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Campus Architecture, Social Climate, and Risky Sexual Behaviour among Undergraduates: A Cross-sectional descriptive study.

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Abstract

Background:

The university environment presents unique spatial and social conditions that may predispose undergraduates to risky sexual behaviour. Despite growing evidence on sexual risk-taking among university students in sub-Saharan Africa, the role of campus architecture and social climate as predictors remains underexplored in Nigeria.

Objective:

This study examined the extent to which spatial and social settings of the university environment predict risky sexual behaviour among undergraduates at the University of Ibadan, Nigeria

Methods:

A descriptive cross-sectional survey design was employed. Using a multistage sampling procedure, 1,263 accommodated undergraduates were selected from nine halls of residence. Data were collected via the University Environment and Risky Sexual Behaviour Questionnaire (UERSBQ; Cronbach $\alpha = 0.89$). Simple linear regression tested the two study hypotheses, supplemented by Structural Equation Modelling (SEM) to assess simultaneous and direct pathways through which both settings influence risky sexual behaviour.

Results:

Of the 1,263 participants, 55.3% were male and 44.7% female. Most (73.6%) were aged 15–24 years, and 83.4% reported being in a defined heterosexual relationship. Spatial setting significantly predicted risky sexual behaviour ($R = 0.536$, $R^2 = 0.288$, $F(1, 1261) = 509.239$, $p < 0.001$), as did social setting ($R = 0.294$, $R^2 = 0.086$, $F(1, 1261) = 119.340$, $p < 0.001$). SEM confirmed acceptable model fit ($\chi^2/df = 2.41$, CFI = 0.94, RMSEA = 0.048) and revealed that spatial setting exerted a stronger direct effect ($\beta = 0.52$, $p < 0.001$) than social setting ($\beta = 0.27$, $p < 0.001$).

Conclusion:

Both campus architecture and social climate independently and significantly predict risky sexual behaviour among undergraduates.

Recommendations:

Universities must strengthen sexuality health education programmes and implement environmental management strategies to mitigate sexual risk-taking on campus.

Keywords: *campus architecture, social climate, risky sexual behaviour, undergraduates, University Health Education, Nigeria, structural equation modelling.*
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Introduction

Young people constitute a significant and rapidly growing segment of the global population, forming a demographic cohort that faces unique health challenges arising from the developmental characteristics of adolescence and early adulthood (United Nations Population Division, 2015; Offerdahl et al., 2014). Addressing the health and developmental needs of young people is widely recognised as one of the most critical investments a nation can make to secure its social, economic, and political future (Federal Ministry of Health, 2007). Among the key settings where young people navigate these challenges is the university campus, an environment that simultaneously provides educational opportunity and exposes students to conditions that may predispose them to health-compromising behaviours, most notably risky sexual behaviour (Anyanwu & Okeke, 2015).

The permissive character of university life has been consistently identified as a predisposing factor to sexual risk behaviour among undergraduates (Adal et al., 2024; Omisore et al., 2022). Freedom from parental and guardian supervision, independent residency arrangements, and exposure to peers with diverse social norms combine to create an environment in which sexual experimentation and risk-taking are relatively commonplace (Ajuwon, 2013). Research conducted across multiple African countries and beyond confirms that risky sexual practices, including unprotected sex, multiple concurrent sexual partnerships, and alcohol-facilitated sexual encounters, are highly prevalent among university students (Anyanwu and Okeke, 2015; Mavhandu-Mudzusi and Asgedom, 2016; Menon et al., 2016; Okeke and Okeke-Obayemi, 2016; Idoko and Nympha, 2023; Lungu et al., 2022).

In Nigeria, Idoko and Nympha (2023) found that sexual risk behaviours, including unprotected sex, multiple sexual partners, and alcohol use in sexual encounters, were prevalent among medical undergraduates in Enugu, with substance abuse identified as a key driver of reduced contraceptive use. Similarly, Omisore et al. (2022), in a study of 266 sexually experienced undergraduates in Osun State, found that 65.8% were involved in at least one risky sexual behaviour, and that males, alcohol users, and drug users were significantly more likely to engage in such behaviour. These figures signal a public health concern of considerable magnitude, given the associated risks of sexually transmitted infections (STIs), HIV/AIDS transmission, and unintended pregnancy (National Agency for the Control of AIDS, 2011).

