have not had children in the past five years, and have never used contraception; (2) they report not having menstruated in the last five years; or (3) they report that they are not able to become pregnant, are menopausal, or have had a hysterectomy (14). Evidence from other studies have shown that the potential misclassification of women who may, in fact, be able to conceive has a substantial impact on the measurement of unmet need (13).

Perhaps the most problematic feature of the current measure, however, is its reliance on women's reported fertility preferences, and particularly the measurement of women's wantedness of births through direct retrospective recall. This recall is ascertained by asking women "At the time you became pregnant with [name of the most recent birth], did you want to become pregnant then, did you want to wait until later, or did not want (more) children at all?" This approach clearly suffers from the ex-post rationalization bias that is present in women's reluctance to declare a past pregnancy or birth as unwanted, and particularly when the past birth of interest refers to a child who is

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alive at the time of the interview (15,16). Many studies have demonstrated the significant bias of this approach to eliciting a woman's preferences and have examined alternative measures for identifying fertility preferences, including:

1. Eliciting a woman's stated ideal number of children that she would want over her lifetime if she could go back to the time when she did not have children.

2. Eliciting fertility preferences prospectively using prospectively-oriented questions (e.g. "Would you like to have (a/another) child, or would you prefer not to have any (more) children?") in either cross-sectional or, preferably, longitudinal surveys where respondents are repeatedly interviewed.

While both alternatives have certain advantages, each approach falls well short of its goal to effectively and unbiasedly measure women's fertility preferences. In particular, the direct elicitation of a woman's ideal number of children, for the same reason as the retrospective recall approach, is limited in that women are likely to ex-post rationalize their past births and are therefore unlikely to report an ideal number of children that is less than their current number of living children. Moreover, empirical evidence on the measurement of this variables has shown that a considerable proportion of survey respondents are either unsure about their ideal number of children or do not provide a numeric response to the question (16).

On the other hand, the elicitation of preferences for future births using prospective questions and longitudinal data methods can be appealing in its forward-looking approach (thereby eliminating any biases induced by retrospective inquiry) and in its potential to infer women's preferences for births occurring between survey rounds. Unfortunately, conducting longitudinal data collection is costly, requires tracking and follow-ups with respondents, and suffers from a new set of empirical concerns that limits inference (attrition and non-response between waves, time-in-sample bias, compounded mismeasurement and selection bias, etc.) (17). For these reasons, most large-scale surveys of fertility and health (e.g. Demographic and Health Surveys (DHS), Multiple Indicator Cluster Surveys (MICS), World Fertility Surveys (WFS), etc.) are cross-sectional. Conceptually, the use of longitudinal measures also assumes that fertility preferences are stable over time and particularly between survey rounds; the stability of fertility preferences over time has been extensively questioned, with recent findings demonstrating that both women's contraceptive and fertility preferences are likely to be malleable and unstable over relatively short intervals (18).

More generally, unmet need's reliance on women's stated (reported) preferences as a proxy for their true (revealed) fertility preferences is itself problematic. One of the main criticisms of using stated preferences is that their measurement typically use surveys in which respondents often face hypothetical choice problems to elicit individual valuations over alternatives. As a result, respondents may not make the same choices in a hypothetical situation as they would in real life (19). In the case of fertility, this "hypothetical bias" implies that respondents may be willing to state a preference for more or fewer children when asked in a survey than they would if the opportunity to realize this preference were to truly present itself. This bias is generated both from a lack of incentive to tell the truth in a survey and from the difficulty that the respondent faces from projecting herself into a hypothetical situation that may not be directly familiar to her – this is particularly true for eliciting stated preferences when costs or constraints cannot directly be internalized. For example, women who have never been pregnant may be more likely to not internalize the costs of pregnancy and childbearing and may therefore be more likely to misreport (in this case, overstate) their ideal fertility. On the other hand, respondents who identify and internalize the costs of alternatives might narrow their choice set *a priori* even if these costs are misperceived. In the case of fertility, women who have experienced difficulty conceiving in the past may anchor their fertility potential to this constraint and may therefore underreport their true desired fertility. As a result, while a respondent's stated fertility

preferences are likely to be correlated with her true latent preferences, the gap between these preference measures is likely to be significant, to the extent that the utility of the stated preference measure is unclear. Alternatively, a more robust measure of a woman's revealed fertility preferences may be more informative about her true underlying fertility preferences and, in turn, may reveal her latent demand for contraception.

CONCEPTUALIZING UNMET NEED WITH COUNTERFACTUALS: A STEP BACK AND A WAY FORWARD

In light of the conceptual, empirical, and operational challenges to estimating unmet need, combined with the numerous revisions and debates around its validity and usefulness as a measure over the years, it would be incumbent upon the family planning field to take a step back and remind ourselves of its potential utility and aim as a measure. The primary objective of unmet need is to estimate the proportion of women at an aggregate (population)-level who are not using contraception but who have a preference for limiting or spacing births.

