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Women empowerment as an enabling factor of fertility decisions: Evidence from 53 Low Resource Countries

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2020-045952
Article Type:	Original research
Date Submitted by the Author:	17-Oct-2020
Complete List of Authors:	Haque, Rezwana; American International University Bangladesh, Department of Economics Alam, Khorshed ; University of Southern Queensland, Health Economics and Policy Research, Centre for Health, Informatics and Economic; University of Southern Queensland, Centre for Health Research Rahman, Syed Mahbubur; American International University Bangladesh, Faculty of Business Administration Keramat, Syed Afroz; University of Southern Queensland, School of Commerce; Khulna University, Economics Discipline Al-Hanawi, Mohammed; King Abdulaziz University, Department of Health Services and Hospital Administration, Faculty of Economics and Administration
Keywords:	Health policy < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, PUBLIC HEALTH, Health economics < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

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Women empowerment as an enabling factor of fertility decisions: Evidence from 53 Low Resource Countries

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Keywords: Women empowerment; Fertility preferences; Negative Binomial Regression Model; Low Resource Countries

Word count: 4891 words

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Abstract

Objective: To investigate the association between women empowerment and fertility preferences in Low Resources Countries (LRCs) to create intervention strategies for central-level promotional health policy.

Design: Cross Sectional study using the Demographic and Health Survey (DHS) database.

Settings: 53 LRCs from six different regions for the period ranging 2006–2018.

Participants: The data of women-only aged 35 years and above is used as a unit of analysis due to separate young women who may not have completed their childbearing tenure. The final sample was limited to 91,070 married women.

Primary and secondary outcome measures: Women’s perception regarding the number of children they wish to ideally conceive using Negative Binomial Regression Model (NBRM) and ability of women to achieve their preferred fertility using Multivariable logistic regression.

Results: The study found that more empowered women desire a significantly lower ideal number of children irrespective of the measures used to assess women empowerment. In this study, the measures were participation in household decision-making (Incidence Rate Ratio [IRR]: 0.96, 95% Confidence Interval [CI]: 0.95, 0.98), attitude towards wife-beating (IRR: 0.96, 95% CI: 0.95, 0.98) and attitude towards refusing sex (IRR: 0.97, 95% CI: 0.95, 0.98). In the LRCs, household decision-making was associated with the reduced odds (Odd Ratio [OR]: 0.95, 95% CI: 0.90, 0.99) of having more than their ideal number of children.

Conclusion: The study argues in favour of reduced fertility preference by women, and of the ability to achieve ideal family size by enhancing women empowerment. Husbands’ preferences for number of ideal children, women education, marital age and wealth or socio-economic status are found as the key issues. Health-related policies should pay careful attention to address inequalities in women empowerment to yield benefits to individuals, families, and societies in general.

Strengths and limitations of this Study

- First initiatives to investigate the pooled association between women empowerment and their fertility decisions, and the ability to achieve their desired fertility in the context of LRCs.
- The findings are generalisable to women in LRCs and can assist in creating central-level promotional health policy to reduce fertility preference and achieve fertility desire in LRCs.
- This study includes the husband's influence on women's perceived and actual fertility, a factor that is barely considered in earlier studies.
- Due to the cross-sectional nature of the data, this study can only establish the association between women empowerment and fertility rates but is unable to establish any causal effects.

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Introduction

Women empowerment has attracted significant attention from researchers, policymakers, and practitioners over the last couple of decades, particularly in Asia and Africa, in various fields. With diverse attributes, empowerment occurs at varying levels from household to global scale (1,2). A general consensus is that women empowerment influences the reproductive health outcomes such as fertility, birth-interval, and contraceptive use (3,4). Women empowerment in the form of the ability to make their own choices, pursue goals, and to control personal living and resources (5,6) has been considered crucial in both the United Nations (UN) Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs). The goals to promote gender equality and empower women in the MDGs (i.e. MDG 3) were fine-tuned in the SDGs (i.e. SDG 4), both of which urged for ending discrimination against women and girls to ensure economic growth and development for a sustainable future (7).

Women empowerment is challenging to measure because of its multidimensional nature. Extant literature assess empowerment using various measures, including women liberty in lone movement (8), age-education gap between married couples (9) and cohabiting partner selection (10). However, decision-making on household issues that signifies the extent to which women control their surroundings is often used to assess women’s autonomy (11). Women empowerment can also be appraised through thier ability to contribute towards household decision-making including domestic, economic, and free movement (12,13).

The household decision-making domain is the earliest and most used measure to assess women empowerment (14), which formed the basis of the Demographic and Health Survey (DHS) standard questionnaire in the late 1990s. The DHS includes questions about household decision-making, justifying wife-beating by the husband and wife refusal of having sex (15) to assess women empowerment in low and middle-income countries (LMIC). To date, few studies have used these measures to interpret its association with fertility preferences (4,11,16,17).

In most of the cases, the number of children is negatively associated with the women empowerment indicators. By contrast, spousal decision about fertility and corresponding communication about the number of children are positively associated with the indicators (4,17). In the African context,

the association of women empowerment is not consistent with their desire for a smaller family size (11).

Paid employment, along with resource control and access, might have an influence on women empowerment, and thereby affect the ideal number of offspring in a family (4). Conjugal agreement has little to do with the subsequent fertility of couples; however, the view changed after a couple of decades (18). Discussions about fertility between husband and wife are now considered important in family planning, such as in Kenya (19). However, the level of importance might not remain the same for the third child as for the first child, given that progression through the number of births plays pivotal role in women's preferences, as observed in Nepal (20).

The association of socio-economic and decision-making freedom of women with pregnancy prevention measures, conjugal violence, and medical services on fertility declines either for a single or a coalition of nations (4,11,12,16,17). However, the association of fertility desire and achievement of fertility choice in the context of LRCs has not been examined. The UN and other global bodies are actively promoting the concept of smaller family size to ensure a concentrated effort on fewer children to secure better food, education, and health services, which would result in a thriving future overall (21). Of similar importance is to assess the connections between women empowerment and their fertility intention, and the achievement of their fertility choice to promote central-level family planning and promotional health programs in LRCs. By improving the social status of females and thereby empowering them, society may enjoy several benefits.

Evidence in extant literature is insufficient to establish a connection between women empowerment and the perceived fertility decision and ability to achieve that desire, especially in LRCs. The results of earlier research are inconsistent across countries and regions. Hence, to provide a comprehensive view of the association between women empowerment and fertility preferences in LRCs, this study aims to investigate the above association using the DHS indicators while controlling for socio-economic and demographic features. Given that the husband's decision strongly influences a couple's childbearing behaviour (22,23), this study also examines how the husband's fertility decision is associated with the wife's perceptions of children. This study can contribute in the creation of central-level promotional health policy to ensure reduced fertility

preference and to achieve the desired fertility in LRCs through equitable gender roles in the decision-making process, increased awareness, and enhanced motivation. Given that birth control remains a huge challenge in most of the LRCs, promotional health policy is a necessity.

Materials and Methods

Setting and data sources

The data are collected from the DHS website (<https://www.dhsprogram.com>). The standard DHS survey, typically conducted in five-year interval in selected LMICs, provides large and nationally representative cross-sectional surveys of 5,000–30,000 households (24). Individual female with an age range of 15–49 years, i.e. the reproductive age, are directly interviewed about their literacy, employment history, decision-making capacity, fertility and fertility preferences, pregnancy prevention tools, and other related topics (15). The DHS survey follows guided data collection methods, reliability, and validation assessments (25). DHS has developed the concept of the ‘recode’ file aimed to facilitate the analysis. In general, seven ‘recode’ files are provided together with the core questionnaires. Since the role of husband in fertility desire is vital, ‘matched couples’ (from DHS recode file) are selected in this study (11).

Study Participants

The data of women-only aged 35 years and above is used as a unit of analysis following prior studies (4,11). The reason for such age restriction was to separate young women who may not have completed their childbearing tenure. The study selected 53 out of 87 countries from six different regions as classified by the World Health Organization (WHO) (26). The remaining 34 countries are excluded from the analysis due to publicly inaccessible, inadequate, and/or obsolete data. The final sample was limited to 91,070 married women, aged 35 years and above, living with their husbands for the period ranging 2006–2018 (Figure 1).

[Figure 1. Distribution of Study participants]

Outcome variable

The preliminary outcome variable for the research is attributed to women's perception regarding the number of children they wish to ideally conceive. In DHS questionnaire For the determination of the optimal quantity of children a woman may wish to bear, every married female respondent is hypothetically requested to position themselves in a time period before they gave birth and to choose the exact number of offspring they would wish to have in their entire lifetime. Females who have borne no children are asked for a similar response albeit without having to account for any existing children. In each question, non-numeric responses are permitted, for example God's wishes, and to avoid bias, these responses are included in the analysis, which is also consistent with earlier studies (4,11,27). However, several studies treat non-numeric response as 'fatalistic' and conclude that these respondents have a higher probability to claim greater optimum quantity of children borne (11,28). In the present study, non-numerical responses are considered and recorded as the mean value for the overall sample.

The second outcome variable is the ability of women to achieve their preferred fertility. The processing of this variable is achieved through the difference between the actual number of living children and the ideal number of children perceived by the respondent (4,11). If the result exceeds zero, the women are coded as having excessive children than desired.

Exposure variables

To detect women empowerment, this study identifies three markers from the standard questionnaire developed by DHS, namely, the female's participation in the decision making of households, attitude towards physical abuse of the wife, and the attitude towards refusing sex (4,11,29).

Women's role in household decision-making

Female member's involvement in decision making within their households affects the individual's reproductive desires and preferences (30), and hence, decision-making ability is considered as an exposure variable. The DHS standard questionnaire inquires of each married woman about their final decision-making roles in four key areas: medical health, key household purchases, domestic

procurements for everyday requirements, and visits to family and other relatives. The data related to domestic purchases for daily consumption are found in a limited manner in few countries, and thus excluded from the analysis. Possible respondent answers are ‘woman alone’, ‘woman jointly with others’, ‘husband alone’ and ‘others alone’. This study records any voice of women (either alone or jointly) in all three decisions as a new dichotomous variable, because this response reflects higher empowerment compared with any other decision-making combinations.

Attitude towards wife-beating

The study by DHS also raises the issues the annoyance and anger incited in the husband by the activities of his wife. It extrapolates the opinion of whether it can be validated for a husband to physically assault his female partner in some scenarios: What if she leaves the home without informing him? What if she is negligent towards their offspring? What if she has a quarrel with the male partner? What if she declines to engage in sexual relations with the husband? What if she burns the meal?’ A dichotomous variable was generated, with those who said ‘no reason’ was justified in any of the five situations reflects higher empowerment than those who said that at least one or more reason/s are justified.

Attitude towards refusing sex

Women were asked four different questions about their attitudes towards refusing sex. The respondents were given the situation that if husbands and wives do not always agree on everything whether they thought the female partner is justified in her refusal of sex on select scenarios. Firstly, if she is aware that her husband has a sexually transmitted disease is she allowed to opt out of sex? Secondly, if the wife was aware that her husband is sexually promiscuous with other women can she withdraw from sexual advances of her husband? Third, does the wife have a choice to not engage in sex after she has recently given birth? Finally, if the female partner is tired or not in the mood can she assert her refusal of sex? This study only includes this measure if the husband is involved in extra-marital sexual relationships and excluded the additional reasons due to data unavailability for all the selected countries.