Despite growing documentation of the prevalence of risky sexual behaviour among Nigerian undergraduates, relatively limited attention has been paid to the role of the physical and social configuration of the university environment as predictors of such behaviour. Most existing studies focus on individual-level factors such as knowledge, attitudes, alcohol use, and peer influence, while the environmental dimensions, particularly how campus architecture and social climate shape sexual risk-taking, have received insufficient empirical attention in the Nigerian context.

Furthermore, prior studies have predominantly employed single-variable regression approaches, which do not fully capture the complex, simultaneous relationships between environmental predictors and behavioural outcomes. Structural Equation Modelling (SEM) offers a more robust analytical framework by allowing the simultaneous estimation of direct, indirect, and total effects of multiple latent variables, thereby providing a more comprehensive understanding of the pathways through which environmental factors influence risky sexual behaviour (Hair et al., 2019). This study, therefore, sought to address this gap by examining the predictive effect of campus architecture (spatial setting) and social climate (social setting) on risky sexual behaviour among undergraduates at the University of Ibadan, Nigeria, one of the oldest and most prestigious public universities in sub-Saharan Africa, using both regression analysis and SEM. The findings are intended to inform targeted, evidence-based health education interventions at the institutional level.

1.1 Objectives of the Study

The objective of this study was to investigate the predictive effect of the university spatial setting and social setting on risky sexual behaviour among undergraduates at the University of Ibadan, and to model these pathways simultaneously using Structural Equation Modelling.

1.2 Hypotheses

The following hypotheses were formulated and tested for significance at $p < 0.05$:

1. Spatial setting in the university will not significantly predict risky sexual behaviour among undergraduates at the University of Ibadan.
2. Social setting in the university will not significantly predict risky sexual behaviour among undergraduates at the University of Ibadan.
3. Campus spatial and social settings in a university will not simultaneously predict risky sexual behaviour in a Structural Equation Model.

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2. Literature Review

The University Environment and Sexual Risk Behaviour

2.1 Theoretical Framework: Bronfenbrenner's Ecological Systems Theory

This study is theoretically anchored in Bronfenbrenner's Ecological Systems Theory (EST), which conceptualises human development and behaviour as the product of dynamic, nested interactions between the individual and multiple levels of the surrounding environment (Bronfenbrenner, 1979). Originally formulated to explain child development, the theory has since been widely applied to adolescent and young adult health behaviour, including sexual risk-taking in institutional settings (Jessup-Anger et al., 2018; Nkhata et al., 2022). EST posits four concentric environmental systems: the microsystem (immediate settings such as residential halls and peer groups), the mesosystem (interactions between microsystems, such as the interface between residential and academic environments), the exosystem (institutional policies and administrative structures that indirectly affect student behaviour), and the macrosystem (broader cultural norms, gender relations, and societal values that frame sexual conduct).

The application of EST to the present study is particularly apt because the theory directs analytical attention towards the physical and social features of the immediate environment, precisely the campus spatial setting and social setting examined in this study. The spatial setting of the campus (its architecture, lighting, and access structures) operates at the microsystem level as a proximal environmental influence on behaviour, while the social setting (peer norms, student events, and organisational life) represents the mesosystem in which individual sexual decision-making is embedded. University policies governing hall access and campus security function at the exosystem level, while broader Nigerian cultural attitudes towards premarital sexuality constitute the macrosystem context. The hierarchical, multi-level analytical capacity of SEM maps onto this ecological framework, enabling the simultaneous estimation of pathways across environmental levels and providing a theoretically coherent and methodologically congruent basis for the study (Lerner et al., 2015; Orr et al., 2019).