Equivalently, unmet need can be understood through the following counterfactual thought experiment. Let us define the *current contraceptive prevalence rate* as the proportion of women who use contraception under the current state of the world. Now, let us define the *ideal contraceptive prevalence rate* as the proportion of women in the population who use contraception in the state of the world where fertility preferences in this population can be fully realized without constraint. In this hypothetical state of the world, women would face no barriers, costs, or constraints of any kind to identifying and realizing their preferences for limiting and spacing births over their lifetimes. Features of this state of the world include, but are not limited to: 1) women's ability to completely control their family planning and reproductive health decisions, including full, free, and informed choice over their contraceptive use, non-use, and type of use (i.e. complete choice over methods and method type); 2) women's capability to realize any changes to preferences that they make over fertility and childbearing; and 3) a lack of social, structural, emotional, or physical barriers that women face to forming, identifying, and executing their contraceptive and fertility decision-making, with complete support from their partners, families, and communities on all reproductive decisions. Unmet need for contraception can therefore be simply calculated as the difference between the ideal contraceptive prevalence rate and the current contraceptive prevalence rate, i.e.

$$Unmet\ need = iCPR - CPR$$

In reflecting on this calculation, we recognize that while is relatively straightforward[2] to infer with reported survey data, the identification of the ideal contraceptive prevalence rate is, by construction, a hypothetical measure. To estimate this rate, previous estimators of unmet need have relied on first estimating women's latent fertility preferences, measured with stated preferences, and then inferring the extent to which contraceptive use concords with these preferences. We propose an approach that follows the inverse process: first, we infer the ideal environment under which all fertility preferences can be realized, and we then estimate the contraceptive prevalence in this environment. This approach hinges on the premise that the contraceptive prevalence under this ideal environment would reflect women's revealed fertility preferences and, by extension, demand for contraception. If such a counterfactual environment could be identified, then this approach has a distinct advantage over traditional estimators in that it captures women's level of empowerment and capability over

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[2] We say "relatively" because the measurement of contraceptive prevalence at the population level, and a woman's current contraceptive use at the individual level, also presents itself with its own measurement challenges, some of which have been discussed in this study.

contraceptive decision-making without the need for any direct measures or estimation of preferences. Similar approaches have been utilized in the child development literature, where studies have constructed "ideal" reference populations and have conducted comparative analyses that identify gaps in child growth and stunting relative to the reference group (20).

As an attempt to identify this counterfactual environment, we could imagine that contraceptive prevalence under an "ideal" environment would be the prevalence among the sub-population of women who are situated in "ideal" conditions in which they have full, free, informed choice over their contraceptive use and are capable of acting on their preferences to the greatest possible extent – this approach broadly speaks to the Sen capability approach to welfare gain and on subsequent developments in women's empowerment in reproductive decision-making (21,22). To identify this "ideal" sub-population, we narrow down the sample of women based on characteristics that are more likely to signal their level of contraceptive and reproductive empowerment. These observable characteristics can be selected based on the set of determinants been theorized to be correlated with women's contraceptive autonomy, access, and reproductive decision-making. Obvious characteristics for selection include women's socioeconomic status (those from the topmost income or wealth echelons), educational attainment (those who are the most educated), knowledge of family planning (those who are the most informed about contraceptive methods), autonomy (particularly those who have autonomy to make decisions and seek their own health care), familial and social support (those who have their partner's and community's approval to use / not use contraception), and access (those who are able to receive the full range of contraceptive methods without constraint). These are but a few of the characteristics that would approximate an "ideal" enabling environment for women; however, a key advantage in this approach is that women who live in these selective environments can be identified using routine survey data (e.g. DHS, MICS).

TESTING A NEW UNMET NEED MEASURE: EMPIRICAL EVIDENCE

We estimate this new approach to estimating unmet need using data on 2,073,523 women from 80 DHS surveys that cover 56 countries from 2010 to 2019. We then identify the subsample of women who meet the following five criteria:

1. They belong to the highest wealth quintile, a proxy for their socioeconomic status. Women who belong to this group are less likely to face access or cost constraints and are more likely, in general, to be empowered to follow through on their contraceptive preferences.

2. They are either currently married or have been sexually active for the past month. These two variables serve as part of the selection criteria that is used to define the population of women who are at risk of pregnancy.

3. They have attained at least a tertiary level of schooling, which selects on those women who are less likely to have information or access barriers.

