

Article

Locus of Control and Utilization of Skilled Birth Care in Nigeria: The Mediating Influence of Neuroticism

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Abstract: Despite ongoing efforts to reduce maternal mortality in Nigeria, the uptake of skilled birth attendance remains persistently low, especially in rural areas. While structural and socio-demographic barriers have been widely studied, less attention has been paid to psychological determinants of maternal healthcare-seeking behavior in low-resource settings. This study explores how the locus of control influences the use of skilled birth care among postpartum women in rural Edo State, Nigeria, and whether neuroticism serves as a mediating factor in this relationship. We draw on data from a cross-sectional survey involving 1411 women aged 15–45 who had given birth within the two years preceding the study. Participants were recruited from 20 randomly selected communities across two rural Local Government Areas. Data were collected using structured interviews that included validated measures of locus of control, neuroticism, and self-reported use of skilled birth care. We applied the Baron and Kenny mediation framework using linear and logistic regression models with standardized coefficients, adjusting for education, household wealth, and women’s decision-making autonomy. The findings show that women with a more external locus of control were significantly less likely to utilize skilled birth care ($p < 0.01$), and that neuroticism partially mediated this effect. Higher levels of neuroticism were associated with a reduced likelihood of engaging with skilled maternity care services. These results highlight the importance of psychological traits in shaping maternal health behaviors. Integrating psychosocial interventions, such as emotional support, cognitive reframing, and community health education, into maternal healthcare programs may improve service uptake in marginalized rural populations.

Keywords: skilled birth care; locus of control; neuroticism; maternal health; mediation analysis; psychological traits



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1. Introduction

Maternal mortality remains a significant public health challenge, particularly in low- and lower-middle-income countries, where it is a leading cause of death among women of childbearing age [1]. Sub-Saharan Africa bears a disproportionate share of the global maternal mortality burden, accounting for approximately 68% of maternal deaths worldwide [1,2]. Despite decades of global and national investments in maternal health, progress in reducing maternal mortality has been slow and uneven in many low-income countries [2].

Nigeria stands out as one of the countries with the highest maternal mortality ratios globally [3]. The World Bank estimated Nigeria's maternal mortality ratio at 1047 per 100,000 live births in 2020, while a 2023 report by the World Health Organization highlights that Nigeria accounts for approximately 28.5% of the global burden of maternal deaths [4]. Key contributors to these alarming statistics include limited utilization of maternal health-care services, with over 70% of maternal deaths arising from five significant complications: hemorrhage (25%), infections (15%), unsafe abortion (13%), hypertension (12%), and obstructed labor (8%). These emergencies necessitate timely access to skilled birth care and emergency obstetric services [4,5].

The World Health Organization (WHO) has emphasized that 74% of maternal deaths could be prevented through effective healthcare interventions that address complications arising during pregnancy and childbirth [6]. Beyond mortality, maternal morbidity also takes a significant toll, with a significant proportion of women experiencing pregnancy-related health complications such as vesicovaginal fistulae and infertility or psychological conditions like postpartum depression [6,7]. These conditions often lead to long-term disability, further exacerbating health inequities in low-resource settings [7].

Efforts to improve maternal health outcomes have identified various “pull” factors such as high-quality care, proximity to healthcare services, and affordability that attract women to utilize skilled care [8]. Conversely, “push” factors like fear of disrespectful treatment, fear of unnecessary medical interventions, socio-cultural norms favoring traditional birth attendants, transportation challenges, and high out-of-pocket costs discourage the utilization of skilled maternity care [9,10]. Even with interventions such as cash transfer programs in Northern Nigeria or the distribution of incentives like insecticide-treated nets in Kenya to encourage antenatal care, the uptake of skilled services has remained limited, pointing to the need to look beyond infrastructure and financial access [11,12]. In many sub-Saharan African settings, maternal healthcare decisions are not made in isolation but are influenced by broader intra-household dynamics, power relations, and gender norms [13]. Women's ability to independently decide healthcare use is often constrained by male partners, mothers-in-law, or other family members [13,14]. Consequently, even when healthcare facilities are available, women may lack the autonomy or self-efficacy to act on their preferences [14]. Decision-making power is a key dimension of women's empowerment and is increasingly recognized as a critical determinant of maternal healthcare services utilization [15]. Women who are empowered to make healthcare decisions are more likely to utilize skilled maternity care services [15]. Empowerment encompasses economic, educational, and psychological dimensions [13–15]. Psychological constructs such as locus of control (whether individuals perceive life outcomes as within their control or determined by external forces) and personality traits like neuroticism (the tendency toward emotional stability and anxiety) can significantly influence healthcare-seeking behavior [16,17]. Women with an internal locus of control may feel more capable of making healthcare decisions and navigating obstacles, while those with an external locus of control may defer decisions to others or fate [16]. Similarly, women with high neuroticism may be more risk-averse, anxious, or fearful, impacting their healthcare decisions [17]. In contexts like Nigeria, where socio-cultural and religious beliefs may restrict women's mobility or access to services, understanding these psychological determinants is essential.

1.1. Locus of Control and Health Outcomes

Locus of control, a psychological concept introduced by Julian Rotter in 1966, describes an individual's perception of control over events in their life [16]. Individuals with an internal locus of control believe outcomes result primarily from their actions, while those with an external locus of control attribute events to external factors like chance, fate, or the

influence of others [16]. This distinction has drawn considerable interest, particularly in understanding behaviors and decision-making in various domains, including health.