Husband's Influence

The husband's influence on the fertility rate is considered one of the key exposure variables for this analysis. Therefore, this study considers the optimal number of offspring from the perception of the husband, which in DHS is coded as a continuous variable. The questions inquired from the husbands are similar to those asked of their wives, and non-numeric answers are replaced by the mean value.

Other covariates

Other relevant confounder variables are also selected after analysing published documents on women empowerment and fertility desire (4,11,17,31,32), along with the DHS dataset. Bivariate analysis was conducted and later the covariates were included in the fully adjusted model if found significant at 5% or less.

This study also included gender-related variables such as interpersonal age and interpersonal educational differences and women's age at first marriage, problems in obtaining permission to seek healthcare, and contraceptive decisions (11,33,34).

The present study attempts to incorporate most of the social, demographic and economic variables used in other studies, such as types of residence, household wealth, women education status, polygamous unions, number of living children and experience with any media exposure (i.e. television, radio, and newspaper/magazine) about family planning (4,11,29,32–35).

Estimation strategy

A pooled data set of the 53 LRCs and its subsequent observations of women aged 35 years and above are constructed for analysis. Selecting women above 35 allows for the segregation of young women who may not have completed their childbearing tenure (4,11). The study first carried out a descriptive analysis to describe the three indicators of women empowerment: women's ideal number of children, husband's ideal number of children, and gender-related variables and other social, economic and demographic factors in the form of mean, standard deviation (SD), frequency (n) and percentage.

Subsequently, the Negative Binomial Regression model (NBRM) is used to investigate if whether women empowerment and the husband’s perceived ideal number of children have any association with the ideal number of children perceived by women aged 35 years or above after controlling for social, economic and demographic variables. Although the Ordinary Least Squares estimation is used in previous research (11), the present study uses the NBRM that has statistical benefits over simple linear regression (4,36,37). Moreover, the NBRM assumes unequal mean and variance, and is principally correct for over depression in the data, i.e. the variance is greater than the conditional mean (17,38). The statistical model developed to capture the association is as follows:

$$Y_i = \alpha_0 + \beta_1 WE_i + \beta_2 HIC_{it} + \beta_3 HC_{it} + \beta_4 SD_{it} + \dots + \varepsilon_{it} \tag{1}$$

In Equation 1, Y_i represents the ideal number of children that a woman desires, WE_i is the indicator of women empowerment, HIC_i is the husband’s perception of the ideal number of children, HC_{it} represents the vector of the socio-economic and demographic characteristics and ε_{it} is the error term.

In the first regression, both adjusted and unadjusted models are used to analyse the potential factors that significantly influence women’s fertility preference. The outcome variable (women’s perceptions about their ideal number of children) is continuous and the predictor variables in the unadjusted model that are significant at $\leq 5\%$ risk level are included in the adjusted model to avoid the effect of potential confounding variables. The results are demonstrated in the form of the incidence rate ratio (IRR) for each variable. This study sets a p-value at <0.05 level for statistical significance.

Finally, to examine the association between empowerment and women’s ability to achieve their desired family size, this study uses multivariable logistic regression to explore the probability of having more than their ideal number of children. Similar to the previous model, all the variables used in the earlier analyses are integrated as explanatory variables. To avoid the possible multicollinearity issue, this study carried out a variance inflation factor test (not shown) and found no correlation among the explanatory variables. The results of this model are expressed as Odd Ratio (OR) and a p-value at <0.05 level for statistical significance.

Patient and Public Involvement

"No patient involved"

Descriptive characteristics of the sample

Fertility preferences

Table 1 reports the survey years, sample size, mean ideal number of children, and the SD for the sampled countries. Overall, the mean value of the ideal number of children as perceived by women for all countries was 3.81. However, the women's perception of the mean ideal number of children varies across regions, with the highest figure being in Africa (5.71) and the lowest in Europe (2.82). Among the countries, women from Niger expressed the highest ideal number of children (9.99), whereas women from Ukraine stated the lowest ideal number of children, 2.12.

[Table 1]

Women Empowerment

Table 2 describes the selected measures of women empowerment in matched couples for LRCs. Among the participants, 61% have a voice in all household decisions either alone or jointly with their husbands. In addition, 58% of the women agree that husbands should not be allowed to beat their wives for any reason and 75% of the women mention reserving the right to refuse sex with their partners if their husband maintains any relation or has sex with other women. In the case of husbands, the ideal number of children seems higher (4.64) than those of women. For most of the women, permission to seek healthcare purposes (83.5) is not a big problem.

[Table 2]

Empowerment and Women's Ideal Number of Children

Table 3 presents the estimates of the pooled association between women empowerment and fertility rate after controlling for the husbands' influence, gender-related variables, and the socio-demographic and economic characteristics. The results of the NBRM for LRCs show a statistically significant inverse relationship between all empowerment indicators and the women's perceived ideal number of children. This result indicates that women with high levels of empowerment expect fewer children than the ideal number, which matches the study expectations. In all three

decisions, women express an ideal number of children that is 3% lower (IRR: 0.97, 95% CI: 0.96, 0.98) than their counterparts. Moreover, women who agree that no reason is justified for wife-beating express a 4% lower number (IRR: 0.96, 95% CI: 0.95, 0.98) of children as ideal. Furthermore, responses of women who reserve the right to refuse sex, if the husband has sex with other women, also shows an inverse association (IRR: 0.97, 95% CI: 0.95, 0.98) with the ideal number of children. Meanwhile, another exposure variable of interest in this model, the husband's perceived ideal number of children, show a significant positive association with women's perception of the ideal number of children (IRR: 1.04, 95% CI: 1.03, 1.05).

[Table 3]

Several other socio-economic and demographic factors also influence women's perceived fertility decisions in LRCs (Table 3). For example, age difference between spouses (IRR: 1.02, 95% CI 1.01, 1.03) and women's age at first marriage (IRR: 1.01, 95% CI 0.99, 1.02), primary and secondary education (IRR: 1.06, 95% CI 1.05, 1.08) and (IRR: 1.03, 95% CI 1.01, 1.05), respectively, residence in a rural area (IRR: 1.02, 95% CI: 1.01, 1.03), belonging in the richest quintile (IRR: 1.04, CI: 1.01, 1.06), living in a polygamous union (IRR: 1.09, CI: 1.06, 1.11), work (IRR: 1.09, CI: 1.07, 1.1) and having more than five children (IRR: 2.12, 95% CI: 1.82, 2.48) have a significant impact on the increased ideal number of children compared with their counterparts. However, obtaining permission to seek health care (IRR: 0.96, 95% CI: 0.94, 0.98), any exposure to media (IRR: 0.93, 95% CI: 0.92, 0.95) and the contraceptive decision made by wife alone or jointly (IRR: 0.95, 95% CI: 0.93, 0.97) demonstrate a significant impact on the low preference of the ideal number of children compared with their counterparts.

Empowerment and unmet desired number of children

Table 4 presents the findings from the logistic regression model. Results show the adjusted association of unmet desired number of children with women empowerment-related indicators and husband's match with wife in terms of the ideal number of children after controlling socio-economic and demographic factors. Women who have a voice in any of the three household decisions are 5% less likely (OR: 0.95, 95% CI: 0.90, 0.99) to have more children than their ideal

number as compared with their counterparts. However, those who believe that no reason can justify wife-beating are 1.12 times more likely (OR: 1.12, 95% CI: 1.07, 1.17) to have more children than the ideal number as compared with other women. The final empowerment variable of women who believe that wives can refuse sex because of the husband having relationships with other women are significantly associated with 1.16 times elevated odds (OR: 1.16, 95% CI: 1.10, 1.23) of having more children than they desire.

Our second exposure variable of interest, husband's perceived ideal number of children that is higher than that of the wife are associated with 4.46 times higher odds (OR: 4.46, 95% CI: 4.23, 4.70) of having more children than desired as compared with the matched (husband-wife) perception. Among socio-economic and demographic variables, age difference between spouses, and women's age at marriage are not huge concerns. Education, residence in a rural area, belonging in the richest quintiles, living in a polygamous union, and work significantly influence the ability of women to decide having their desired number of children.

[Table 4]

Discussion

According to the results, all three women empowerment indicators in the form of household decision making, justifying no reasons for wife-beating and ability to refuse sex are associated with a lower ideal number of children amongst women in LRCs. The husband's expectation about the ideal number of children is positively associated with women's perception of having more children. These results vary in terms of the association between women's empowerment and ability to achieve their perceived ideal family size. Having a voice in all household decisions are associated with having fewer children than desired. However, no reason is justified for wife-beating and ability of refusing sex are associated with having more children than desired.

The results of this study show that women empowerment as measured by a voice in household decision-making is associated with a low perceived ideal number of children. The findings are consistent with prior studies that report household decision-making is inversely associated with the lower perceived ideal number of children in Guinea (11), Eritrea (29) and Bangladesh (39,40).

However, other studies found no significant association between household decision-making and women’s perceived ideal number of children (16). The possible reason for this contrast may be the selection of the current sample of women aged 35 years or above. Higher decision-making power with increased age may influence the women to make their own decisions of fertility choice whereby newly married women usually perform household duties under the primary decision-maker of the family, such as the husband or in several cases, the mother-in-law (41). The present study findings also reveal that women’s decision-making power is significantly associated with the ability to achieve their fertility preferences. This result contradicts previous studies where the decision-making power is more likely to have unmet fertility desire in Namibia (11) and Bangladesh (16). Notably, the discrepancy may be a result of the varying cultural contexts in different regions. While other studies are mainly carried out within a country or global region, this study is a pooled multi-country analysis accounting for the heterogeneity across different regions. Levels of factors included in the model indicate that household decision-making may not be as relevant for women empowerment in a country or regional context. Women with greater decision-making power are expected to possess the agency and capacity to recognise their intentions and thus limit their perceived ideal number of children. Hence, the present findings can assist policymakers to achieve greater gains in reducing fertility preference and the desired fertility choice in the LRCs. By improving women’s decision-making power to secure better food, education and health services, such achievements can result in a thriving future overall.

Concerning the perceived ideal number of children, negative attitudes towards wife-beating, and the right to refuse sex result in a smaller number of children in many African nations (11,16). The same is reflected in this study, given that all these criteria strengthen women’s status in their families. The same outcome is likely for other developing countries in Southeast Asia and Sub-Saharan Africa. Furthermore, after creating a women empowerment index, as assessed by the DHS measure, more empowered women were found to desire significantly fewer kids compared with women less empowered in four African nations: Burkina Faso, Mali, Niger, and Chad (4).