4. They know at least one contraceptive method, which also serves as a proxy for being informed about family planning and reproductive health services.

5. They do not report distance to a facility as being a significant problem in their access to health care. This measure of perceived access is likely to be correlated with true access and may be more likely to impact a woman's care-seeking behavior.

When filtering the full sample of women by these five criteria, we are left with a sample of 55,318 women from 52 countries across 73 DHS surveys, which constitute 2.71 percent of the full sample of

women. Table 1 presents the distribution of women who are selected from ideal environments within each DHS survey.

Table 1: Total Sample of Women, Sample of Women from Ideal Environments

	Full *N*	Full Pct.	Ideal *N*	Ideal Pct.
Afghanistan	29,461	1.45	214	0.39
Albania	15,000	0.74	429	0.78
Armenia	12,038	0.59	818	1.48
Angola	14,379	0.71	186	0.34
Bangladesh	55,739	2.74	0	0.00
Burkina Faso	17,087	0.84	69	0.12
Benin	32,527	1.60	285	0.52
Burundi	26,658	1.31	167	0.30
DRC	18,827	0.92	191	0.35
Congo, Republic	10,819	0.53	84	0.15
Cote d'Ivoire	10,060	0.49	99	0.18
Cameroon	30,103	1.48	506	0.91
Colombia	92,239	4.53	0	0.00
Dominican Republic	9,372	0.46	481	0.87
Egypt	21,762	1.07	1,548	2.80
Ethiopia	32,198	1.58	744	1.34
Gabon	8,422	0.41	78	0.14
Ghana	9,396	0.46	179	0.32
Gambia	10,233	0.50	127	0.23
Guinea	20,016	0.98	147	0.27
Guyana	25,914	1.27	623	1.13
Honduras	22,757	1.12	449	0.81
Haiti	29,800	1.46	515	0.93
India	699,686	34.34	25,539	46.17
Indonesia	95,234	4.67	4,315	7.80
Jordan	26,041	1.28	1,240	2.24
Kenya	31,079	1.53	490	0.89
Cambodia	36,332	1.78	453	0.82
Comoros	5,329	0.26	115	0.21
Kyrgyz Republic	8,208	0.40	508	0.92
Liberia	9,239	0.45	108	0.20
Lesotho	6,621	0.32	253	0.46
Mali	20,943	1.03	175	0.32
Maldives	7,699	0.38	99	0.18

Table 1: continued

	Full *N*	Full Pct.	Ideal *N*	Ideal Pct.
Malawi	47,582	2.34	473	0.86
Mozambique	13,745	0.67	177	0.32
Nigeria	80,769	3.96	3,350	6.06
Niger	11,160	0.55	54	0.10
Namibia	9,176	0.45	267	0.48
Nepal	25,536	1.25	824	1.49
Philippines	41,229	2.02	2,531	4.58
Pakistan	25,922	1.27	2,035	3.68
Rwanda	27,168	1.33	346	0.63
Sierra Leone	32,232	1.58	543	0.98
Senegal	15,688	0.77	41	0.07
Chad	17,719	0.87	25	0.05
Togo	9,480	0.47	96	0.17
Tajikistan	9,656	0.47	552	1.00
Timor Leste	25,744	1.26	393	0.71
Turkey	9,746	0.48	0	0.00
Tanzania	23,405	1.15	91	0.16
Uganda	27,180	1.33	793	1.43
Yemen	25,434	1.25	0	0.00
South Africa	8,514	0.42	116	0.21
Zambia	30,094	1.48	797	1.44
Zimbabwe	19,126	0.94	580	1.05
Total	**2,037,523**		**55,318**	

Table 2 presents descriptive statistics of the full sample and the selected sample of women from ideal environments. We find significant differences between women from the full sample and women who were selected to be from ideal environments. In particular, women from ideal environments are:

1. More likely to reside in urban settings (80.7 percent) compared to women in the full sample (37.6 percent).

2. More likely to be older, on average (33.1 years) compared to women in the full sample (29.6 years).

3. Have fewer children, on average (1.7 children) than women in the full sample (2.3 children).

4. Are married to husbands who are significantly more likely to have a tertiary level of education (74.7 percent) compared to women in the full sample (11.4 percent).

5. Are more likely to earn as much or more than their husbands / partners (37.1 percent) compared to women in the full sample (26.6 percent).