Empirical studies underscore the locus of control as a significant predictor of health outcomes. For instance, Sachit et al. in their study conducted in Iraq to examine the role of locus of control in adolescents' pregnancy behaviors found that pregnant adolescent girls were external in their locus of control and showed high levels of beliefs regarding powerful others [18]. Similarly, Shifrer found that adolescents with an external locus of control had a higher risk of adverse health outcomes than their counterparts with an internal locus of control [19]. In Australia, Cobb-Clark et al. observed that individuals with an internal locus of control were likelier to adopt healthy lifestyle behaviors, emphasizing the role of personal agency in health-related decision-making [20].

Locus of control also plays a pivotal role in healthcare utilization. Kesavayuth et al. found that individuals with an external locus of control relied more on curative care and were less likely to engage in preventive health measures [21]. Similarly, in Nigeria, Aikpitanyi et al. reported that women with an external locus of control were significantly less likely to access antenatal and skilled birth care, illustrating the impact of psychological characteristics on maternal healthcare behaviors [22].

1.2. Neuroticism and Health Outcomes

Neuroticism, one of the Big Five personality traits, is characterized by heightened emotional sensitivity to stressors such as threat, frustration, or loss [23]. This trait has been extensively studied for its physical and mental health links. Neuroticism is a stable and heritable personality trait with widespread implications, influencing reactions to stress and the likelihood of developing psychopathological conditions [23].

The relationship between neuroticism and health outcomes is well documented. Friedman suggests that neuroticism can lead to maladaptive health behaviors, often driven by anxiety [24]. Furthermore, Roberts et al. observed that neurotic individuals are more prone to physical health issues, tend to perceive illnesses as more severe, and often experience reduced treatment efficacy [25]. For example, Shakari et al. in their study conducted in southern Iran, linked high neuroticism with lower weight gain during pregnancy and neonatal birth weight [26]. They also found that women who scored high on the neuroticism scale were less likely to consume vegetable-rich diets during pregnancy [26]. Elevated neuroticism has also been associated with increased exposure to stressful life events, ineffective coping mechanisms, and negative emotions such as hostility and depression [27]. For example, Weston et al. found that individuals with high neuroticism levels often interpret ordinary situations as threatening and react disproportionately to minor frustrations, leading to chronic stress and poor health outcomes [28]. Similar findings have also been reported in maternal health; for instance, Jomeen et al. implicated neuroticism as facilitating the likelihood of women choosing a normal birth as opposed to having a caesarean section [29].

1.3. Locus of Control, Neuroticism, and Health Outcomes

The intersection of locus of control and neuroticism provides a nuanced understanding of health-related behaviors and outcomes [13]. Research from high-income countries highlights significant associations between these traits. For example, Horner found that individuals with an external locus of control exhibited higher levels of neuroticism and were less likely to employ problem-focused coping strategies [30]. Recent studies also highlight the role of neuroticism in maternal health. High neuroticism has been linked to increased susceptibility to prenatal depression, which can have long-term consequences for both the mother and child [31]. Asselmann et al. noted that prenatal neuroticism not

only affects maternal mental health but may also contribute to behavioral challenges in offspring [31]. A comprehensive understanding of these pathways is essential for developing targeted interventions to enhance maternal healthcare utilization in resource-limited settings. This knowledge can help healthcare policymakers design effective strategies to promote skilled maternity care by addressing intrinsic psychological factors, such as locus of control and neuroticism.

In this study, we investigate the mediating role of neuroticism in the relationship between locus of control and the utilization of skilled birth care, addressing an under-explored dimension of maternal healthcare decision-making in resource-limited settings. While locus of control has been commonly conceptualized as a mediator in health behavior research, this study takes a different theoretical stance. Drawing on the Five-Factor Model of personality, we posit that neuroticism, a relatively stable, affective disposition, influences how individuals perceive and respond to health-related control, and thereby acts as a mediator between locus of control and healthcare behavior.

2. Materials and Methods

2.1. Empirical Analysis

Using a mediation specification, we start our empirical analysis by investigating the link between locus of control and neuroticism. The mediation specification aims to identify whether explanatory variables influence the outcome variable directly or indirectly, that is, by affecting or being affected by another variable, which is often referred to as the mediator [32]. The mediation concept was developed based on path analysis, which decomposes the total exposure effect into an indirect and direct effect [32]. The indirect impact is the part of the total effect that the mediator explains, and the direct impact is the part of the total effect that is not explained by the mediator [32].

Figure 1 shows a diagrammatic representation of a single-mediator model. The explanatory variable, locus of control; the mediating variable, neuroticism; and the outcome variable, skilled birth attendance, are in rectangles, with the pathways represented by arrows.

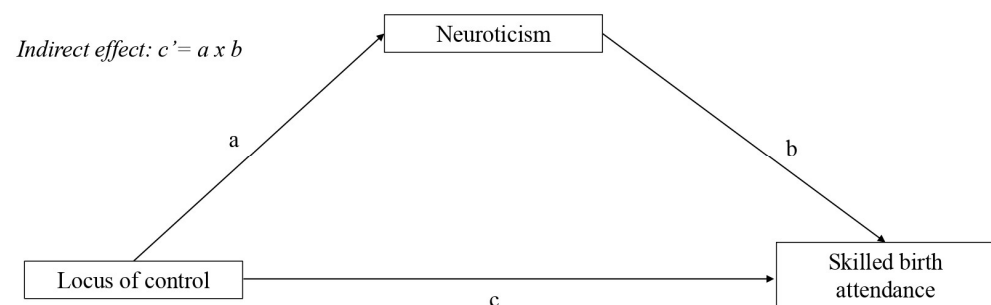


Figure 1. Path diagram of the single mediator model.

Where a represents the direct pathway between the locus of control and neuroticism, b represents the direct pathway between neuroticism and skilled birth attendance, c represents the direct pathway between the locus of control and skilled birth attendance, and c' represents the indirect pathway between the locus of control and skilled birth attendance that is mediated by neuroticism.