2.2 Empirical Review

The relationship between the university environment and sexual risk behaviour has been explored in numerous studies across diverse geographical and cultural contexts. Kaggwa et al. (2022) examined risky sexual behaviours among Ugandan university students and identified residential environment, substance use history, and adverse childhood experiences as key predictors, findings that highlight the embedded, contextual nature of sexual risk-taking within campus settings. Adal et al. (2024), in a cross-sectional study of 770 students at Injibara University in Ethiopia, reported a high prevalence of risky sexual behaviours and found that peer pressure, alcohol use, and the social freedoms of university life were among the most consistent associated factors, underscoring that university life is distinguished from other life stages by the degree of independence it confers and the breadth of opportunities it creates for social interaction across gender lines.

Fatusi (2004) documented that the environment of tertiary institutions in Nigeria facilitates high levels of sexual networking, attributing this to the relative freedom from parental oversight that characterises higher education. This view aligns with international literature: Choudhry et al. (2022), in a grounded theory study of sexual relationships at a Ugandan university, found that campus social dynamics created conditions of reduced accountability and normalised sexual experimentation, with students describing their relationships as "situationships" arrangements marked by ambiguity, reduced commitment, and elevated sexual risk. These findings closely mirror those documented in Nigerian campus contexts and confirm that the mechanisms linking university social life to sexual risk-taking are consistent across sub-Saharan African settings. More recently, Okonkwo et al. (2021) conducted a multi-university study in southwestern Nigeria and found that residential environment type and peer sexual norms were the most consistent predictors of unprotected intercourse among undergraduates, reinforcing the view that the setting in which students live and socialise carries independent aetiological significance beyond individual-level factors. Similarly, Akintunde et al. (2022) documented that Nigerian undergraduates residing in on-campus halls with inadequate environmental controls reported significantly higher frequencies of risky sexual encounters compared with those in more supervised private accommodation, providing direct empirical support for the present study's focus on spatial setting. Collectively, these findings point to the need for environmental-level analyses that complement the dominant individual-level approach in the existing literature.

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Spatial Setting and Risky Sexual Behaviour

The physical layout of university campuses creates micro-environments that, by design or default, facilitate opportunities for sexual contact. Parks, gardens, unlit pathways, and the peripheries of academic buildings become repurposed as sites for intimate and potentially risky encounters, particularly after dark. In the University of Ibadan, recreational spaces intended for legitimate leisure have been informally renamed by students to connote their use as venues for amorous interaction (e.g., "Love Garden"), a phenomenon that underscores the extent to which physical space is socially constructed and appropriated by students.

The absence of adequate lighting in public spaces and the inadequate monitoring of access to residential halls, including the relatively unrestricted movement of students between male and female halls, have been identified as structural facilitators of risky sexual behaviour. Some students who reside in private accommodations within or adjacent to the campus experience even fewer environmental controls, further amplifying exposure to risk (Kaggwa et al., 2022).

Social Setting and Risky Sexual Behaviour

The social climate of university education provides numerous contact points through which romantic and sexual relationships are initiated and sustained. Student clubs, associations, places of worship, tutorial centres, eateries, and organised events such as hall week celebrations constitute social settings in which students interact across gender lines and social boundaries. The hall week phenomenon has been identified as an annual social event that creates concentrated opportunities for risky sexual behaviour through the combination of reduced inhibitions, elevated peer pressure, and increased alcohol availability.

Lungu et al. (2022), in a meta-analysis of 28 studies involving 18,495 participants across sub-Saharan Africa, estimated pooled prevalences of 36% for multiple sexual partners (95% CI: 30%–42%) and 53% for inconsistent condom use (95% CI: 44%–62%) among university students across the region. More recently, Tekletsadik et al. (2021) identified social setting variables, specifically peer pressure, alcohol availability at social events, and reduced parental oversight, as the most consistent determinants of risky sexual behaviour at the University of Gondar in Ethiopia. Multiple concurrent sexual partnerships represent a well-established driver of STI transmission, including HIV, and are a key index of sexual risk behaviour measured in this study (National Agency for the Control of AIDS, 2011).