Table 2: Descriptive Statistics, Woman Characteristics

	Mean	SD	N
Full Sample			
Outcome and Selection Characteristics			
Contraceptive use (1 = Yes)	0.337		681,542
Highest wealth quintile (1 = Yes)	0.199		406,073
Currently married (1 = Yes)	0.686		1,396,560
Sexually active (1 = Yes)	0.664		752,338
Tertiary education (1 = Yes)	0.106		212,751
Knows 1+ FP method (1 = Yes)	0.958		1,884,897
Distance to facility not problem (1 = Yes)	0.652		1,206,110
Other Characteristics			
Place of residence (1 = Urban)	0.376		766,643
Age (years)	29.608	9.830	
Children ever born	2.329	2.336	
Husband has tertiary education (1 = Yes)	0.114		115,262
Respondent earns more than husband (1 = Yes)	0.266		101,328
Observations	**2,037,523**		
Ideal Environment Sample			
Contraceptive Use (1 = Yes)	0.521	32,786	
Place of residence (1 = Urban)	0.807		44,655
Age (years)	33.168	7.495	
Children ever born	1.705	1.278	
Husband has tertiary education (1 = Yes)	0.747		24,200
Respondent earns more than husband (1 = Yes)	0.371		7,141
Observations	**55,318**		

Notes: The unit of observation is the woman.

Table 3 presents descriptive statistics comparing the newly calculated measure of unmet need and the currently used measures of unmet need. Unmet need using the new counterfactual-based measure is, on average, 5 to 6 percentage points (30 percent) higher than the standard measures of unmet need that are currently used by the DHS. Moreover, we find that the variation in unmet need, as indicated by the standard deviation, is also higher with our new counterfactual measure as compared to traditional measures of unmet need. This implies that the distribution of unmet need measures using the counterfactual approach is wider, yielding more extreme estimates of unmet need on both the lower and higher end; Figure 2 corroborates this implication by plotting the distributions of predicted unmet need under the various methodologies.

Table 3: Descriptive Statistics, Unmet Need

	Mean	SD	Min	Max
Unmet Need, New Definition	0.216	0.088	0.021	0.510
Unmet Need, Definition 1	0.161	0.060	0.053	0.279
Unmet Need, Definition 2	0.152	0.059	0.010	0.271
Difference 1 (New – Def. 1)	0.051	0.102	-0.193	0.338
Difference 2 (New – Def. 2)	0.060	0.101	-0.184	0.348
N	80			

Notes: The unit of observation is the DHS survey round. The variable "Unmet Need, New Definition" is defined as the difference in CPR between the subsample of WRA who are from "ideal" environments (highest wealth quintile, highest educational attainment, currently married, and knows of at least one FP method) and CPR for all WRA. The variable Unmet Need, Definition 1 is calculated using the categorical unmet need variable (v624) in the DHS survey round, which classifies women to fall into one of the following categories: 1) no unmet need; 2) an unmet need for spacing; 3) an unmet need for limiting; 4) having a spacing failure or limiting failure; or 5) infecund. The variable Unmet Need, Definition 2 is calculated using a second categorical unmet need variable (v626) in the DHS survey round. The variable Difference 1 is the calculated difference between the new Unmet Need variable and the Unmet Need, Definition 1 variable. The variable Difference 2 is the calculated difference between the new Unmet Need variable and the Unmet Need, Definition 2 variable.

Figure 2: Kernel Density Plots, Unmet Need Across Definitions
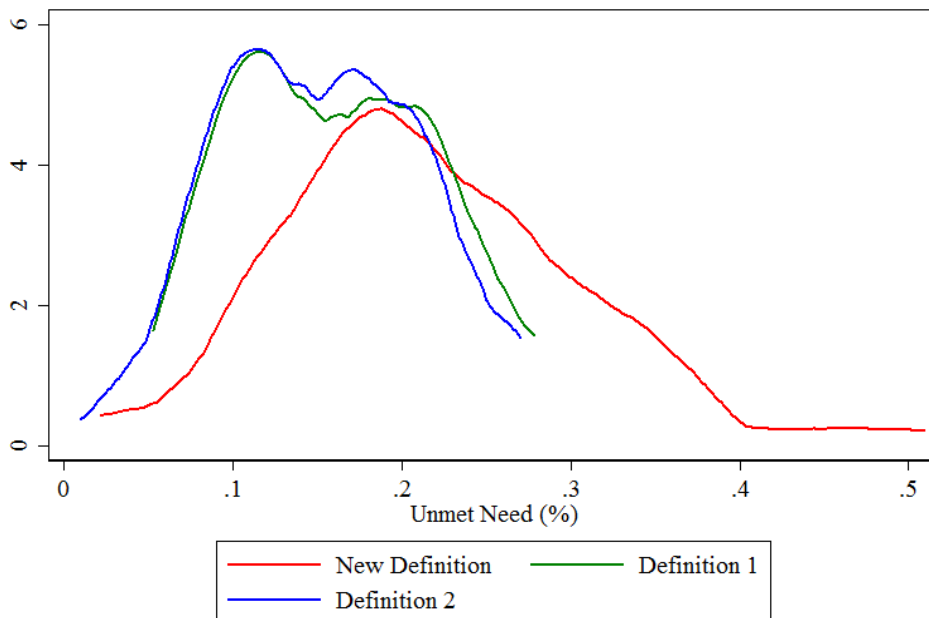
Source: Author analysis.

