# Regional Disparities and Determinants of Anemia and Modern Contraceptive Use among Women in Myanmar

## Further Analysis of the Myanmar Demographic and Health Survey 2015-16

DHS Further Analysis Reports No. 126

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June 2019

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**Acknowledgments:** We would like to express our thanks to USAID for funding support and ICF for the Myanmar DHS Further Analysis Program, which is implemented by The Demographic and Health Surveys Program. We especially thank Dr. Thet Thet Mu, Deputy Director-General (HMIS), Department of Public Health, Ministry of Health and Sports, for facilitating the entire process from the very beginning. We appreciate the cofacilitator, Dr. Elma Laguna, for her assistance. Special thanks also to Professor Khay Mar Mya, Former Rector of The University of Public Health, Yangon, for the kind support of our research.

Editor: Diane Stoy
Document Production: Joan Wardell

This report presents findings from a further analysis that was undertaken as part of the follow-up to the 2015-16 Myanmar Demographic and Health Survey (MDHS). ICF provided technical assistance for the project. This report is a publication of The DHS Program, which is designed to collect, analyze, and disseminate data on fertility, family planning, maternal and child health, nutrition, and HIV/AIDS. Funding was provided by the U.S. Agency for International Development (USAID) through the DHS Program (#AID-OAA-C-13-00095). The opinions expressed here are those of the authors and do not necessarily reflect the views of USAID and other cooperating agencies.

The 2015-16 MDHS was implemented by the Ministry of Health and Sports of the Republic of the Union of Myanmar. Funding for the survey was provided by USAID and the Three Millennium Development Goal Fund (3MDG). ICF provided technical assistance through The DHS Program, which assists countries in the implementation of population and health surveys in countries worldwide.

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Recommended citation:

Ko Ko, Min, Hla Hla Win, and Kerry L. D. MacQuarrie. 2019. *Regional Disparities and Determinants of Anemia and Modern Contraceptive Use among Women in Myanmar. Further Analysis of the Myanmar Demographic and Health Survey 2015-16*. DHS Further Analysis Reports No. 126. Rockville, Maryland, USA: ICF.

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# ABSTRACT

Geographic disparities are an important consideration in the health equity of a country. Understanding regional disparities, the determinants of anemia, and the use of modern contraception by women of reproductive age would help to reduce the anemic burden, unwanted pregnancy, and related deaths. The aim of this study is to determine regional disparities and determinants of anemic health outcomes and use of modern contraception methods by women of reproductive age in Myanmar. The study is a secondary analysis that used cross-sectional data from the 2015-16 Myanmar Demographic and Health Survey. The unit of analysis for the anemic outcome is based on weighted samples of 12,489 eligible women of reproductive age (age 15-49). Analysis of modern contraception use was restricted to a weighted sample of 12,419 women age 15-49 who were not currently pregnant.

The findings show that there are regional disparities in anemia and use of modern contraception within geographical zones, and that the disparities across States and Regions in Myanmar were especially large. Rakhine State in the Coastal zone was the most vulnerable region for anemic disparities (55.4%), while women of Chin State (17.5%) in the Hilly zone and Rakhine State (23%) in the Coastal zone were the least likely to use modern contraception. The determinants for anemia were biological and factors related to pregnancy, and not socioeconomic factors. Determinants of the use of modern contraception methods were region, age, education, marital status, wealth, and number of children. Regional disparities in anemia health outcomes and the low use of modern contraception methods remain major public health problems in Myanmar.

The study recommends qualitative research that would explore food patterns and nutrient contents of households in the assessment of anemia status and cultural perspectives on family planning methods among communities in the different geographic areas. Providing iron tablets for women of reproductive age and all pregnant women would be the easiest, most effective way to prevent anemia in women. Investments in family planning and maternal and child health care services that focus on vulnerable areas in Myanmar would be a better solution for narrowing the geographic disparities in Myanmar.

**Key words:** Anemia, contraception, geographic disparity, modern methods, women of reproductive age, determinants, Myanmar

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| BMI | body mass index |
| CEB | children ever born |
| CI | confidence interval |
| DHS | Demographic and Health Survey |
| FP | family planning |
| IUD | intrauterine contraceptive device |
| LAM | lactational amenorrhea method |
| MDHS | Myanmar Demographic and Health Survey |
| MDG | Millennium Development Goal |
| OR | odds ratio |
| SDG | Sustainability Development Goal |
| SEAR | South East Asia Region |
| WHO | World Health Organization |

# 1 INTRODUCTION

## 1.1 Regional Disparities and Health

Myanmar, the largest country in mainland Southeast Asia, is classified by the World Bank as a "least developed country" (World Bank 2018). The latest census in 2014 reported a population in Myanmar estimated at 51.5 million, of which 70% live in rural and 30% in urban settings (Department of Population 2015).

The administrative structure divides Myanmar into 15 administrative units including Nay Pyi Taw, the capital, seven States, and seven other Regions, while there are four geographic zones in Myanmar. In general, Regions and Nay Pyi Taw are located in the central lowland and delta areas, while most of the States are located in the hilly and border areas. The Regions have a relatively large Burmese ethnic group, while the States have relatively large non-Burmese ethnic populations (Department of Population 2015).

Despite the country's abundant natural resources and local development plans, there are socioeconomic inequalities and poverty within and among the States and Regions in Myanmar. Demographic data have identified regional disparities in health outcomes, with some States and Regions lagging behind (Min Ko Ko and Sawaengdee 2014). The 2015-16 Myanmar Demographic and Health Survey (MDHS) and the 2014 Myanmar Census found a large socioeconomic gap within and among Regions (Department of Population 2015; Ministry of Health and Sports and ICF 2016).

A 2014 health system review of the country by the World Health Organization (WHO) and the Asia Pacific Observatory on Health Systems and Policies noted, "Addressing health inequities is of paramount importance for Myanmar, needing a major reform that will ensure health care services reach the poor and the disadvantaged groups, minority groups in particular, and in conflict-affected and hard-to-reach areas" (WHO and Asia Pacific Observatory on Health Systems and Policies 2014). Advocates have argued that addressing health equity is a necessary strategy for achieving international health targets, such as those in the Millennium Development Goals (MDGs) (Gwatkin 2002; Tugwell 2007; Wirth et al. 2006). In response, the successor global goals, the Sustainability Development Goals (SDGs), emphasize equity (Marmot and Bell 2018). Regional disparities are an important dimension of health equity (Burgert-Brucker, Yourkavitch, Assaf, and Delgado 2015; Burgert-Brucker, Dontamsetti, Marshall, and Gething 2016; Wirth et al. 2006).

## 1.2 Anemia

In developing countries, anemia among women of reproductive age is a public health problem that has long-term consequences to health, social, and economic development if not addressed. Despite the availability of preventive approaches, anemia continues to be a global public health problem in both developed and developing countries (Hakizimana 2016; SPRING and Ghana Health Service 2016; WHO 2014).

The WHO defines anemia as *"a condition in which the number of red blood cells (and consequently their oxygen-carrying capacity) is insufficient to meet the body's physiologic need."* Anemia has also been defined as hemoglobin concentrations that are below recommended thresholds (≥ 120 g/dl for reproductive women) (WHO 2011a, 2014).

In 2011, 29% of non-pregnant women and 38% of pregnant women age 15-49 worldwide were anemic. The WHO estimates that 12.8% of maternal deaths in Asia are related to anemia (WHO 2016). In the South East Asia Region (SEAR), the WHO estimated that in 2011, over 200 million women of reproductive age were anemic, including 191 million non-pregnant women (41.5%) and 11.5 million pregnant women (WHO 2016). Since anemia affects half a billion women of reproductive age worldwide, the WHO created a target of 50% reduction of anemia in women of reproductive age by 2025 (WHO 2014).

Anemia has important health implications, especially for children and mothers, and for human capital development. Research has shown that anemia among women of reproductive age contributes to a higher risk of unfavorable pregnancy outcomes such as premature birth and low birth weight (Hakizimana 2016; Siddiqui et al. 2017; Yasutake et al. 2013). Individuals with anemia generally experience fatigue, which affects productivity at work and, ultimately, a country's socioeconomic development (WHO 2011a; Yasutake et al. 2013).

The disparities in anemia prevalence between developed and developing countries are large. The burden of anemia is not uniformly distributed across regions or countries in the world (Balarajan, Fawzi, and Subramanian 2013; Greffeuille et al. 2016; Lakew, Biadgilign, and Haile 2014; Siddiqui et al. 2017). The prevalence of anemia was the highest in south Asia and central and west Africa (WHO 2014).

According to the 2015-16 MDHS, 47% of women in Myanmar are anemic (Ministry of Health and Sports and ICF 2016). Women in Rakhine State and Tanintharyi Region have an anemia prevalence of 55%. The prevalence of anemia varies considerably by numerous factors such as age, sex, education, socioeconomic status, region and residence, as well as reproductive and obstetric factors (Alemu and Umeta 2015; Bwalya and Alebachew 2012; Gebremedhin and Enquselassie 2011; Hakizimana 2016; Lakew, Biadgilign, and Haile 2014; Siddiqui et al. 2017; WHO 2016; Wilunda, Massawe, and Jackson 2013).

Like other countries, anemia in Myanmar continues to be challenging, with a high burden for women of reproductive age. Disparities in health outcomes reflect the health system of Myanmar, where there has been slow progress in achieving universal health coverage, greater accessibility to health services, and improvement in socioeconomic status.