We used the traditional Baron and Kenny mediation analysis approach introduced in 1986 to test the direct effect of locus of control (explanatory variable) on skilled birth care (outcome variable) and its indirect effect through neuroticism (mediator) [33]. The approach highlighted four steps to establish mediation—first, a significant correlation between the explanatory and outcome variables. Second, there is a significant correlation between the explanatory and hypothesized mediating variables. Third, the mediating

variable is significantly correlated to the outcome variable when both the explanatory and mediating variables are set as predictors of the outcome variable. Fourth, the coefficient relating the explanatory variable to the outcome variable is more significant (in absolute value) than the coefficient relating the explanatory variable to the outcome variable in the regression model, with both the explanatory and mediating variables predicting the outcome variable. We specified these steps in the following equations:

$$NEU_i = \alpha_1 + aLOC_i + \beta X_1 + \varepsilon_1 \quad (1)$$

$$SBA_i = \alpha_2 + c'LOC_i + bNEU_i + \beta X_1 + \varepsilon_2 \quad (2)$$

$$SBA_i = \alpha_3 + cLOC_i + \beta X_1 + \varepsilon_3 \quad (3)$$

where α_1 , α_2 , and α_3 are intercepts; SBA_i is the outcome variable representing utilization of skilled birth care; LOC_i represents external locus of control; and NEU_i represents neuroticism. X_1 is a vector of the woman's socio-demographic, household, and decision-making characteristics. a is the coefficient relating the independent variable to the mediator, b is the coefficient relating the mediator to the dependent variable adjusted for the independent variable, c is the coefficient describing the explanatory variable and the outcome variable, c' is the coefficient relating the explanatory variable to the outcome variable adjusted for the mediator, and ε_1 , ε_2 , and ε_3 are residuals.

In this paper, we estimate mediation effects using the product coefficient method. This method involved estimating Equations (1) and (2) and computing the product of a and b to form the mediated or indirect effect. We standardized the regression to account for differences in scale between the linear and logistic models used in the mediation analysis, as recommended by Winship and Mare [34].

2.2. Data

We used data from a cross-sectional community-based study conducted in Edo State, southern Nigeria, as part of an intervention project to increase women's access to skilled maternal healthcare services. The study was conducted in two rural Local Government Areas (LGAs), Esan Southeast and Etsako East, in Edo State, Nigeria. Nigeria comprises 36 states and a Federal Capital Territory (Abuja), with each state divided into LGAs. These LGAs are subdivided into political or health wards, encompassing multiple smaller communities or villages. Edo State, situated in Nigeria's south-south geopolitical zone, had an estimated population of 4.7 million in 2020, and comprises 18 LGAs [35]. The selected study areas, Esan Southeast and Etsako East, are located in the riverine belt of the state, bordering the River Niger. Etsako East lies in the northern riverine region, while Esan Southeast is situated in the southern part. The two LGAs have a population of 455,432, with Esan Southeast comprising 241,492 residents and Etsako East accounting for 213,940 [35]. The primary sources of maternity care in both LGAs are Primary Health Centers [36].

Each LGA comprises 10 administrative wards, which are further divided into multiple communities. Twenty communities (10 from each LGA) were randomly selected for inclusion. Within each selected community, a household listing was conducted, and all women of reproductive age (15–45 years) who met the eligibility criteria, having given birth within two years preceding the study period, were identified and interviewed. The estimated population of eligible women was used to calculate the survey sample size of 1318 women. A 10% adjustment accounted for potential non-response, resulting in a target sample size of 1450 women, or 725 per LGA. A total of 1411 women were successfully interviewed from 3116 households across the same twenty communities. More details of the sampling technique have been described elsewhere [37].

To better understand the barriers to using maternal health services in the study population, we conducted a baseline study where women identified factors as determinants of non-utilization of skilled maternity care services. These factors included financial constraints, lack of transportation to healthcare facilities, an inadequate number of trained healthcare providers, and a lack of medications and other needed consumables at healthcare facilities as barriers to the utilization of maternal health services [38]. As part of intervention activities, financial assistance to women in the form of a community-based health insurance scheme that subsidized the cost of delivery by 80% was set up in the study population. We made advocacy visits to relevant authorities to ensure the provision of healthcare providers (doctors and nurses) to the various healthcare centers. We made transportation arrangements with local transporters in collaboration with the healthcare providers to transport women to healthcare facilities. Women were also provided with mobile phones with dedicated SIM cards linked to healthcare providers and transporters to ease access to healthcare facilities.

Trained research assistants administered the questionnaire to the study participants. The questionnaire consisted of pre-validated questions adapted from the Nigeria Demographic and Health Survey [3]. Section 1 contained the respondents' socio-demographic characteristics. Section 2 presented partners and other family characteristics. Section 3 contained questions on the respondents' reproductive history. Section 4 featured antenatal, intrapartum, and postnatal care experience for current pregnancy and births in the preceding five years. Standardized questions on locus of control and the Big Five personality traits were also included. The questionnaire was administered through face-to-face interviews of respondents by trained assistants. We fielded the questions in English or Pidgin English as appropriate since all women in both communities understood English or Pidgin English.

2.3. Measurement

2.3.1. Outcome Variable (Skilled Birth Attendant)

The outcome variable for this analysis was childbirth with a skilled birth attendant (SBA) for the birth of the last child. We generated the variable from answers to the question, "Who assisted with delivering your last child?" The variable takes the value "1" for women who utilized the services of a skilled birth attendant and "0" if women had their childbirth at home or in other places without a skilled birth attendant.