When disaggregating the comparative analysis of unmet need at the DHS survey (country-year) level (Table 4), we observe a lot of variation across the surveys; in some cases, we see that our approach estimates a significantly higher (up to 30 percentage points higher) unmet need than what is currently estimated with the DHS methodology, while in other cases, our approach yields significantly lower estimates (up to 20 percentage points lower) of unmet need compared to the DHS. Figure 3 plots the differences between the counterfactual unmet need measure and the currently used DHS measures. In the survey-based calculations of unmet need, we also note that several calculations of the measure were conducted using small samples of women from identified ideal environments (fewer than 100 women) – the lack of sample in some surveys poses an empirical concern over the extent to which we have enough statistical precision to estimate ideal contraceptive prevalence.

Table 4: Unmet Need by DHS Survey

| DHS Survey Round	Country	Year	Unmet Need, New Def.	Unmet Need (Def. 1)	Difference (New - Def. 1)	Unmet Need (Def. 2)	Difference (New - Def. 2)
AF7	Afghanistan	2015	17.39%	25.38%	-7.99%	24.82%	-7.43%
AL7	Albania	2018	20.76%	12.72%	8.03%	12.39%	8.36%
AM6	Armenia	2010	24.88%	13.64%	11.24%	13.64%	11.24%
AM7	Armenia	2016	23.38%	8.24%	15.15%	7.75%	15.63%
AO7	Angola	2016	32.32%	25.54%	6.78%	24.57%	7.75%
BF6	Burkina Faso	2010	48.08%	19.72%	28.36%	19.09%	28.99%
BJ6	Benin	2012	24.43%	24.87%	-0.45%	24.31%	0.12%
BJ7	Benin	2018	20.97%	25.52%	-4.55%	24.88%	-3.91%
BU6	Burundi	2010	29.33%	17.94%	11.39%	17.52%	11.81%
BU7	Burundi	2017	16.19%	16.50%	-0.32%	15.85%	0.34%
CD6	DRC	2014	35.50%	21.63%	13.87%	20.64%	14.86%
CG6	Congo, Republic	2012	19.53%	14.30%	5.24%	13.96%	5.58%
CI6	Cote d'Ivoire	2012	17.58%	22.27%	-4.69%	21.57%	-3.99%
CM6	Cameroon	2011	31.72%	18.26%	13.46%	17.35%	14.36%
CM7	Cameroon	2018	22.83%	17.63%	5.20%	16.72%	6.11%
DR6	Dominican Republic	2013	15.53%	8.11%	7.42%	7.82%	7.71%
EG6	Egypt	2014	7.03%	9.53%	-2.50%	9.51%	-2.47%
ET6	Ethiopia	2011	40.38%	15.10%	25.28%	14.42%	25.96%
ET7	Ethiopia	2016	33.00%	11.96%	21.04%	11.58%	21.42%
GA6	Gabon	2012	21.02%	22.20%	-1.19%	20.81%	0.20%
GH6	Ghana	2014	13.60%	19.79%	-6.20%	18.68%	-5.08%
GM6	Gambia	2013	16.15%	17.59%	-1.44%	17.05%	-0.90%
GN7	Guinea	2018	21.14%	17.07%	4.07%	16.38%	4.76%
GU6	Guyana	2015	37.35%	7.93%	29.42%	7.75%	29.60%
HN6	Honduras	2012	32.93%	6.81%	26.13%	6.62%	26.32%
HT6	Haiti	2012	15.35%	24.64%	-9.29%	23.45%	-8.09%
HT7	Haiti	2017	6.15%	25.42%	-19.26%	24.60%	-18.44%
IA6	India	2016	14.64%	10.29%	4.35%	9.66%	4.98%
ID6	Indonesia	2012	13.38%	6.49%	6.89%	6.44%	6.94%
ID7	Indonesia	2017	15.64%	6.10%	9.54%	5.91%	9.73%
JO6	Jordan	2012	7.60%	9.05%	-1.45%	8.71%	-1.12%
JO7	Jordan	2018	2.14%	13.82%	-11.69%	13.31%	-11.17%
KE6	Kenya	2014	25.37%	12.31%	13.06%	11.81%	13.56%
KH5	Cambodia	2010	33.34%	13.39%	19.95%	12.90%	20.44%

