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Urban -rural differential in the association between household wealth index and anemia among women in reproductive age in Ethiopia, 2016.

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Abstract

Background: Anemia is more prevalent among women, and it is a moderate public health problem in Ethiopia. The wealth status and place of residence of a woman have implications on the intervention of anemia. Studies that examined the relationship between women's wealth index status and place of residency in Ethiopia are scarce. We aimed to identify the urban-rural differential in the association between household wealth index and anemia among women of childbearing age in Ethiopia.

Method: A cross-sectional design was employed with nationally representative sample of 14100 women aged 15–49-year-old from the Ethiopian demographic and health survey conducted in 2016. Samples were selected by the two-stage clustering sampling method. The primary outcome was anemia in women of childbearing age. A hemoglobin level of below 11 g/dl for pregnant women and 12 g/dl for non-pregnant women was used as the indicator of anemia. Using a three-level random intercept model to explore associated factors at individual and household levels quantified the observed and unobserved variations between households' wealth index and place of residence.

Results: Women of low household wealth index category were anemic (29.6%) than those middle and rich wealth index categories. Women who live in rural areas were (25.5%) were anemic than those who live in urban. The odds of anemia were significantly higher in women of low household wealth category, compared to women of high household wealth category (AOR = 1.37, 95%CI = 1.14–1.65, P < 0.001). This is not true for women to live in urban residency.

Conclusion: Since the driver of anemia in this study is the place of residency affecting women of reproductive age groups, novel public health interventions should consider urban residency those women with the lowest household wealth status.

Keywords: Anemia, Women, Reproductive age, Factors, Urban, Rural

Introduction

Anemia is a health condition characterized by a low level of hemoglobin (HGB) in which blood has fewer red blood cells (RBC) than normal. A low HGB level impairs blood from delivering oxygen to the body tissues (1). Anemia is caused by a genetic defect, infections (malaria, hookworm, and bone marrow disease), deficiency of iron, range of vitamins, folate, copper, and total nutritional deficiencies. Nutritional deficiency anemia is the most common (2,3).

Anemia is associated with a defect in birth outcomes miscarriage, preterm delivery, placental abruption, a low birth weight, a higher risk of prenatal and maternal mortality (6,7). Anemia can reduce physical activities, cognitive capacities, and reduced work productivity (8). Anemia is the most public health concern worldwide affect 27% (1.93 billion people) of the world's population in 2013. Hence, it is a common public health issue, and particularly in developing countries account for more than 89% of the burden. According to 2011 WHO estimates anemia affects around 800 million children and women of reproductive age globally (9,10).

The global prevalence of anemia for pregnant women was 38.2% and for all women of reproductive age was 29.4% (5, 9). In Africa, anemia affects 35% of women of reproductive age (9, 11). Its prevalence is even higher in low-income countries such as Ethiopia due to a lot of contributing factors (12,13). The symptoms of anemia have consistently related the quality of life, a poor-quality diet due to poverty, socioeconomic status, residence, education, and pregnancy status (4). Besides, due to sex-specific experiences, such as pregnancy, bleeding at childbirth, lactation, and menstruation in women of reproductive age (15–49 years) have an increased risk of iron loss and therefore anemia compared to their male counterparts (14).

The illness is diagnosed when hemoglobin levels fall below 12 g/dl in adult non-pregnant women and below 11 g/dl during pregnancy (1). Based on time there are two main causes of anemia; namely immediate causes and distal causes. The immediate causes are mainly attributable to micronutrient deficiencies (15), physiological adaptations during pregnancy or breastfeeding (16), and infections such as malaria (17), hookworm, and HIV (18). Besides these immediate risk factors of anemia, there are ranges of known distal factors that operate at the household and community levels. These include maternal age (4), education status (13), marital status, occupation (19), rural/urban residence (20), household wealth index (18,21), hormonal contraceptive user, and body mass index (10,22,23).