## 1.3 Modern Contraceptive Use

The health and wellbeing of women of reproductive age have a major impact on key indicators of mortality, as well as the social and ecological development of a country. Family planning (FP) prevents unwanted pregnancies and reduces the need for abortion (WHO 2011b; Worku, Tessema, and Zeleke 2015). The FP methods are classified as either modern or traditional. Modern methods include female sterilization, male sterilization, intrauterine contraceptive device (IUD), implants, injectables, the pill, condoms, and the lactational amenorrhea method (LAM). Methods such as rhythm, withdrawal, and folk methods are grouped together as traditional methods (Ministry of Health and Sports and ICF 2016). Modern methods have been shown to be more effective at preventing unwanted pregnancies than traditional methods (Hatcher et al. 2011), and have been widely acknowledged to be one of the most cost-effective strategies for promoting reproductive health and fostering socioeconomic development around the world (Aviisah et al. 2018; Wang and Cao 2019).

In 2017, the global contraceptive prevalence rate among women of reproductive age who are married or in a union in the FP2020 focus countries was 45.7%. Between 2012 and 2017, the number of women of reproductive age who are married or in a union and who use modern methods increased by 28.8 million (Cahill et al. 2018). Providing access to affordable FP methods is a key step in helping countries move toward a demographic transition in which both fertility and mortality rates decline (O'Regan and Thompson 2017). Regional disparities continue to persist with low FP use, which is a critical public health challenge for fast-growing populations in developing countries such as Nigeria (Wang and Cao 2019; NPC and ICF International 2013), Cameroon (Edietah et al. 2018), Ethiopia (Worku, Tessema, and Zeleke 2015) and Myanmar (Ministry of Health and Sports and ICF 2016).

Although there has been an increase in FP and contraceptive use over the last few decades, the number of women using modern contraceptives remains low in Myanmar, where 52% of currently married women use FP, with 51% using a modern method and 1% a traditional method. Regional disparities show that use of contraception is highest in Yangon Region, followed by Bago Region and Nay Pyi Taw, and is lowest in Chin State (Ministry of Health and Sports and ICF 2016).

There are many factors that determine the use of FP among women of reproductive age such as place of residence, religion, educational status of a woman, wealth index, partner, educational level, television as source of information, health education by FP workers, home ownership, spouse approval, desire for children, ideal family size, fertility preference, woman's age, type of earnings, religion, ethnicity, women's empowerment, and radio and newspapers/magazines as sources of information (Assaf and Davis 2019; Aviisah et al. 2018; Edietah et al. 2018; Kidayi et al. 2015; O'Regan and Thompson 2017; Worku, Tessema, and Zeleke 2015).

## 1.4 Study Purpose and Rationale

Greater understanding of the regional disparities in and determinants of anemia or modern contraception use can help to identify innovative, evidence-based interventions. This potential led to the researchers' interest in examining the regional disparities and determining factors in anemia and modern contraceptive use in women of reproductive age, age 15-49, in Myanmar.

The 2015-16 MDHS, the first DHS in Myanmar, is a rich source of demographic information. Since there is no research on anemia among women of reproductive age in Myanmar with nationally representative samples using the MDHS, this further analysis of regional disparities attempts to fill the information gaps. The findings of this further analysis will guide the development of appropriate policies for regional development and potential programs that provide priority-based interventions in public health.

The objectives of this study were to:

- determine the regional disparities in anemia health outcomes
- examine the determinants of anemia
- determine regional disparities in the use of modern contraceptive methods
- examine the determinants of modern contraceptive use among women of reproductive age in Myanmar.

# 2 MATERIALS AND METHODS

## 2.1 Data and Methods

The data for this study were taken from the 2015-16 MDHS, which collected information about social, behavioral, and demographic indicators, including health status and reproductive health issues, from women age 15-49 and men age 15-59. The MDHS, the first DHS in Myanmar, is a nationally representative survey conducted by the Myanmar Ministry of Health and Sports and supported by USAID and ICF (Ministry of Health and Sports and ICF 2016). The MDHS collected representative data from all Regions in Myanmar. This study used a cross-sectional study design with secondary data analysis. Access to the recode data files for STATA was approved by USAID and ICF.

The unit of analysis in the study was women of reproductive age, age 15-49. The analysis was based on weighted samples of 12,489 age-eligible women from the 15 States and Regions in Myanmar. The analysis of modern contraceptive use was restricted to women who were not currently pregnant, which yielded a sample of 12,419 women age 15-49.

### 2.1.1 Measure of anemia

Anemia in this study is defined by the MDHS as a blood hemoglobin level below 12.0 g/dl in non-pregnant women of reproductive age 15-49. Anemia was measured using capillary blood collected from a finger prick.

The outcome variable is *anemia status*, which is dichotomous as anemic or not. The study used two dichotomous variables where "0" denoted no anemia and "1" as anemia based on the DHS definition (Ministry of Health and Sports and ICF 2016).

### 2.1.2 Measure of modern contraceptive use

Modern contraceptive use is defined by the MDHS as the number of women age 15-49 who say they have used at least one of the following methods: male and female sterilization, injectables, IUDs, contraceptive pills, implants, male condoms, and the LAM. The outcome variable is dichotomous with '0' denoting non-use or '1' use of a modern FP method.

### 2.1.3 Predictor variables

The main predictor variable, *region*, is determined by a categorical variable. In Myanmar, administrative areas are composed of 15 States and Regions. In this analysis, the *region* variable is recoded into four geographical zones: *Hilly, Coastal, Delta,* and *Central Plain* zones. The *Hilly* zone includes Shan State, Kachin State, Kayin State, Chin State, and the Kayah State. The *Coastal* zone includes Mon State, Rakhine State, and Tanintharyi Region. The *Delta* zone includes Yangon Region, Ayeyarwady Region, and Bago Region. The *Central Plain* zone includes Mandalay Region, Magway Region, Sagaing Region, and Nay Pyi Taw, the capital. Secondly, the analysis measures region as a categorical with each of the 15 States and Regions, for a more detailed examination of regional disparities.

The independent variables are household characteristics (*residence* and *wealth status*) and individual characteristics such as *age, educational status, marital status,* and *employment status.* The analysis of anemia has two additional individual characteristics*: body mass index* (underweight: <18.5, normal: 18.50–24.99, overweight: 24.99–<30, obese: ≥30.00), and *pregnancy status*. The analysis of modern contraceptive use has one additional individual characteristic: *number of children*. All independent variables were analyzed as categorical variables.

## 2.2 Analytical Strategy

Data analysis was conducted with STATA 15. Missing values were checked and the samples were weighted. Background characteristics were analyzed initially by descriptive statistics on regional disparities in anemic health and modern contraceptive use.

To identify the determinants of the study's two health outcomes—anemia and modern contraceptive use—among women of reproductive age in Myanmar, odds ratios (ORs) and 95% confidence intervals (CI) were estimated by using binary logistic regression with both unadjusted and adjusted OR methods. All test statistics were two-sided with a p-value of less than 0.05 considered as statistically significant.

## 2.3 Ethical Considerations

The MDHS data, like other DHS survey data, are publicly available free of charge from The DHS Program. The study authors registered to use the recode data files of the 2015-16 MDHS with STATA after receiving approval from The DHS Program. The original DHS data were collected in accordance with international and national ethical guidelines.

# 3 REGIONAL DISPARITIES IN ANEMIA

## 3.1 Background Characteristics

A total of 12,489 women of reproductive age were included in the study. Women from Yangon Region (n= 1,861) were the largest group, followed by women from Ayeyarwady Region (n= 1,598) and Sagaing Region (1,376). The lowest number of women came from Chin State (100) and Kayah State (63).

In all States and Regions, the majority of women were living in rural settings except for women from Yangon Region, where a higher proportion of women lived in urban areas (70.3% versus 29.7%). The majority of the women were younger than age 40, currently married, had a normal body mass index (BMI), were not pregnant, and had no children. The highest proportion of underweight women was found in Bago Region (21.7%) and Rakhine State (19.1%).

Regional differentials in education status were found in Myanmar, particularly in States where most women had an education level of primary or below such as in Rakhine State (69.5%), Shan State (67.3%) and Kayin State (59.1%). Women in Rakhine State (53.3%) and Kayin State (52.3%) were not currently employed, while there were more women from other Regions who were currently working. With wealth quintile, Rakhine State and Ayeyarwady Region had the highest proportion of women in the poorest quintile (50.5% and 38.1%) and the lowest proportion in the richest quintile (4.7% and 7.5%). The detailed findings are found in Table 1.