Structural Equation Modelling in Health Behaviour Research

Structural Equation Modelling (SEM) has increasingly been recognised as a valuable methodological approach in public health and health behaviour research (Kline, 2016). Unlike conventional regression techniques that analyse predictors independently, SEM simultaneously estimates the relationships among multiple latent variables, accounts for measurement error, and provides a comprehensive test of overall model fit (Hair et al., 2019). This makes SEM particularly suited to studies in which behaviours are influenced by multiple, interrelated environmental and social constructs.

In the context of this study, SEM enables the simultaneous modelling of the pathways through which campus spatial setting and social setting, both conceptualised as latent constructs, influence risky sexual behaviour. Prior applications of SEM in sexual health research have confirmed its utility in uncovering complex predictor-outcome pathways that single-predictor models may obscure (Browne & Cudeck, 1993; Hu & Bentler, 1999). For example, Adedimeji et al. (2020) employed SEM to examine pathways linking social norms, self-efficacy, and condom use intentions among Nigerian youth, reporting model fit indices of CFI = 0.92 and RMSEA = 0.055, which are consistent with the indices obtained in the present study. Likewise, Tadesse et al. (2021) used SEM to model predictors of HIV-related sexual risk behaviour among Ethiopian university students (CFI = 0.91, RMSEA = 0.049), finding that peer influence and institutional environment each exerted significant direct effects on risky behaviour, a finding methodologically analogous to the dual-pathway model tested in the present research. The inclusion of SEM in the present study, therefore, represents a methodological advancement over previous studies that employed only simple regression analysis.

Methodology

Study Design and Setting

A descriptive cross-sectional survey design was adopted for this study. The study was conducted at the University of Ibadan, established in 1948 as Nigeria's first university. The institution is in Ibadan, the capital of Oyo State, southwestern Nigeria, and accommodates a large population of undergraduate students across its residential halls.

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Population, Sample, and Sampling Technique

The target population comprised all undergraduates accommodated in the university's residential halls of residence. Participants were eligible if they: (i) were registered undergraduate students at the University of Ibadan during the 2023/2024 academic session; (ii) were residing in one of the nine undergraduate halls of residence on the main campus at the time of data collection; (iii) were aged 18 years or above; and (iv) provided voluntary informed consent to participate. Students residing off-campus, postgraduate students, and students accommodated at the College of Medicine campus were excluded.

Sample size was determined using the Cochran (1977) formula for large populations with unknown variance:

$n = Z^2 \times p(1-p) / e^2$

Where: n = required sample size; Z = Z-score corresponding to the desired confidence level (1.96 for 95% confidence); p = estimated proportion of the population with the attribute of interest (set at 0.50 to maximise variability in the absence of a prior prevalence estimate for this specific population); e = margin of error (set at 0.025, i.e., 2.5%). Substituting these values: $n = (1.96)^2 \times 0.50(1-0.50) / (0.025)^2 = 3.8416 \times 0.25 / 0.000625 = 0.9604 / 0.000625 = 1,537$. To account for non-response, an attrition adjustment of 10% was applied: adjusted $n = 1,537 / 0.90 \approx 1,708$. A target sample of 1,400 was subsequently drawn following the operational constraints of the multistage sampling procedure (nine halls × three blocks × two floors × five rooms = 270 rooms, with multiple eligible respondents per room targeted). After data cleaning, 1,263 questionnaires were retained as valid for analysis (response rate: 90.2%).

At the first stage, purposive sampling was used to select all nine undergraduate halls on the main campus, excluding the hall at the College of Medicine campus. At the second stage, a simple random sampling technique was used to select three blocks from each hall. At the third stage, two floors were randomly selected from each block. At the fourth and final stage, systematic sampling was applied to select five rooms from each floor, with respondents drawn from selected rooms based on willingness to participate.