Former studies in Ethiopia focused on children, pregnant and lactating women nutrition and associated factors (12,24,25). The previous study also identified factors linked to anemia like residence, wealth status, and modern contraceptive users. However, the majority of these studies are small-scale and are limited to specific localities (12,21,25–28). Even though many of them showed us the wealth index and residence area are significantly associated with anemia (29). These former studies did not explain the urban-rural differentiation on the interaction between anemia and wealth index.

Therefore, this study aims to analyze the urban-rural differential in the association between household wealth index and anemia among women of reproductive age in Ethiopia. The Ethiopian Demographic and Health Surveys (EDHS) is the only source of compressive national data on several characteristics of women of reproductive age (15–49 years). The authors decided to investigate the differentials in anemia among women of reproductive age, using data from the 2016 EDHS.

Method

Data source, Study design, sample size, and sampling procedures

This study used data from the 2016 Ethiopian Demographic and Health Survey (EDHS). The EDHS was designed to provide representative data on various health indicators for the whole country across the two city administrations and nine regional states. The survey conducted by the United States Agency for International Development (USAID) in collaboration with the Ministry of Health of Ethiopia and other partner organizations (30).

The 2016 EDHS sample design involved a probabilistic two stages sampling. Each region was stratified into urban and rural areas, yielding 21 sampling strata. Samples of Enumeration Areas (EAs) were selected independently in each stratum in two stages. Implicit stratification and proportional allocation were used at each of the lower administrative levels by sorting the sampling. All women aged 15–49 years who were available in the selected households at the time of the survey were eligible for participation in the survey. A total of 15,683 women aged 15–49 years were selected for anemia testing in the 2016 EDHS. Among these 92.4 % (14,489) of them were tested for anemia. The final analytic sample for this study included 14,100 participants as depicted in (Fig. 1).