**Table 1 Background characteristics of the study population for anemia by States and Regions (n= 12,489)**

| | Hilly | | | | | | | | | | Coastal | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Chin n= 100 | | Kachin (n= 363) | | Kayah (n= 63) | | Kayin (n= 295) | | Shan (n= 1275,) | | Mon (n= 449) | | Rakhine (n= 740) | | Tanintharyi (n= 280) | |
| **Variables** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** |
| **Residence** | | | | | | | | | | | | | | | | |
| Urban | 25.3 | (25) | 34.2 | (124) | 26.3 | (17) | 23.4 | (68) | 25.5 | (324) | 29.7 | (133) | 13.2 | (98) | 24.2 | (68) |
| Rural | 74.7 | (75) | 65.8 | (239) | 73.7 | (46) | 76.6 | (226) | 74.5 | (951) | 70.3 | (316) | 86.8 | (643) | 75.8 | (212) |
| **Age** | | | | | | | | | | | | | | | | |
| <40 years | 73.5 | (74) | 73.4 | (267) | 73.4 | (47) | 72.4 | (213) | 78.5 | (1,000) | 67.5 | (303) | 78.3 | (580) | 74.6 | (209) |
| 40 years and above | 26.5 | (27) | 26.6 | (97) | 24.6 | (16) | 27.6 | (81) | 21.5 | (275) | 32.5 | (146) | 21.7 | (161) | 25.4 | (71) |
| **Educational status** | | | | | | | | | | | | | | | | |
| Primary and below | 43.9 | (44) | 41.1 | (149) | 45.8 | (29) | 59.1 | (174) | 67.3 | (857) | 49.1 | (220) | 69.5 | (515) | 49.0 | (137) |
| Above primary | 56.1 | (56) | 58.9 | (214) | 54.2 | (34) | 40.9 | (121) | 32.7 | (417) | 50.9 | (229) | 30.5 | (226) | 51.0 | (143) |
| **Marital status** | | | | | | | | | | | | | | | | |
| Not married | 35.0 | (35) | 36.1 | (132) | 38.1 | (24) | 33.0 | (97) | 34.0 | (432) | 39.7 | (178) | 41.0 | (303) | 38.5 | (108) |
| Currently married | 65.0 | (65) | 63.9 | (232) | 61.9 | (39) | 67.0 | (196) | 66.0 | (843) | 60.3 | (271) | 59.0 | (437) | 61.5 | (172) |
| **Employment** | | | | | | | | | | | | | | | | |
| No currently working | 34.1 | (34) | 41.8 | (152) | 41.0 | (26) | 52.3 | (154) | 21.7 | (277) | 41.3 | (185) | 53.3 | (394) | 38.7 | (108) |
| Currently working | 65.9 | (66) | 58.2 | (211) | 59.0 | (37) | 47.7 | (140) | 78.3 | (998) | 58.7 | (264) | 46.7 | (345) | 61.3 | (171) |
| **BMI**** | | | | | | | | | | | | | | | | |
| Underweight | 8.4 | (8) | 9.9 | (36) | 8.7 | (5) | 13.1 | (38) | 7.8 | (98) | 13.9 | (63) | 19.1 | (141) | 15.6 | (43) |
| Normal | 76.5 | (76) | 61.9 | (224) | 71.6 | (45) | 61.0 | (180) | 67.3 | (854) | 57.8 | (260) | 66.9 | (494) | 57.9 | (162) |
| Overweight | 13.8 | (14) | 21.1 | (76) | 14.9 | (9) | 19.4 | (57) | 18.6 | (236) | 20.1 | (90) | 12.3 | (91) | 21.4 | (60) |
| Obese | 1.2 | (1) | 7.1 | (26) | 4.7 | (3) | 6.5 | (19) | 6.3 | (80) | 8.2 | (37) | 1.7 | (13) | 5.1 | (14) |
| **Wealth quintile** | | | | | | | | | | | | | | | | |
| Poorest | 21.1 | (21) | 11.5 | (42) | 10.5 | (7) | 22.9 | (68) | 17.0 | (217) | 19.5 | (88) | 50.5 | (374) | 22.1 | (62) |
| Poorer | 27.8 | (28) | 19.4 | (70) | 19.1 | (12) | 17.9 | (53) | 20.5 | (262) | 15.2 | (68) | 21.0 | (156) | 20.8 | (58) |
| Middle | 25.6 | (26) | 23.1 | (84) | 23.3 | (15) | 16.5 | (49) | 17.0 | (216) | 16.9 | (76) | 14.5 | (109) | 18.1 | (51) |
| Richer | 14.3 | (14) | 25.3 | (92) | 30.8 | (19) | 22.4 | (66) | 21.5 | (275) | 22.8 | (103) | 9.0 | (66) | 21.0 | (59) |
| Richest | 11.2 | (11) | 20.7 | (75) | 16.2 | (10) | 20.3 | (60) | 24.0 | (306) | 25.5 | (115) | 4.7 | (35) | 18.0 | (50) |
| **Pregnancy status** | | | | | | | | | | | | | | | | |
| Not currently pregnant | 93.5 | (94) | 94.0 | (341) | 95.2 | (60) | 94.9 | (280) | 95.7 | (1,221) | 96.2 | (432) | 94.9 | (703) | 96.0 | (269) |
| Currently pregnant | 6.5 | (7) | 6.0 | (22) | 4.8 | (3) | 5.1 | (15) | 4.3 | (54) | 3.8 | (17) | 5.1 | (37) | 4.0 | (11) |
| **Number of children ever born** | | | | | | | | | | | | | | | | |
| 0 | 33.9 | (34) | 34.3 | (125) | 36.8 | (23) | 31.2 | (92) | 32.8 | (418) | 41.1 | (184) | 40.1 | (297) | 37.5 | (105) |
| 1 | 10.8 | (11) | 15.2 | (55) | 13.8 | (9) | 13.0 | (38) | 17.5 | (223) | 13.3 | (60) | 16.7 | (123) | 13.5 | (38) |
| 2-3 | 19.3 | (19) | 29.5 | (107) | 27.3 | (17) | 29.6 | (87) | 32.9 | (419) | 26.6 | (120) | 23.5 | (174) | 26.6 | (74) |
| 4-5 | 17.4 | (17) | 13.8 | (50) | 11.7 | (7) | 18.3 | (54) | 11.5 | (147) | 12.0 | (54) | 10.7 | (79) | 13.6 | (38) |
| 6+ | 18.4 | (18) | 7.2 | (26) | 10.3 | (6) | 7.9 | (23) | 5.3 | (68) | 7.1 | (32) | 9.1 | (67) | 8.7 | (24) |

*Continued...*

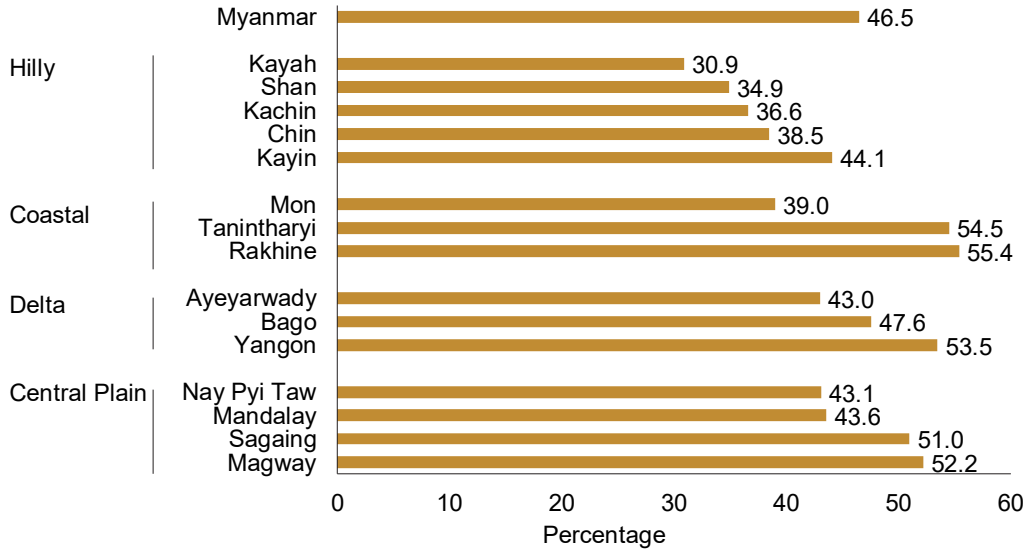
**Table 1—*Continued***

| | Delta | | | | | | Central Plain | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ayeyarwady (n= 1598) | | Bago (n= 1239) | | Yangon (n= 1861) | | Magway (n= 1062) | | Mandalay (n= 1496) | | Nay Pyi Taw (n= 290) | | Sagaing (n= 1376) | |
| **Variables** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** |
| **Residence** | | | | | | | | | | | | | | |
| Urban | 15.5 | (248) | 19.8 | (245) | 70.3 | (1,309) | 14.5 | (154) | 27.6 | (412) | 30.5 | (88) | 17.4 | (239) |
| Rural | 84.5 | (1,350) | 80.2 | (994) | 29.7 | (552) | 85.5 | (909) | 72.4 | (1,084) | 69.5 | (201) | 82.6 | (1,136) |
| **Age** | | | | | | | | | | | | | | |
| <40 years | 74.1 | (1,184) | 74.0 | (917) | 74.0 | (1,375) | 71.3 | (757) | 73.6 | (1,101) | 74.3 | (215) | 72.2 | (992) |
| 40 years and above | 25.9 | (414) | 26.0 | (323) | 26.0 | (486) | 28.7 | (305) | 26.4 | (395) | 25.7 | (74) | 27.8 | (383) |
| **Educational status** | | | | | | | | | | | | | | |
| Primary and below | 59.5 | (950) | 50.6 | (628) | 36.0 | (669) | 57.7 | (612) | 54.8 | (820) | 55.9 | (162) | 56.5 | (777) |
| Above primary | 40.5 | (648) | 49.4 | (612) | 64.0 | (1,192) | 42.3 | (449) | 45.2 | (676) | 44.1 | (128) | 43.5 | (599) |
| **Marital status** | | | | | | | | | | | | | | |
| Not married | 34.0 | (544) | 37.2 | (461) | 46.0 | (854) | 40.4 | (429) | 45.6 | (683) | 34.8 | (101) | 40.7 | (560) |
| Currently married | 66.0 | (1,055) | 62.8 | (779) | 54.0 | (1,007) | 59.6 | (633) | 54.4 | (814) | 65.2 | (189) | 59.3 | (816) |
| **Employment** | | | | | | | | | | | | | | |
| No currently working | 34.6 | (553) | 31.2 | (387) | 47.1 | (877) | 21.1 | (224) | 15.1 | (226) | 34.3 | (99) | 35.5 | (488) |
| Currently working | 65.4 | (1,045) | 68.8 | (853) | 52.9 | (984) | 78.9 | (838) | 84.9 | (1,270) | 65.7 | (190) | 64.5 | (888) |
| **BMI**** | | | | | | | | | | | | | | |
| Underweight | 17.5 | (280) | 21.7 | (269) | 11.7 | (216) | 18.1 | (192) | 17.1 | (255) | 16.0 | (46) | 12.9 | (177) |
| Normal | 59.6 | (951) | 55.5 | (686) | 55.1 | (1,021) | 63.0 | (669) | 60.9 | (911) | 61.4 | (178) | 58.4 | (803) |
| Overweight | 17.7 | (283) | 18.5 | (229) | 25.5 | (472) | 16.4 | (174) | 16.6 | (248) | 16.5 | (48) | 22.4 | (309) |
| Obese | 5.1 | (82) | 4.3 | (53) | 7.8 | (145) | 2.5 | (27) | 5.4 | (80) | 6.1 | (17) | 6.3 | (87) |
| **Wealth quintile** | | | | | | | | | | | | | | |
| Poorest | 38.1 | (608) | 16.7 | (207) | 5.1 | (95) | 16.3 | (173) | 5.9 | (89) | 21.1 | (61) | 8.2 | (112) |
| Poorer | 25.0 | (400) | 22.2 | (275) | 9.2 | (172) | 22.6 | (240) | 16.9 | (254) | 19.0 | (55) | 19.3 | (265) |
| Middle | 16.2 | (259) | 23.5 | (292) | 15.5 | (288) | 29.2 | (310) | 24.8 | (371) | 19.5 | (56) | 28.2 | (388) |
| Richer | 13.2 | (211) | 23.3 | (289) | 22.4 | (416) | 18.2 | (194) | 23.8 | (356) | 14.7 | (43) | 28.8 | (396) |
| Richest | 7.5 | (120) | 14.2 | (176) | 47.8 | (889) | 13.7 | (146) | 28.5 | (427) | 25.6 | (74) | 15.5 | (214) |
| **Pregnancy status** | | | | | | | | | | | | | | |
| Not currently pregnant | 94.8 | (1,515) | 97.2 | (1,024) | 97.5 | (1,814) | 97.0 | (1,031) | 97.1 | (1,453) | 97.5 | (282) | 97.5 | (1,342) |
| Currently pregnant | 5.2 | (83) | 2.8 | (35) | 2.5 | (47) | 3.0 | (32) | 2.9 | (44) | 2.5 | (7) | 2.5 | (34) |
| **Number of children ever born** | | | | | | | | | | | | | | |
| 0 | 35.3 | (565) | 42.5 | (527) | 49.5 | (922) | 41.8 | (444) | 47.2 | (707) | 38.5 | (111) | 39.6 | (545) |
| 1 | 18.3 | (293) | 17.9 | (221) | 16.1 | (299) | 17.4 | (184) | 16.1 | (241) | 19.2 | (56) | 13.1 | (180) |
| 2-3 | 29.4 | (470) | 26.9 | (334) | 25.7 | (478) | 26.8 | (284) | 25.8 | (386) | 26.4 | (76) | 27.9 | (383) |
| 4-5 | 12.6 | (201) | 7.8 | (97) | 6.3 | (117) | 8.9 | (95) | 7.3 | (109) | 10.7 | (31) | 13.8 | (190) |
| 6+ | 4.3 | (69) | 4.8 | (60) | 2.4 | (45) | 5.1 | (54) | 3.6 | (53) | 5.2 | (15) | 5.5 | (76) |

