Research article

The impact of household wealth status on anxiety and depression of Nepal reproductive age women: Propensity score matching analysis

Angwach Abrham Asnake [a,*], Bezawit Melak Fente [b], Beminate Lemma Seifu [c], Hiwot Altaye Asebe [c], Mamaru Melkam [d], Meklit Melaku Bezie [e], Yohannes Mekuria Negussie [f], Zufan Alamrie Asmare [g]

[a] Department of Epidemiology and Biostatistics, School of Public Health, College of Health Sciences and Medicine, Wolaita Sodo University, Wolaita Sodo, Ethiopia
[b] Department of General Midwifery, School of Midwifery, College of Medicine & Health Sciences, University of Gondar, Gondar, Ethiopia
[c] Department of Public Health, College of Medicine and Health Sciences, Samara University, Samara, Ethiopia
[d] University of Gondar College of Medicine and Health Science, Department of Psychiatry, University of Gondar, Gondar, Ethiopia
[e] Department of Public Health Officer, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia
[f] Department of Medicine, Adama General Hospital and Medical College, Adama, Ethiopia
[g] Department of Ophthalmology, School of Medicine and Health Science, Debre Tabor University, Debre Tabor, Ethiopia

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ABSTRACT

Background: Mental health problems, particularly anxiety and depression, are indeed among the leading health challenges worldwide, affecting individuals across all age groups and geographic locations. The relationship between mental health and socioeconomic factors, including household wealth status, is well-documented. However, there are currently no studies demonstrating a causal relationship between household wealth and common mental disorders, such as anxiety and depression. Therefore, this study aimed to assess the effect of household wealth status on anxiety and depression through Propensity Score Matching analysis (PSM) analysis.
Methods: This study used the recent 2022 Nepal Demographic and Health Survey (NDHS). A weighted sample of 7411 reproductive-age (aged 15–49 years) women who were interviewed for mental health conditions were included in this study. Anxiety and depression were the dependent variables of this study. The NDHS utilized the Generalized Anxiety Disorder 7-item scale (GAD-7) to assess levels of anxiety among participants and the Patient Health Questionnaire 9 (PHQ-9) to evaluate depression. PSM analysis was employed to examine the causal connection between household wealth and women's anxiety and depression by controlling for confounding variables.
Results: The average treatment effects (ATE) of non-poor household status on anxiety and depression were −0.015 and −0.052 respectively, indicating that non-poor household status reduces women's anxiety and depression. It implies the difference in risks of anxiety and depression that would be observed if everyone in the population were from non-poor households, versus if everyone in the population were from poor households were 1.5 % and 5.2 % respectively. The average treatment effect on treated (ATT) result showed that women from non-poor wealth status households reduced the risk of anxiety and depression by 1.1 % and 9.2 % respectively among treated groups.

* Corresponding author.
  E-mail address: angwachabrham@gmail.com (A.A. Asnake).

Conclusion: This study evidenced that causal relationship between household wealth status and common mental health conditions as such anxiety and depression. This suggests, it is better to focus on improving the wealth status of households to enhance the mental health of reproductive-age women. By understanding the multidimensional aspects of poverty and their links to mental health, stakeholders can create more effective strategies to support affected individuals and communities. This can contribute to breaking the cycle of poverty and improving overall well-being.

1. Introduction

Mental health problems are characterized by a significant interruption in a person's behavior, emotions, and cognitive function [1]. Depression is a common mental disorder, marked by a variety of symptoms that can significantly impact an individual's daily life, and characterized by low mood, loss of pleasure and interest in activities [2]. Anxiety disorders involve intense and excessive fear and worry, often accompanied by physical, behavioral, and cognitive symptoms [3].