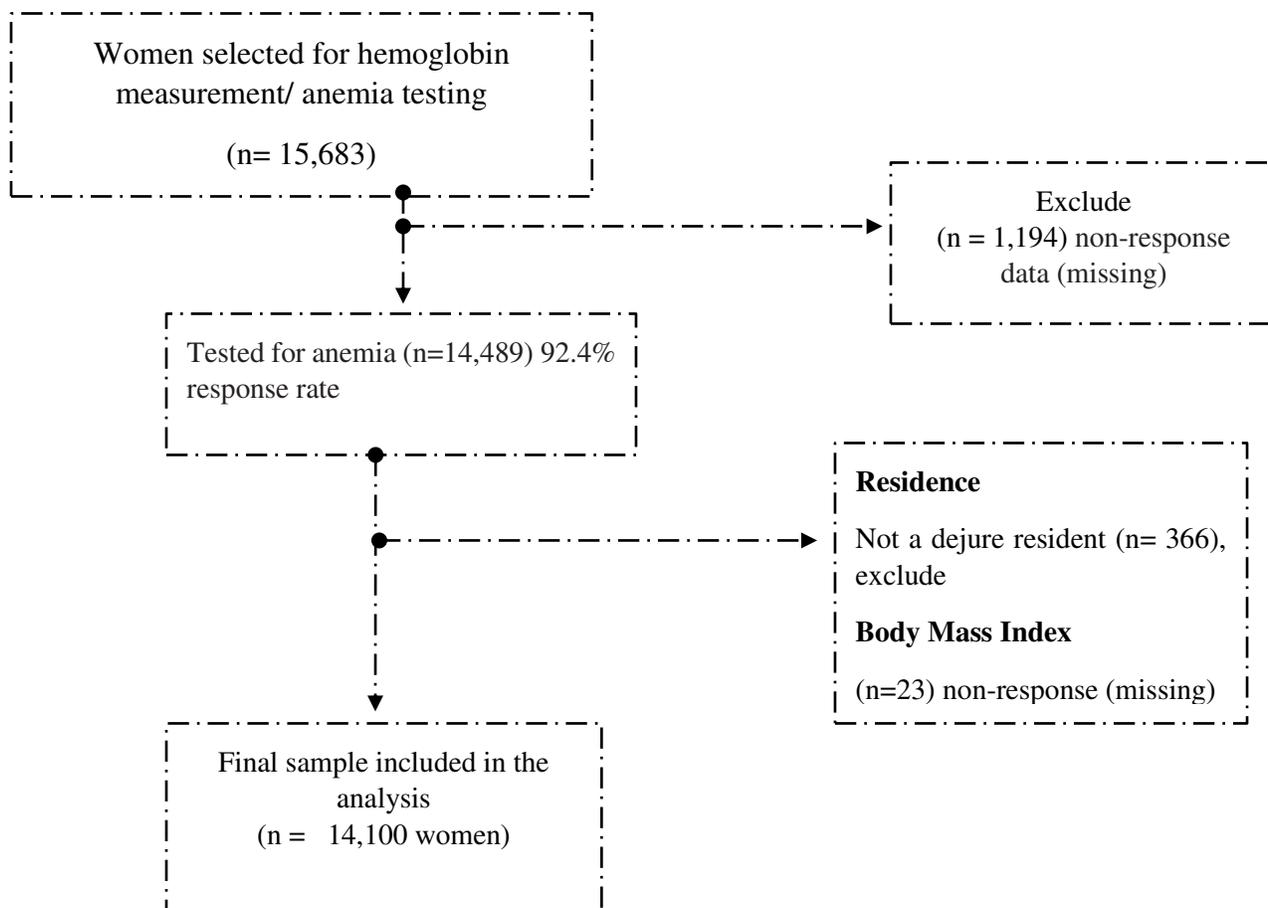


Fig. 1 Schematic presentation of selecting sample from 2016 EDHS data

Variable descriptions

Anemia was chosen as the main outcome variable for this study. Following WHO recommendations (1, 31), anemia in non-pregnant women was defined as any anemia if their hemoglobin concentration was below 12.0 g/dL, moderate or severe if it was below 11.0 g/dL, and severe if it was below 8.0 g/dL. Anemia in pregnant women was also defined as hemoglobin levels below 11.0g/dL whereas non-pregnant women below 12.0g/dL were considered as anemia (30, 32). The main anemia associated variable of interest was the household wealth index and women's place of residence. Based on existing literature, other independent variables included in the analysis are described in Table 1 (4, 10, 18, 20, 22, 23, 33).

Data analysis

All the statistical analyses were done taking into account the complex design of the survey. All the estimates were done after weighing the sample by the sample weighing factor and taking into account the cluster design of the study. While it ensures data representativeness at both national and sub-national

levels, the DHS sampling procedure over-represents small regions. Thus, sample weighting was applied to compensate for the unequal probability of sample selection and ensure the sample resembles the true population distribution. The procedure resulted in a final weighted sample size of 14,100 women (30). Data were analyzed by Chi-square and binary logistic regression models using SPSS software for windows version 20. We described the characteristics of the study population and cross-tabulated our dependent variables with the explanatory variables.

Chi-square was carried out to test the association between the dependent and independent variables. After identifying the association between anemia and independent variables in Chi-square, only one independent variable was included at a time in the regression equation to examine their relationship with anemia. Both the wealth index and place of residence were introduced into the regression equation simultaneously to assess their association with anemia ($p\text{-value} < 0.2$). A significant interaction effect would indicate the residence factor on the relationship between household wealth index and the presence of anemia.

Finally, multivariate logistic regression analyses performed to identify the independent associations of explanatory variables with the outcomes of interest, providing Adjusted Odds ratios (AOR) and 95% confidence intervals (CI). Pearson, Hosmer, and Lemeshow (HL) test to check for model fit (Hosmer & Lemeshow), and the final model had a better HL chi-square value and p-value. The level of statistical significance set at 5%.

Ethical consideration

The EDSH survey was implemented by the CSA of Ethiopia. The study protocol and data collection instruments were reviewed for adherence to ethical standards by the Ethiopian Health and Nutrition Research Institute. All study participants asked for informed written consent. Data collectors explained the purpose of the study and that participation in the study was voluntary. Privacy and confidentiality ensured following the ethical requirements of research. The study involved minimal risk for study participants (30). In our study, since this study was a secondary analysis of the Ethiopian Demographic and Health surveys (EDHS) data, which are publicly available, the study did not require any ethics approval. Only DHS program authorization was requested to download the dataset.