## 3.2 Regional Disparities in Anemia in Women of Reproductive Age in States and Regions of Myanmar

The descriptive findings showed regional disparities in Myanmar. The regional rankings are shown in Figure 1, which depicts regional disparities in anemia outcomes in Myanmar and across the four broad geographic zones ($\chi^2$=148.29, p=<0.001) and 15 States and Regions ($\chi^2$=268.99, p=<0.001). Across the four geographic zones, the lowest prevalence of anemia was found in the Hilly zone (36.6%), while the highest prevalence was among Coastal women (50.3%), and in those who live in the Delta and Central Plain zones where there was a similar prevalence (48%). Among the 15 States and Regions, Rakhine State (55.4%) and Tanintharyi Region had the highest prevalence in anemia, while Kayah State (30.9%) and Shan State (34.9%) had the lowest prevalence in Myanmar.

**Figure 1 Prevalence of anemia by States and Regions**




Disparities are also evident within broad geographic zones. In the Coastal zone, anemia prevalence ranges by more than 16 percentage points from a low in Mon State (39%) to a high in Rakhine State (55.4%). In the Hilly zone, there is a 13 percentage point range from a low in Kayah State (30.9%) to a high in Kayin State (44.1%). The Delta and Central Plain zones show fewer disparities, with a range of 10 and 9 percentage points, respectively.

## 3.3 Determinants of Anemia in Women of Reproductive Age in Myanmar

Both unadjusted and adjusted binary logistic regression analyses were performed to examine the determinants of anemia in 12,489 women of reproductive age in Myanmar.

The regression analyses found that 5 of the 10 predictor variables were statistically associated with anemia outcomes: *region, age, marital status, BMI,* and *pregnancy status*. In contrast, *residence, educational status, employment status*, *wealth status,* and *children ever born* (*CEB) status* were not statistically associated with having anemia.

The regional disparity in the anemic health outcome was further affirmed by regression analyses. After controlling for the other co-variates, women in all States and Regions (except Tanintharyi, Yangon, Magway, and Nay Pyi Taw) were less likely to have anemia compared with women in Rakhine State, which was statistically significant.

Women age ≥40 years had an adjusted OR of 1.2 (95% CI 1.11–1.34) of having anemia; women who were currently married were 20% less likely to have anemia compared with non-married women; and women who were pregnant had an adjusted OR of 1.9 (95% CI 1.54–2.53) of having anemia. Women who were underweight had an adjusted OR of 1.2 (95% CI 1.02–1.30) of having anemia, while women who were overweight had a 36% and obese a 38% lower risk of having anemia than those women with normal body weight.

**Table 2 Determinants of anemia in women age 15-49 in Myanmar (n= 12,489)**

| | Total weighted sample | | Unadjusted analysis | | | Adjusted analysis | | |
|---|---|---|---|---|---|---|---|---|
| **Variables** | **%** | **(n)** | **OR** | **95 % CI** | **p-value** | **OR** | **95 % CI** | **p-value** |
| **Regions** | | | | | | | | |
| *Coastal zone* | | | | | | | | |
| Rakhine (Ref) | 5.9 | (740) | 1 | | | 1 | | |
| Mon | 3.6 | (449) | 0.51*** | 0.37-0.70 | 0.000 | 0.5*** | 0.38-0.74 | 0.000 |
| Tanintharyi | 2.2 | (280) | 0.96 | 0.71-1.30 | 0.814 | 1.0 | 0.73-1.39 | 0.921 |
| *Hilly zone* | | | | | | | | |
| Chin | 0.8 | (100) | 0.50** | 0.34-0.74 | 0.001 | 0.5*** | 0.31-0.70 | 0.000 |
| Kachin | 2.9 | (363) | 0.46*** | 0.35-0.61 | 0.000 | 0.5*** | 0.36-0.64 | 0.000 |
| Kayah | 0.5 | (63) | 0.35*** | 0.26-0.48 | 0.000 | 0.4*** | 0.26-0.50 | 0.000 |
| Kayin | 2.4 | (295) | 0.63** | 0.47-0.84 | 0.002 | 0.7** | 0.49-0.89 | 0.007 |
| Shan | 10.2 | (1,275) | 0.43*** | 0.32-0.57 | 0.000 | 0.5*** | 0.33-0.61 | 0.000 |
| *Delta zone* | | | | | | | | |
| Ayeyarwady | 12.8 | (1,598) | 0.60*** | 0.45-0.79 | 0.000 | 0.6*** | 0.46-0.82 | 0.001 |
| Bago | 9.9 | (1,239) | 0.73* | 0.55-0.95 | 0.024 | 0.8 | 0.57-1.01 | 0.063 |
| Yangon | 14.9 | (1,861) | 0.92 | 0.68-1.24 | 0.602 | 1.1 | 0.76-1.43 | 0.756 |
| *Central Plain zone* | | | | | | | | |
| Magway | 8.5 | (1,062) | 0.87 | 0.64-1.19 | 0.407 | 0.9 | 0.64-1.21 | 0.458 |
| Mandalay | 12.0 | (1,496) | 0.62*** | 0.46-0.83 | 0.001 | 0.6** | 0.46-0.86 | 0.004 |
| Nay Pyi Taw | 2.3 | (290) | 0.60* | 0.44-0.82 | 0.002 | 0.6** | 0.46-0.87 | 0.005 |
| Sagaing | 11.0 | (1,376) | 0.83 | 0.62-1.12 | 0.233 | 0.9 | 0.65-1.22 | 0.500 |
| **Residence** | | | | | | | | |
| Urban (Ref) | 28.5 | (3,554) | 1 | | | 1 | | |
| Rural | 71.5 | (8,935) | 1.0 | 0.87-1.1 | 0.956 | 0.9 | 0.85-1.17 | 0.985 |
| **Age** | | | | | | | | |
| <40 years (Ref) | 73.9 | (9,235) | 1 | | | 1 | | |
| 40 years and above | 26.1 | (3,254) | 1.2*** | 1.11-1.34 | 0.000 | 1.3*** | 1.18-1.47 | 0.000 |
| **Educational status** | | | | | | | | |
| ≤ Primary (Ref) | 54.0 | (6,746) | 1 | | | 1 | | |
| > Primary | 46.0 | (5,743) | 0.98 | 0.89-1.08 | 0.716 | 1.0 | 0.89-1.12 | 0.967 |
| **Marital status** | | | | | | | | |
| Not currently (Ref) | 39.6 | (4,942) | 1 | | | 1 | | |
| Currently married | 60.4 | (7,547) | 0.83*** | 0.75-0.91 | 0.000 | 0.8* | 0.73-0.98 | 0.028 |
| **Employment** | | | | | | | | |
| Not currently (Ref) | 33.5 | (4,186) | 1 | | | 1 | | |
| Currently working | 66.5 | (8,303) | 0.98 | 0.89-1.09 | 0.796 | 1.1 | 0.96-1.18 | 0.186 |
| **BMI** | | | | | | | | |
| Normal (Ref) | 60.2 | (7,520) | 1 | | | 1 | | |
| Underweight | 15.0 | (1,876) | 0.85** | 0.75-0.96 | 0.009 | 1.2* | 1.02-1.30 | 0.019 |
| Overweight | 19.3 | (2,402) | 0.57*** | 0.49-0.67 | 0.000 | 0.64*** | 0.57-0.72 | 0.000 |
| Obese | 5.5 | (691) | 0.54*** | 0.44-0.67 | 0.000 | 0.62*** | 0.51-0.75 | 0.000 |
| **Wealth quintile** | | | | | | | | |
| Poorest (Ref) | 17.8 | (2,223) | 1 | | | 1 | | |
| Poorer | 18.9 | (2,368) | 1.0 | 0.88-1.15 | 0.930 | 1.04 | 0.92-1.19 | 0.478 |
| Middle | 20.8 | (2,590) | 0.9 | 0.86-1.15 | 0.960 | 1.01 | 0.88-1.16 | 0.864 |
| Richer | 20.8 | (2,599) | 0.9 | 0.74-1.03 | 0.131 | 0.92 | 0.78-1.09 | 0.378 |
| Richest | 21.7 | (2,710) | 0.9 | 0.80-1.10 | 0.461 | 0.98 | 0.81-1.18 | 0.850 |
| **Pregnancy status** | | | | | | | | |
| Not currently (Ref) | 96.4 | (12,040) | 1 | | | 1 | | |
| Currently pregnant | 3.6 | (449) | 1.54*** | 1.22-1.94 | 0.000 | 1.9*** | 1.54-2.53 | 0.000 |
| **Number of children ever born** | | | | | | | | |
| 0 (Ref) | 40.8 | (5,099) | 1 | | | 1 | | |
| 1 | 16.3 | (2,032) | 0.8*** | 0.70-0.88 | 0.000 | 0.94 | 0.81-1.10 | 0.467 |
| 2-3 | 27.5 | (3,432) | 0.8*** | 0.72-0.89 | 0.000 | 0.99 | 0.84-1.16 | 0.928 |
| 4-5 | 10.3 | (1,287) | 0.9 | 0.84-1.16 | 0.967 | 1.1 | 0.93-1.40 | 0.208 |
| 6+ | 5.1 | (639) | 1.1 | 0.97-1.41 | 0.095 | 1.24 | 0.98-1.58 | 0.067 |