Table 4: continued

DHS Survey Round	Country	Year	Unmet Need, New Def.	Unmet Need (Def. 1)	Difference (New - Def. 1)	Unmet Need (Def. 2)	Difference (New - Def. 2)
KH6	Cambodia	2014	20.82%	8.51%	12.31%	0.97%	19.84%
KM6	Comoros	2012	15.95%	21.84%	-5.89%	20.12%	-4.17%
KY6	Kenya	2012	14.98%	11.73%	3.24%	11.18%	3.80%
LB6	Liberia	2013	12.15%	27.83%	-15.68%	26.36%	-14.21%
LS6	Lesotho	2014	19.43%	10.94%	8.49%	10.59%	8.84%
ML6	Mali	2013	27.64%	18.84%	8.80%	18.35%	9.29%
ML7	Mali	2018	20.99%	22.29%	-1.30%	18.09%	2.90%
MV7	Maldives	2017	7.61%	26.81%	-19.20%	24.25%	-16.64%
MW5	Malawi	2010	23.11%	18.85%	4.26%	18.30%	4.80%
MW7	Malawi	2016	10.34%	13.38%	-3.04%	12.76%	-2.42%
MZ6	Mozambique	2011	31.47%	18.77%	12.70%	17.93%	13.54%
NG6	Nigeria	2013	28.66%	13.24%	15.43%	12.59%	16.07%
NG7	Nigeria	2018	21.15%	15.13%	6.02%	14.44%	6.71%
NI6	Niger	2012	34.50%	14.69%	19.81%	14.31%	20.19%
NM6	Namibia	2013	18.50%	8.71%	9.79%	8.41%	10.09%
NP6	Nepal	2011	21.21%	19.58%	1.63%	19.38%	1.83%
NP7	Nepal	2016	20.47%	18.52%	1.95%	18.24%	2.23%
PH6	Philippines	2013	15.76%	11.58%	4.17%	10.61%	5.15%
PH7	Philippines	2017	12.33%	11.67%	0.66%	10.41%	1.92%
PK6	Pakistan	2012	19.53%	20.68%	-1.16%	20.61%	-1.08%
PK7	Pakistan	2018	14.52%	18.29%	-3.77%	18.06%	-3.54%
RW6	Rwanda	2010	30.50%	10.22%	20.27%	9.79%	20.70%
SL6	Sierra Leone	2013	28.18%	20.03%	8.15%	18.59%	9.59%
SL7	Sierra Leone	2019	13.32%	19.79%	-6.47%	18.70%	-5.37%
SN6	Senegal	2011	27.95%	21.26%	6.70%	20.56%	7.40%
TD6	Chad	2015	16.02%	18.38%	-2.36%	17.63%	-1.61%
TG6	Chad	2014	22.39%	25.08%	-2.69%	24.28%	-1.88%
TJ6	Tajikistan	2012	21.40%	15.91%	5.49%	15.37%	6.03%
TL5	Timor Leste	2010	22.37%	18.52%	3.85%	18.35%	4.01%
TL7	Timor Leste	2016	15.22%	20.48%	-5.27%	12.83%	2.39%
TZ5	Tanzania	2010	50.98%	17.21%	33.77%	16.22%	34.75%
TZ7	Tanzania	2016	25.48%	16.04%	9.44%	15.30%	10.18%
UG6	Uganda	2011	32.43%	20.59%	11.84%	20.18%	12.25%
UG7	Uganda	2016	21.76%	18.94%	2.82%	18.70%	3.07%

DHS Survey Round	Country	Year	Unmet Need, New Def.	Unmet Need (Def. 1)	Difference (New - Def. 1)	Unmet Need (Def. 2)	Difference (New - Def. 2)
ZA7	South Africa	2016	13.07%	10.40%	2.67%	9.94%	3.13%
ZM6	Zambia	2014	23.37%	14.60%	8.77%	14.26%	9.11%
ZM7	Zambia	2018	14.29%	13.31%	0.98%	12.54%	1.75%
ZW6	Zimbabwe	2011	30.68%	8.92%	21.76%	8.63%	22.06%
ZW7	Zimbabwe	2015	26.15%	7.51%	18.64%	6.29%	19.86%

Note: The surveys that are highlighted in red text are those that have more than a 15 percentage point difference (in either direction) between the new definition of unmet need and the current working definitions of unmet need. The surveys highlighted in yellow indicate those waves in which the new definition of unmet need is calculated with fewer than 100 observations, indicating a potential sample size (power) concern in the calculation of the new measure.