Factors associated with Anemia

Association wealth index and anemia stratified by place of residency

Variables were included in the bivariate regression analysis based on their association in the chi-squared analyses (Table 3). Bivariate model provides the unadjusted odds ratio of the association between anemia and wealth index with the different explanatory variables. Seven variables were significantly associated

with anemia in this model. Six variables remained statistically significant in the final multiple regression model controlling with all explanatory variables.

Women of low household wealth index and live in a rural area were more anemic than women of high house wealth index and live in urban. For instance, women who were low household wealth index and rural residence category were 1.37 times more likely to anemic than their counterparts who belong to the rich class and urban residency. Also, in the interactive expression, being a low household health index played a domineering role in the relationship between residency and wealth-index and level of anemia. In the interactive model, the odds ratio of anemia was higher when women are live in rural rather than urban residences (Table 3).

Other predictors of anemia among the studied women were women who were not used hormonal contraceptives, younger age category, no education, and married women (Table 3). The data further show that either using wealth index and women residency jointly or interactively in the regression equation generated the same predictors with differences in their pattern of the odds ratio. The likelihood of anemia was significantly higher among the poor class women living in a rural area in Ethiopia. Having a poor level of household wealth index and not belonging to the urban has a great influence on anemia level.

Table 1. Description of explanatory variables used in the analysis in Ethiopia 2016 (n=14,100)

Variables	Overall n (wt. %)
Mother's age	
15-24	5631 (38.4)
25-34	4622 (34.1)
35-49	3847 (27.4)
Mother's marital Status	
Unmarried	3662 (24.9)
Married	9024 (66.0)
Others	1414 (9.1)
Mother's education	
None	6467 (48.7)
Primary	4740 (35.2)
Secondary or above	2893 (16.1)
Place of residence	
Urban	4563 (21.2)
Rural	9537 (78.8)
Employment status	
Yes	9078 (66.8)
No	5022 (33.2)
House hold wealth index	

Poor	5487 (35.3)
Middle	1861 (19.5)
Rich	6752 (45.2)
Body mass index	
Under Wt.	3399 (21.2)
Normal	9084 (71.1)
Over Wt.	1617 (7.7)
Hormonal contraceptive use	
No	11407 (76.8)
Yes	2693 (23.2)

Abbreviations: Wt.%: Weighted percent, Wt.: Weight,
Others*: divorced, widowed and no longer living together
Overweight and obese was grouped due to small number of cases

Result

Socio-demographic characteristics of the sample

In this study, a total of 14,100 women were including from nine regional states and two city administrations in Ethiopia. The mean age of the women was 28.2 ± 0.2 and most anemic women lived in rural areas (25.5%). Women of low household wealth index categories were anemic (29.6%) than those rich wealth index categories. women who live in a rural area were (25.5%) were more anemic than those who live in urban areas (Table 2).

Table 2. Characteristics of the study sample and the status of anemia in women of reproductive age (n=14,100)

Variables	Anemia		p
	Yes n (Wt. %)	No n (Wt. %)	
Mother's age			0.020
15-24	1432 (21.9)	4199 (78.1)	
25-34	1361 (25.6)	3261 (74.4)	
35-49	1054 (24.2)	2793 (75.8)	
Mother's marital Status			<0.001
Unmarried	746 (17.9)	2916 (82.1)	
Married	2759 (26.4)	6265 (73.6)	
Others*	342 (20.8)	1072 (79.2)	
Mother's education			<0.001
None	2207 (27.9)	4260 (72.1)	
Primary	1111 (21.5)	3629(78.5)	
Secondary or above	529 (16.2)	2364 (83.8)	
Place of residence			<0.001
Urban	905 (17.1)	3658 (82.9)	