*** p<0.001; ** p<0.01; *p<0.05

# 4 REGIONAL DISPARITIES IN MODERN CONTRACEPTIVE USE

## 4.1 Background Characteristics

The detailed background characteristics of non-pregnant women by States and Regions are shown in Table 3. The data by zones is presented in Appendix Table A1. In all four zones, the majority of women were living in rural areas, currently married and currently working, and had no children. The age distribution of the women is presented in Table 3. Apart from States and Regions in the Delta zone, most women had an education level of primary or below. Regarding wealth status, women in Coastal zone had the highest proportion in the poorest quintile (34.8%) compared to women in other zones. These results are similar to those for the analytic sample for the study of anemia.

**Table 3 Background characteristics of study population for modern contraceptive use by States and Regions (n= 12,419)**

| | Hilly | | | | | | | | | | Coastal | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Chin (n= 100) | | Kachin (n= 363) | | Kayah (n= 63) | | Kayin (n= 295) | | Shan (n= 1,275) | | Mon (n= 449) | | Rakhine (n= 740) | | Tanintharyi (n= 280) | |
| **Variables** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** |
| **Residence** | | | | | | | | | | | | | | | | |
| Urban | 25.9 | (25) | 34.8 | (123) | 28.0 | (17) | 24.2 | (70) | 26.8 | (350) | 31.0 | (138) | 14.2 | (105) | 25.0 | (68) |
| Rural | 74.1 | (70) | 65.2 | (229) | 72.0 | (45) | 75.8 | (218) | 73.2 | (957) | 69.0 | (307) | 85.8 | (633) | 75.0 | (204) |
| **Age** | | | | | | | | | | | | | | | | |
| <40 years | 72.5 | (69) | 71.3 | (251) | 74.6 | (46) | 70.8 | (204) | 78.5 | (1,027) | 66.2 | (295) | 77.3 | (570) | 73.9 | (201) |
| 40 years and above | 27.5 | (26) | 28.7 | (101) | 25.4 | (16) | 29.2 | (84) | 21.5 | (280) | 33.8 | (150) | 22.7 | (168) | 26.1 | (71) |
| **Educational status** | | | | | | | | | | | | | | | | |
| Primary and below | 43.7 | (42) | 40.9 | (144) | 44.7 | (28) | 58.8 | (169) | 66.0 | (862) | 48.8 | (217) | 68.3 | (504) | 48.6 | (132) |
| Above primary | 56.3 | (53) | 59.1 | (208) | 55.3 | (34) | 41.2 | (119) | 34.0 | (445) | 51.2 | (228) | 31.7 | (234) | 51.4 | (140) |
| **Marital status** | | | | | | | | | | | | | | | | |
| Not currently married | 37.9 | (36) | 38.7 | (136) | 40.0 | (25) | 35.5 | (102) | 35.6 | (465) | 41.4 | (185) | 43.6 | (322) | 39.9 | (109) |
| Currently married | 62.1 | (59) | 61.3 | (216) | 60.0 | (37) | 64.5 | (186) | 64.4 | (842) | 58.6 | (260) | 56.4 | (416) | 60.0 | (164) |
| **Employment** | | | | | | | | | | | | | | | | |
| Not currently working | 34.7 | (33) | 40.3 | (142) | 40.7 | (25) | 50.5 | (145) | 21.2 | (277) | 39.8 | (177) | 51.2 | (378) | 37.8 | (103) |
| Currently working | 65.3 | (62) | 58.7 | (210) | 59.3 | (37) | 49.5 | (143) | 78.8 | (1,030) | 60.2 | (268) | (48.8) | (360) | 62.2 | (169) |
| **Wealth quintile** | | | | | | | | | | | | | | | | |
| Poorest | 21.4 | (20) | 11.5 | (40) | 9.9 | (6) | 22.6 | (65) | 16.2 | (212) | 19.0 | (85) | 49.3 | (364) | 21.3 | (57) |
| Poorer | 27.5 | (26) | 19.5 | (69) | 18.9 | (12) | 17.2 | (49) | 19.7 | (257) | 14.8 | (66) | 21.4 | (158) | 20.5 | (56) |
| Middle | 25.0 | (24) | 22.1 | (78) | 23.5 | (14) | 16.7 | (48) | 16.7 | (218) | 16.8 | (75) | 14.4 | (106) | 18.2 | (50) |
| Richer | 14.7 | (14) | 25.5 | (90) | 30.0 | (19) | 22.9 | (66) | 21.9 | (286) | 23.2 | (103) | 9.6 | (71) | 21.3 | (58) |
| Richest | 11.4 | (11) | 21.4 | (75) | 17.7 | (11) | 20.7 | (60) | 25.5 | (334) | 26.2 | (116) | 5.3 | (39) | 18.7 | (51) |
| **Number of children ever born** | | | | | | | | | | | | | | | | |
| 0 | 35.3 | (33) | 34.7 | (122) | 37.0 | (23) | 31.7 | (91) | 33.6 | (439) | 41.3 | (184) | 40.9 | (302) | 38.0 | (104) |
| 1 | 10.5 | (10) | 13.5 | (47) | 13.4 | (8) | 12.4 | (36) | 15.8 | (206) | 13.0 | (58) | 16.6 | (122) | 13.3 | (36) |
| 2-3 | 18.7 | (18) | 30.3 | (107) | 27.7 | (17) | 29.8 | (86) | 33.7 | (441) | 26.2 | (116) | 23.1 | (171) | 26.2 | (71) |
| 4+ | 35.5 | (34) | 21.5 | (76) | 21.9 | (14) | 26.1 | (75) | 16.9 | (221) | 19.5 | (87) | 19.4 | (143) | 22.5 | (61) |