Additionally, this study also exposes that negative attitude towards wife-beating and positive attitude towards refusal of sex is associated with having more children than desired. Earlier studies found negative attitudes towards wife-beating were found associated with women’s ability to

obtain their preferred family size in Mali, but similar results in the case of the ability of a woman to refuse sex in Zambia (11). Possible explanations of the contrasting findings may be that the women misunderstand the different hypothetical situations asked during the survey or provide socially desirable responses. Another explanation is that from Upadhyay and Karasek that empowered women personally desire smaller families but often fulfill social or family expectations of higher fertility (11). Moreover, this paradox may be influenced by the beliefs that children are the sources of old age indemnification, alternative strength in case of child death, and the prestige to have larger family sizes in certain societies.

This paper also demonstrates that the husband's perceived ideal number of children is significantly associated with women's fertility preferences and achievement to maintain their desired fertility. This finding is consistent with the study from the African context where, irrespective of the women's level of employment, a husband with a smaller ideal number of children ultimately matches women's fertility preference and achievement of desired family size (11). A possible explanation for this is that the women are coupled with like-minded men or that spouses confirmed each other's ideas after marriage (11). A prior study in Pakistan found that the empowerment measure shows a substantial effect on contraceptive use when couples consider joint decision-making (12). This finding provides a useful pathway to determine how a husband's involvement may affect the use of contraception, and thus also women's fertility preference. Knowledge about limiting to ideal number of children and the corresponding birth interval is essential for males, and could be a useful investment for formulating maternal health policies and family planning programs.

This study enriches the current literature by using a large sample of 91,070 married women from 53 countries. As such, the findings are generalisable to women in LRCs and can assist in creating central-level promotional health policy to reduce fertility preference and achieve fertility desire in LRCs though equitable gender roles in the decision-making process, increased awareness, and motivation. This study is among the very first initiatives to investigate the pooled association between women empowerment and their fertility decisions, and the ability to achieve their desired fertility in the context of LRCs. The large dataset provides sufficient power to assess the association between women empowerment and fertility rates. A large pooled dataset also helps to

justify prior findings in single or group of countries in a specific region. Moreover, this study includes the husband’s influence on women’s perceived and actual fertility, a factor that is barely considered in earlier studies.

Of similar importance is to acknowledge the limitations of the study. First, due to the cross-sectional nature of the data, this study can only establish the association between women empowerment and fertility rates but is unable to establish any causal effects. Second, other factors, such as social and family environments, religion, and health system characteristics, might also influence fertility preferences but are excluded from this analysis due to the lack of information in the DHS dataset. Third, the results can only be generalised for the 53 LRCs; any extrapolation for other countries require careful consideration. Fourth, the DHS questionnaire’s non-numeric response to the question about the ideal number of children is another concern, because several respondents provided a non-numeric response. However, such responses are few and thus the biases are assumed to be small.

Conclusion

This study reveals that high women empowerment leads to small family sizes in LRCs. Family empowerment in the form of decision-making within the household enhances women’s ability to achieve their desired fertility. Husband’s preference for ideal number of children, women’s education, marital age and wealth or socioeconomic status may significantly reduce women’s fertility preference and enhance their ability to achieve their ideal number of children, and therefore achieve better maternal and child health programs in LRCs. Additionally, attaining gender equality and women empowerment is integral to each of the 17 goals of the Agenda 2030 of UN Resolution. Hence, identifying a proper instrument with longitudinal data is pivotal to enable comprehensive future research on women empowerment and reproductive health.

Abbreviations

LRCs	Low Resource Countries
DHS	Demographic Health Survey
NBRM	Negative Binomial Regression Model
IRR	Incidence Rate Ratio
OR	Odd Ratio
CI	Confidence Interval
WHO	World Health Organization
LMIC	Low- and Middle-Income Country

Acknowledgments

We gratefully acknowledge MEASURE DHS for their permission to use the Demographic Health Surveys. We are also grateful to the editors and the reviewers who provided constructive comments to help shape this paper.

Author's contributions

Conceptualized the study: RH, SAK; Contributed data extraction and analyses: RH. Result interpretation: RH. Prepared the first draft: RH, SMR. Contributed during the conceptualization and interpretation of results and substantial revision: RH, KA, SMR, and SAK. Revised and finalized the final draft manuscript: RH, KA, SMR, SAK, and MKA. All authors read and approved the final version of the manuscript.

Conflict of interest

The authors declare no conflicts of interest.

Funding:

The research received no specific grants from any funding agency in the public, commercial or not for profit sectors.

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Table 1. Distribution of women ideal number of children across 53 countries

Country	Survey year	Sample size	Women's ideal number of children	
			(Mean)*	SD
Overall			3.89	2.54
African Region			5.71	2.86
<i>Angola</i>	2015-16	715	6.51	2.76
<i>Benin</i>	2017-18	1,351	5.82	2.56
<i>Burkina Faso</i>	2017-18	1,560	6.4	2.23
<i>Burundi</i>	2016-17	1,382	4.13	1.68
<i>Cameroon</i>	2011	997	6.51	3.06
<i>Chad</i>	2014-15	886	7.65	3.61
<i>Comoros</i>	2012	304	5.62	2.68
<i>Côte d'Ivoire</i>	2011-12	707	6.41	2.63
<i>Democratic Republic of Congo</i>	2013-14	1,475	7.14	3.17
<i>Eswatini</i>	2006-07	225	3	1.69
<i>Ethiopia</i>	2016	1,960	5.5	3.14
<i>Gabon</i>	2012	822	5.44	2.62
<i>Gambia</i>	2013	384	6.6	2.61
<i>Ghana</i>	2014	807	5.06	2.08
<i>Kenya</i>	2014	1,638	4.07	1.98
<i>Lesotho</i>	2014	273	3.35	1.62
<i>Liberia</i>	2013	582	5.84	2.72
<i>Madagascar</i>	2008-09	1,620	5.36	2.53
<i>Malawi</i>	2015-16	1,069	4.45	1.75
<i>Mali</i>	2012-13	901	6.44	2.72
<i>Mozambique</i>	2011	668	6.31	2.6
<i>Namibia</i>	2013	671	4.01	2.32
<i>Niger</i>	2012	807	9.99	3.42
<i>Nigeria</i>	2018	2,762	6.49	3.26
<i>Rwanda</i>	2014-15	1,094	4.1	1.82
<i>Sao Tome and Principe</i>	2008-09	319	4.17	1.9
<i>Senegal</i>	2010-11	1,286	5.25	2.2
<i>Sierra Leone</i>	2013	635	5.97	2.59
<i>South Africa</i>	2016	322	3.1	1.51
<i>Togo</i>	2013-14	876	5.1	2.11
<i>Uganda</i>	2016	683	5.99	2.59
<i>Zambia</i>	2018	2,034	5.83	2.27
<i>Zimbabwe</i>	2015	1,064	4.73	1.96
Eastern Mediterranean Region			4.98	2.31
<i>Afghanistan</i>	2015	3,082	5.61	2.34
<i>Jordan</i>	2017-18	1,401	4.17	1.91
<i>Pakistan</i>	2017-18	1,096	4.03	2.08
European Region			2.82	1.19
<i>Albania</i>	2017-18	1,668	2.6	0.95
<i>Armenia</i>	2015-16	607	2.79	0.87
<i>Azerbaijan</i>	2006	776	2.85	1.04
<i>Kyrgyzstan</i>	2012	542	4.43	1.46
<i>Ukraine</i>	2007	730	2.12	0.71
Region of the Americas			2.93	1.69
<i>Bolivia</i>	2008	1,207	2.86	1.72
<i>Colombia</i>	2015	5,859	2.64	1.55
<i>Dominican Republic</i>	2013	1,574	3.42	1.85
<i>Guyana</i>	2009	679	3.23	1.73

<i>Haiti</i>	2016-17	1,515	3.46	1.71
South-East Asian Region			2.52	1.22
<i>Bangladesh</i>	2011	1,123	2.37	0.79
<i>India</i>	2015-16	27,427	2.37	1.06
<i>Indonesia</i>	2017	4,742	2.85	1.22
<i>Myanmar</i>	2015-16	1,230	3.05	1.51
<i>Nepal</i>	2016	912	2.34	0.88
<i>Timor-Leste</i>	2016	904	4.84	2.61
Western Pacific Region			3.73	1.31
<i>Cambodia</i>	2014	1,117	3.73	1.31

*Non-numeric responses considered as a mean ideal number of children

Table 2. Selected measures among women in matched couples in 53 LRCs, DHS 2006-2018

Variables	Percentage / Mean
Husbands' ideal number of children (mean)¹	4.64
Decision-making²	
<i>Any voice of women in all three decisions (%)</i>	61.14
<i>Women voice count in household decision (0-3) (mean)</i>	2.23
Attitudes toward wife beating³	
<i>No reason is rationalized for wife beating (%)</i>	57.34
<i>Count of reasons for which wife beating is rationalized (0-5) (mean)</i>	3.8
Attitudes toward refusing sex⁴	
<i>The belief that women have a right of denial sex if husband extra-marital sexual relationship(%)</i>	75.29
Gender-related Variables	
<i>Interspousal age difference (mean years)</i>	4.72
<i>Interspousal education difference (mean years)</i>	0.27
<i>Age at first marriage (mean)</i>	19.5
<i>Going to health care center is permitted (%)</i>	83.5
<i>Contraceptive decision</i>	
<i>Wife has taken alone or jointly</i>	91.41
Socio-economic and demographic characteristics	
<i>Residence (%)</i>	
<i>Rural</i>	60.95
<i>Urban</i>	39.05
<i>Household Wealth Index (%)</i>	
<i>poorest</i>	17.46
<i>poor</i>	19.41
<i>middle</i>	19.89
<i>rich</i>	20.86
<i>richest</i>	22.38
<i>Education (%)</i>	
<i>No education</i>	35.96
<i>Primary</i>	26.66
<i>Secondary and more</i>	28.14
<i>Higher</i>	9.23
<i>Polygamous union (%)</i>	
<i>No</i>	88.34

Yes	11.66
No. living children (%)	
0	2.61
1-2	29.88
3-4	34.8
5 & more	32.71
Any media exposure on FP ⁵	
no	49.79
yes	50.21
Employment Status	
No work in last 1 year	41.17
At least work in last 1 year	58.83
1 Non-numeric replies added as mean of preferred number of children.	
2 Final say of women either alone or jointly with husband regarding own healthcare, household purchase, and family visit and kin.	
3 Whether a husband is justified in beating his wife if she goes out without telling him, negligent towards their offspring, a quarrel with the male partner, declines to engage in sexual relations with the husband or burns the meal.	
4 If the husband is involved in extra-marital sexual relationships.	
5 Any exposure of media like radio, television and newspaper regarding family planning in last one year	

Table 3. Negative Binomial Regression model examining the association between women’s empowerment and the ideal number of children for LRCs