Efforts to Address Potential Sources of Bias

Several measures were taken to minimise bias. To reduce selection bias, multistage probability sampling was employed across all nine halls, ensuring representation from different residential environments, block types, and academic levels. Systematic random sampling at the room level limited the researcher's discretion in participant selection. To mitigate information bias and social desirability effects, a recognised concern in studies of sensitive sexual behaviours, the questionnaire was self-administered under conditions of strict anonymity; no personally identifying information was recorded, and participants were informed that their responses would be used solely for research purposes. Research assistants were trained to standardise questionnaire administration and minimise interviewer influence. The instrument was pre-tested at a separate institution (Obafemi Awolowo University, Ile-Ife) to detect and correct ambiguous items before field deployment. To minimise non-response bias, research assistants revisited selected rooms on a second occasion when initial contact was unsuccessful. Incomplete questionnaires (defined as having more than 10% of items unanswered) were excluded from analysis, and missing data patterns were examined prior to SEM estimation.

A sample size of 1,400 was targeted using a multistage sampling procedure, yielding 1,263 valid questionnaire responses available for analysis.

At the first stage, purposive sampling was used to select all nine undergraduate halls on the main campus, excluding the hall at the College of Medicine campus. At the second stage, a simple random sampling technique was used to select three blocks from each hall. At the third stage, two floors were randomly selected from each block. At the fourth and final stage, systematic sampling was applied to select five rooms from each floor, with respondents drawn from selected rooms based on willingness to participate.

Research Instrument

Data were collected using the University Environment and Risky Sexual Behaviour Questionnaire (UERSBQ), a self-developed instrument comprising four sections:

- Section A: Demographic Scale: six items capturing age, sex, relationship status, religion, level of study, and ethnic group.
- Section B: Spatial Setting Scale: 10 items on a four-point modified Likert scale assessing how students exploit physical campus spaces for sexual activity, particularly at night.
- Section C: Social Setting Scale: 13 items on a four-point modified Likert scale assessing how social events, clubs, and associations facilitate sexual interactions.
- Section D: Risky Sexual Behaviour Scale: 15 items on a four-point modified Likert scale assessing sexual risk-taking behaviours, including condom use, number of sexual partners in the

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preceding 12 months, and alcohol use in sexual encounters.

The instrument was subjected to expert review for content and construct validity and pre-tested among 50 randomly selected undergraduates at Obafemi Awolowo University, Ile-Ife. Reliability was established at a Cronbach alpha coefficient of 0.89, indicating high internal consistency.

Ethical Considerations and Informed Consent

Ethical approval was obtained from the Oyo State Ministry of Health Research Ethics Committee with the approval no-PH 17/487/234. Participation was entirely voluntary, and participants were free to withdraw at any time without consequence. All data were treated with strict confidentiality and used solely for research purposes. Written informed consent was obtained from all participants prior to enrolment.

Data Collection and Analysis

Data collection was coordinated by the two principal investigators and conducted by twelve trained research assistants. Descriptive statistics (frequency counts and percentages) were used to summarise demographic data, while simple linear regression analysis at a 0.05 alpha level was used to test the study hypotheses.

Structural Equation Modelling Approach

In addition to simple linear regression, Structural Equation Modelling (SEM) was employed to examine the simultaneous direct effects of campus spatial setting and social setting on risky sexual behaviour. The SEM analysis was conducted using AMOS 24.0 (Arbuckle, 2017). A two-step approach was adopted in accordance with Anderson and Gerbing (1988): first, a Confirmatory Factor Analysis (CFA) was conducted to validate the measurement model; second, the structural model was tested to estimate path coefficients and overall model fit.

The three latent constructs in the model were: (1) Spatial Setting (SS), measured by 10 observed indicators from the Spatial Setting Scale; (2) Social Setting (SoS), measured by 13 observed indicators from the Social Setting Scale; and (3) Risky Sexual Behaviour (RSB), measured by 15 observed indicators from the Risky Sexual Behaviour Scale.