2.3.2. Explanatory Variable (Locus of Control)

We asked respondents all seven original items from the Psychological Coping Resources component of the Mastery Module developed by Pearlin and Schooler [39]. Mastery refers to beliefs about the extent to which one's life outcomes are under one's control. The following questions are used:

- (a) I have little control over the things that happen to me.
- (b) There is really no way I can solve some of the problems I have.
- (c) There is little I can do to change many of the important things in my life.
- (d) I often feel helpless in dealing with the problems of life.
- (e) Sometimes, I feel that I am being pushed around in life.
- (f) What happens to me in the future mostly depends on me.
- (g) I can do just about anything I really set my mind to do.

Specifically, we asked respondents how much they agreed with the seven statements. Possible responses ranged from 1 (strongly disagree) to 5 (strongly agree). We generated an index variable for the external locus of control by reversing the values obtained from the last two questions and adding them to the values obtained from the first five questions, with higher scores indicating an external locus of control. An internal consistency test

yields a Cronbach's reliability statistic of 0.78, suggesting that the seven items are highly reliable [40].

2.3.3. Mediating Variable (Neuroticism)

We measured neuroticism using a subset of questions from the 44-item Big Five Inventory questionnaire [41]. The scale for neuroticism contained five questions.

- (a) I see myself as someone who is relaxed and handles stress well.
- (b) I see myself as someone who does not easily get upset and is emotionally stable.
- (c) I see myself as someone who gets nervous easily.
- (d) I see myself as someone who worries a lot.
- (e) I see myself as someone who is easily distracted.

Responses were derived from a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). We generated an index by reversing the values obtained from the first two questions and adding them to the values obtained from the last three questions, with higher scores indicating higher levels of neuroticism. A Cronbach's Alpha score of 0.71 validates the reliability of the items [40].

2.3.4. Control Variables

To minimize bias in our data analysis, we included control variables associated with women's utilization of skilled birth care. We chose our control variables based on empirical studies on determinants of skilled birth care utilization in low and lower-middle-income countries. These variables were related to women's socio-demographic status, including age, level of education, occupational status, cohabitation status, religion, and number of children. We also included household characteristics and decision-making status, such as the partner's age, partner's level of education, partner's occupational status, and the woman's ability to make decisions relating to healthcare utilization.

2.4. Data Analysis

We coded the obtained data and entered them into Stata 18.0 for Windows. We first estimated a linear regression model for Equation (1) and logistic regression models for Equations (2) and (3) using the `medeff` command on Stata 18. To test the significance of the indirect effect of the mediation, we conducted a bias-corrected bootstrap test using 1000 replications. Several researchers have confirmed the bootstrap method introduced by Efron in 1987 to be superior to other methods of testing for indirect mediation effects [42,43]. We estimated the p -value for the indirect effect to be the smallest significant level where the confidence interval obtained from the bootstrapped distribution does not contain zero. We then conducted a sensitivity analysis test to check for the robustness of the mediation effect to the presence of potential confounders that could affect the outcome (skilled birth attendance), the explanatory variable (locus of control), and the mediator (neuroticism) using the Stata `medsens` command introduced by Hicks and Tingley in 2011 [44].

3. Results

Table 1 summarizes the descriptive statistics of the explanatory, mediating, and outcome variables. The number of observations (Obs.) was 1411. The participants' mean scores on the scales were 25.37 for locus of control (Std. Dev = 4.53) and 16.19 for neuroticism (Std. Dev = 3.41). To ensure confidence in our psychological measures, we examined their internal consistency and alignment with the established psychometric properties. The locus of control scale demonstrated acceptable reliability (Cronbach's $\alpha = 0.78$), consistent with previous research. Similarly, the neuroticism subscale exhibited good internal consistency ($\alpha = 0.71$), aligning with prior use of the scale in cross-cultural contexts.

Table 1. Descriptive statistics.

Variables	Obs.	Mean	Std. Dev	Min	Max	Prop.
Explanatory						
LOC	1411	25.37	4.53	7	35	
Internal						0.113
External						0.887
Neuroticism	1411	16.19	3.41	5	25	
Low						0.236
High						0.763
Outcome						
SBA	1359			0	1	
No						0.122
Yes						0.878

A total of 12.4% of the participants had not utilized a skilled birth attendant during their last childbirth. We provide a more detailed description of the study participants in Appendix A. Table 2 presents a correlation matrix showing the relationships between locus of control, neuroticism, skilled birth care utilization, and some control variables. We found a significant negative correlation between locus of control and skilled birth care and a positive correlation between locus of control and neuroticism, suggesting a tendency for individuals with an external locus of control to have higher neuroticism levels.

Table 2. Correlation matrix.

	Locus of Control	Neuroticism	Skilled Birth Care	Age	Education	Partner's Education	Healthcare Decision
Locus of control	1.000						
Neuroticism	0.168 ***	1.000					
Skilled birth care	−0.131 ***	0.099 ***	1.000				
Age	−0.186 ***	−0.117 ***	0.015	1.000			
Education	−0.009	−0.043	0.137 ***	−0.242 ***	1.000		
Partner's education	0.115 ***	0.013	0.118 ***	−0.152 ***	0.541 ***	1.000	
Healthcare decision	−0.097 ***	0.112 ***	0.005	−0.084 ***	−0.004	0.016	1.000

Significance levels: *** 1%.

Table 3 shows the results of two linear regression models exploring the relationship between external locus of control and neuroticism while controlling for demographic, social, and partner-related characteristics. We report two model specifications: Model (1) includes only the external locus of control as a predictor, while Model (2) adds control variables. In Model 1, we find that the external locus of control significantly predicts neuroticism ($\beta = 0.369$, $p < 0.01$), suggesting that individuals with a higher external locus of control are more likely to exhibit higher levels of neuroticism. After adjusting for other variables, in Model 2, we find that the effect of the external locus of control remains significant ($\beta = 0.224$, $p < 0.05$), though its magnitude decreases.