Figure 3: Kernel Density Plots, Difference between the New and Old Unmet Need Measure
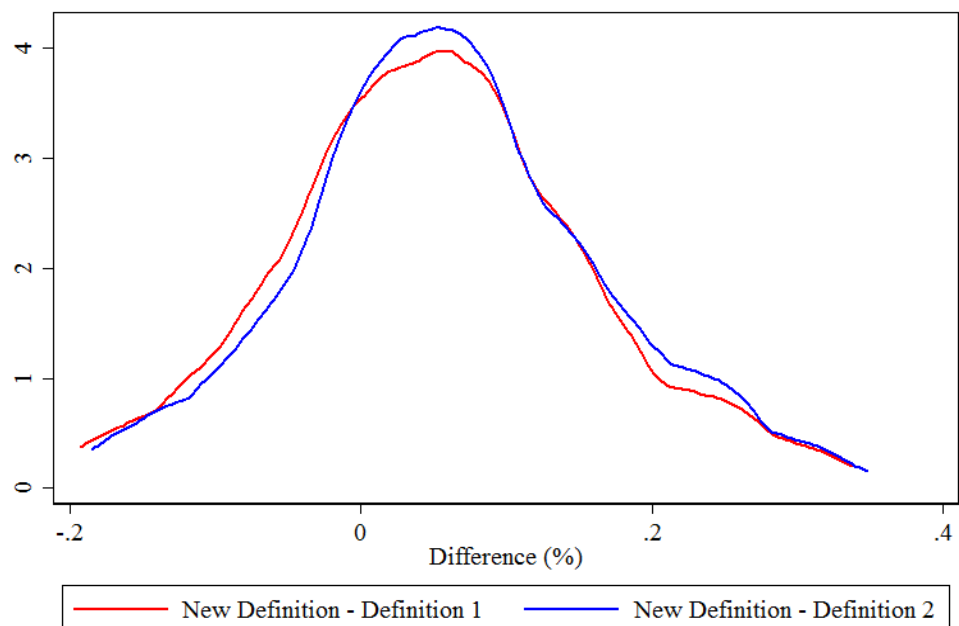
Source: Author analysis.

To estimate the relative contribution of each selecting factor to ideal contraceptive use, we calculate the deficit that could be attributed to each of the 5 key selecting factors that were used for defining the ideal family planning environment. We estimate a linear probability model of contraceptive use on these factors together and take the product of the estimated factor coefficients, each of which captured the association between that particular factor and contraceptive use, and the proportion of the pooled DHS sample who did not exhibit that factor. Table 5 presents the results from this analysis. We find that selecting on socioeconomic status (proxied by wealth) and current sexual activity explain the most variation in ideal contraceptive use in women who live in ideal environments relative to the general sample of women. For example, up to 40 percent of the variation in ideal contraceptive use can be attributed to selection into higher socioeconomic status.

Table 5: Estimated Ideal Contraceptive Use Deficit and Attributable Deficit by Target Criteria, Global Analysis

	(1)	(2)	(3)	(4)
	Ideal contraceptive use	Proportion of sample without factor	Attributable ideal contraceptive use deficit from factor adjustment	% of total deficit
Highest quintile	0.079***	0.801	0.063	39.55%
	0.063 – 0.096			
Currently married	0.015	0.314	0.0047	2.94%
	–0.027 – 0.058			
Sexually active in last month	0.215***	0.336	0.0722	45.15%
	0.190 – 0.240			
High education	–0.002	0.894	–0.0018	–1.12%
	–0.037 – 0.033			
Knows a FP method	0.204***	0.042	0.0086	5.36%
	0.174 – 0.233			
Distance to facility is not a problem	0.036***	0.348	0.0125	7.83%
	0.030 – 0.042			
Observations **R-squared**	**970,943** **0.171**	**Total attributable ideal contraceptive use deficit**	**0.160**	

Notes: The table presents results from a multivariable linear probability model using the full analytic sample of women. Coefficient estimates are presented in Column 1 with 95% confidence intervals below. The regression includes survey (country–year) fixed effects, and coefficient standard errors are clustered at the survey level. Column 2 presents the proportion of the full analytic sample that does not have the particular factor for which the coefficient estimate is calculated; for example, 89.4 percent of women in the analytic sample do not have a tertiary level of education. Column 3 presents the attributable ideal contraceptive use deficit after having adjusted for the particular factor. The attributable ideal contraceptive use deficit for a given factor, along with its corresponding confidence interval, is calculated by taking the product of the factor's coefficient estimate obtained from column 1 and the proportion of the analytic sample without that factor from column 2. The total attributable ideal contraceptive use deficit is calculated by summing up the attributable deficits from each of the five factors, and Column 4 presents the proportion of the total attributable deficit that can be attributed to that particular factor, which is calculated by taking the ratio of the attributable deficit from that factor as a percentage of the total attributable deficit.