Mental health disorders have become significant global health challenges, anxiety and depression consistently rank among the most prevalent mental health disorders across various age groups and geographic locations [4]. In 2019, it was estimated that around 12 % of the global population experienced some form of mental health problem [4]. Around 4 % of the worldwide population suffer from anxiety disorders, and 3.8 % from depression [5,6]. The prevalence rates of depression and anxiety in Africa were 47 % and 48 %, respectively [7]. In the Western Pacific and South-East Asian regions, depression affects 50 % of the population, while anxiety affects 23 % of them [8]. The prevalence rates of anxiety and depression in Nepal was 17.7 % and 4.0 % respectively, this highlights significant mental health challenges faced by the population [9].

Financial stress and household wealth are significant contributing factors to anxiety and depression [10–16]. People from lower-income households are more likely to experience depression and anxiety, this association is likely influenced by a complex interplay of factors, including increased exposure to medical problems, criminal activity, violence, and life-threatening concerns [17]. Being a young adult and middle age [16,18,19], being female [16,20], low level of education [21], occupation [22], and being unmarried/divorced/widowed [21–23] increase the risk of anxiety and depression.

Anxiety and depression lead to a variety of medical conditions, including immune system weakness, asthma, heart disease, digestive disorders, and breathing difficulties [24]. Patients with anxiety and depression dying 7.9 years earlier than the overall population, highlights the possibility that these mental health issues are related to a number of physical health issues or lifestyle choices that shorten life expectancy [25]. Additionally, with anxiety and depression accounting for 3.5 % of deaths in the population, it emphasizes the need for effective mental health interventions [25].

Several studies demonstrate the association between household wealth and common mental disorders (i.e. anxiety and depression) [10–16]. However, these kinds of studies have built-in drawbacks, like bias due to confounding variables [26]. Currently, there is limited evidence that shows the causal relationship of household income status with common mental health problems. Therefore, this study aimed to assess the effect of household wealth status on anxiety and depression using Propensity Score Matching (PSM). PSM is a statistical technique that matches each individual in the treated group with a non-treated (control) individual who has similar characteristics. By utilizing these matched pairs, the study estimated the impact of household wealth status on anxiety and depression. This method helps to reduce bias and confounding in estimating treatment effects and allows for a more accurate understanding of how wealth influences mental health outcomes.

2. Method

2.1. Study design, setting, and population

This study used the recent 2022 Nepal Demographic and Health Survey (2022 NDHS), it was cross-sectional by design. Nepal is divided into seven geographic regions: Koshi Province, Madhesh Province, Bagmati Province, Gandaki Province, Lumbini Province, Karnali Province, and Sudurpashchim Province. Nepal has 77 districts comprising a total of 753 (local-level) municipalities (293 are urban and 460 are rural) [27]. Out of a total of 14,845 reproductive-age women included in NDHS, a weighted sample of 7411 reproductive-age women (aged 15–49 years) who were interviewed for mental health conditions were included in this study.

2.2. Outcome variables and their definition

Anxiety and depression were the dependent variables of this study. The NDHS used general anxiety disorder 7 (GAD 7) to measure anxiety, and its internal constancy (Cronbach α) was 0.86. Patient depression questionnaire 9 (PHQ 9) with an internal consistency of (Cronbach α) of 0.86 was used to measure depression. The two scales relate to symptoms that were experienced during the two weeks prior to the survey. The Likert scale used for both tools is used to represent the severity of symptoms; scores of 0, 1, 2, and 3 correspond to the response categories "not at all" (never), "several days" (rarely), "more than half the days" (often), and "nearly every day" (always), respectively [28]. The individual item scores are added together to generate the total score. A score more than the cutoff of 10, was considered as she had anxiety and depression [29,30].

2.3. Treatment/exposure variable

The exposure variable of interest was household wealth status. The NDHS collected information on household assets including household construction materials, types of water sources and sanitation facilities, as well as electricity and other belongings [27]. The wealth index was constructed by principal component analyses, and it was divided into quintiles (poorest, poorer, middle, richer, and richest). Finally for the current study we merged the poorest and poorer categories into the poor class and other categories into the non-poor class.