For other control variables, we find that neuroticism decreases significantly with age. Respondents aged 35–44 ($\beta = -0.683$, $p < 0.05$) and those over 44 ($\beta = -1.464$, $p < 0.01$) report significantly lower levels of neuroticism compared to the 15–24 age group. This suggests that neuroticism diminishes as individuals age, possibly due to increased emotional regulation or life experience. Regarding education, we find higher levels of education are associated with lower neuroticism. Respondents with higher education have significantly lower neuroticism scores ($\beta = -1.407$, $p < 0.05$) than those without education. Cohabitation is significantly associated with lower neuroticism ($\beta = -0.845$, $p < 0.01$). This could indicate that individuals not living with a partner may face fewer interpersonal stres-

sors that could reduce neuroticism. Regarding religion, we find that respondents practicing Islam ($\beta = 1.515$, $p < 0.05$) exhibit higher levels of neuroticism compared to Christians. Cultural or contextual differences may influence this finding in stress experiences and coping mechanisms. Regarding healthcare decision-making, we find that decision-making by both partners significantly predicts higher neuroticism ($\beta = 1.037$, $p < 0.01$) compared to respondents making decisions independently. This may indicate potential stress arising from joint decision-making dynamics.

Table 3. Linear regression results of neuroticism and external locus of control.

Variables	(1) Coeff. (Std. Err)	(2) Coeff. (Std. Err)
External locus of control	0.369 *** (0.090)	0.224 ** (0.091)
Age		Ref
15–24		Ref
25–34		−0.325 (0.271)
35–44		−0.683 ** (0.332)
>44		−1.464 *** (0.415)
Education		Ref
None		Ref
Primary		0.312 (0.312)
Secondary		−0.118 (0.337)
Higher		−1.407 ** (0.555)
Cohabitation status		Ref
Cohabiting		Ref
Not cohabiting		−0.845 *** (0.187)
Occupation		Ref
Not working		Ref
Working		0.422 (0.245)
Religion		Ref
Christianity		Ref
Islam		1.515 ** (0.516)
Others		0.875 (0.762)
Number of children		Ref
1		Ref
2		−0.537 ** (0.224)
3		−1.933 ** (0.609)
Partner's age		Ref
15–37		Ref
38–57		−0.139 (0.244)
58–77		−1.448 ** (0.503)
>77		−1.933 ** (0.609)
Partner's education		Ref
None		Ref
Primary		0.752 ** (0.321)
Secondary		0.539 (0.318)
Higher		0.308 (0.396)
Partner's occupation		Ref
Not working		Ref
Working		0.069 (0.295)
Healthcare decision		Ref
Self		Ref
Partner		0.540 (0.290)
Both		1.037 *** (0.298)
Adjusted R2	0.0110	0.0890
Number of observations	1411	1411

Significance levels: *** 1%, ** 5%; standardized coefficients are presented.

Table 4 presents logistic regression models predicting skilled birth attendance. Here, we specify two models: Model 3 includes the external locus of control and other control variables, and Model 4 includes neuroticism. We find in Model 3 that an external

locus of control significantly predicts lower odds of using skilled birth care ($\beta = -0.330$, $p < 0.01$). This relationship remains robust in Model 4 ($\beta = -0.316$, $p < 0.01$). This showed that individuals with a higher external locus of control (believing outcomes are influenced by external factors rather than personal control) were less likely to seek skilled birth care, highlighting the importance of autonomy and self-efficacy in healthcare decisions. We also find in Model 4 that neuroticism significantly predicts lower odds of using skilled birth care ($\beta = -0.073$, $p < 0.01$), suggesting that higher neuroticism, characterized by emotional instability and anxiety, may deter individuals from engaging with skilled healthcare, possibly due to fear, mistrust, or perceived barriers.

Table 4. Logistic regression with skilled birth care, locus of control, neuroticism, and control variables.

Variables	(3) Coeff. (Std. Err)	(4) Coeff. (Std. Err)
External locus of control	−0.330 *** (0.103)	−0.316 *** (0.104)
Neuroticism		−0.073 (0.028) ***
Age		
15–24	Ref	Ref
25–34	−0.018 (0.283)	−0.036 (0.285)
35–44	−0.038 (0.331)	−0.096 (0.333)
>44	0.291 (0.449)	0.142 (0.453)
Education		
None	Ref	Ref
Primary	0.345 (0.254)	0.382 (0.256)
Secondary	0.924 ** (0.302)	0.933 ** (0.304)
Higher	0.742 (0.574)	0.645 (0.576)
Cohabitation status		
Cohabiting	Ref	Ref
Not cohabiting	0.742 *** (0.198)	0.672 *** (0.202)
Occupation		
Not working	Ref	Ref
Working	−0.088 (0.249)	−0.056 (0.250)
Religion		
Christianity	Ref	Ref
Islam	−0.516 (0.411)	−0.438 (0.411)
Others	0.648 (0.794)	0.615 (0.783)
Number of children		
1	Ref	Ref
2	0.149 (0.229)	0.079 (0.231)
3	−0.062 (0.640)	−0.220 (0.645)
Partner's age		
15–37	Ref	Ref
38–57	0.266 (0.238)	0.266 (0.239)
58–77	1.179 (0.613)	1.122 (0.615)
>77	−0.302 (0.583)	−0.494 (0.587)
Partner's education		
None	Ref	Ref
Primary	0.552 (0.278)	0.576 ** (0.280)
Secondary	0.586 ** (0.279)	0.623 ** (0.281)
Higher	0.932 ** (0.399)	0.929 ** (0.401)
Partner's occupation		
Not working	Ref	Ref
Working	−0.228 (0.301)	−0.206 (0.303)
Healthcare decision		
Self	Ref	Ref
Partner	0.599 ** (0.277)	0.634 ** (0.279)
Both	0.359 (0.281)	0.413 (0.283)
Pseudo R2	0.0786	0.0855
Prob.	0.0000	0.0000
Number of observations	1359	1359

Significance levels: *** 1%, ** 5%; standardized coefficients are presented.