*Continued...*

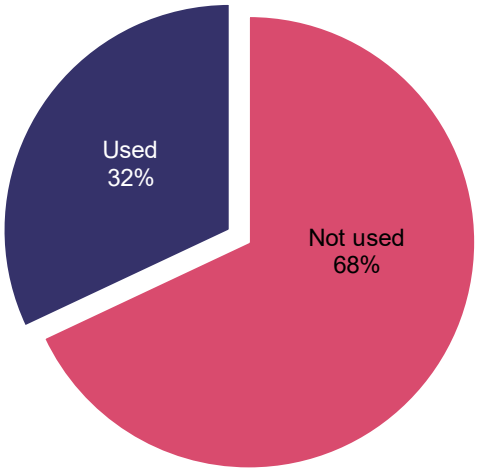
**Table 3—*Continued***

| | Delta | | | | | | Central Plain | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ayeyarwady (n= 1,598) | | Bago (n= 1,239) | | Yangon (n= 1,861) | | Magway (n= 1,062) | | Mandalay (n= 1,496) | | Nay Pyi Taw (n= 290) | | Sagaing (n= 1,376) | |
| **Variables** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** |
| **Residence** | | | | | | | | | | | | | | |
| Urban | 16.3 | (254) | 20.2 | (244) | 71.8 | (1,348) | 15.0 | (157) | 28.9 | (432) | 31.7 | (93) | 17.3 | (238) |
| Rural | 83.7 | (1,306) | 79.8 | (964) | 28.2 | (529) | 85.0 | (891) | 71.1 | (1,063) | 68.3 | (199) | 82.7 | (1,138) |
| **Age** | | | | | | | | | | | | | | |
| <40 years | 73.3 | (1,144) | 73.3 | (885) | 72.8 | (1,366) | 70.2 | (736) | 73.3 | (1,096) | 74.2 | (217) | 71.7 | (986) |
| 40 years and above | 26.7 | (416) | 26.7 | (323) | 27.2 | (511) | 29.8 | (312) | 26.7 | (399) | 25.8 | (75) | 28.3 | (390) |
| **Educational status** | | | | | | | | | | | | | | |
| Primary and below | 59.1 | (923) | 50.8 | (614) | 35.0 | (657) | 57.6 | (604) | 53.9 | (806) | 55.8 | (163) | 56.7 | (781) |
| Above primary | (40.9) | (637) | 49.2 | (594) | 65.0 | (1,220) | 42.4 | (444) | 46.1 | (689) | 44.2 | (129) | 43.3 | (595) |
| **Marital status** | | | | | | | | | | | | | | |
| Not currently married | 36.2 | (564) | 38.4 | (464) | 47.1 | (884) | 41.8 | (438) | 47.0 | (703) | 36.0 | (105) | 42.3 | (582) |
| Currently married | 63.8 | (996) | 61.6 | (744) | 52.9 | (993) | 58.2 | (610) | 53.0 | (792) | 64.0 | (187) | 57.7 | (794) |
| **Employment** | | | | | | | | | | | | | | |
| Not currently working | 33.1 | (516) | 30.5 | (369) | 46.6 | (875) | 20.0 | (210) | 15.0 | (224) | 33.7 | (98) | 34.0 | (468) |
| Currently working | 66.9 | (1,044) | 69.5 | (839) | 53.4 | (1,002) | 80.0 | (838) | 85.0 | (1,271) | 66.3 | (194) | 66.0 | (908) |
| **Wealth quintile** | | | | | | | | | | | | | | |
| Poorest | 36.8 | (574) | 16.2 | (195) | 4.9 | (92) | 15.8 | (165) | 6.0 | (89) | 20.9 | (61) | 7.8 | (108) |
| Poorer | 25.4 | (396) | 22.5 | (272) | 8.6 | (162) | 22.3 | (234) | 15.8 | (236) | 18.9 | (55) | 19.4 | (267) |
| Middle | 16.5 | (257) | 23.8 | (287) | 15.0 | (282) | 29.3 | (307) | 24.5 | (367) | 19.0 | (56) | 28.1 | (387) |
| Richer | 13.6 | (212) | 23.1 | (279) | 23.1 | (433) | 18.4 | (193) | 23.7 | (354) | 15.1 | (44) | 29.4 | (404) |
| Richest | 7.7 | (121) | 14.4 | (175) | 48.4 | (908) | 14.2 | (149) | 30.0 | (449) | 26.1 | (76) | 15.3 | (210) |
| **Number of children ever born** | | | | | | | | | | | | | | |
| 0 | 36.1 | (563) | 42.1 | (508) | 49.3 | (925) | 41.9 | (440) | 47.9 | (716) | 38.6 | (113) | 40.3 | (554) |
| 1 | 17.8 | (278) | 17.5 | (212) | 15.9 | (299) | 16.6 | (174) | 15.3 | (228) | 19.5 | (57) | 12.5 | (171) |
| 2-3 | 29.4 | (459) | 27.4 | (331) | 26.2 | (492) | 27.0 | (283) | 26.0 | (389) | 26.0 | (76) | 27.6 | (381) |
| 4+ | 16.7 | (260) | 13.0 | (157) | 8.6 | (161) | 14.5 | (151) | 10.8 | (162) | 15.9 | (46) | 19.6 | (270) |

## 4.2 Regional Disparities in Modern Contraceptive Use in States and Regions of Myanmar

A total of 12,419 weighted samples of non-pregnant women age 15-49 were included in the analysis. Only one-third (32%) of non-pregnant women currently use modern FP methods while the majority (68%) did not (Figure 2).

**Figure 2 Current use of modern contraception among non-pregnant women age 15-49 in Myanmar (n= 12,419)**




Figures 3 and 4 show the use of modern FP methods among non-pregnant women age 15-49 across zones and States and Regions in Myanmar. Regional disparities are evident across the four broad geographic zones ($\chi^2$=94.49, p=<0.001) in Figure 3 and across the 15 States and Regions ($\chi^2$=172.12, p=<0.001) in Figure 4, with use of modern contraception varying by more than 10 percentage points. Women from the Delta zone had the highest proportion using modern FP (36.6%) followed by women from the Central Plain zone (30.6%) and women from the Hilly zone (30.3%). The lowest use of modern FP methods was found in women from the Coastal zone (25.49%).

**Figure 3** **Regional use of modern contraceptive methods among non-pregnant women age 15-49 by zone in Myanmar (n= 12,419)**

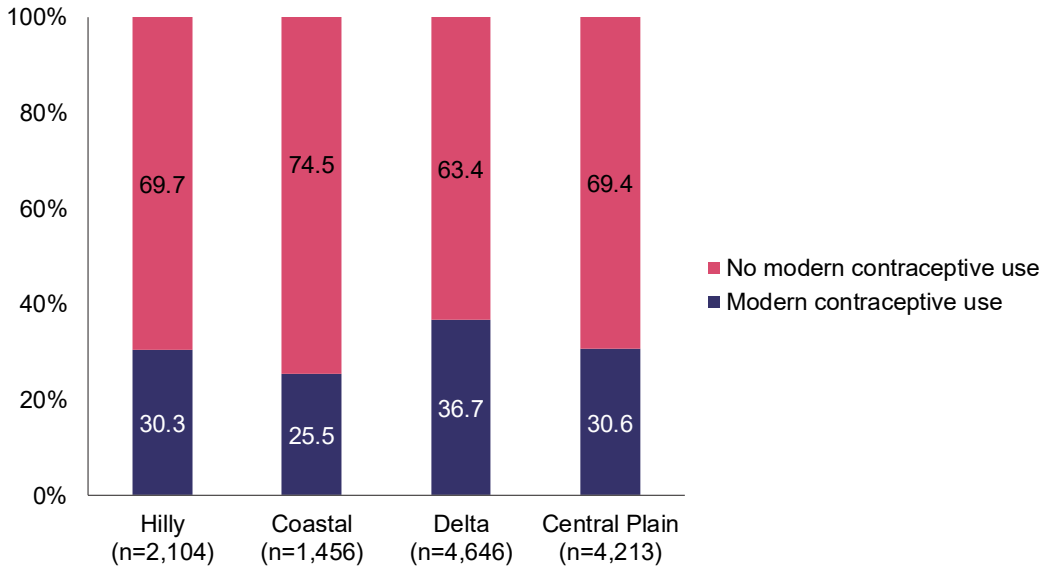
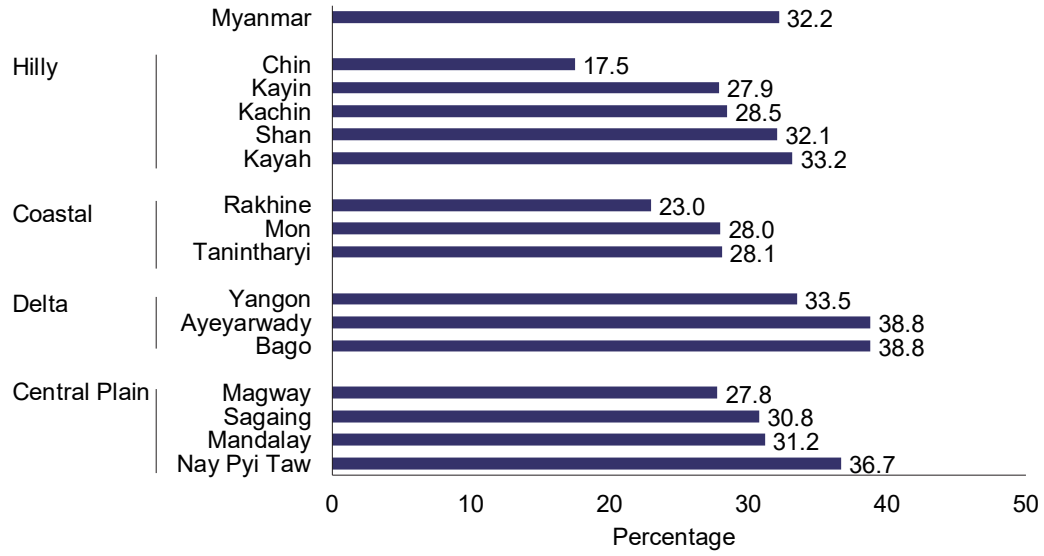



**Figure 4** **Modern contraceptive use by States and Regions (n= 12,419)**




Across the broad geographic zones, the use of modern FP methods ranged from the lowest (17.5%) in Chin State to the highest (38.8%) in Ayeyarwady and Bago Regions. Disparities were found within and among the four geographic zones, with the lowest contraceptive use among women in Chin and Rakhine States, and Yangon and Magway Regions.

## 4.3 Determinants of Modern Contraceptive Use

The results of the unadjusted and adjusted logistic regression analyses of the determinants of modern contraceptive use in women age 15-49 in Myanmar are shown in Table 4.