2.4. Confounding variables

The study included covariates that influence the relationship between household wealth and mental health conditions like anxiety and depression, but are not affected by treatment (household wealth. the age of respondents, marital status, place of residence, and province were considered as a confounding variable.

2.5. Model building and statistical analysis

Statistical analysis was conducted by STATA version 18. Among other non-experimental techniques, propensity score matching (PSM) was selected because it does not require baseline data, matching estimators draw emphasis on the issue of common support, and matching is nonparametric (it does not require functional form assumptions for the outcome equation) [31]. PSM is now a widely used method for estimating the impact of causative treatments.

2.5.1. Estimating the propensity score

Propensity score estimation is the first stage in PSM. There are two options to consider when estimating the propensity score. The first one relates to the estimated model, and the second one to the variables that will be included in this model. Logit and probit models typically produce similar findings for the binary treatment situation, when the objective is to predict the probability of participation vs. non-participation. Therefore, even if the logit distribution has a higher density mass in the boundaries, the decision is not overly critical [32]. Women from poor wealth status and non-poor wealth status matched using logistic regression. The dependent variable in the logit model estimate was household wealth status, which took a value of 1 if the wealth belonged to the category of non-poor and 0 if it belonged to the poor group. It is mathematically expressed by:

$$\text{logit}(P_i) = \ln\left(\frac{P_i}{1 - P_i}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_n x_n$$

Where p_i indicates the probability of belonging to a non-poor household, and x indicating the explanatory variables. Since only factors that influence simultaneously the exposure and the outcome variable should be included, this study considered the variables that affect household wealth and mental health conditions were included.

2.5.2. Matching algorithm

The Nearest Neighbour (NN), Caliper and Radius, Stratification and Interval, Kernel and Local, and Linear Weighting matching algorithms are frequently employed [32]. If the nearest neighbour is far away, there is a chance that NN matching will yield bad matches. By placing a tolerance threshold on the greatest propensity score distance (caliper), this can be prevented. We considered nearest neighbour matching to match an individual from non-poor household with another individual from poor household based on their propensity scores within the caliper of 0.015. The size of the caliper was calculated from 0.2 of the standard deviation of the logit of the propensity score [33].

2.5.3. Common support

The common support region is the area that contains the minimum and maximum propensity scores of treatment and control groups respectively [34]. Only the region of common support (overlap) is used to define average treatment effect (ATE) and average treatment effect on treated (ATT) [32]. Examining the overlap and the area of common support between the treatment and comparison groups is therefore an essential step. In this study, all observations whose propensity score is smaller than the minimum and larger than the maximum in the opposite group were delated.

2.5.4. Quality of matching

Pseudo-R^2 with standardized bias (SB) between participant and non-participant samples is used to assess the quality of covariate between participants and non-participants [35]. Moreover, p-values of the likelihood ratio Chi-square suggest no systematic differences in the distribution of covariates between treatment and control cases after matching. This study assessed the quality of matching using pseudo-R^2 with SB, and p value of likelihood ratio.

2.5.5. Sensitivity analysis

Since the outcome variables were binary, the Mantel-Haenszel test statistic was used to assess whether the PSM estimates were sensitive to hidden bias [36]. We explicitly state that we are curious about the data's sensitivity up to the point at which $\Gamma = e^{\gamma} = 2$.

2.6. Ethical consideration

Ethics approval and participant agreement were not necessary for this study because it employed secondary (NDHS) data. After the submission of the study application, we received permission to download and use the anonymized dataset from http://www.dhsprogram.com.

3. Results

3.1. Characteristics of the participants

A weighted sample of 7411 reproductive-age women was included in this study, the median age 0f 29 with Interquartile Range (IQR): 21–38. More than one-third (36.65 %) of women had poor wealth status, 6.72 %(183) of them had anxiety, and 5.23 %(142) of them had depression. About 3.31 %(245) of participants were widowed, divorced, and separated, of them 16.81 %(41) developed anxiety and 12.05 %(30) had developed depression. The majority 68.33 % (5064) of the women were from urban, and 5.46 % (276) of them had developed anxiety and 4.19 % (212) developed depression (Table 1).

