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# Sex Differences in the Utilisation of Premarital Genetic Screening Among Students at Zamfara College of Arts and Science, Gusau, Nigeria

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**Abstract:** Premarital genetic screening can identify haemoglobin genotype and clarify inherited risk before marriage, but actual use may differ from future willingness. This study examined associations between sex and actual and potential utilization among students of Zamfara College of Arts and Science, Gusau. A descriptive cross-sectional survey was specified for 350 students selected through proportionate stratified and systematic sampling. Actual utilization meant genotype testing before marriage or during a serious relationship; potential utilization meant definite or probable willingness to screen when planning marriage. In the modelled dataset, 169 students (48.3%) reported actual utilization and 316 (90.3%) reported positive potential utilization. Females had higher actual utilization than males (53.8% versus 42.7%; p=0.038; OR=1.57, 95% CI: 1.02-2.39) and higher positive intention (93.5% versus 87.1%; p=0.045; OR=2.13, 95% CI: 1.00-4.52). Sex may influence screening behaviour, but findings require confirmation with actual data and adjusted analysis.

**Keywords:** actual utilization; genotype testing; potential utilization; premarital genetic screening; sex differences; students

## I. INTRODUCTION

Sickle cell disease (SCD) is an inherited haemoglobin disorder that remains a major public-health concern, particularly in sub-Saharan Africa. It can cause recurrent painful crises, chronic anaemia, infection, organ damage, reduced quality of life, psychosocial distress, and substantial long-term healthcare expenditure. Screening, genetic counselling, early diagnosis, and comprehensive care are therefore central components of prevention and control [9,10]. Because persons with carrier states such as AS may appear healthy, visual appearance and family assumptions cannot reliably establish genetic compatibility.

Premarital genetic screening refers to laboratory testing and counselling undertaken before marriage or before a serious marital commitment to identify carrier status and explain the probability of transmitting inherited disorders to future children. In Nigeria, the practice is commonly associated with haemoglobin genotype testing for SCD prevention. When two persons with AS genotype have children, each pregnancy carries a 25% probability of producing a child with sickle cell anaemia, a 50% probability of producing a carrier, and a 25% probability of producing a child with AA genotype. These probabilities apply independently to each pregnancy. Screening is therefore intended to support informed, voluntary, confidential, and non-discriminatory decision-making rather than to compel a specific marital choice.

Previous studies among Nigerian students and young adults have reported substantial awareness of genotype testing and generally favourable attitudes toward premarital screening [1,3,7,12]. Nevertheless, awareness does not necessarily indicate actual preventive behaviour. A student may have undergone genotype testing during childhood, school admission, illness investigation, employment screening, or blood donation without ever using the result during a serious relationship or receiving genetic counselling. For this reason, general genotype testing should be distinguished from actual premarital utilization, which involves testing within a marital or relationship decision-making context.

A systematic review and meta-analysis of African studies estimated pooled uptake of premarital sickle-cell trait screening at 47.82%, with considerable variation across populations and settings [2]. Nigerian evidence similarly indicates that uptake is shaped by cost, accessibility, information quality, fear of relationship disruption, stigma, confidentiality concerns, family influence, partner cooperation, and religious interpretation [1,5,7]. These barriers can prevent individuals who acknowledge the value of screening from acting on that knowledge.

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Potential utilization represents an individual's stated willingness or intention to undergo screening when planning marriage. It is conceptually different from actual utilization. A high level of potential utilization may indicate favourable perceived benefit, but intention can remain unrealized when practical, social, or emotional barriers arise. Comparing actual and potential utilization therefore helps identify an intention-practice gap and provides a basis for intervention planning.

Sex may influence both actual and potential utilization. Female students may have greater exposure to reproductive-health information, more contact with health services, or stronger perceived responsibility for future pregnancy and child health. Male students may have fewer routine reproductive-health contacts or may regard genotype testing as a partner-led issue. Conversely, females may experience greater fear of rejection, blame, or stigma following an unfavourable result. Qualitative evidence from Cameroon, Ghana, and Tanzania shows that the social consequences and preferences surrounding genetic testing can be gendered [6]. These dynamics justify sex-disaggregated analysis while recognizing that inherited risk and screening responsibility are shared by both partners.

Students of Zamfara College of Arts and Science, Gusau, constitute a relevant population because many are entering adulthood, forming serious relationships, and making future marital and reproductive decisions. Institutional settings also provide organized opportunities for health education, confidential counselling, referral, and screening. However, evidence specifically examining whether sex is related to both completed and intended premarital genetic screening among students in this setting is limited. This study therefore focused on the relationship of sex with actual and potential utilization of premarital genetic screening.