Dependent Variable: Women Ideal Number of Children		
	Unadjusted	Adjusted
Women's Empowerment	IRR (95% CI)	IRR (95% CI)
No voice of women in all three decisions (ref)		
Has any voice in three household decision	0.76*** (0.75 - 0.77)	0.97*** (0.96 - 0.98)
At least one reason is rationalized for wife beating (ref)		
No reason is rationalized for wife beating	0.83*** (0.82 - 0.84)	0.96*** (0.95 - 0.98)
No right of denial sex if husband extra-marital sexual relationship (ref)		
Right of denial sex if husband extra-marital sexual relationship	0.78*** (0.77 - 0.79)	0.97*** (0.95 - 0.98)
Husband’s Influence		
Husband's preferred number of offspring	1.05*** (1.04 - 1.06)	1.04*** (1.03 - 1.05)
socio-economic and demographic characteristics		
Age difference	1.02*** (1.01 - 1.03)	1.02*** (1.01 - 1.03)
Educational difference	1.04*** (1.03 - 1.05)	1.01 (0.99 - 1.02)
Age at first marriage	0.98*** (0.97 - 0.99)	1.01*** (0.99 - 1.02)
Going to health care center is not permitted (ref)		
Going to health care center is permitted	0.84*** (0.83 - 0.85)	0.96*** (0.90 - 0.98)
Women education		
No education (ref)		
Primary	0.84*** (0.83 - 0.85)	1.06*** (1.05 - 1.08)
Secondary	0.64*** (0.63 - 0.65)	1.03** (1.01 - 1.05)
Higher	0.57*** (0.56 - 0.58)	1.02 (0.99 - 1.06)
Residence type		
Urban (ref)		
Rural	1.29*** (1.28 - 1.3)	1.02* (1.01 - 1.03)
Wealth Index		
Poorest (ref)		
poor	0.91*** (0.90 - 0.92)	1.01 (0.98 - 1.03)
Middle	0.85*** (0.84 - 0.86)	0.99 (0.97 - 1.01)
Rich	0.79*** (0.78 - 0.80)	1.01 (0.99 - 1.03)
Richest	0.69*** (0.68 - 0.70)	1.04** (1.01 - 1.06)
Role of media on family planning (Radio, Television or Newspaper)		
No exposure (ref)		
At least any exposure	0.79*** (0.78 - 0.80)	0.93*** (0.92 - 0.95)
Polygamous Union		
No (ref)		

Yes	1.60*** (1.58 - 1.62)	1.09*** (1.06 - 1.11)
Employment Status		
<i>No work in the preceding year (ref)</i>		
<i>At least work in preceding year</i>	1.16*** (1.15 - 1.17)	1.09*** (1.07 - 1.10)
Women Living Children		
<i>No children (ref)</i>		
<i>1-2</i>	0.85*** (0.83 - 0.88)	1.08 (0.92 - 1.26)
<i>3-4</i>	1.20*** (1.17 - 1.24)	1.52*** (1.3 - 1.77)
<i>5+</i>	1.88*** (1.83 - 1.93)	2.12*** (1.82 - 2.48)
Wife contraceptive decision		
<i>No decision (ref)</i>		
<i>At least any decision</i>	0.90*** (0.88 - 0.91)	0.95*** (0.93 - 0.97)

***p < 0.001, **p < 0.01, *p < 0.05.

Abbreviations: ref Reference; IRR Incidence Rate Ratio; CI Confidence Interval

Table 4. Multivariable logistic regression analysis examining the association between women's empowerment and ability to achieve fertility preference for LRCs

Dependent Variable: Women's ability to achieve fertility desire	Adjusted OR (95% CI)
Women's Empowerment	
<i>No voice of women in all three decisions (ref)</i>	
<i>Has any voice in three household decision</i>	0.95* (0.90 - 0.99)
<i>At least one reason is rationalized for wife beating (ref)</i>	
<i>No reason is rationalized for wife beating</i>	1.12*** (1.07 - 1.17)
<i>No right of denial sex if husband extra-marital sexual relationship (ref)</i>	
<i>Right of denial sex if husband extra-marital sexual relationship</i>	1.16*** (1.10 - 1.23)
Husband's Influence	
<i>Husband-wife match with preferred offspring (ref)</i>	
<i>Husband desire higher preferred offspring than wife</i>	4.46*** (4.23 - 4.70)
<i>Husband desire lower preferred offspring than wife</i>	0.71*** (0.67 - 0.75)
Socio-economic and demographic characteristics	
<i>Age difference</i>	0.97*** (0.97 - 0.98)
<i>Educational difference</i>	0.99 (0.96 - 1.02)
<i>Age at first marriage</i>	0.92*** (0.92 - 0.93)
<i>Going to health care center is not permitted (ref)</i>	
<i>Going to health care center is permitted</i>	1.23*** (1.14 - 1.32)
Women education	
<i>No education (ref)</i>	
<i>Primary</i>	0.71*** (0.67 - 0.76)
<i>Secondary</i>	0.48*** (0.45 - 0.52)
<i>Higher</i>	0.28*** (0.25 - 0.32)
Residence type	
<i>Urban (ref)</i>	
<i>Rural</i>	0.98*** (0.93 - 1.04)
Wealth Index	
<i>Poorest (ref)</i>	

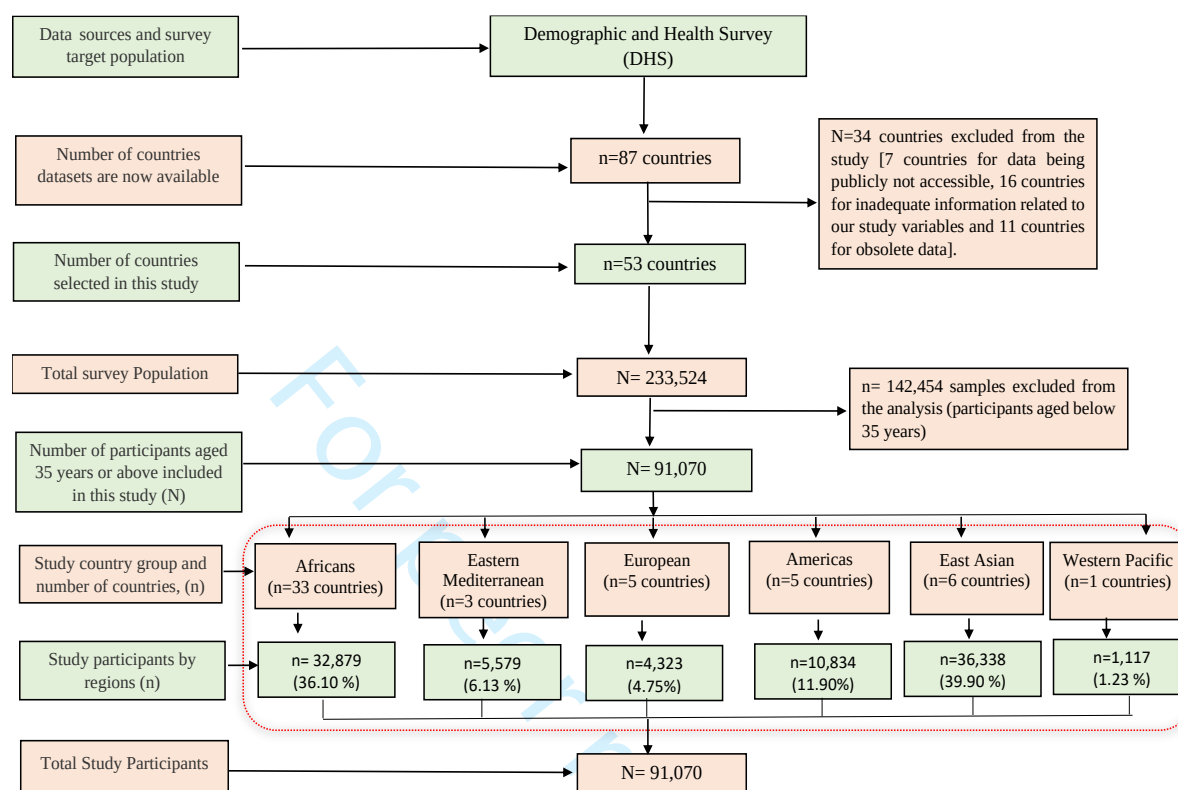
poor	0.87*** (0.81 - 0.95)
Middle	0.86*** (0.80 - 0.93)
Rich	0.79*** (0.73 - 0.86)
Richest	0.74 (0.68 - 0.81)
Role of media on family planning (Radio, Television or Newspaper)	
No exposure (ref)	
At least any exposure	1.13*** (1.08 - 1.19)
Polygamous Union	
No (ref)	
Yes	0.52*** (0.47 - 0.58)
Employment Status	
No work in the preceding year (ref)	
At least work in preceding year	0.95* (0.91 - 0.99)
Wife contraceptive decision	
No decision (ref)	
At least any decision	1.14*** (1.05 - 1.24)

***p < 0.001, **p < 0.01. *p < 0.05.

Abbreviations: ref Reference; OR: Odd Ratio; CI Confidence Interval

Figure 1. Distribution of Study Participants

Figure 1. Distribution of Study Participants



STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Bias	9	Describe any efforts to address potential sources of bias	N/A
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7-9
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	10
		(b) Describe any methods used to examine subgroups and interactions	N/A
		(c) Explain how missing data were addressed	10
		(d) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	28
		(b) Give reasons for non-participation at each stage	28
		(c) Consider use of a flow diagram	28
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11
		(b) Indicate number of participants with missing data for each variable of interest	11
Outcome data	15*	Report numbers of outcome events or summary measures	11-13

Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11-13
		(b) Report category boundaries when continuous variables were categorized	11-13
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17

*Give information separately for exposed and unexposed groups.

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BMJ Open

Women's empowerment and fertility decision-making in 53 low and middle resource countries: A pooled analysis of demographic and health surveys

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2020-045952.R1
Article Type:	Original research
Date Submitted by the Author:	27-May-2021
Complete List of Authors:	Haque, Rezwanul; American International University Bangladesh, Department of Economics Alam, Khorshed ; University of Southern Queensland, School of Business; University of Southern Queensland, Centre for Health Research Rahman, Syed; American International University Bangladesh, Faculty of Business Administration Keramat, Syed Afroz; University of Southern Queensland, School of Business; Khulna University, Economics Discipline Al-Hanawi, Mohammed; King Abdulaziz University,
Primary Subject Heading:	Health policy
Secondary Subject Heading:	Health policy
Keywords:	Health policy < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, PUBLIC HEALTH, Health economics < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

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Women's empowerment and fertility decision-making in 53 low and middle resource countries: A pooled analysis of demographic and health surveys

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Keywords: Women empowerment; Fertility preferences; Negative Binomial Regression Model; Low Resource Countries

Word count: 4784 words

Abstract

Objective: Women’s empowerment and its association with fertility preference are vital for central-level promotional health policy strategies. This study examines the association between women’s empowerment and fertility decision-making in low and middle resource countries (LMRCs).

Design: This cross-sectional study uses the Demographic and Health Survey (DHS) database.

Settings: 53 LMRCs from six different regions for the period ranging 2006–2018.

Participants: The data of women-only aged 35 years and above is used as a unit of analysis. The final sample consists of 91,070 married women.

Methods: We considered two outcome variables: women’s perceived ideal number of children and their ability to achieve preferred fertility desire and the association with women empowerment. Women empowerment was measured by their participation in household decision-making and attitude towards wife-beating. The negative binomial regression model was used to assess women’s perceived ideal number of children, and multivariable logistic regression was used to evaluate women’s ability to achieve preferred fertility desire.