SOME FINAL THOUGHTS

Unmet need has been a key indicator in family planning and reproductive health for more than four decades. It is an indicator that holds significant policy and programmatic weight and serves an important role in advocacy, resource allocation, and agenda setting in family planning. At the same time, it is recognized to be a highly biased measure that is difficult to conceptualize both theoretically and empirically. As a result, a number of definitions of unmet need have been used over time and have resulted in estimates that are not comparable with each other and have limited scope for unbiased inference.

In this study, we use a counterfactual approach to derive a simplified definition of unmet need that can be consistently applied over time and across countries. Our indicator is preferable to existing measures due to: 1) its conceptual appeal and grounding in revealed preference theory through observed behavior; 2) its independence from biases that are generated through the use of reported

preferences and other problematic assumptions that typically form the foundation of such indicators, instead exclusively relying on observable characteristics or behavior; 3) its simplicity in its derivation, requiring only 6 routinely collected survey items that do not require additional preference-specific module; and 4) its flexibility to be both generalizable for cross-country comparisons as well as tailored for context-specific analyses. In conducting a number of empirical analyses of our new indicator, we find significant mean differences between our approach and existing DHS approaches to calculating unmet need, and we observe significant variation across countries when comparing the different indicators.

Previous studies and reviews of unmet need have raised a key question: "What is desirable contraceptive coverage in the 'perfect contracepting' society, and what principles should guide the answer to this large question?" (13). Our study answers this question by estimating what contraceptive coverage would be in an environment where women have the capability to "perfectly contracept" if they choose. We define an approach for identifying this environment, and the proportion of women who belong to this environment, using observable factors related to reproductive empowerment and well-being as a proxy for this ideal environment. We then propose that contraceptive coverage in such an environment would reflect the ideal level of contraceptive use.

In reflecting on our approach, it is likely that there will be concerns over our choice of selecting variables. In theory, we would aim to select on as many variables that, together, identify the subset of women who face no constraints to their family planning and reproductive health decision-making. While conceptually appealing, one of the challenges to identifying these women in surveys like the DHS is that there may be very few women who fit into this highly selective sub-population in some surveys, which would limit the statistical precision with which prevalence can be estimated. To this end, there is a direct trade-off between the marginal utility from including a characteristic to screen and select women in "ideal" environments and the reduced size of the sub-sample of women who belong to these more selective environments. With this said, if obtaining larger samples, with larger potential to identify highly empowered women, were feasible, then we can be more confident that our estimates of ideal contraceptive prevalence, and hence unmet need, would converge to the true value of unmet need.

Our indicator of unmet need is not without its own conceptual limitations. Given that our estimate is derived using point prevalence measures, we are only able to generate unbiased inference at the moment when women's revealed fertility preferences, as indicated by their current contraceptive use, is reported in the survey. Specifically, our estimate implies that at the time of interview, the contraceptive use for women who are identified to live in ideal environments reflect their true contraceptive preferences at that moment. To this end, our approach, as well as current approaches to measuring unmet need, is limited in the extent to which we are able to interpret contraceptive use over time, when preferences can vary. Our approach is comparable recent approaches that estimate unmet need as a point prevalence (23); however, we deliberately do not include measures of fertility preference and/or contraceptive intention, both of which are likely to be biased in traditional survey data.

Like other approaches, our metric for unmet need does not account for husband or partner preferences for contraception. To the extent that male preferences can be included using the women's DHS datasets, we run a sensitivity analysis that selects ideal women based on whether they had a partner who supported them in their contraceptive use / non-use. The inclusion of partner approval of contraception does not seem to significantly change our empirical estimates of unmet need. On a broader conceptual note, however, it is not clear as to how one would in fact calculate unmet need by including male preferences, particular in the case where there is discordance in preferences between men and women – would a couple have an unmet need for contraception if women want to use contraceptive methods but their male partners do not? What about the converse? In a sense,

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the (lack of) inclusion of male preferences in the unmet need measurement speaks to the tension between women's reproductive rights over contraceptive choice and male involvement in contraceptive decision-making that the field continues to debate.

Given that our approach questions the utility of direct preference elicitation through surveys, our findings also call for a critical review of existing surveys and a reprioritization of survey questions that are currently asked as part of large-scale data collection efforts, like the DHS. Our study specifically calls for the substitution away from the use of problematic fertility preference questions that are known to be biased from the onset and towards a wider and more inclusive range of observable metrics that would serve to capture latent constructs related to reproductive empowerment, family planning access, and well-being. In the absence of any changes to the current data collection efforts, we encourage future efforts in this domain to continue testing a wider range of factors that capture women's ideal reproductive health environments to determine the extent to which ideal contraceptive use, and by extension unmet need, are sensitive to these choices.

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