### *A. Objectives of the Study*

1. Determine the relationship between sex and actual utilization of premarital genetic screening among students of Zamfara College of Arts and Science, Gusau.
2. Determine the relationship between sex and potential utilization of premarital genetic screening among students of Zamfara College of Arts and Science, Gusau.

### *B. Research Questions*

1. What is the relationship between sex and actual utilization of premarital genetic screening among the students?
2. What is the relationship between sex and potential utilization of premarital genetic screening among the students?

### *C. Research Hypotheses*

1. H01: There is no statistically significant relationship between sex and actual utilization of premarital genetic screening among the students.
2. H02: There is no statistically significant relationship between sex and potential utilization of premarital genetic screening among the students.

### *D. Conceptual Framework*

The Health Belief Model (HBM) guided the interpretation of screening behaviour [4,8]. Perceived susceptibility concerns whether students believe that they or their partners may carry an abnormal haemoglobin gene. Perceived severity reflects their understanding of the medical, psychological, social, and financial consequences of SCD. Perceived benefits refer to the belief that screening and counselling can support informed reproductive decisions and reduce preventable risk.

Perceived barriers include cost, distance, inconvenient service hours, fear of an unfavourable result, relationship disruption, stigma, confidentiality concerns, distrust of laboratory results, and partner or family opposition. Advice from healthcare workers, school programmes, family discussions, religious premarital counselling, and media messages can act as cues to action. Accessible and confidential services can improve self-efficacy. Sex may influence exposure to these constructs and the relative weight assigned to benefits and barriers, thereby affecting both completed screening and future intention.

## II. METHODS AND MATERIALS

### *A. Study Design and Setting*

A descriptive cross-sectional survey design was specified. The proposed setting was Zamfara College of Arts and Science, Gusau, Zamfara State, Nigeria. The College includes students from several academic units and programmes, creating a heterogeneous post-secondary population suitable for examining premarital genetic-screening behaviour. The manuscript was organized with reference to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) principles [9].

### *B. Study Population and Eligibility*

The target population comprised registered students aged 18 years or older. Students were eligible if they were enrolled during the study period, available within the selected classes or programme lists, and willing to provide informed consent. Students younger than 18 years, non-registered persons, those who declined participation, and questionnaires with substantial missing outcome information were to be excluded.

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*C. Sample Size and Sampling Procedure*

The parent survey specified 350 complete student responses for analysis. The final empirical report must insert the verified total enrolment, sample-size computation, number approached, number consenting, number of usable questionnaires, and response rate. A proportionate stratified sampling procedure was proposed, using the College academic units as strata. Respondents were to be allocated proportionately to verified enrolment within each stratum and selected systematically from class or programme lists after a random start.

*D. Research Instrument*

Data were to be collected using the structured questionnaire contained in the attached parent manuscript. The instrument obtained socio-demographic and academic information, general genotype-testing history, testing specifically before marriage or during a serious relationship, exchange of genotype results with a partner, receipt of genetic counselling, willingness to undergo screening when planning marriage, and willingness to ask an intended partner to test. The sex variable contained Male, Female, and Prefer not to say response options.

*E. Validity and Reliability*

For actual field use, experts in nursing research, public health, haematology or genetics, and measurement should evaluate the questionnaire for relevance, clarity, cultural appropriateness, and coverage of the study objectives. A pilot test should be conducted among students in a comparable institution who are not included in the main study. The final submitted manuscript must report verified reliability estimates and describe any revisions made following expert review and pilot testing.

*F. Operational Definitions and Outcome Coding*

Actual utilization was defined as a Yes response to the question asking whether the respondent had undergone genotype testing specifically before marriage or during a serious relationship. For the principal binary analysis, No and Not applicable were classified as no actual utilization. The three-category distribution was retained in descriptive presentation so that the extent of the Not applicable response remained visible.

Potential utilization was defined as a Definitely yes or Probably yes response to the question asking whether the respondent would undergo premarital genetic screening when planning marriage. Not sure, Probably no, and Definitely no were grouped as non-positive potential utilization. Respondents who selected Prefer not to say for sex were retained in descriptive results but excluded from the two-by-two analyses of sex and utilization.

*G. Data Collection Procedure*

Following ethical approval and administrative permission, trained research assistants were to approach selected students at times that did not interfere with classes or examinations. The purpose of the study, voluntary nature of participation, confidentiality safeguards, and right to withdraw were to be explained. Questionnaires were to be completed anonymously; names, matriculation numbers, telephone numbers, and other direct identifiers were not to be collected.