3.2. The impact of household wealth status on anxiety and depression

This study employed PSM analysis to evaluate the influence of household wealth on common mental health conditions (i.e. anxiety and depression), controlling for confounding variables effect. The study used caliper and radius matching with a maximum propensity score distance of 0.15 to compare anxiety and depression in individuals from poor households with non-poor households.

The unmatched results revealed that women from non-poor wealth status experienced a 1.4 % reduction in anxiety risk and a 1.3 % reduction in depression. The average treatment effects (ATE) of non-poor household status on anxiety and depression were −0.015 and −0.052 respectively, indicating that non-poor household status reduces women's anxiety and depression by 1.5 % and 5.2 % respectively. It implies the difference in risks of anxiety and depression that would be observed if everyone in the population were from non-poor households, versus if everyone in the population were from poor households were 1.5 % and 5.2 % respectively. The average treatment effect on treated (ATT) result showed that women from non-poor wealth status households reduced the risk of anxiety and depression by 1.1 % and 9.2 % respectively among treated groups (Table 2).

Table 1
Characteristics of participants (weighted sample n = 7411).

Variables	Frequency (%)	Anxiety		Depression	
		Yes (%)	No (%)	Yes (%)	No (%)
Age (in years)					
15-19	1323 (17.85)	56 (4.23)	1267 (95.77)	56 (4.23)	1267 (95.77)
20-24	1289 (17.40)	68 (5.30)	1221 (94.70)	68 (5.30)	1221 (94.70)
25-29	1230 (16.59)	74 (6.01)	1556 (93.99)	74 (6.01)	1156 (93.99)
30-34	1062 (14.33)	52 (4.91)	1010 (95.09)	52 (4.91)	1010 (95.09)
35-39	1005 (13.56)	63 (6.25)	942 (93.75)	63(6.25)	942 (93.75)
40-44	804 (10.85)	65 (8.09)	739 (91.91)	65 (8.09)	739 (91.91)
45-49	698 (9.42)	47 (6.76)	651 (93.24)	47 (6.76)	651 (93.24)
Wealth status					
Poor	2716 (36.65)	183 (6.72)	2533 (93.28)	142 (5.23)	2574 (94.77)
Non-poor	4695 (63.35)	243 (5.17)	4452 (94.83)	192 (4.08)	4503 (95.92)
Marital status					
Single/no living together	1632 (22.03)	60 (3.66)	1573 (96.34)	46 (2.83)	1586 (97.17)
Married/living together	5533 (74.66)	324 (5.86)	5208 (94.14)	258 (4.66)	5275 (95.34)
Widowed/divorced/separated	245 (3.31)	41 (16.81)	204 (83.19)	30 (12.05)	216 (87.95)
Occupation					
Not working	2442 (32.95)	97 (3.98)	2345 (96.02)	78 (3.08)	2364 (96.82)
Working	4969 (67.05)	328 (6.60)	4641 (93.40)	256 (5.15)	4713 (94.85)
Husband occupation					
Not working	138 (1.86)	13 (9.34)	125 (90.66)	13 (9.24)	125 (90.76)
Working	7273 (98.14)	413 (5.74)	6860 (94.33)	321 (4.41)	6952 (95.59)
Place of residence					
Urban	5064 (68.33)	276 (5.46)	4788 (94.54)	212 (4.19)	4852 (95.81)
Rural	2347 (31.67)	149 (6.35)	2198 (93.65)	122 (5.18)	2225 (94.82)
Province					
Koshi	1241 (16.75)	98 (7.88)	1143 (92.12)	64 (5.15)	1177 (94.85)
Madhesh	1512 (20.41)	87 (5.72)	1426 (94.28)	70 (4.60)	1443 (95.40)
Bagmati	1494 (20.15)	56 (3.73)	1438 (96.27)	55 (3.66)	1439 (94.34)
Gandaki	1494 (9.51)	21 (3.02)	683 (96.98)	25 (3.53)	680 (96.47)
Lumbini	1360 (18.35)	88 (6.44)	1273 (93.56)	55 (4.01)	1306 (92.38)
Karnali	458 (6.18)	35 (7.63)	423 (92.37)	35 (7.62)	423 (92.38)
Sudurpashchim	641 (8.65)	42 (6.47)	600 (93.53)	31 (4.87)	610 (95.13)