Results: Our study found that empowered women have a relatively low ideal number of children irrespective of the measures used to assess women empowerment. In this study, the measures were participation in household decision-making (Incidence Rate Ratio [IRR]: 0.92, 95% Confidence Interval [CI]: 0.91, 0.93) and attitude towards wife-beating (IRR: 0.96, 95% CI: 0.95, 0.97). In the LMRCs, household decision-making and negative attitude towards wife beating have been found associated with 1.12 and 1.08 times greater odds of having more than their ideal number of children.

Conclusion: Our findings suggest that women’s perceived fertility desire can be achieved by enhancing their empowerment. Therefore, a modified community-based family planning program at the national level is required, highlighting the importance of women’s empowerment on reproductive health care as a part of the mission to assist women and couples to have only the number of children they desire.

Strengths and limitations of this Study

- This study is among the first initiatives to investigate the pooled association between women empowerment and their fertility decisions and their ability to achieve their desired fertility in the context of LMRCs.
- The findings are generalisable to women in LMRCs and can assist in creating a central-level promotional health policy to reduce fertility preference in LMRCs.
- This study includes husbands' influence on women's perceived and actual fertility, a factor that is barely considered in earlier studies.
- Given the cross-sectional nature of the data, this study can only establish the association between women empowerment and fertility rates. However, it is unable to establish any causal effects.

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Introduction

Women empowerment has attracted significant attention from researchers, policymakers, and practitioners over the last couple of decades, particularly in Asia and Africa. With diverse attributes, empowerment occurs at varying levels from household to global scale [1,2]. A consensus is that women empowerment influences reproductive health outcomes, such as fertility, birth interval and contraceptive use [3,4]. Women’s empowerment in the form of the ability to make their own choices and pursue goals and control personal living and resources [5,6] has been considered crucial in the United Nations (UN) Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs). The goals to promote gender equality and empower women in the MDGs (i.e. MDG 3) were fine-tuned before inclusion in the SDGs (i.e. SDG 4), both of which urged for ending discrimination against women and girls to ensure economic growth and development for a sustainable future [7].

Women empowerment is challenging to measure because of its multi-dimensional nature. Extant literature has assessed empowerment using various measures, including women’s liberty in lone movement [8], the age-education gap between married couples [9] and cohabiting partner selection [10]. Furthermore, decision-making on household issues that signifies the extent to which women control their surroundings is often used to assess women’s autonomy [11]. Finally, women empowerment can also be appraised through their ability to contribute towards household decision-making, including domestic, economic and free movement [12,13].

The household decision-making domain is the earliest and most used measure to assess women empowerment [14], which formed the basis of the Demographic and Health Survey (DHS) standard questionnaire in the late 1990s. The DHS includes questions about household decision-making, justifying wife-beating by the husband and wife refusal of having sex [15] to assess women empowerment in LMRCs.

Given the DHS data’s official launch, substantial research have been conducted involving women empowerment and various health-related outcomes. For instance, studies have demonstrated the association of women empowerment with reproductive health, including contraceptive use [3,12], fertility [16–18] and birth intervals [19]. In addition, some other pieces of investigation have highlighted the relationships of women empowerment with maternal health care service [20],

antenatal care [21], children anthropometric status [22,23], infant mortality [24] and intimate partner violence [25].

To date, few studies have used DHS empowerment measures to interpret its association with fertility preferences. In the Sub-Saharan African (SSA) context, greater household decision-making was found associated with a smaller ideal number of children in Guinea [11], Zimbabwe [26] and Eritrea [27]. A study focusing on Bangladesh with similar empowerment measures found a significant association with unmet fertility desire [17]. These results demonstrated that women's final voice in the daily household purchase has sufficient independent explanatory power to explain fertility preferences beyond traditional measures of women status, for example, education and employment status. Another empowerment measure, negative attitude towards wife-beating, was associated with a small ideal number of children in Guinea and Zambia; however, negative attitude towards refusal of sex was found to be associated with greater odds of having more children than desire in Namibia and Zambia and lower odds than desire in Mali [11]. In another study, Atake and Ali constructed a multi-dimensional empowerment index by using all three empowerment measures in four SSA countries and found that more empowered women in every country desire a fewer ideal number of children [4].

Women's fertility decision is influenced by several external factors other than empowerment and partner influences, such as social norms and cultural context, family and community, particularly in LMRCs. Social norms and cultural beliefs are well known to influence fertility preferences [28, 29]. For example, cultural attitude and norms towards reproduction in some societies in Africa and South Asia are based on the assumption that children are the sources of old age financial support and alternative strength in case of child death and that larger family size is prestigious, which encourages high fertility preferences [18,30]. Furthermore, the family tradition of early marriage and pressure from the in-laws' family are also associated with high fertility choice [31]

The association of socio-economic and decision-making freedom of women with pregnancy prevention measures, conjugal violence and medical services on fertility has been found to decline either for a single or a coalition of nations [4,11,12,17,18]. However, the association of fertility desire and the achievement of fertility choice in the context of LMRCs have not been examined. The UN and other global bodies actively promote the concept of smaller family size to ensure a concentrated effort on fewer children to secure better food, education and health services, which

would result in a thriving future overall [32]. Assessing the connections between women empowerment and their fertility intention and the achievement of their fertility choice to promote central-level family planning and promotional health programs in LMRCs are of equal importance. By improving the social status of females and empowering them, society may enjoy several benefits.

Evidence in the extant literature is insufficient to establish a connection between women empowerment and perceived fertility decision, and the ability to achieve that desire, especially in LMRCs. Furthermore, the results of earlier research are inconsistent across countries and regions. Thus, to provide a comprehensive understanding of the association between women empowerment and fertility preferences in LMRCs, the authors aim to investigate the above association using the DHS indicators while controlling for socio-economic and demographic features. Given that the husband’s decision strongly influences a couple’s childbearing behaviour [33,34], this study also examines how the husband’s fertility decision is associated with the wife’s perceptions about the number of children. This study can contribute to the creation of central-level promotional health policy to ensure reduced fertility preference and to achieve the desired fertility in LMRCs through equitable gender roles in the decision-making process, increased awareness, and enhanced motivation. Given that birth control remains a huge challenge in most LMRCs, promotional health policy is necessary.

Materials and Methods

Setting and data sources

The data were collected from the DHS website (<https://www.dhsprogram.com>). The standard DHS survey, typically conducted in five-year interval in selected LMRCs, provided large and nationally representative cross-sectional surveys of 5,000–30,000 households [35]. Female respondents with an age range of 15-49 years (i.e. the reproductive age) were directly interviewed about their literacy, employment history, decision-making capacity, fertility and fertility preferences, pregnancy prevention tools and other related topics [15]. The DHS followed guided data collection methods, reliability and validation assessments [36]. The DHS developed the concept of the ‘recode’ file aimed to facilitate the analysis. In general, seven ‘recode’ files were provided together with the core questionnaires. Given that the role of husbands in fertility desire is vital, this study selected ‘matched couples’ from DHS recode file [11].

Study Participants

The data of women aged 35 years and above were used as a unit of analysis following prior studies [4,11]. The reason for such age restriction is to separate young women who may not have completed their childbearing tenure. The study selected 53 out of 87 countries from six different regions classified by the World Health Organization [37]. The remaining 34 countries were excluded from the analysis because their data are publicly inaccessible, inadequate and obsolete. The final sample was limited to 91,070 married women, aged 35 years and above, living with their husbands for the period ranging from 2006–2018 (Figure 1).

[Figure 1 here]

Outcome variable

The preliminary outcome variable for the research was attributed to women's perception regarding the number of children they wish to ideally conceive. In the DHS questionnaire, to determine the optimal number of children a woman may wish to bear, every married female respondent was hypothetically requested to position themselves at the time before they gave birth and to choose the exact number of offspring they would wish to have in their entire lifetime. Females who have borne no children were asked for a similar response, albeit without considering any existing children. In each question, non-numeric responses were permitted, for example, God's wishes. In this study, a non-numeric response is a continuous variable that consists of 3.73% of the total participants. Researchers have recommended the inclusion of non-numeric responses to analyse the desire for family size [26]. Few studies have found a lack of a statistically significant difference in the indicators of empowerment for the two groups of responses (i.e. numeric and nonnumeric) [4,11]. Thus, to avoid bias, non-numerical responses were considered and recorded as the mean value for the overall sample, which is consistent with the earlier literature [4,11,26]

The second outcome variable is the ability of women to achieve their preferred fertility. The processing of this variable is achieved through the difference between the actual number of living children and the ideal number of children perceived by the respondent [4,11]. If the difference is greater than zero, the woman is coded as having more children than her stated ideal number, and if the difference is zero or less than zero, the woman is considered a preferred fertility achiever.

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Exposure Variables

This study detects women empowerment by identifying two markers from the standard questionnaire developed by DHS, namely, the female’s participation in the decision making of households and attitude towards physical abuse of the wife [4,11,27]. However, given the incomplete data set, the third empowerment domain attitude towards refusing sex was not included in this study.

Women’s role in household decision-making

Female members’ involvement in decision-making within their households affects the individual’s reproductive desires and preferences [38]; thus, decision-making ability is an exposure variable. The DHS standard questionnaire inquires of each married woman about their final decision-making roles in four key areas: medical health, key household purchases, domestic procurements for everyday requirements and visits to family and other relatives. The data relating to domestic purchases for daily consumption were found in a limited manner in few countries and thus excluded from the analysis. Possible respondent answers are ‘woman alone’, ‘woman jointly with others’, ‘husband alone’ and ‘others alone’. This study recorded any voice of women (either alone or jointly) in all three decisions as a new dichotomous variable because this response reflects higher empowerment compared with any other decision-making combinations.

Attitude towards wife-beating

The study by the DHS also raises the issues of the annoyance and anger incited in the husband by his wife’s activities. It extrapolates the opinion of whether it can be validated for a husband to physically assault his female partner in some scenarios: What if she leaves home without informing him? What if she is negligent towards their offspring? What if she quarrels with the male partner? What if she declines to engage in sexual relations with the husband? What if she burns the meal?’ A dichotomous variable was generated; those who said ‘no reason’ was justified in any of the five situations reflect higher empowerment than those who said that at least one or more reason/s are justified.

Husband’s influence

The husband’s influence on the fertility rate was considered one of the key exposure variables for this analysis. Therefore, this study assessed the optimal number of offspring from the husband’s

perception coded in the DHS as a continuous variable. The questions inquired from the husbands were similar to those asked of their wives, and the mean value replaced non-numeric answers.

Other Covariates

Other relevant confounder variables were also selected after analysing published documents on women empowerment and fertility desire [4,11,18,39,40], along with the DHS dataset. Bivariate analysis was conducted, and the covariates were included later in the fully adjusted model if found significant at 5% or less.

This study also included gender-related variables, such as interpersonal age and educational differences, women's age at first marriage, problems in obtaining permission to seek healthcare and contraceptive decisions [11,41,42].

The present study attempted to incorporate most of the social, demographic and economic variables used in other studies, such as types of residence, household wealth, women education status, polygamous unions, number of living children and experience with any media exposure (i.e. television, radio and newspaper/magazine) about family planning [4,11,27,40–43].