*H. Data Analysis*

Data were to be coded and analysed using an appropriate statistical package. Frequencies and percentages summarized demographic variables and utilization outcomes. Pearson's chi-square test examined the relationship between sex and actual utilization and between sex and potential utilization. Odds ratios with 95% confidence intervals quantified the direction and magnitude of associations, using male students as the reference category. Expected cell frequencies were checked before interpreting Pearson's test. Statistical significance was set at $p<0.05$. Because potential-utilization non-positive responses were relatively few, Fisher's exact test was also considered as a sensitivity check. All results reported below are modelled and must be replaced or validated with actual field data.

## III. RESULTS

TABLE I. SELECTED CHARACTERISTICS OF RESPONDENTS (N=350)

| Variable | Category | Frequency | % |
|---|---|---|---|
| Age group | 18–22 years | 241 | 68.9 |
| | 23–27 years | 82 | 23.4 |
| | 28–32 years | 20 | 5.7 |
| | 33 years or older | 7 | 2.0 |
| Sex | Male | 178 | 50.9 |
| | Female | 169 | 48.3 |
| | Prefer not to say | 3 | 0.9 |
| Marital/relationship status | Single, not in a serious relationship | 188 | 53.7 |

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| Variable | Category | Frequency | % |
|---|---|---|---|
| | Single, in a serious relationship | 104 | 29.7 |
| | Engaged | 31 | 8.9 |
| | Married | 23 | 6.6 |
| | Divorced/Widowed | 4 | 1.1 |

The analysis comprised 350 students. Most respondents were aged 18–22 years (68.9%). There were 178 male students (50.9%), 169 female students (48.3%), and three respondents (0.9%) who preferred not to disclose sex. Most respondents were single, either outside a serious relationship (53.7%) or within a serious relationship (29.7%). The three respondents who preferred not to disclose sex were excluded from the sex-association analyses, leaving 347 observations.

TABLE II. OVERALL ACTUAL AND POTENTIAL UTILIZATION (N=350)

| Indicator | Response | Frequency | % |
|---|---|---|---|
| Ever undergone genotype testing | Yes | 263 | 75.1 |
| | No | 78 | 22.3 |
| | Not sure | 9 | 2.6 |
| Actual utilization: tested before marriage/serious relationship | Yes | 169 | 48.3 |
| | No | 142 | 40.6 |
| | Not applicable | 39 | 11.1 |
| Potential utilization when planning marriage | Definitely yes | 235 | 67.1 |
| | Probably yes | 81 | 23.1 |
| | Not sure | 23 | 6.6 |
| | Probably no | 8 | 2.3 |
| | Definitely no | 3 | 0.9 |

Although 263 students (75.1%) had undergone genotype testing at least once, only 169 (48.3%) reported testing specifically before marriage or during a serious relationship and therefore met the study definition of actual utilization. A further 142 (40.6%) answered No and 39 (11.1%) selected Not applicable. Potential utilization was substantially higher: 235 students (67.1%) answered Definitely yes and 81 (23.1%) answered Probably yes, producing a combined positive intention of 316 (90.3%). Thirty-four students (9.7%) had non-positive potential utilization. These findings demonstrate a marked gap between completed relationship-context screening and stated future willingness.

TABLE III. RELATIONSHIP BETWEEN SEX AND ACTUAL UTILIZATION (N=347)

| Sex | Actual utilization: Yes n (%) | No n (%) | Total | $\chi^2$ | p-value | OR (95% CI) |
|---|---|---|---|---|---|---|
| Male | 76 (42.7) | 102 (57.3) | 178 | 4.32 | 0.038 | Reference |
| Female | 91 (53.8) | 78 (46.2) | 169 | | | 1.57 (1.02–2.39) |

Among male students, 76 of 178 (42.7%) reported actual utilization, compared with 91 of 169 female students (53.8%). Pearson's chi-square test showed a statistically significant relationship between sex and actual utilization ($\chi^2$=4.32, df=1, p=0.038). Female students had 1.57 times the odds of actual utilization compared with male students (OR=1.57, 95% CI: 1.02–2.39). H01 was therefore rejected in the modelled dataset.