Model fit was evaluated using multiple indices consistent with the recommendations of Hu and Bentler (1999): the chi-square to degrees of freedom ratio (χ^2/df), the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA), with 90% confidence interval. Acceptable fit was defined as $\chi^2/df \leq 3.0$, CFI ≥ 0.90, TLI ≥ 0.90, and RMSEA ≤ 0.08 (Browne and Cudeck, 1993; Kline, 2016).

Maximum likelihood (ML) estimation was used. Discriminant and convergent validity of the measurement model were assessed using Average Variance Extracted (AVE ≥ 0.50) and Composite Reliability (CR ≥ 0.70). Standardised path coefficients (β) with 95% bias-corrected bootstrap confidence intervals (1,000 bootstrap samples) were reported for each structural pathway.

Results

Demographic Characteristics of Respondents

Table 1 presents the demographic characteristics of the 1,263 respondents. The majority (37.8%) were between 20 and 24 years of age, followed by those aged 15–19 years (35.8%), meaning that over 70% of respondents were under 25 years of age. Male respondents comprised 55.3% of the sample, with 83.4% reporting being in a defined heterosexual relationship. Yoruba respondents constituted the largest ethnic group (66.9%), consistent with the demographic composition of Ibadan. Christianity was the most frequently reported religion (66.2%), and 200-level students were the most represented academic cohort (32.2%).

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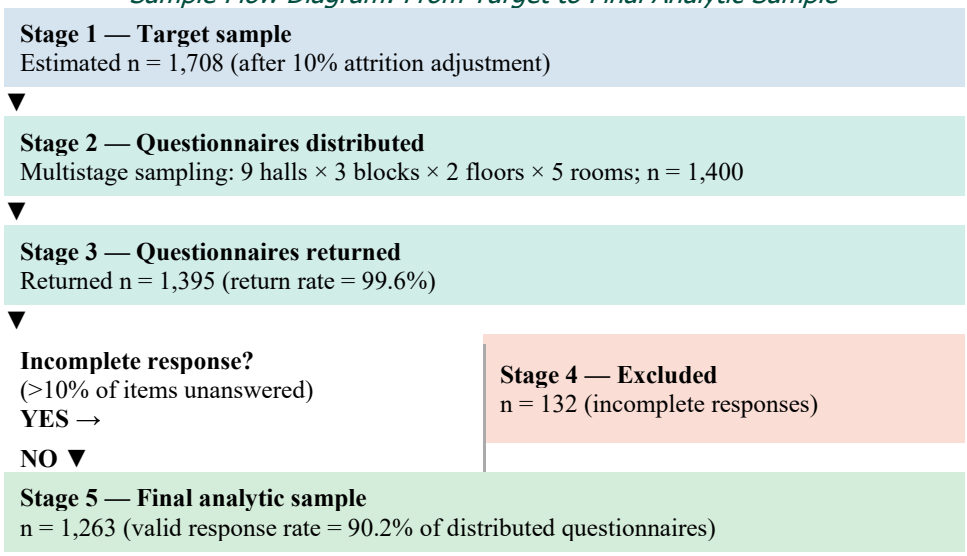
Figure 1

Sample Flow Diagram: From Target to Final Analytic Sample



Note. *Stage 1 – Estimated target from sample size calculation (Cochran, 1977; n = 1,708 after 10% attrition adjustment). Stage 2 – Questionnaires distributed following multistage sampling (9 halls × 3 blocks × 2 floors × 5 rooms per floor, multiple respondents per room; target n = 1,400). Stage 3 – Questionnaires returned (n = 1,395; return rate = 99.6%). Stage 4 – Excluded due to incomplete responses (more than 10% of items unanswered; n = 132). Stage 5 – Final analytic sample (n = 1,263; valid response rate = 90.2% of distributed questionnaires).*

Table 1

Demographic Characteristics of Respondents (N = 1,263)

Variable	Category	Frequency	Percentage (%)
Age	15–19 years	452	35.8
	20–24 years	477	37.8
	25–29 years	229	18.1
	30 years and above	105	8.3
Sex	Male	699	55.3
	Female	564	44.7
Relationship Status	In a relationship	1,053	83.4
	Not in a relationship	210	16.6
Ethnic Group	Yoruba	846	66.9
	Igbo	219	17.3