3.3. Common support

ATT and ATE are only defined in the region of common support, 7 and 8 observations were removed due to common support when used PSM to investigate the impact of wealth on anxiety and depression, respectively. To see the distributions of propensity scores, we produce a histogram. For both groups' post-matching propensity scores, the distribution is essentially the same (Figs. 1 and 2).

3.4. Quality of matching

The quality of matching was assessed by standard bias and pseudo-R^2. The mean standardized bias (SB) reduction after matching is 17.5 % for anxiety and 13.5 % for depression. This shows a good level of covariate balancing. The pseudo-R^2 estimates drop from 0.077 to 0.001 for anxiety and from 0.206 to 0.026 after matching (Table 3). Thus, the covariates have low explanatory power after matching for selection into the treatment group.

The p-values of the likelihood ratio Chi-square suggest no systematic differences in the distribution of covariates between treatment and control cases after matching. The p-value after matching is 0.701 for anxiety and 0.342 for depression. Thus, the hypothesis that both groups have the same distribution in the covariates after matching cannot be rejected.

3.5. Sensitivity analysis

To examine if the PSM estimates were sensitive to the hidden bias, the Mantel-Haenszel test statistic was employed. The Q_{MH} test statistic yields the same result when no hidden bias ($\Gamma = 1$) is assumed, suggesting a strong treatment effect (Tables 4 and 5). In a study free of hidden bias, i.e., where $\Gamma = 1$, the Q_{MH} test statistic is 0.45 for anxiety and 1.69 for depression and would constitute strong evidence that poor household wealth causes anxiety and depression.

4. Discussion

This study examined the impact of household wealth status on anxiety and depression in reproductive-age women of Nepal using PSM. Using PSM enable us to matching each non-poor participants with poor participants of similar characteristics.

The PSM analysis reviled that, non-poor household status is associated with anxiety (ATE = −0.015) and depression (ATE = −0.052). This indicates that being part of a non-poor household reduces women's anxiety by 1.5 % and depression by 5.2 %. Moreover, the ATT results indicate that women from non-poor households saw a reduction in the risk of anxiety and depression by 1.1 % and 9.2 %, respectively, within the treated groups. These findings are consistent with studies conducted in Vietnam [37], Indonesia [38], Koria [39], United State [40], and Australia [41].

There are several reasons why the associations between household poverty status and mental health outcomes may exist. For instance, poverty adversely affects health by limiting access to essential resources that contribute to a person's standard of living [42, 43]. Basic needs including food have a significant impact on the onset, treatment, and avoidance of many mental health issues [44]. Due to the aforementioned reason poor wealth status is highly related to the release of stress hormone cortisol [45]. Moreover, This financial uncertainty creates added stress, leading to heightened anxiety and chronic worry about meeting basic needs such as housing, food, and healthcare [46]. Individuals living in poverty frequently encounter a range of environmental stressors that can exacerbate both physical and mental health challenges [17,47]. Addressing these challenges requires not only economic support but also access to financial education, mental health services, and community resources that can help individuals develop coping strategies and build resilience amidst their difficult circumstances.