TABLE IV. RELATIONSHIP BETWEEN SEX AND POTENTIAL UTILIZATION (N=347)

| Sex | Positive intention n (%) | Non-positive n (%) | Total | $\chi^2$ | p-value | OR (95% CI) |
|---|---|---|---|---|---|---|
| Male | 155 (87.1) | 23 (12.9) | 178 | 4.03 | 0.045 | Reference |
| Female | 158 (93.5) | 11 (6.5) | 169 | | | 2.13 (1.00–4.52) |

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Positive potential utilization was reported by 155 of 178 male students (87.1%) and 158 of 169 female students (93.5%). Pearson's chi-square test indicated a statistically significant relationship at the 5% level ($\chi^2$=4.03, df=1, p=0.045). Female students had 2.13 times the odds of positive potential utilization compared with male students (OR=2.13, 95% CI: 1.00–4.52). Fisher's exact test produced p=0.048, supporting the same conclusion, although the confidence interval approached unity and the non-positive group was small. H02 was rejected in the modelled dataset, but the result should be interpreted as borderline and confirmed using actual data.

TABLE V. SUMMARY OF HYPOTHESIS TESTS

| Hypothesis | Relationship tested | $\chi^2$ | p-value | Decision |
|---|---|---|---|---|
| H01 | Sex and actual utilization | 4.32 | 0.038 | Reject H01 |
| H02 | Sex and potential utilization | 4.03 | 0.045 | Reject H02 cautiously |

## IV. DISCUSSION

### *A. Actual Utilization of Premarital Genetic Screening*

The modelled findings show that fewer than half of the students met the operational definition of actual utilization, even though three-quarters had undergone genotype testing at least once. This distinction is methodologically important. A genotype result obtained for school admission, childhood illness, blood donation, or another reason may establish an individual's reported genotype but does not necessarily represent premarital screening. Deliberate premarital utilization normally requires timely testing, result verification, partner communication, risk interpretation, and access to counselling.

The observed actual-utilization level of 48.3% is close to the pooled African premarital screening uptake of 47.82% reported by Dilli et al. [2]. It also aligns with Nigerian evidence showing that favourable knowledge and previous genotype testing may coexist with incomplete premarital practice [1,5,7,12]. This awareness-practice gap may arise because students postpone screening until engagement, assume that a previous result is sufficient, lack confidential counselling, or fear the relational consequences of an incompatible result.

From the perspective of the Health Belief Model, actual utilization occurs when perceived benefits and cues to action are strong enough to overcome perceived barriers [4,8]. Students may acknowledge the value of protecting future children yet remain inactive when screening is costly, distant, inconvenient, or emotionally threatening. Institutional interventions should therefore go beyond general awareness and provide clear pathways to affordable, confidential, quality-assured testing and counselling.

### *B. Potential Utilization and the Intention-Practice Gap*

Potential utilization was very high, with 90.3% of respondents indicating that they would definitely or probably undergo screening when planning marriage. This suggests that premarital screening has substantial social and preventive acceptability among students. However, potential utilization measures intention rather than completed behaviour. Intentions may be influenced by social desirability, the abstract nature of a future decision, or the absence of an immediate relationship conflict.

The difference of 42 percentage points between positive potential utilization (90.3%) and actual utilization (48.3%) demonstrates a pronounced intention-practice gap. Similar gaps have been observed in studies where young adults expressed favourable attitudes but did not obtain screening or counselling within an appropriate premarital context [1,7]. The implication is that campaigns that only increase willingness may have limited impact unless practical service barriers and emotional concerns are addressed.

Potential utilization nevertheless represents an opportunity. Students who already express willingness may respond positively to campus screening days, mobile clinics, appointment systems outside lecture hours, clear information on service costs and locations, and confidential pre- and post-test counselling. Behavioural cues should encourage screening before strong emotional commitment rather than immediately before marriage.

### *C. Sex and Actual Utilization*

Female students reported significantly higher actual utilization than male students. The odds of actual utilization were 57% higher among females in the modelled data. Several mechanisms may plausibly explain this pattern. Women may have greater exposure to reproductive-health information, more frequent contact with health services, stronger anticipation of pregnancy-related consequences, or a greater perceived responsibility for the health of future children. They may also be more willing to discuss genotype results within relationships.

The finding is broadly compatible with the view that genetic testing behaviours and consequences can be gendered [6]. However, the result should not be interpreted as proof that sex itself causes utilization. Age, relationship status, family history of SCD, academic programme, awareness level, previous health-service contact, income, and partner influence may differ between male and female respondents and may confound the observed relationship. A cross-sectional chi-square analysis cannot separate these effects.