Rural	2942 (25.5)	6595 (74.5)	
Employment status			0.003
Yes	1139 (21.4)	3883 (78.6)	
No	2708 (24.9)	6370 (75.1)	
House hold wealth index			<0.001
Poor	2027 (29.6)	3460 (70.6)	
Middle	477 (23.8)	1384 (76.2)	
Rich	1343 (19.2)	5409 (80.8)	
Body mass index			0.035
Under Wt.	1096 (26.2)	2303 (73.8)	
Normal Wt.	2404 (23.3)	6680 (76.7)	
Over Wt.	347 (21.2)	1270 (78.8)	
Hormonal contraceptive use			<0.001
No	3358 (25.3)	8049 (7.7)	
Yes	489 (18.8)	2204 (81.2)	

Abbreviations: Wt.%: Weighted percent, Wt.: Weight

Others*: divorced, widowed and no longer living together

P- Value * less than 0.005

Association wealth index and anemia stratified by place of residency

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was significantly higher among the poor class women living in a rural area in Ethiopia. Having a poor level of household wealth index and not belonging to the urban has a great influence on anemia level (Table 3).

Table 3. Association wealth index and anemia stratified by place of residency (n=14,100)

Variables	Rural		Urban	
	Adjusted OR (95% CI)	P	Adjusted OR (95% CI)	p
Mother's age				
15-24	1.13 (1.057-1.68)	0.017	0.81 (0.59-1.12)	0.199
24-34	1.27 (1.05-1.52)	0.013	0.75 (0.56-1.01)	0.58
35-49*	1	1		1
Mother's education				
None	1.59 (1.13-2.23)	0.008	0.98 (0.68-1.41)	0.906
Primary	1.27 (0.94-1.71)	0.122	1.14 (0.75-1.730)	0.539
Secondary or above*		1		1
Marital status				
Unmarried	0.84 (0.62-1.14)	0.268	0.81 (0.50-1.2)	0.284
Married	1.53 (1.20-1.97)	0.001	0.98 (0.71-1.35)	0.901
Others*	1	1		1
Wealth index				
Poor	1.37 (1.14-1.65)	0.001	0.86 (0.46-1.62)	0.648
Middle	1.11 (0.93-1.33)	0.247	1.10 (0.43-2.77)	0.843
Rich*	1	1		1
Hormonal contraceptive				
yes*	1	1		1
No	1.67 (1.41-1.95)	<0.001	1.53 (1.13-2.07)	0.006
Body mass index				
Under weight	1.06 (0.74-1.52)	0.752	1.10 (0.71-1.7)	0.674
Normal	0.89 (0.65-1.24)	0.507	1.10 (0.72-1.58)	0.741
Overweight*	1			
Employment				
yes*	1			
No	1.04 (0.89-1.21)	0.634	1.159 (0.87-1.51)	0.326

Abbreviations: Wt.%: Weighted percent; OR: Odds Ratio; CI: Confidence Interval

*: Reference group

Others: divorced, widowed and no longer living together

Discussion

This study uses country level, representative data in Ethiopia to describe urban-rural differential in the association between household wealth index and anemia among women in the reproductive age group. This study provides evidence link specific anemia factors related to women's reproductive age group. Since successful anemia prevention strategies should rely on evidence-based approaches, the result of this study should represent recommended public health interventions and policies aimed at a target age group. And then reduce the burden and consequences of anemia in this group.

The prevalence of anemia among women in Ethiopia is 24% in 2016 (30), making it a moderate public health problem according to the WHO threshold (34). The results suggest that level of household wealth was associated with anemia in women who live in rural. The prevalence of anemia in women varies significantly between urban and rural and region to region in the communities (18). Even though the prevalence of anemia among women age 15-49 declined from 27% in 2005 to 17% in 2011, it turns increased to 24% in 2016 in Ethiopia (30).

In our study, the authors showed that the impact of economic status on the place of residency was the single greatest contributor to anemia among reproductive-age women in Ethiopia. This study found that 29.6% of women of reproductive age who come from poor house wealth status were anemic. Of the total participants, 25.1% of anemic women of reproductive age were living in a rural area. The prevalence of anemia (29.6% and 25.1%) revealed by this study is higher than the national average (24%). It is also high when compared to urban residency in the country.