Estimation Strategy

A pooled data set of the 53 LMRCs and subsequent observations of women aged 35 years and above are constructed for analysis. Selecting women above 35 years allows for the segregation of young women who may not have completed their childbearing tenure [4,11]. The study first carried out a descriptive analysis to describe the three indicators of women empowerment: women's ideal number of children; husband's ideal number of children; gender-related variables and other social, economic and demographic factors in the form of mean, standard deviation (SD), frequency (n) and percentage.

Subsequently, the negative binomial regression model (NBRM) was used to investigate whether women empowerment and the husband's perceived ideal number of children have any association with the ideal number of children perceived by women aged 35 years or above after controlling for social, economic and demographic variables. Although the ordinary least squares estimation is used in previous research [11], the present study used the NBRM with statistical benefits over

simple linear regression [4,44,45]. Furthermore, the NBRM assumes unequal mean and variance and is principally correct for over depression in the data (i.e. the variance is greater than the conditional mean) [18,46]. The statistical model developed to capture the association is as follows:

$$Y_i = \alpha_0 + \beta_1 WE_i + \beta_2 HIC_{it} + \beta_3 HC_{it} + \beta_4 SD_{it} + + \varepsilon_{it} . \tag{1}$$

In Equation 1, Y_i represents the ideal number of children that a woman desires, WE_i is the indicator of women empowerment, HIC_i is the husband’s perception of the ideal number of children, HC_{it} represents the vector of the socio-economic and demographic characteristics and ε_{it} is the error term.

In the first regression, adjusted and unadjusted models are used to analyse the potential factors that significantly influence women’s fertility preference. The outcome variable (women’s perceptions about their ideal number of children) is continuous. The predictor variables in the unadjusted model that are significant at $\leq 5\%$ risk level are included in the adjusted model to avoid the effect of potential confounding variables. The results are demonstrated in the form of the incidence rate ratio (IRR) for each variable. This study set a p-value at <0.05 level for statistical significance.

Finally, to examine the association between empowerment and women’s ability to achieve their desired family size, this study used multivariable logistic regression to explore the probability of having more than their ideal number of children. Similar to the previous model, all the variables used in the earlier analyses were integrated as explanatory variables. This study attempts to avoid the possible multicollinearity issue by carrying out a variance inflation factor test (not shown) and found no correlation among the explanatory variables. The results of this model are expressed as an odd ratio and a p-value at <0.05 level for statistical significance.

Patient and Public Involvement

We had no contact with any patients or the public for this study.

Descriptive characteristics of the sample

Fertility preferences

Table 1 reports the survey years, sample size, the mean ideal number of children and the SD for the sampled countries. Overall, the mean value of the ideal number of children perceived by

women for all countries was 3.81. However, the women's perception of the mean ideal number of children varied across regions, with the highest figure being in Africa (5.71) and the lowest in Europe (2.82). Among the countries, women from Niger expressed the highest ideal number of children (9.99), whereas women from Ukraine stated the lowest ideal number of children (2.12).

[Table 1]

Women Empowerment

Table 2 describes the selected measures of women empowerment in matched couples for LMRCs. Among the participants, around 61% have a voice in all household decisions either alone or jointly with their husbands. In addition, about 58% of the women agree that husbands should not be allowed to beat their wives for any reason. In the case of husbands, the ideal number of children seems higher (4.64) than those of women. For most of the women, permission to seek healthcare purposes (83.5) is not a big problem.

[Table 2]

Empowerment and Women's Ideal Number of Children

Table 3 presents the estimates of the pooled association between women empowerment and fertility rate after controlling for the husbands' influence, gender-related variables and the socio-demographic and economic characteristics. The pooled results of the NBRM for LMRCs show a statistically significant inverse relationship between all empowerment indicators and the women's perceived ideal number of children. This result indicates that women with high levels of empowerment expect fewer children than the ideal number, which matches the study expectations. In all three decisions, women express an ideal number of children that is 8% lower (IRR: 0.92, 95% CI: 0.91, 0.93) than their counterparts. Furthermore, women who agree that no reason is justified for wife-beating express 4% lower the ideal number of children (IRR: 0.96, 95% CI: 0.95, 0.97). Meanwhile, another exposure variable of interest in this model, the husband's perceived ideal number of children, show a significant positive association with women's perception of the ideal number of children (IRR: 1.03, 95% CI: 1.02, 1.04). The authors also constructed sensitivity analysis to see the regional variation, which is presented in Appendix 1. In the form of empowerment measure, women empowerment is not consistently associated with the ideal number of children in all regions.

[Table 3]

This study relates the current women employment domains to the retrospective information of the ideal number of children and the ability to achieve the ideal number of children to address the research question. The indicators that were found as important drivers in the earlier studies may not have equal importance in the future because of change in indicator-fertility desire associations. Furthermore, without considering some of the retrospective covariates during a woman’s peak childbearing years, addressing a holistic research question such as how empowerment changes over the time of a women’s life is extremely challenging to answer because of the cross-sectional design of this study.

Empowerment and unmet desired number of children

Table 4 presents the findings from the logistic regression model. The results show the adjusted association of the unmet desired number of children with women empowerment-related indicators and the husband’s match with wife in terms of the ideal number of children after controlling socio-economic and demographic factors. For example, women who have a voice in any of the three household decisions are 1.12 times more likely (OR: 1.12, 95% CI: 1.08, 1.16) to have more children than their ideal number compared with their counterparts. Similarly, those who believe that no reason can justify wife-beating are 1.08 times more likely (OR: 1.08, 95% CI: 1.05, 1.12) to have more children than the ideal number compared with other women.

[Table 4]

Our second exposure variable of interest, the husband’s perceived ideal number of children that is higher than that of the wife, are associated with 3.50 times higher odds (OR: 3.50, 95% CI: 3.37, 3.63) of having more children than desired as compared with the matched (husband–wife) perception. The authors also constructed sensitivity analysis to see the regional variation, presented in Appendix 2. The result seems mostly consistent in almost every region where empowered women are likely to have more children than their ideal number of children.

Discussion

According to the results, women empowerment indicators in household decision-making and justifying no reasons for wife-beating are associated with a low ideal number of children amongst women in LMRCs. The husband’s expectation about the ideal number of children is positively associated with women’s perception of having more children. The results in terms of women

empowerment domain (i.e. having a voice in all household decisions and no reason is justified for beating wife) are associated with having more children than desire.

Our study revealed that women empowerment, as measured by a voice in household decision-making, is associated with a low perceived ideal number of children. The findings are consistent with prior studies that report household decision-making is inversely associated with a lower perceived ideal number of children in Guinea [11], Eritrea [27] and Bangladesh [47,48]. However, other studies have found no significant association between household decision-making and women's perceived ideal number of children [17]. The possible reason for this contrast may be the selection of the current sample of women aged 35 years or above. Higher decision-making power with increased age may influence the women to make their own decisions of fertility choice, whereby newly married women usually perform household duties under the primary decision-maker of the family, such as the husband or, in several cases, the mother-in-law [49]. Women with greater decision-making power are expected to possess the agency and capacity to recognise their intentions and thus limit their perceived ideal number of children. Thus, the present findings can assist policymakers in achieving greater gains in reducing fertility preference and the desired fertility choice in the LMRCs. By improving women's decision-making power to secure better food, education and health services, such achievements, can result in a thriving future overall. However, the findings also reveal that women's decision-making power is significantly associated with a higher chance of having more children than desired. This result is in the line with previous studies, where the authors also found that decision-making power is likely to have unmet fertility desire in Namibia [11] and Bangladesh [17]. Earlier studies have explained that the situation in which women are taking sole decision-making power means an absent or non-participating partner. In such a case, the sole decision does not indicate empowerment; instead, it means women carry the entire burden of the household responsibilities [11,26]

Concerning the perceived ideal number of children, negative attitudes towards wife-beating and the right to refuse sex result in a smaller number of children in many African nations [11,17]. The same is reflected in the present study given that all these criteria strengthen women's status in their families. The same outcome is likely for other developing countries in Southeast Asia and Sub-Saharan Africa. Furthermore, after creating a women empowerment index, as assessed by the DHS measure, more empowered women desire significantly fewer kids than women less empowered in four African nations of Burkina Faso, Mali, Niger and Chad [4].

Moreover, a negative attitude towards wife-beating is associated with having more children than desired. Earlier studies have found that negative attitudes towards wife-beating were associated with women’s ability to obtain their preferred family size in Mali [11]. Possible explanations of the contrasting findings may be that the women misunderstand the different hypothetical situations asked during the survey or provide socially desirable responses. Another explanation by Upadhyay and Karasek is that empowered women personally desire smaller families but often fulfil social or family expectations of higher fertility [11]. This paradox may be influenced by the beliefs that children are the sources of old age indemnification, the alternative strength in child death and the prestige to have larger family sizes in certain societies.

Our study also demonstrated that the husband’s perceived ideal number of children is significantly associated with women’s fertility preferences and achievement to maintain their desired fertility. This finding is consistent with the study from the African context where, irrespective of the women’s level of employment, a husband with a smaller ideal number of children ultimately matches women’s fertility preference and achievement of desired family size [11]. A possible explanation is that women are coupled with like-minded men or that spouses confirmed each other’s ideas after marriage [11]. A study in Pakistan found that the empowerment measure substantially affects contraceptive use when couples consider joint decision-making [12]. This finding provides a useful pathway to determine how a husband’s involvement may affect contraception and women’s fertility preference. Knowledge about limiting to the ideal number of children and the corresponding birth interval is essential for males and could be an asset for formulating maternal health policies and family planning programs.

Our study enriches the current literature by using a large sample of 91,070 married women from 53 countries. Thus, the findings are generalisable to women in LMRCs and can assist in creating central-level promotional health policy to reduce fertility preference and achieve fertility desire in LMRCs through equitable gender roles in the decision-making process, increased awareness and motivation. This study is among the first initiatives to investigate the pooled association between women empowerment and their fertility decisions and the ability to achieve their desired fertility in the context of LMRCs. The large dataset provides sufficient power to assess the association between women empowerment and fertility rates. A large pooled dataset also helps justify prior findings in a single or group of countries in a specific region. Furthermore, this study includes the

husband's influence on women's perceived and actual fertility, a factor that is barely considered in earlier studies.