To formally investigate the extent of this mediation, we decompose the total effect of locus of control on the utilization of skilled birth care into its direct and indirect effects. In Table 5, we present the results of a mediation analysis examining the direct relationships between external locus of control and skilled birth attendance, the direct relationship between neuroticism and skilled birth attendance, and the indirect relationship between external locus of control and skilled birth attendance through neuroticism. The key pathways are described using the standard mediation model paths: Path a shows the relationship between the independent variable (LOC) and the mediator (NEU). Path b shows the relationship between the mediator (NEU) and the dependent variable (SBA). Path c shows the total effect of the independent variable (LOC) on the dependent variable (SBA). Path c' shows the direct effect of the independent variable (LOC) on the dependent variable (SBA), controlling for the mediator (NEU). The indirect effect (LOC → NEU → SBA) shows the indirect pathway through NEU.

Table 5. Estimated direct and indirect effect sizes and bootstrap test for indirect effect and 95% bias-corrected confidence interval.

Model Pathways	β	Std. Err.	95% Confidence Interval	
			Lower	Upper
Estimated direct effects:				
Path a (LOC -> NEU)	0.369 ***	0.090	0.048	0.134
Path b (NEU -> SBA)	−0.073 ***	0.028	−0.550	−0.144
Path c (LOC -> SBA)	−0.330 ***	0.103	−0.555	−0.171
Path c' (LOC -> SBA)	−0.316 ***	0.104	−0.529	−0.146
Bootstrap test for indirect effect			95% bias-corrected confidence interval	
			Lower	Upper
LOC -> NEU -> SBA	−0.084 ***	0.027	−0.514	−0.153

Significance levels: *** 1%; Note: the indirect effect is significant, as the 95% bias-corrected confidence interval does not overlap with zero.

The mediation specification shows that the indirect effect is significant, as indicated by the confidence interval (−0.514, −0.153), which does not overlap with zero. This suggests that part of the effect of an external locus of control on the utilization of skilled birth attendance operates through neuroticism. Specifically, this indicates that individuals with an external locus of control tend to exhibit higher neuroticism, which, in turn, decreases their likelihood of utilizing skilled birth care. The bootstrap test confirms the significance of the indirect effect with a bias-corrected 95% confidence interval.

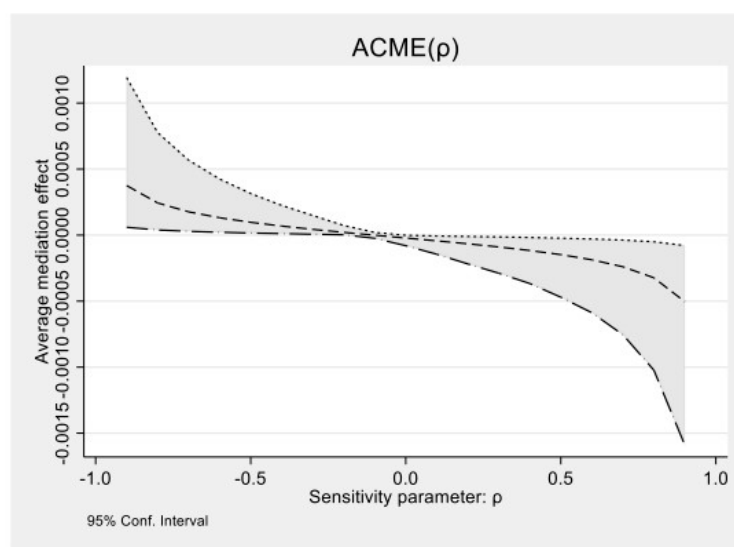
Sensitivity Analysis

We present the results from the sensitivity analysis test in Table 6. With this setup, the sensitivity parameter ρ could be expressed as a function of the proportions of previously unexplained variances in the mediator and outcome regressions or based on the original variances explained by the unobserved confounder in the mediator and outcome regressions. Our results showed that the indirect effect of the locus of control on skilled birth attendance through neuroticism would be zero only if there exist confounders of the mediator–outcome relationship that together explain 40% or more of the residual variance. For example, an omitted confounder should explain 20% of the remaining variance in the outcome for the indirect effect of the locus of control on skilled birth attendance to be zero. We depicted this in Figure 2.

Table 6. Sensitivity analysis.

Variables	Coeff. (Std. Err)	p-Value	95% Confidence Interval	
			Lower	Upper
Neuroticism	−0.261 ** (0.106)	0.013	−0.468	−0.054
Locus of control	−0.089 *** (0.021)	0.000	−0.131	−0.048
Rho at which AME = 0	−0.20			
R ² _MR ² _Y at which AME = 0:	0.04			
R ² _M~R ² _Y~ at which AME = 0:	0.0314			

Significance levels: *** 1%, ** 5%, AME = average mediation effect.