In this study, the wealth status of the household was significantly associated with the development of anemia in those who live in rural areas but not in an urban one. Women who had the lowest wealth statuses (AOR=1.37; 95% CI: 1.14-1.65) increase the chance of developing anemia in rural residency. This finding is consistent with the findings from other studies in low and middle- income countries, which found that the associated factors of anemia among women living in the lowest wealth status were increased when compared with those living in the heights wealth status (11, 18, 20, 22, 23, 33).

This could be because those from the lowest wealth status in the countryside lack the ability to purchase the quality or quantity of foods compared with those from higher wealth status. Lower-income households purchase less healthful foods compared with higher-income households. It is plausible that diets of women from low wealth status homes, as with urban residents, may have diversified diets and supplements, thereby decreasing their chance of nutrition-related anemia (32, 35,36). Another fact also the most reported diet consumption of the household in rural residency is monotonous foodstuff and low diet diversification (1, 32). Rural participants with lower socioeconomic status could have greater

inadequacy of household food resources, food did not last, and they could not afford balanced meals, or reduced meal size or skipped meals (37,38). The women knowledge of different vitamin and mineral containing foods and their benefit may be other contributors (19).

We observed a place of residency -specific variations in the association of anemia among women with similar household wealth status. Place of residency may be mediated anemia difference in similar wealth status in the Ethiopian reproductive women age group. Our study showed associations between the low socioeconomic status of those who live in rural and anemia. This may be in rural regions has been attributed to disparities in health service provision and access, and disease risk, fertility preferences (37, 39, 40). On the other round, farming can increase the chance of anemia-inducing infectious diseases such as malaria, intestinal parasites like schistosomiasis and hookworm, and such exposures may be more common in rural residency (33, 41).

In this study, there were significant differences in anemia between urban and rural areas with similar socioeconomic status. The cause of urban-rural differences was related to the socio-cultural conditions of the participant. The potential cause of this may be restricted access to diverse micronutrient-rich diets (food taboo), not access to mass media, and nutrition information for women who live in rural can exacerbate anemia. Multiple deficiencies tend to cluster within individuals, and the synergistic effect of these deficiencies is important in the development of anemia in rural residency (39,42, 45,46). Other than residency and socioeconomic status, women who were not used hormonal contraceptive, younger age category, and no education and married were potential predictors of anemia among the studied participants in Ethiopia; other studies have reported a similar relation (4, 9, 10, 18, 23, 24, 33, 46).

Strengths and limitations

This study used large population-based data with a large sample size, which is representative of all regions of Ethiopia. Due to the cross-sectional nature of the EDHS data, the cause/effect and the temporal relationship could not be established based on these study findings. Similarly, essential factors such as family size, gravidity, and parity, religion, current breastfeeding, smoking, and HIV factors were not incorporate these variables in the analysis.

Conclusion

The result of this study should represent recommended public health interventions and policies aiming at a target age group (rural residency) and reduce the burden and consequences of anemia in this age group in the nation. This study provides evidence link specific anemia factors related to women's reproductive age group those who live in the countryside. Since the driver of anemia in this study is a place of residency

affecting women of reproductive age groups, novel public health interventions should consider urban residency for those women with the lowest household wealth status.

Declaration

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Author contributions

Teshager Weldegiorgis Abate, Biruk Getahun, and Mekuriaw Mesfin Birhan are formulating the research question(s), initiate the idea, designing the study and analyzing the data. Teshager Weldegiorgis Abate, Getasew Mulatu Aknaw, Sefealem Assefa Belay, and Dessalegn Demeke are interpreting the results and writing the drafting of the manuscript. Dagninet Derebe Abie, Adela Memberu Alemu, and Yirga Mengiste are writing reviewing and approving the final manuscript. All authors read and approved the final document.

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Competing interests

The author declares that no competing of interest.

Data availability

All data generated or analyzed during this study are included in this the manuscript.