Acknowledging the limitations of the study is of equal importance. First, the DHS explicitly acknowledges the possibilities of a recall bias of retrospective intention measure, such as the ideal number of children [50], which is the primary outcome variable of this analysis. The issue of the ideal number of children is vital in the reproductive analysis; however, given that the answer is self-reported, the quality of data depends on the respondents' honesty, accuracy, and memory volume. Earlier literature has stated that the ideal number of children is upwardly biased because women are reluctant to express a number less than their current number of living children [50]. Another problem of the retrospective ideal number of children could be the danger of rationalisation; for example, an unwanted conception may well become a cherished child. Even though some potential problems are found, results from the earlier survey proved plausible where most of the participants were willing to report unwanted conceptions [36]. Second, researchers have asked questions regarding the validity of DHS empowerment measures because appropriately answering the questions is challenging given the nature of the questions, which are vague and require a quick guess about general trends in decision making [11,51]. Furthermore, these questions focus on whether or not women take part in the decision-making, and their participation is in any way instrumental (i.e. able to influence the outcome) [52]. Attitude towards the justification of wife-beating, another DHS measure, is criticised because it does not necessarily signify approval of the rights for men; rather, it indicates women's acceptance of norms that gives men these rights [52]. Third, pooling data from multiple countries may result in over-generalising findings across socio-cultural settings. Given that the relationships are rooted in different country-specific social factors, the interpretations of the result should be done with care. The significant association of women empowerment and fertility should not be explained as a causal relationship but rather as symptomatic importance of contextual differences across social and cultural groups. This study recommends future country-level quantitative studies and in-depth qualitative analyses to help resolve some of the discrepancies across the region. Fourth, the DHS questionnaire's non-numeric response to the question about the ideal number of children is another concern because several respondents provided a non-numeric response. However, such responses are few, and the biases are assumed to be small.

Conclusion

Our study reveals that high women empowerment leads to small family sizes in LMRCs. Family empowerment in the form of decision-making within the household enhances women’s ability to achieve their desired fertility. Husband’s preference for the ideal number of children, women’s education, marital age and wealth or socio-economic status may significantly reduce women’s fertility preference and achieve improved maternal and child health programs in LMRCs. The family planning programs in developing countries have been implemented by several institutions, such as the Population Council, and International Center for Research on Women. These institutions primarily focus on clinic and hospital-based family planning programs that are further supplemented by the deployment of trained field health workers but need to consider women empowerment as an enabling factor to achieve desired fertility choice. At the national level, the ministry of health and family affairs needs to prepare revised community-based family planning programs, highlighting the importance of women’s autonomy on reproductive health care, as a part of their mission to assist women and couples to have only the number of children they desire. Substantial reduction in the fertility rate could be achieved if women could have the number of children they consider ideal.

Furthermore, as a policy option, to reduce the dependency on their husbands, women empowerment programs, such as control over family resources and access to credit and other institutional supports, should be considered. For instance, the protection of the inherent land rights of women and the re-distribution of government-owned land to poor women that guarantees joint ownership of husband and wife need to be ensured through national-level legal policies. Moreover, adult learning and illiteracy elimination programs, together with access to media targeting married couple, could help achieve fertility desire through overcoming cultural inhibitions and religious opposition towards birth control, thereby attaining gender equality and women empowerment, which are integral to each of the 17 goals of the 2030 Agenda of the UN Resolution.

Abbreviations

LMRCs	Low and Middle Resource Countries
DHS	Demographic Health Survey
NBRM	Negative Binomial Regression Model
IRR	Incidence Rate Ratio
OR	Odd Ratio
CI	Confidence Interval
WHO	World Health Organization

Acknowledgments

We gratefully acknowledge MEASURE DHS for their permission to use the Demographic Health Surveys. We are also grateful to the editors and the reviewers who provided constructive comments to help shape this paper.

Author's contributions

Conceptualized the study: RH, SAK; Contributed data extraction and analyses: RH. Result interpretation: RH. Prepared the first draft: RH, SMR. Contributed during the conceptualization and interpretation of results and substantial revision: RH, KA, SMR, and SAK. Revised and finalized the final draft manuscript: RH, KA, SMR, SAK, and MKA. All authors read and approved the final version of the manuscript.

Ethics approval

Not applicable

Conflict of interest

The authors declare no conflicts of interest.

Funding

The research received no specific grants from any funding agency in the public, commercial or not for profit sectors.

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Data sharing statement

The data used in this study are freely accessible to the public at the DHS website <https://www.dhsprogram.com/Data/>.

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Figure 1. Distribution of Study Participants

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Table 1. Distribution of women ideal number of children across 53 countries

Country	Survey year	Sample size	Women's ideal number of children	
			(Mean)*	SD
Overall			3.89	2.54
African Region			5.71	2.86
<i>Angola</i>	2015-16	715	6.51	2.76
<i>Benin</i>	2017-18	1,351	5.82	2.56
<i>Burkina Faso</i>	2017-18	1,560	6.4	2.23
<i>Burundi</i>	2016-17	1,382	4.13	1.68
<i>Cameroon</i>	2011	997	6.51	3.06
<i>Chad</i>	2014-15	886	7.65	3.61
<i>Comoros</i>	2012	304	5.62	2.68
<i>Côte d'Ivoire</i>	2011-12	707	6.41	2.63
<i>Democratic Republic of Congo</i>	2013-14	1,475	7.14	3.17
<i>Eswatini</i>	2006-07	225	3	1.69
<i>Ethiopia</i>	2016	1,960	5.5	3.14
<i>Gabon</i>	2012	822	5.44	2.62
<i>Gambia</i>	2013	384	6.6	2.61
<i>Ghana</i>	2014	807	5.06	2.08
<i>Kenya</i>	2014	1,638	4.07	1.98
<i>Lesotho</i>	2014	273	3.35	1.62
<i>Liberia</i>	2013	582	5.84	2.72
<i>Madagascar</i>	2008-09	1,620	5.36	2.53
<i>Malawi</i>	2015-16	1,069	4.45	1.75
<i>Mali</i>	2012-13	901	6.44	2.72
<i>Mozambique</i>	2011	668	6.31	2.6
<i>Namibia</i>	2013	671	4.01	2.32
<i>Niger</i>	2012	807	9.99	3.42
<i>Nigeria</i>	2018	2,762	6.49	3.26
<i>Rwanda</i>	2014-15	1,094	4.1	1.82
<i>Sao Tome and Principe</i>	2008-09	319	4.17	1.9
<i>Senegal</i>	2010-11	1,286	5.25	2.2
<i>Sierra Leone</i>	2013	635	5.97	2.59
<i>South Africa</i>	2016	322	3.1	1.51
<i>Togo</i>	2013-14	876	5.1	2.11
<i>Uganda</i>	2016	683	5.99	2.59
<i>Zambia</i>	2018	2,034	5.83	2.27
<i>Zimbabwe</i>	2015	1,064	4.73	1.96
Eastern Mediterranean Region			4.98	2.31
<i>Afghanistan</i>	2015	3,082	5.61	2.34
<i>Jordan</i>	2017-18	1,401	4.17	1.91
<i>Pakistan</i>	2017-18	1,096	4.03	2.08
European Region			2.82	1.19
<i>Albania</i>	2017-18	1,668	2.6	0.95
<i>Armenia</i>	2015-16	607	2.79	0.87
<i>Azerbaijan</i>	2006	776	2.85	1.04
<i>Kyrgyzstan</i>	2012	542	4.43	1.46
<i>Ukraine</i>	2007	730	2.12	0.71
Region of the Americas			2.93	1.69
<i>Bolivia</i>	2008	1,207	2.86	1.72
<i>Colombia</i>	2015	5,859	2.64	1.55
<i>Dominican Republic</i>	2013	1,574	3.42	1.85
<i>Guyana</i>	2009	679	3.23	1.73
<i>Haiti</i>	2016-17	1,515	3.46	1.71
South-East Asian Region			2.52	1.22

<i>Bangladesh</i>	2011	1,123	2.37	0.79
<i>India</i>	2015-16	27,427	2.37	1.06
<i>Indonesia</i>	2017	4,742	2.85	1.22
<i>Myanmar</i>	2015-16	1,230	3.05	1.51
<i>Nepal</i>	2016	912	2.34	0.88
<i>Timor-Leste</i>	2016	904	4.84	2.61
Western Pacific Region			3.73	1.31
<i>Cambodia</i>	2014	1,117	3.73	1.31

*Non-numeric responses considered as a mean ideal number of children

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Table 2. Selected measures among women in matched couples in 53 LMRCs, DHS 2006-2018

Variables	Percentage / Mean
Husbands' ideal number of children (mean)¹	4.64
Decision-making²	
<i>Any voice of women in all three decisions (%)</i>	61.14
<i>Women voice count in household decision (0-3) (mean)</i>	2.23
Attitudes toward wife beating³	
<i>No reason is rationalized for wife beating (%)</i>	57.34
<i>Count of reasons for which wife beating is rationalized (0-5) (mean)</i>	3.8
Gender-related Variables	
<i>Interspousal age difference (mean years)</i>	4.72
<i>Interspousal education difference (mean years)</i>	0.27
<i>Age at first marriage (mean)</i>	19.5
<i>Going to health care center is permitted (%)</i>	83.5
<i>Contraceptive decision</i>	
<i>Wife has taken alone or jointly</i>	91.41
Socio-economic and demographic characteristics	
<i>Residence (%)</i>	
<i>Rural</i>	60.95
<i>Urban</i>	39.05
<i>Household Wealth Index (%)</i>	
<i>poorest</i>	17.46
<i>poor</i>	19.41
<i>middle</i>	19.89
<i>rich</i>	20.86
<i>richest</i>	22.38
<i>Education (%)</i>	
<i>No education</i>	35.96
<i>Primary</i>	26.66
<i>Secondary and more</i>	28.14
<i>Higher</i>	9.23
<i>Polygamous union (%)</i>	
<i>No</i>	88.34
<i>Yes</i>	11.66
<i>No. living children (%)</i>	
<i>0</i>	2.61
<i>1-2</i>	29.88
<i>3-4</i>	34.8
<i>5 & more</i>	32.71
<i>Any media exposure on FP⁴</i>	
<i>no</i>	49.79
<i>yes</i>	50.21
<i>Employment Status</i>	
<i>No work in last 1 year</i>	41.17
<i>At least work in last 1 year</i>	58.83

¹ Non-numeric replies added as mean of preferred number of children.

²Final say of women either alone or jointly with husband regarding own healthcare, household purchase, and family visit and kin.

³Whether a husband is justified in beating his wife if she goes out without telling him, negligent towards their offspring, a quarrel with the male partner, declines

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to engage in sexual relations with the husband or burns the meal.