**Figure 2.** Sensitivity analysis test for average mediation effect between locus of control and neuroticism.

4. Discussion

This study advances the understanding of maternal healthcare behavior by examining the mediating role of neuroticism in the relationship between locus of control and the utilization of skilled birth care. It contributes to a growing body of research that integrates psychological dimensions into maternal health, an area often dominated by structural and demographic analyses. Our findings demonstrate that women with an external locus of control and high neuroticism are significantly less likely to use facility-based skilled birth care services, while those with a more internal orientation and lower neuroticism scores are more likely to do so. Our results align with earlier studies identifying psychological traits as relevant predictors of health behavior and healthcare utilization and support behavioral and health psychology theories, which suggest that healthcare-seeking behaviors are not purely rational choices but are shaped by deep-seated psychological traits and emotional predispositions [25,26,45]. However, this study is one of the first to empirically document this pathway in the context of skilled birth care in a sub-Saharan African setting, where maternal mortality remains high and behavior change remains a public health priority.

While this study provides valuable insights into the psychological drivers of maternal healthcare preferences, particularly the role of neuroticism and locus of control, it is essential to interpret the findings in light of the study setting's broader cultural and environmental context. In many sub-Saharan African societies, cultural norms, religious beliefs, and patriarchal structures frame how women understand health, illness, and agency [46]. For instance, in communities where childbirth is deeply spiritual or heavily influenced by traditional practices, women may be socialized to rely more on community norms,

religious leaders, or traditional birth attendants than on formal healthcare providers [47,48]. Such environments reinforce an external locus of control and diminish perceptions of personal agency.

Moreover, environmental stressors prevalent in low-resource settings, such as chronic poverty, gender inequality, and experiences of conflict or displacement, can intensify neurotic tendencies. Women exposed to these conditions often face heightened anxiety, diminished self-efficacy, and increased risk aversion, all of which may deter them from seeking institutional health services. These psychological vulnerabilities are further compounded by structural barriers, including long distances to health facilities, inadequate infrastructure, and unreliable service delivery. Other factors, including prior negative interactions with the healthcare system, such as mistreatment, prolonged wait times, or informal payment demands, can erode trust and reinforce external locus of control beliefs. Additionally, undiagnosed depression may act as a confounding factor, influencing both neuroticism and maternal healthcare-seeking behaviors. Together, these factors create a multi-layered web of disadvantages that perpetuates the underutilization of skilled birth care [49].

Beyond psychological traits, we observed that socio-demographic characteristics, particularly education, cohabitation status, and the partner's education, play significant roles in predicting both neuroticism and the utilization of skilled birth care. Higher education among women and their partners was positively associated with skilled birth care use and negatively associated with neuroticism, highlighting the importance of education as a protective factor. It is important to contextualize these findings within the broader socio-demographic profile of the study sample. While we find significant associations between maternal and partner education and the use of skilled birth care, the general level of education in our sample is skewed toward primary and secondary education, with relatively few respondents having attained higher education. This distribution broadly reflects national trends in Nigeria, particularly among women of reproductive age in rural and peri-urban areas.

Notably, we also found that women not cohabiting with a partner were more likely to use skilled care and report lower neuroticism. This may reflect greater autonomy or reduced interpersonal stress, but further qualitative exploration is needed to fully understand this dynamic. Interestingly, while joint decision-making with a partner increased the utilization of skilled birth care, it was also associated with higher neuroticism, suggesting potential psychological costs associated with navigating shared decision contexts. These contrasting findings underline the complex role of gender dynamics and power relations in maternal healthcare behavior and merit further investigation.

4.1. Implications for Policy

The implications of this research are critical for improving maternal healthcare in low-resource settings. Interventions to increase utilization of skilled birth care must move beyond surface-level incentives and infrastructure improvements. Culturally sensitive psychosocial interventions are needed through programs that not only raise awareness about the benefits of skilled birth attendance but also challenge fatalistic beliefs, reduce emotional vulnerability, and strengthen women's sense of agency. Community leaders and trusted influencers, such as pastors, traditional chiefs, and women's group leaders, can transform norms and reinforce women's internal locus of control.

We also recommend that community advocacy programs integrate psychological insights into their strategies. For example, messaging campaigns could emphasize building women's self-efficacy, gradually shifting them toward a more internal locus of control. Simultaneously, providing psychosocial support to address neurotic tendencies, such as

counseling or stress management workshops, could mitigate the impact of neuroticism on health-seeking behaviors. While this study focuses on adult women, psychological traits like locus of control and neuroticism are shaped early in life [13,25]. Investing in early childhood interventions, such as education programs that foster self-regulation and resilience, can have lasting benefits for adult health outcomes. In the same way, investing in policies that nurture an internal locus of control from childhood could improve maternal health outcomes in the long run [26]. We also recommend incorporating simple psychological assessments into maternal healthcare programs, as this could help identify women at risk of low healthcare utilization. For example, regular screening for neuroticism and locus of control could enable healthcare providers to design individual-specific interventions, ensuring that resources are directed to those most likely to benefit.

4.2. Limitations and Future Directions

While this study's findings provide valuable insights, several limitations should be acknowledged. First, the cross-sectional design limits our ability to infer causal relationships between psychological traits and skilled birth care utilization. While the mediation analysis offers a plausible pathway, longitudinal or experimental designs would be needed to establish temporality. Second, the reliance on self-reported data introduces the potential for bias, including social desirability bias, recall bias, and self-reporting inaccuracies, particularly concerning sensitive topics such as locus of control and emotional disposition. Our study utilized well-established measures for locus of control and neuroticism previously employed in diverse settings. While these instruments have demonstrated validity and reliability in Western and other African populations, it is essential to note that they were not specifically validated for the Nigerian context before this study. To adapt the measures for our sample, we made minor modifications to the wording of specific items to reflect culturally relevant expressions without altering the underlying constructs. Third, while we controlled for various demographic and social variables, unmeasured confounding, including cultural norms, health system quality, and local infrastructure, could have influenced the observed relationships. Our sensitivity analysis suggests that strong unmeasured confounders would be required to nullify the indirect effects, yet we cannot rule them out entirely. Fourth, although we include education and partner-related characteristics, regional disparities within Nigeria were not explored. Nigeria's diverse ethnic, cultural, and healthcare landscapes may moderate the effects of psychological traits on health behavior. The educational profile of our sample, while broadly reflective of national trends in low-income settings, may not be generalizable to all Nigerian regions. Future research should adopt a comparative regional design to better understand contextual variability.