**Table 4 Determinants of modern contraceptive use in women age (15-49) of Myanmar (n= 12,419)**

| | Total weighted sample | | Unadjusted analysis | | Adjusted analysis | |
|---|---|---|---|---|---|---|
| **Variables** | **%** | **(n)** | **OR** | **95 % CI** | **OR** | **95 % CI** |
| **Region** | | | | | | |
| *Hilly* | | | | | | |
| Chin (Ref) | 0.7 | 95 | 1 | | 1 | |
| Kachin | 2.8 | 352 | 1.8** | (1.2-2.8) | 2.2** | (1.3-3.6) |
| Kayah | 0.5 | 62 | 2.3*** | (1.5-3.6) | 3.1*** | (1.8-5.5) |
| Kayin | 2.3 | 288 | 1.8** | (1.2-2.7) | 2.1** | (1.3-3.5) |
| Shan | 10.5 | 1,307 | 2.2*** | (1.5-3.4) | 2.4*** | (1.5-3.9) |
| *Coastal* | | | | | | |
| Mon | 3.6 | 445 | 1.8** | (1.2-2.7) | 2.9*** | (1.8-4.8) |
| Tanintharyi | 2.2 | 272 | 1.8** | (1.2-2.7) | 2.5*** | (1.5-3.9) |
| Rakhine | 5.9 | 738 | 1.4 | (0.9-2.1) | 2.3** | (1.4-3.8) |
| *Delta* | | | | | | |
| Ayeyarwady | 12.5 | 1,560 | 2.9*** | (2.0-4.4) | 5.2*** | (3.3-8.1) |
| Bago | 9.7 | 1,208 | 2.9*** | (2.1-4.3) | 5.8*** | (3.7-9.0) |
| Yangon | 15.1 | 1,877 | 2.4*** | (1.6-3.4) | 5.4*** | (3.5-8.4) |
| *Central Plain* | | | | | | |
| Magway | 8.5 | 1,048 | 1.8** | (1.2-2.7) | 2.9*** | (1.9-4.8) |
| Mandalay | 12.0 | 1,495 | 2.1*** | (1.5-3.1) | 4.3*** | (2.8-6.7) |
| Nay Pyi Taw | 2.3 | 292 | 2.7*** | (1.9-3.9) | 4.5*** | (2.8-7.1) |
| Sagaing | 11.1 | 1,376 | 2.1*** | (1.4-3.0) | 3.5*** | (2.1-5.7) |
| **Residence** | | | | | | |
| Rural (Ref) | 70.5 | 8,758 | 1 | | 1 | |
| Urban | 29.5 | 3,661 | 1.0 | (0.9-1.1) | 1.2 | (0.9-1.4) |
| **Age** | | | | | | |
| 15-19 (Ref) | 14.4 | 1,788 | 1 | | 1 | |
| 20-24 | 14.2 | 1,758 | 5.4*** | (4.3-6.9) | 1.0 | (0.7-1.5) |
| 25-29 | 13.8 | 1,715 | 10.3*** | (8.1-13.1) | 0.6** | (0.4-0.9) |
| 30-34 | 15.6 | 1,940 | 10.9*** | (8.6-14.1) | 0.4*** | (0.3-0.6) |
| 35-39 | 15.2 | 1,893 | 13.1*** | (10.1-16.9) | 0.4*** | (0.3-0.6) |
| 40-44 | 13.8 | 1,707 | 7.5*** | (5.8-9.6) | 0.2*** | (0.1-0.3) |
| 45-49 | 13.0 | 1,617 | 2.7*** | (2.0-3.6) | 0.1*** | (0.0-0.1) |
| **Educational status** | | | | | | |
| ≤ Primary (Ref) | 53.5 | 6,643 | 1 | | 1 | |
| > Primary | 46.5 | 5,772 | 0.8*** | (0.7-0.9) | 1.3*** | (1.1-1.5) |
| **Marital status** | | | | | | |
| Not currently (Ref) | 41.2 | 5,121 | 1 | | 1 | |
| Currently married | 58.8 | 7,298 | 266.3*** | (164.4-431.4) | 183.6*** | (104.7-321.7) |
| **Employment** | | | | | | |
| Not currently (Ref) | 32.5 | 4,041 | 1 | | 1 | |
| Currently working | 67.5 | 8,376 | 0.8** | (0.7-0.9) | 1.2* | (1.0-1.3) |
| **Wealth quintile** | | | | | | |
| Poorest (Ref) | 17.2 | 2,135 | 1 | | 1 | |
| Poorer | 18.6 | 2,315 | 0.9 | (0.8-1.1) | 1.2* | (1.0-1.4) |
| Middle | 20.6 | 2,557 | 0.8** | (0.7-0.9) | 1.3** | (1.1-1.6) |
| Richer | 21.2 | 2,627 | 0.8 | (0.7-1.0) | 1.4** | (1.2-1.8) |
| Richest | 22.4 | 2,785 | 0.8* | (0.7-0.9) | 1.6** | (1.2-2.2) |
| **Number of children ever born** | | | | | | |
| 0 (Ref) | 41.2 | 5,117 | 1 | | 1 | |
| 1 | 15.6 | 1,944 | 20.2*** | (16.5-24.7) | 3.9*** | (3.1-5.1) |
| 3-Feb | 27.7 | 3,438 | 22.5*** | (18.6-27.3) | 7.4*** | (5.7-9.6) |
| 4+ | 15.5 | 1,920 | 10.9*** | (8.8-13.9) | 6.6*** | (4.9-8.8) |

*** p≤0.001; ** p<0.01; * p<0.05

After controlling for the other covariates, compared with women in Chin State, women of Bago Region had odds of 5.8 of using modern FP methods, while those in Yangon Region had odds of 5.4 and those in Ayeyarwady Region had odds of 5.2 of using modern FP methods. In the unadjusted analysis, women of Rakhine State had odds of 1.4 of using modern FP methods (95% CI 0.9 – 2.1), compared with women in Chin State, which was not statistically significant. However, an adjusted OR of 2.3 (95% CI 1.4 – 3.8) of using modern FP methods was statistically significant at $p < 0.01$ after controlling for the other variables.

Both the unadjusted and adjusted logistic regression analysis showed that urban/rural residence was not associated with use of modern FP methods. The variables associated with use of modern FP methods were region, age, education, marital status, employment, wealth status, and number of children.

The unadjusted odds of the older age group were more likely to use modern FP methods when compared to women age 15-19. However, apart from women age 20-24, after controlling the covariates, women of older ages were less likely to use modern FP methods than women age 15-19, which was statistically significant.

Women with secondary and above education had an adjusted OR of 1.3 of using modern FP methods compared to those women with primary and below education (95% CI 1.1 – 1.5) with a p value < 0.001. The adjusted ORs of currently married women and women who are currently working were 183.6 (95% CI 104.7 – 321.7) and 1.2 (95% CI 1.0 – 1.3) respectively when compared with their counterparts, which were statistically significant.

Thus, the use of modern FP methods increased with wealth with a statistically significant association in the adjusted model. Compared with the poorest women, the adjusted OR was 1.2 (95% CI 1.0–1.4) in the poorer quintile, 1.3 (95% CI 1.1–1.6) in the middle quintile, 1.4 (95% CI 1.2–1.8) in the richer quintile, and 1.6 (95% CI 1.2–2.2) in the richest quintile of women.

# 5 DISCUSSION AND CONCLUSION

The descriptive statistics in this study identified geographic disparities in women's anemia and modern contraceptive use. The study also found socioeconomic disparities among the geographic zones in Myanmar. However, geographic disparities in both outcomes persist in the multivariate models that control for the socioeconomic factors. This suggests that variation in the socioeconomic composition of the population within Myanmar's States and Regions does not fully explain the geographic disparities in anemia and modern contraceptive use that we observe.

In this study, there was a variation in anemia prevalence by geographic area, a phenomenon that has been found in other settings (Balarajan, Fawzi, and Subramanian 2013; Greffeuille et al. 2016; Lakew, Biadgilign, and Haile 2014; Yasutake et al. 2013). Three of four geographic zones had a higher prevalence of anemia that was above the national prevalence of Myanmar, in which 47% of women age 15-49 are anemic and 41.5% in SEAR (Ministry of Health and Sports and ICF 2016; WHO 2016). Only women in the Hilly zone had a lower prevalence of anemia than the prevalence in Myanmar or SEAR.

Previous work by the study's authors found important disparities in anemia across broad geographic zones (Win and Ko Ko 2018). This study elaborates upon those findings and finds larger disparities across the 15 States and Regions within those broader geographic zones than across the broader geographic zones in Myanmar. The magnitude of these inter-state/region disparities and their persistence after controlling for other characteristics indicates the importance of examining geographic disparities with the most granular lens possible. Doing so provides more nuanced insights that nutrition policy experts can use to direct programming efforts.

The highest prevalence of anemia was found in Rakhine State (55.4%). Both the descriptive and regression analyses found that women in Rakhine State had the least favorable outcomes in anemia along with low socioeconomic status. Myanmar is prone to natural disasters and the Coastal zone (particularly Rakhine State) is the most vulnerable area, which experiences cyclones, tropical storms, and tsunamis. These conditions may affect the socioeconomic progress of Rakhine women and may affect their anemia status (United Nations Country Team in Myanmar 2011).

Previous studies in Myanmar in different areas in different years have found that anemia becomes a public health challenge among women of reproductive age and lactating women when the prevalence is greater than 50% (Oo, Myint, Nyunt, and Yi 2016; Zhao et al. 2014, 2016). Although there has been some improvement during the past 5 years, anemia remains a challenging issue in some areas within the 15 States and Regions of Myanmar (United Nations Country Team in Myanmar 2011). Since there are considerable disparities in anemic health outcomes across and within zones in this study, it is important to conduct further analysis of anemia in every geographic area in Myanmar. Moreover, Myanmar needs a regional development plan and equitable health care facilities in all areas. Without a reduction in disparities, WHO's Global Nutrition Target for anemia 2025 is unlikely to be achieved (WHO 2016). Thus, national and regional strategies about anemia and other micronutrients must be a priority in Myanmar.

In addition to geographic disparities, this study analyzed socioeconomic factors because other research that used DHS data found that improved socioeconomic status reduces the risk of anemia in women of reproductive age (Balarajan, Fawzi, and Subramanian 2013; Hakizimana 2016; Lakew, Biadgilign, and

Haile 2014; Wilunda, Massawe, and Jackson 2013). Prior research also included one Myanmar study conducted in the Hilly zone during 2014 (Zhao et al. 2014). In the current study, socioeconomic factors such as urban residence, education, employment, and wealth status were not contributing factors for anemia. These findings are consistent with previous Myanmar studies conducted in the Hilly zone during 2014 (Zhao et al. 2016) and in a tertiary hospital in the Central Plain zone during 2012-2013 (Oo et al. 2016). Anemia could be related to dietary patterns in which local residents have low-cost, high-nutrient diets, particularly in the poorer communities in Coastal and Delta zones of Myanmar.