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Figures

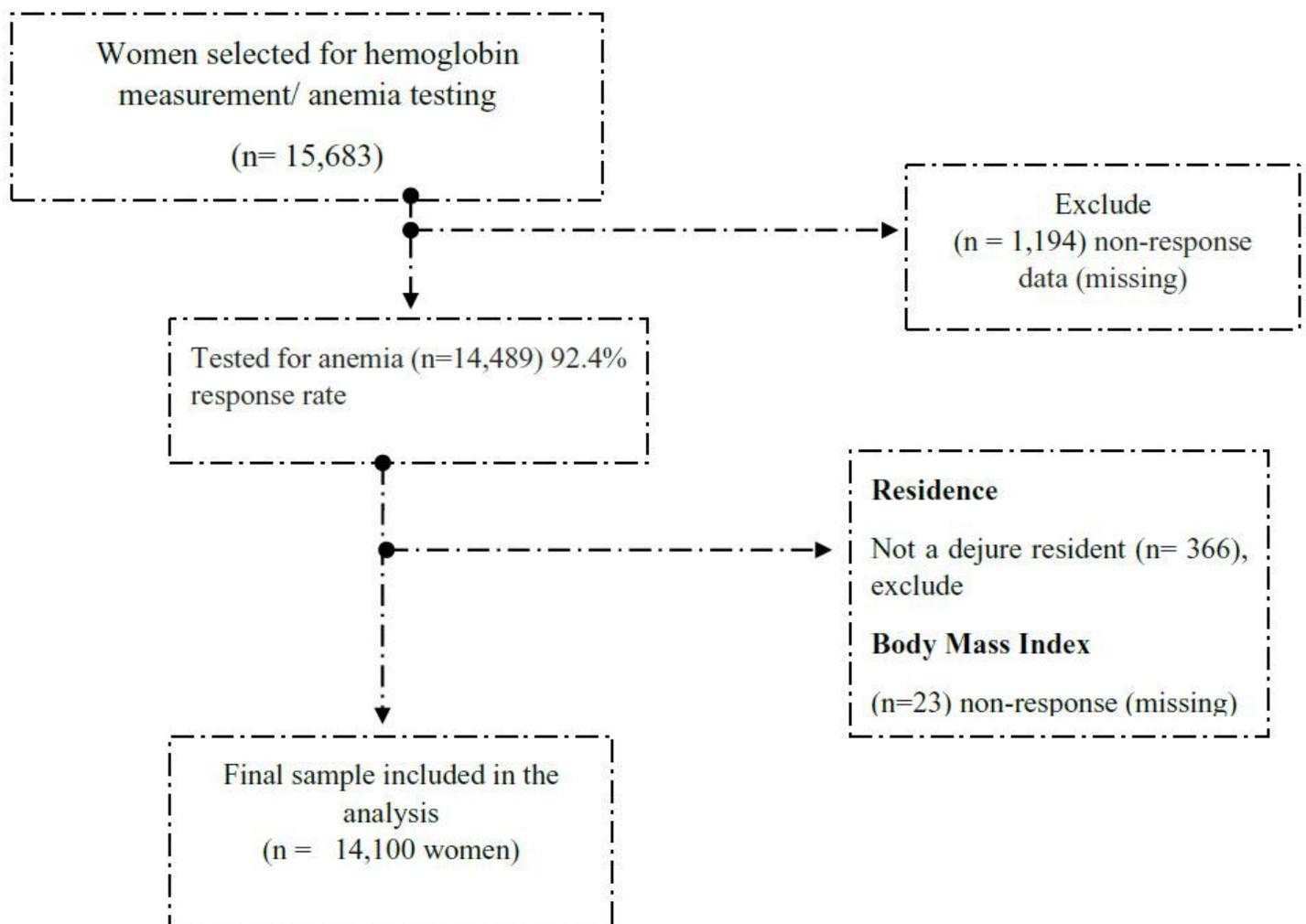


Figure 1

Schematic presentation of selecting sample from 2016 EDHS data