Examining the causal links between conditions like household wealth and common mental disorders can yield insights that are crucial for effective policy interventions. Households with limited wealth often lack access to mental health services, recreational activities, and social support systems, which are essential for promoting mental well-being. This lack can perpetuate the cycle of poverty and poor mental health.

Table 2

The propensity scores matching analysis showed the impact of household wealth status on anxiety and depression.

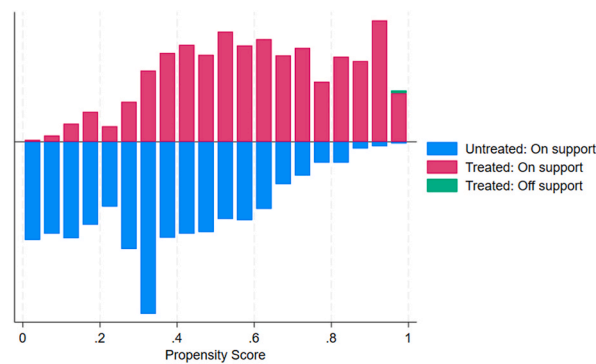| Outcome	Treated	Control	Difference	SE	T-test
Anxiety					
Unmatched	0.052	0.066	−0.014	0.005	−1.90
ATT	0.052	0.058	−0.011	0.025	−1.56
ATU	0.066	0.041	−0.024		
ATE			−0.015		
Depression					
Unmatched	0.042	0.055	−0.013	0.007	−2.68
ATT	0.042	0.133	−0.092	0.019	−3.15
ATU	0.060	0.048	−0.007		
ATE			−0.052		

Fig. 1. Propensity score distribution for treated and control groups for the impact of household wealth status on anxiety.
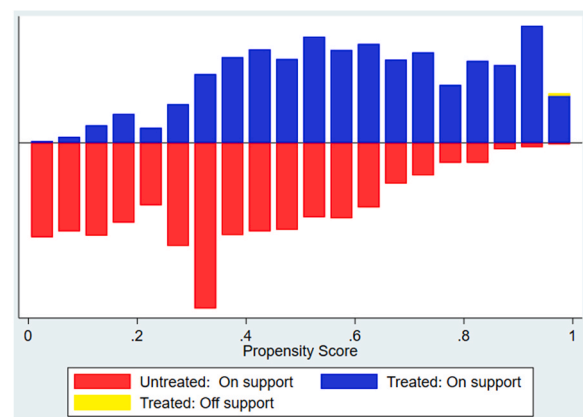

Fig. 2. Propensity score distribution for treated and control groups for the impact of household wealth status on depression.

Table 3
Covariate balancing test results for the PSM.

Outcome variables	Pseudo R^2	Likelihood ratio Chi-square	p-value of Likelihood ratio	Bias reduction
Anxiety				
Unmatched	0.077	484.74	<0.001	17.5 %
Matched	0.001	4.63	0.701	
Depression				
Unmatched	0.206	1294.17	<0.001	13.5 %
Matched	0.026	157.40	0.342	

4.1. Strengths and limitations of the study

This study used nationally representative data with a large sample size to enhance the generalizability of the study findings. Employing PSM enables this study to balance the non-poor (treatment group) on confounding factors to make them comparable using a non-experimental causal inference technique. Due to the matching was conducted exclusively with the observed factors. Despite these strengths, there are limitations on our study. PSM compares the treated to controls, which improves treatment effect estimates; still, estimates depend on the assumption of un confoundedness. As a result, residual confounding could happen.

5. Conclusion

This study evidenced that causal relationship between household wealth status and common mental health conditions as such anxiety and depression. This suggests, it is better to focus on improving the wealth status of households to enhance the mental health of reproductive-age women. By understanding the multidimensional aspects of poverty and their links to mental health, stakeholders can create more effective strategies to support affected individuals and communities. This can contribute to breaking the cycle of poverty and improving overall well-being.

Table 4
Sensitivity analysis for the impact of household wealth on anxiety.