In this study, we recommend integrating psychological screening into routine maternal care programs, particularly at the community level. However, such integration raises important concerns about feasibility, cost, and implementation. Future research should pilot these approaches and evaluate their cost-effectiveness, scalability, and acceptability among both childbearing women and healthcare providers. Digital tools, such as mobile-based assessments or decision-support systems, may offer a cost-effective and scalable solution, especially in hard-to-reach rural areas.

Finally, although our study focuses on individual-level psychological traits, it does not negate the critical importance of systemic and structural barriers to maternal healthcare. Psychological interventions may enhance the effectiveness of system-wide reforms, but are not substitutes for them. While our policy recommendations focus on individual-level psychological characteristics, we do not suggest that these are the sole or primary levers for reducing maternal mortality. Our literature review acknowledges that systemic barriers,

including healthcare financing, service availability, and infrastructure, fundamentally shape maternal mortality.

Our findings are best understood as complementary to these structural concerns. Interventions targeting psychological traits such as locus of control and neuroticism should be viewed as enhancing the effectiveness of broader system-level reforms, particularly those aimed at increasing healthcare accessibility and quality. For example, programs that combine psychological and behavioral support with improvements in facility readiness and affordability may yield greater impact than either approach alone. In summary, integrating psychological insights should not detract from the urgent need for systemic reform. Instead, our findings support a multi-level approach to maternal health that addresses both internal and external determinants of care-seeking behavior. Future interventions could benefit from explicitly aligning individual-focused strategies with structural improvements to optimize maternal health outcomes.

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Institutional Review Board Statement: This study was conducted in accordance with the Declaration of Helsinki, and ethical approval for the study was obtained from the National Health Research Ethics Committee (NHREC) of Nigeria—protocol number NHREC/01/01/2007–10/04/2017. Community leaders and household heads in the study settings granted the researchers permission to conduct the study. Participation was voluntary, and all study participants signed written informed consent. We respected individual rights to privacy and anonymity throughout the study.

Informed Consent Statement: Informed consent was obtained from all subjects involved in this study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author due to privacy reasons.

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Appendix A

Table A1. Descriptive characteristics of the study sample.

Variables	Sample Size (n = 1359)			p-Value
	Total N = 1359 N (%)	No SBA N = 166 N (%)	SBA N = 1193 N (%)	
Locus of control				0.010
External LOC	1205 (88.67)	157 (11.55)	1048 (77.12)	
Internal LOC	154 (1.31)	9 (0.66)	145 (10.65)	
Age				0.087
15–24	231 (17.1)	24 (1.8)	207 (15.3)	
25–34	563 (41.5)	75 (5.5)	488 (36.0)	
35–44	401 (29.6)	55 (4.1)	346 (25.5)	
>44	161 (11.9)	11 (0.8)	150 (11.1)	

Table A1. Cont.

Variables	Sample Size (n = 1359)			p-Value
	Total N = 1359 N (%)	No SBA N = 166 N (%)	SBA N = 1193 N (%)	
Education				0.000
No education	170 (12.5)	40 (2.9)	130 (9.6)	
Primary	570 (41.9)	75 (5.5)	495 (36.4)	
Secondary	557 (41.0)	46 (3.4)	511 (37.6)	
Higher	62 (4.6)	5 (0.4)	57 (4.2)	
Cohabitation status				0.000
Cohabiting	743 (54.6)	116 (8.5)	627 (46.1)	
Not cohabiting	616 (45.4)	50 (3.7)	566 (41.7)	
Occupation				0.729
Not working	305 (22.5)	39 (2.9)	266 (19.6)	
Working	1054 (77.6)	127 (9.4)	927 (68.2)	
Religion				0.108
Christianity	1301 (95.7)	155 (11.4)	1146 (84.3)	
Islam	39 (2.9)	9 (0.7)	30 (2.2)	
Others	19 (1.5)	2 (0.2)	17 (1.3)	
Number of children				0.843
1	807 (70.8)	79 (6.9)	728 (63.9)	
2	301 (26.4)	30 (2.6)	271 (23.8)	
3	30 (2.7)	2 (0.2)	28 (2.5)	
Partner's age				0.133
18–37	470 (34.6)	52 (3.8)	418 (30.8)	
38–57	796 (58.6)	105 (7.7)	691 (50.9)	
58–77	69 (5.1)	4 (0.3)	65 (4.8)	
>77	24 (1.8)	5 (0.4)	19 (1.4)	
Partner's education				0.000
No education	202 (14.9)	44 (3.3)	158 (11.6)	
Primary	369 (27.1)	45 (3.3)	324 (23.8)	
Secondary	615 (45.2)	64 (4.7)	551 (40.5)	
Higher	173 (12.7)	13 (0.9)	160 (11.8)	
Partner's occupation				0.653
Not working	221 (16.2)	29 (2.1)	192 (14.1)	
Working	1138 (83.8)	137 (10.1)	1001 (73.7)	
Healthcare decision				0.247
Self	186 (13.7)	28 (2.1)	158 (11.6)	
Partner	712 (52.4)	77 (5.7)	635 (46.7)	
Both	455 (33.4)	61 (4.5)	394 (28.9)	
Others	6 (0.4)	0 (0.0)	6 (0.4)	

SBA = Skilled Birth Attendance.

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