⁴ Any exposure of media like radio, television and newspaper regarding family planning in last one year

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Table 3. Negative Binomial Regression model examining the association between women's empowerment and the ideal number of children for LMRCs

Dependent Variable: Women Ideal Number of Children	Unadjusted	Adjusted
Women's Empowerment	IRR (95% CI)	IRR (95% CI)
<i>No voice of women in all three decisions (ref)</i>		
<i>Has any voice in three household decision</i>	0.76*** (0.75 - 0.77)	0.92*** (0.91-0.93)
<i>At least one reason is rationalized for wife beating (ref)</i>		
<i>No reason is rationalized for wife beating</i>	0.83*** (0.82 - 0.84)	0.96*** (0.95-0.97)
<u>Husband's Influence</u>		
<i>Husband's preferred number of offspring</i>	1.05*** (1.04 - 1.06)	1.03*** (1.02-1.04)
<u>socio-economic and demographic characteristics</u>		
<i>Age difference</i>	1.02*** (1.01 - 1.03)	0.97*** (0.96-0.98)
<i>Educational difference</i>	1.04*** (1.03 - 1.05)	0.90*** (0.89-0.91)
<i>Age at first marriage</i>	0.98*** (0.97 - 0.99)	0.90*** (0.88-0.92)
<i>Going to health care center is not permitted (ref)</i>		
<i>Going to health care center is permitted</i>	0.84*** (0.83 - 0.85)	0.95*** (0.94-0.96)
Women education		
<i>No education (ref)</i>		
<i>Primary</i>	0.84*** (0.83 - 0.85)	0.97*** (0.96-0.98)
<i>Secondary</i>	0.64*** (0.63 - 0.65)	0.90*** (0.89-0.91)
<i>Higher</i>	0.57*** (0.56 - 0.58)	0.90*** (0.88-0.92)
Residence type		
<i>Urban (ref)</i>		
<i>Rural</i>	1.29*** (1.28 - 1.3)	1.01* (0.99-1.02)
Wealth Index		
<i>Poorest (ref)</i>		
<i>poor</i>	0.91*** (0.90 - 0.92)	0.98*** (0.97-0.99)
<i>Middle</i>	0.85*** (0.84 - 0.86)	0.97*** (0.96-0.98)
<i>Rich</i>	0.79*** (0.78 - 0.80)	0.97*** (0.96-0.98)
<i>Richest</i>	0.69*** (0.68 - 0.70)	1.01*** (0.99-1.02)
Role of media on family planning (Radio, Television or Newspaper)		
<i>No exposure (ref)</i>		
<i>At least any exposure</i>	0.79*** (0.78 - 0.80)	0.93*** (0.92-0.94)
Polygamous Union		
<i>No (ref)</i>		
<i>Yes</i>	1.60*** (1.58 - 1.62)	1.11*** (1.10-1.12)
Employment Status		
<i>No work in the preceding year (ref)</i>		
<i>At least work in preceding year</i>	1.16*** (1.15 - 1.17)	1.10*** (1.09-1.11)

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Women Living Children		
<i>No children (ref)</i>		
<i>1-2</i>	0.85*** (0.83 - 0.88)	0.91*** (0.88-0.93)
<i>3-4</i>	1.20*** (1.17 - 1.24)	1.19*** (1.16-1.23)
<i>5+</i>	1.88*** (1.83 - 1.93)	1.58*** (1.54-1.62)
Wife contraceptive decision		
<i>No decision (ref)</i>		
<i>At least any decision</i>	0.90*** (0.88 - 0.91)	0.95*** (0.94-0.97)

***p < 0.001, **p < 0.01. *p < 0.05.
Abbreviations: ref Reference; IRR Incidence Rate Ratio; CI Confidence Interval

Table 4. Multivariable logistic regression analysis examining the association between women's empowerment and ability to achieve fertility preference for LMRCs

Dependent Variable: Women's ability to achieve fertility desire	Adjusted OR (95% CI)
Women's Empowerment	
<i>No voice of women in all three decisions (ref)</i>	
<i>Has any voice in three household decision</i>	1.12*** (1.08- 1.16)
<i>At least one reason is rationalized for wife beating (ref)</i>	
<i>No reason is rationalized for wife beating</i>	1.08*** (1.05- 1.12)
Husband's Influence	
<i>Husband-wife match with preferred offspring (ref)</i>	
<i>Husband desire higher preferred offspring than wife</i>	3.50*** (3.37- 3.63)
<i>Husband desire lower preferred offspring than wife</i>	0.68*** (0.65- 0.71)
Socio-economic and demographic characteristics	
<i>Age difference</i>	0.97*** (0.97- 0.98)
<i>Educational difference</i>	1.01 (0.99- 1.03)
<i>Age at first marriage</i>	0.93*** (0.92- 0.93)
<i>Going to health care center is not permitted (ref)</i>	
<i>Going to health care center is permitted</i>	1.09*** (1.05- 1.14)
Women education	
<i>No education (ref)</i>	
<i>Primary</i>	0.93*** (0.89- 0.97)
<i>Secondary</i>	0.64*** (0.60- 0.67)
<i>Higher</i>	0.37*** (0.33- 0.40)
Residence type	
<i>Urban (ref)</i>	
<i>Rural</i>	1.06** (1.02- 1.10)
Wealth Index	
<i>Poorest (ref)</i>	
<i>poor</i>	0.96 (0.92- 1.02)
<i>Middle</i>	0.97 (0.92- 1.02)
<i>Rich</i>	0.94* (0.89- 0.99)
<i>Richest</i>	0.84*** (0.79- 0.89)
Role of media on family planning (Radio, Television or Newspaper)	
<i>No exposure (ref)</i>	
<i>At least any exposure</i>	1.09*** (1.06- 1.13)
Polygamous Union	
<i>No (ref)</i>	
<i>Yes</i>	0.42*** (0.40- 0.44)
Employment Status	
<i>No work in the preceding year (ref)</i>	
<i>At least work in preceding year</i>	0.92*** (0.89- 0.95)
Wife contraceptive decision	
<i>No decision (ref)</i>	
<i>At least any decision</i>	1.16*** (1.10- 1.23))

***p < 0.001, **p < 0.01. *p < 0.05.

Abbreviations: ref Reference; OR: Odd Ratio; CI Confidence Interval

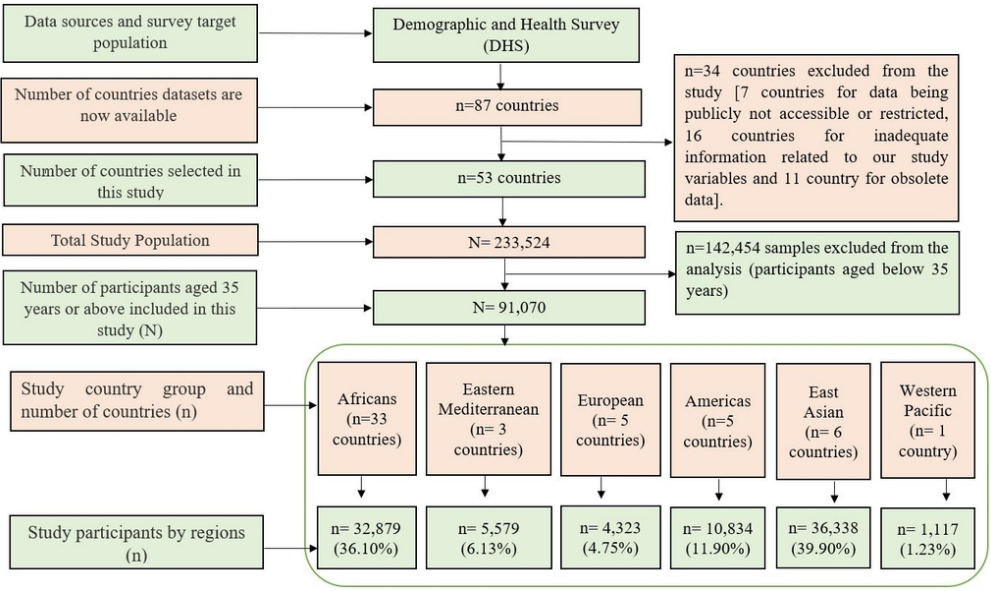


Figure 1. Distribution of Study Participants

86x51mm (300 x 300 DPI)

Appendix 1. Negative Binomial Regression model examining the association between women's empowerment and the ideal number of children for LMRCs (By Region)¹

Dependent Variable: Women Ideal Number of Children	African Region	Eastern Mediterranean Region	European Region	Americans Region	South East Asia	Western Pacific
	Adjusted	Adjusted	Adjusted	Adjusted	Adjusted	Adjusted
	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)
Women's Empowerment						
No voice of women in all three decisions (ref)						
Has any voice in three household decision	0.94*** (0.93-0.95)	0.95*** (0.92-0.97)	1.06* (1.01-1.11)	0.94*** (0.90-0.98)	1.02* (1.01-1.03)	1.04 (0.94-1.14)
At least one reason is rationalized for wife beating (ref)						
No reason is rationalized for wife beating	0.96*** (0.95-0.97)	0.89*** (0.86-0.93)	0.93*** (0.89-0.98)	1.01 (0.96-1.06)	1.01*** (0.95-0.98)	1.03 (0.97-1.10)
Husband Influence						
Husband's preferred number of offspring	1.02*** (1.01-1.03)	1.02*** (1.01-1.03)	1.04*** (1.03-1.06)	1.04*** (1.03-1.05)	1.07*** (1.06-1.08)	1.03*** (1.01-1.06)

***p < 0.001, **p < 0.01. *p < 0.05.

Abbreviations: ref Reference; IRR Incidence Rate Ratio; CI Confidence Interval

¹Only exposure variables are reported in this analysis. The model is adjusted with age difference, education difference, age at first marriage, getting permission to health care is a problem, women's education, residence type, wealth index, polygamous Union any media exposure to family planning, women working status, women living children and women's decision in contraceptive use

Appendix 2. Multivariable logistic regression analysis examining the association between women’s empowerment and ability to achieve fertility preference for LMRCs (By Region)²

	African Region	Eastern Mediterranean Region	European Region	Americans Region	South East Asia	Western Pacific
Dependent Variable: Women’s ability to achieve fertility desire	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Women's Empowerment						
No voice of women in all three decisions (ref)						
Has any voice in three household decision	1.21*** (1.15-1.28)	1.16* (1.02-1.33)	0.95 (0.72-1.26)	1.11 (0.95-1.30)	0.98 (0.89-0.99)	0.91 (0.57-1.45)
At least one reason is rationalized for wife beating (ref)						
No reason is rationalized for wife beating	1.01 (0.95-1.05)	1.27*** (1.08-1.50)	0.64*** (0.50-0.83)	1.12 (0.92-1.36)	1.14*** (1.08-1.19)	0.56*** (0.40-0.77)
Husband’s Influence						
Husband-wife match with preferred offspring (ref)						
Husband desire higher preferred offspring than wife	2.4*** (2.24-2.57)	5.11*** (4.29-6.09)	9.85*** (7.33-13.23)	1.90*** (1.57-2.30)	5.12*** (4.84-5.42)	4.88*** (3.45-6.91)
Husband desire lower preferred offspring than wife	0.59*** (0.55-0.64)	0.76** (0.63-0.92)	0.66 (0.42-1.04)	0.28*** (0.23-0.34)	0.65*** (0.61-0.70)	0.50*** (0.32-0.81)

***p < 0.001, **p < 0.01. *p < 0.05.

Abbreviations: ref Reference; OR: Odd Ratio; CI Confidence Interval

²Only exposure variables are reported in this analysis. The model is adjusted with age difference, education difference, age at first marriage, getting permission to health care is a problem, women's education, residence type, wealth index, polygamous Union any media exposure to family planning, women working status, and women's decision in contraceptive use

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8, 9
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Bias	9	Describe any efforts to address potential sources of bias	7
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7-9
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	9-10
		(b) Describe any methods used to examine subgroups and interactions	N/A
		(c) Explain how missing data were addressed	N/A
		(d) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	31, 32
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	23
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7-9
		(b) Indicate number of participants with missing data for each variable of interest	7-9

Outcome data	15*	Report numbers of outcome events or summary measures	7-9
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11-13
		(b) Report category boundaries when continuous variables were categorized	11-13
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	31-32
Discussion			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15-16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15
Generalisability	21	Discuss the generalisability (external validity) of the study results	15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.