Gamma (Γ)	Test statistics		Significance level	
	Overestimation (Q_mh+)	Underestimation (Q_mh−)	Overestimation (p_mh+)	Underestimation (p_mh−)
1	0.45	0.45	0.33	0.33
1.05	0.67	0.23	0.25	0.41
1.1	0.88	0.02	0.19	0.49
1.15	1.08	0.04	0.14	0.52
1.2	1.28	0.15	0.10	0.44
1.25	1.46	0.33	0.72	0.37
1.3	1.64	0.50	0.05	0.31
1.35	1.81	0.67	<0.05	0.25
1.4	1.98	0.84	<0.05	0.20
1.45	2.14	1.00	<0.05	0.16
1.5	2.30	1.15	<0.05	0.13
1.55	2.45	1.30	<0.05	0.10
1.6	2.59	1.44	<0.05	0.07
1.65	2.74	1.58	<0.05	0.56
1.7	2.88	1.72	<0.05	<0.05
1.75	3.01	1.85	<0.001	<0.05
1.8	3.14	1.98	<0.001	<0.05
1.85	3.27	2.10	<0.001	<0.05
1.9	3.40	2.23	<0.001	<0.05
1.95	3.52	2.35	<0.001	<0.05
2	3.65	2.46	<0.001	<0.001

Table 5
Sensitivity analysis for the impact of household wealth on depression.

Gamma (Γ)	Test statistics		Significance level	
	Overestimation (Q_mh+)	Underestimation (Q_mh−)	Overestimation (p_mh+)	Underestimation (p_mh−)
1	1.69	1.69	<0.05	0.04
1.05	1.90	1.49	<0.05	0.07
1.1	2.09	1.30	0 < 0.05	0.10
1.15	2.28	1.11	<0.05	0.13
1.2	2.46	0.94	<0.05	0.17
1.25	2.63	0.78	0 < 0.05	0.22
1.3	2.80	0.62	<0.05	0.27
1.35	2.95	0.46	<0.05	0.32
1.4	3.11	0.31	<0.001	0.38
1.45	3.27	0.17	<0.001	0.43
1.5	3.42	0.03	<0.001	0.49
1.55	3.56	0.10	<0.001	0.54
1.6	3.70	0.01	<0.001	0.51
1.65	3.84	0.11	<0.001	0.46
1.7	3.97	0.23	<0.001	0.41
1.75	4.10	0.35	<0.001	0.36
1.8	4.23	0.46	<0.001	0.32
1.85	4.35	0.57	<0.001	0.28
1.9	4.47	0.68	<0.001	0.25
1.95	4.59	0.78	<0.001	0.22

CRediT authorship contribution statement

Angwach Abrham Asnake: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Methodology, Formal analysis, Data curation, Conceptualization. **Bezawit Melak Fente:** Writing – review & editing, Visualization, Validation, Supervision, Software, Methodology, Data curation, Conceptualization. **Beminate Lemma Seifu:** Writing – review & editing, Visualization, Validation, Software, Formal analysis, Data curation, Conceptualization. **Hiwot Altaye Asebe:** Writing – review & editing, Visualization, Validation, Software, Methodology, Data curation, Conceptualization. **Mamaru Melkam:** Writing – review & editing, Visualization, Validation, Software, Methodology, Data curation, Conceptualization. **Meklit Melaku Bezie:** Writing – review & editing, Visualization, Validation, Software, Methodology, Data curation, Conceptualization. **Yohannes Mekuria Negussie:** Writing – review & editing, Visualization, Validation, Software, Methodology, Data curation, Conceptualization. **Zufan Alamrie Asmare:** Writing – review & editing, Visualization, Validation, Software, Methodology, Data curation, Conceptualization.

Availability of data and materials

The data can be accessed from the DHS website (http://www.dhsprogram.com) after permission obtained through an online request by explaining the objective of the study.

Consent for publication

This is not applicable.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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