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The practical response should not be to direct services primarily toward female students. Genetic compatibility depends on both partners, and male non-participation can delay couple-level decision-making. Male-inclusive strategies should present screening as a shared reproductive responsibility rather than a women's health issue. Male peer educators, flexible service hours, confidential individual counselling, and messages emphasizing fatherhood and protection of future children may improve engagement.

*D. Sex and Potential Utilization*

Female students also showed higher potential utilization. The odds of positive intention were approximately twice those of male students, but the confidence interval was wide and its lower limit was 1.00. The Pearson and Fisher tests were just below the 5% threshold, indicating that the association is statistically borderline. Small changes in the observed cell counts could alter the conclusion. The result therefore requires cautious interpretation and independent confirmation.

The high level of positive intention in both sexes is noteworthy. More than four-fifths of male students and more than nine-tenths of female students expressed willingness to screen. Thus, the principal challenge is not absolute rejection of screening but conversion of favourable intention into timely practice. Male students nevertheless constituted a larger share of the non-positive group, suggesting that tailored education may be beneficial.

Future empirical analysis should apply multivariable logistic regression to estimate the independent relationship between sex and each utilization outcome after adjustment for age, marital or relationship status, awareness score, family history, income, academic unit, and information exposure. Interaction terms could assess whether the effect of sex differs by relationship status or awareness. Qualitative interviews would also help clarify whether fear of rejection, masculinity norms, perceived invulnerability, or service design influences male participation.

*E. Implications for Nursing and Student Health Services*

Nurses and student-health professionals are strategically positioned to reduce the intention-practice gap. They can provide accurate education on inheritance probabilities, assess misconceptions, offer confidential pre-test and post-test counselling, coordinate testing with accredited laboratories, explain the need for result verification, and refer students requiring specialist genetic counselling. Communication should distinguish carrier status from disease and should avoid blame, deterministic language, or stigmatizing labels.

Programmes should be gender-responsive but not gender-divisive. Male and female students require private, respectful counselling, while couple-oriented communication should be offered when appropriate and voluntary. Institutional protocols should protect confidentiality, define secure handling of results, ensure informed consent, and provide psychosocial support when results create anxiety or relationship conflict.

*F. Strengths and Limitations*

A major strength of the study is the distinction between general genotype testing, actual utilization within a marriage or serious-relationship context, and potential utilization. This improves conceptual clarity and prevents previous testing from being misclassified as deliberate premarital practice. The study also reports sex-disaggregated proportions, effect sizes, confidence intervals, and a sensitivity check for the potential-utilization comparison.

The study has important limitations. The cross-sectional design cannot establish causality or temporal direction. Testing history and intention are self-reported and may be affected by recall or social-desirability bias. Classifying Not applicable as no actual utilization may underestimate utilization opportunity among students who have not entered serious relationships; sensitivity analyses should therefore be considered in actual data. Potential utilization measures intention rather than future behaviour. The single-institution setting limits generalizability. Unadjusted chi-square tests cannot account for confounding. Most importantly, the present numerical results are simulated and cannot be represented as empirical findings until replaced or validated using actual field data.

## V. CONCLUSION

The modelled study indicates that sex may be related to both actual and potential utilization of premarital genetic screening among students of Zamfara College of Arts and Science. Female students demonstrated higher actual utilization and higher positive intention than male students. Nevertheless, actual utilization remained substantially lower than potential utilization in both sexes, revealing a major intention-practice gap. The association with potential utilization was borderline and requires confirmation with real data and adjusted analysis. Effective institutional action should combine affordable and accessible testing, confidential professional counselling, early relationship-stage education, and deliberate male engagement while emphasizing that genetic screening is a shared responsibility.

*A. Recommendations*

1. Zamfara College of Arts and Science should partner with recognized hospitals and accredited laboratories to provide periodic subsidized or free campus-based genotype screening.
2. Every organized screening programme should include confidential pre-test and post-test counselling delivered by trained healthcare professionals.
3. Male-inclusive strategies should be introduced, including male peer educators, targeted messages, flexible screening hours, and communication that presents screening as a shared responsibility.

4. Students should be encouraged to verify genotype status before entering a serious relationship or early during courtship rather than waiting until engagement or immediate marriage preparation.
5. Student-health education should explain inheritance probabilities, the difference between carrier status and disease, the limitations of screening, and the importance of testing both partners.
6. Privacy safeguards, secure result handling, and psychosocial referral pathways should be established to reduce stigma, fear of rejection, and relationship conflict.
7. Future studies should use actual institutional sampling frames, verified response rates, multivariable logistic regression, and qualitative methods to clarify the independent influence of sex and the reasons for the intention-practice gap.

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