Interestingly, there were no rural and urban differences in anemic health outcomes for women in Myanmar, after controlling for the other covariates in this study. Although more than 70% of the samples in this study came from women living in the rural areas (except Yangon Region), this study found no statistically significant difference between rural or urban areas.

Instead of socioeconomic factors, biological factors and pregnancy status were the main determining factors of anemia in women of reproductive age. Women who are married and pregnant are prone to anemia. The significant role of biological and pregnancy factors was found in international studies such as Cambodia (Greffeuille et al. 2016), India (Siddiqui et al. 2017), and Ethiopia (Alemu and Umeta 2015). Biologically, anemia prevalence increases with age and low body weight. It could be explained by the fact that anemia itself is a form of malnutrition and those who are underweight have a greater risk of iron deficiency anemia (Hakizimana 2016). Thus, public health strategies should prioritize care for target groups including women of reproductive age and pregnant mothers, particularly antenatal care services that provide iron tablets.

This study also found geographic disparities in the use of modern contraception. Specifically, the study found disparities across broad geographic zones and between States and Regions within those zones. Lower levels were found in the Coastal zone with the highest levels in the Delta zone. The disparities across States and Regions were especially large, with the odds of modern contraceptive use in Bago, Yangon, and Ayeyarwady more than five times that in Chin State, even after controlling for the other determinants.

Our further analysis consistently supported persisting geographic disparities in modern contraceptive use found among women of reproductive age in Nigeria (Wang and Cao 2019), Cameroon (Edietah et al. 2018), Burundi, Kenya, Rwanda, Tanzania and Uganda (Bakibinga et al. 2016), Ethiopia (Worku, Tessema, and Zeleke 2015), Sub-Saharan Africa (Burgert-Brucker, Yourkavitch, Assaf, and Delgado 2015), and Bangladesh (Amin, Basu, and Stephenson 2002). Inequalities in health are pervasive within countries, rich and poor alike. Although national, aggregate health indicators are improving, some health gaps are widening or remaining stagnant (Wirth et al. 2006). In this study, women in Chin State within the Hilly zone were the group least likely to be accessing and using modern FP methods.

In addition to geographic disparities, this study identified several other determinants of modern contraceptive use. Similar to other studies, we found that modern contraceptive use was predicted by currently being married (Wang and Cao 2019; O'Regan and Thompson 2017), currently working (Aviisah et al. 2018; Wang and Cao 2019), a greater number of children (Wang and Cao 2019; O'Regan and Thompson 2017), greater educational attainment (Aviisah et al. 2018; Wang and Cao 2019; Kidayi et al. 2015; O'Regan and Thompson 2017), and wealth status (Wang and Cao 2019; Kidayi et al. 2015). In contrast to other studies that found urban residence to be an important correlate of modern contraceptive use (Aviisah et al. 2018; Wang and Cao 2019; O'Regan and Thompson 2017; Wirth et al. 2006), this study

found no association with urban/rural residence after we accounted for the state and region of residence (Kidayi et al. 2015).

The absolute regional disparities in anemia are similar to those observed in modern contraceptive use. The prevalence of anemia had a range of 12 points across broad geographic zones and 24.5 points across 15 States and Regions, while these figures for modern contraceptive use were 11 points and 21 points, respectively. Within the four broad geographic zones, regional disparities across States and Regions in the prevalence of both anemia and modern contraceptive use were greatest in the Coastal and Hilly zones.

The WHO reported that anemia due to iron deficiency is among the top 10 leading causes of years lost to disability in low- and middle-income countries (WHO 2016, 2014, 2011a), as well as in Myanmar (Zhao et al. 2016). This study's findings suggest that national goals to reduce anemia will likely not be met unless regional disparities are targeted for elimination. Since anemia has an effect on the health status of mothers and children, as well as on the country's productivity and socioeconomic development, health care personnel must provide targeted messages on the important role of iron tablets in preventing anemia in pregnant mothers and women of reproductive age, especially in those States and Regions of Myanmar with the highest levels of anemia. This action would further support commitment to the Sustainable Development Goals (SDG), as well as Global Nutrition Target for anemia 2025.

The present findings of regional disparities in modern contraception use in Myanmar have important implications for local development and the wide socioeconomic gap, particularly in Chin State in the Hilly zone and Rakhine State in the Coastal zone, because there are consequences of the high fertility rate among women of reproductive age who are the rural poor, low educated, and unemployed. Disparities also have a great impact on preventing unwanted pregnancies and abortions, which are related to maternal mortality in a country. Although Myanmar has made significant progress in reducing unmet need for FP among women of reproductive age (Ministry of Health and Sports and ICF 2016; Ministry of Immigration and Population and United Nations Population Fund 2007), the country is unlikely to meet the United Nations' Sustainable Development Goals if geographic gaps in regional equity are not addressed effectively.

## 5.1 Conclusion and Recommendation

Regional disparities in anemia health outcomes and low use of modern FP remain major public health problems in Myanmar. The Coastal zone, particularly in Rakhine State, was the most vulnerable area for anemic disparities, while women in Chin State in the Hilly zone and Rakhine State in the Coastal zone were the least likely to use modern FP methods. The most influential factors for anemia among women of reproductive age in Myanmar were biological factors and pregnancy-related factors, and not socioeconomic factors. Use of modern FP methods was associated with region, age, education, marital status, wealth, and the number of children.

The study calls for qualitative research that explores the role of food patterns and nutrient contents of households in the assessment of anemia status and geographic disparities, and the availability of FP services on cultural perspectives about using FP methods among communities in different geographic areas. Providing iron tablets for women of reproductive age and pregnant women would be the easiest, most effective way to prevent anemia in women of reproductive age. Programs that promote safe motherhood and reduce unmet need for FP would also reduce unintended pregnancy and abortion. Local development plans with a holistic approach are vital to reducing disparities among the States and Regions of Myanmar.

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# APPENDIX

**Appendix Table A1 Background characteristics of study population for modern contraceptive use by geographic zones (n= 12,419)**

| | Coastal n= 1,456 | | Hilly n= 2,104 | | Delta n= 4,646 | | Central Plain n= 4,213 | |
|---|---|---|---|---|---|---|---|---|
| **Variables** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** | **%** | **(n)** |
| **Residence** | | | | | | | | |
| Urban | 21.4 | (311) | 27.8 | (584) | 39.7 | (1,846) | 21.8 | (920) |
| Rural | 78.6 | (1,145) | 72.2 | (1,520) | 60.8 | (2,800) | 78.2 | (3,293) |
| **Age** | | | | | | | | |
| 15-19 | 15.9 | (231) | 16.5 | (348) | 14.8 | (689) | 12.3 | (519) |
| 20-24 | 16.4 | (239) | 14.7 | (310) | 14.1 | (654) | 13.2 | (555) |
| 25-29 | 13.9 | (203) | 14.9 | (313) | 13.3 | (616) | 13.8 | (583) |
| 30-34 | 13.4 | (194) | 15.6 | (327) | 15.8 | (735) | 16.2 | (684) |
| 35-39 | 13.7 | (200) | 14.2 | (299) | 15.1 | (702) | 16.5 | (694) |
| 40-44 | 13.0 | (190) | 12.6 | (265) | 14.0 | (651) | 14.3 | (601) |
| 45-49 | 13.7 | (199) | 11.5 | (242) | 12.9 | (599) | 13.7 | (577) |
| **Educational status** | | | | | | | | |
| Primary and below | 58.7 | (854) | 59.1 | (1,244) | 47.2 | (2,194) | 55.9 | (2,354) |
| Secondary and above | 41.3 | (602) | 40.9 | (860) | 52.8 | (2,452) | 44.1 | (1,858) |
| **Marital status** | | | | | | | | |
| Not currently married | 42.2 | (615) | 36.3 | (764) | 41.2 | (1,913) | 43.4 | (1,829) |
| Currently married | 57.8 | (841) | 63.7 | (1,340) | 58.8 | (2,733) | 56.6 | (2,384) |
| **Employment** | | | | | | | | |
| Not currently working | 45.2 | (658) | 29.6 | (623) | 37.9 | (1,760) | 23.8 | (1,000) |
| Currently working | 54.8 | (798) | 70.4 | (1,481) | 62.1 | (2,886) | 76.2 | (3,211) |
| **Wealth quintile** | | | | | | | | |
| Poorest | 34.8 | (507) | 16.3 | (344) | 18.5 | (861) | 10.1 | (424) |
| Poorer | 19.2 | (280) | 19.7 | (413) | 17.9 | (830) | 18.8 | (792) |
| Middle | 15.9 | (231) | 18.2 | (382) | 17.8 | (826) | 26.5 | (1,117) |
| Richer | 15.9 | (232) | 22.5 | (474) | 19.9 | (924) | 23.6 | (996) |
| Richest | 14.2 | (206) | 23.3 | (491) | 25.9 | (1,205) | 21.0 | (884) |
| **Number of children ever born** | | | | | | | | |
| 0 | 40.5 | (589) | 33.7 | (709) | 42.9 | (1,997) | 43.3 | (1,822) |
| 1 | 14.9 | (217) | 14.6 | (308) | 16.9 | (789) | 14.9 | (631) |
| 2-3 | 24.6 | (358) | 31.8 | (668) | 2.8 | (1,282) | 26.8 | (1,128) |
| 4-5 | 11.8 | (171) | 13.4 | (283) | 8.7 | (407) | 10.1 | (427) |
| 6+ | 8.2 | (121) | 6.5 | (136) | 3.7 | (171) | 4.9 | (205) |