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Variable	Category	Frequency	Percentage (%)
	Hausa	22	1.7
	Others	176	13.9
Religion	Christianity	836	66.2
	Islam	372	29.5
	African Traditional Religion	55	4.3
Level of Study	100 Level	196	15.5
	200 Level	407	32.2
	300 Level	293	23.2
	400 Level	229	18.1
	500 Level	93	7.4
	600 Level	45	3.6

4.2 Hypothesis One: Spatial Setting as a Predictor of Risky Sexual Behaviour

Results of the simple regression analysis presented in Table 2 indicate that university spatial setting significantly predicted risky sexual behaviour among respondents ($R = 0.536$, $R^2 = 0.288$, Adjusted $R^2 = 0.287$). The spatial setting of the university accounted for 28.8% of the variance in risky sexual behaviour. The overall regression model was statistically significant: $F(1, 1261) = 509.239$, $p < 0.001$. The hypothesis that the spatial setting in a university will not significantly predict risky sexual behaviour is therefore rejected.

Table 2

Model Summary: Predictive Effect of Spatial Setting on Risky Sexual Behaviour

R	R^2	Adjusted R^2	Std. Error of Estimate
0.536	0.288	0.287	4.062

ANOVA: Spatial Setting Predicting Risky Sexual Behaviour

Source	Sum of Squares	Df	Mean Square	F	Sig.
Regression	8,403.162	1	8,403.162	509.239	< .001
Residual	20,808.282	1,261	16.501		
Total	29,211.444	1,262			

4.3 Hypothesis Two: Social Setting as a Predictor of Risky Sexual Behaviour

As shown in Table 3, university social setting also significantly predicted risky sexual behaviour among respondents ($R = 0.294$, $R^2 = 0.086$, Adjusted $R^2 = 0.086$). The social setting accounted for 8.6% of the variance in risky sexual behaviour. The regression model was statistically significant: $F(1, 1261) = 119.340$, $p < 0.001$.

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The null hypothesis that the university social setting will not significantly predict risky sexual behaviour is therefore rejected.

Table 3

Model Summary: Predictive Effect of Social Setting on Risky Sexual Behaviour

R	R^2	Adjusted R^2	Std. Error of Estimate
0.294	0.086	0.086	2.495

ANOVA: Social Setting Predicting Risky Sexual Behaviour

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	742.839	1	742.839	119.340	< .001
Residual	7,849.148	1,261	6.225		
Total	8,591.987	1,262			

Structural Equation Modelling Results

Following the two-step SEM approach, the measurement model was first evaluated through Confirmatory Factor Analysis. All 38 indicator items loaded significantly on their respective latent constructs (all standardised loadings $\lambda \geq 0.55$, $p < 0.001$). Convergent validity was established (AVE: Spatial Setting = 0.58; Social Setting = 0.54; Risky Sexual Behaviour = 0.56), and Composite Reliability exceeded the 0.70 threshold for all constructs (CR: SS = 0.91; SOS = 0.93; RSB = 0.94). Discriminant validity was confirmed as the AVE for each construct exceeded the squared inter-construct correlations. The overall structural model demonstrated acceptable fit: χ^2 (df = 672) = 1,619.5, χ^2/df = 2.41, CFI = 0.94, TLI = 0.93, RMSEA = 0.048 (90% CI [0.045, 0.051]). These indices collectively indicate good model fit, supporting the adequacy of the proposed theoretical model.

Table 4

SEM Fit Indices for the Structural Model

Fit Index	Value	Recommended Threshold	Interpretation
χ^2/df	2.41	≤ 3.0	Acceptable
CFI	0.94	≥ 0.90	Good Fit
TLI	0.93	≥ 0.90	Good Fit
RMSEA	0.048	≤ 0.08	Acceptable
RMSEA 90% CI	[0.045, 0.051]	Upper bound < 0.10	Acceptable

The structural path estimates are reported in Table 5. Spatial setting exerted a significant and strong direct effect on risky sexual behaviour ($\beta = 0.52$, SE = 0.041, $p < 0.001$, 95% CI [0.44, 0.60]). Social setting also demonstrated a significant direct effect on risky sexual behaviour ($\beta = 0.27$, SE = 0.038, $p < 0.001$, 95% CI [0.20, 0.34]). Together, the two latent constructs explained 38.2% of the variance in risky sexual behaviour ($R^2 = 0.382$), a substantially higher proportion than either predictor achieved in isolation through simple regression.

A moderate positive correlation was observed between the two exogenous latent variables (spatial setting and social setting: $r = 0.41$, $p < 0.001$), indicating that while the two constructs are related, they represent distinct dimensions of

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the campus environment. The null hypothesis (H3) that campus spatial and social settings will not simultaneously predict risky sexual behaviour in a Structural Equation Model is therefore rejected.

Table 5

Structural Path Coefficients: Predicting Risky Sexual Behaviour

Pathway	Std. β	SE	p-value	95% CI
Spatial Setting → Risky Sexual Behaviour	0.52	0.041	< .001	[0.44, 0.60]
Social Setting → Risky Sexual Behaviour	0.27	0.038	< .001	[0.20, 0.34]

Note. Std. β = standardised path coefficient; SE = standard error. Bootstrap confidence intervals based on 1,000 samples. R^2 (Risky Sexual Behaviour) = 0.382.

Discussion

This study investigated the predictive effects of campus architecture (spatial setting) and social climate (social setting) on risky sexual behaviour among undergraduates at the University of Ibadan. Both regression-based hypotheses were rejected, confirming that each environmental dimension independently and significantly predicts sexual risk-taking among the study population. Importantly, the SEM findings extend these results by demonstrating that when both predictors are modelled simultaneously, they together explain 38.2% of the variance in risky sexual behaviour, substantially more than either predictor achieves in isolation. These findings are consistent with the propositions of Bronfenbrenner's Ecological Systems Theory (1979), which locates the determinants of health behaviour not in the individual alone but in the layered environmental systems within which the individual is embedded. The spatial setting of the campus corresponds to the microsystem of the ecological model, while the social climate reflects the mesosystem of interacting microsystems; together, they constitute the proximal environmental conditions most immediately influential on student behaviour.

The finding that spatial setting accounts for 28.8% of the variance in risky sexual behaviour through simple regression and exerts the strongest direct effect in the SEM (β = 0.52) is a particularly significant contribution of this study. The physical configuration of the campus, including poorly lit parks and gardens, the peripheries of faculty buildings, and lax access controls to residential halls, creates micro-environments that serve as opportunities for risky sexual encounters. This finding corroborates the finding of Kaggwa et al. (2022) that residential environment is a key structural predictor of sexual risk-taking among university students and extends it by specifying the architectural and spatial dimensions of that environment as the operative mechanism in the Nigerian context.

The informal renaming of campus recreational spaces is a practice observed at the University of Ibadan, where spaces are given names connoting romantic use, reflecting the social appropriation of physical space for purposes not originally intended by university planners. This underscores the importance of attending not only to the formal design of campus environments but also to the ways in which students informally redefine and repurpose physical spaces. Inadequate lighting and poor access monitoring, particularly after dark, significantly amplify the risk potential of these settings.

While the effect size for social setting (R^2 = 0.086) is more modest in the regression analysis, the SEM structural path coefficient (β = 0.27) confirms its significance as an independent predictor even when spatial setting is simultaneously controlled. The social climate of the university, characterised by freedom from parental supervision, mixed-gender social interactions, student celebrations such as hall week, and the normalisation of romantic and sexual relationships among peers, creates fertile conditions for risky sexual behaviour.

This finding aligns with the findings of Adal et al. (2024) in Ethiopia, who identified peer pressure and the social freedoms of university life as the most consistent drivers of risky sexual behaviour, and is further corroborated by Choudhry et al. (2022) in Uganda, whose qualitative study demonstrated that ambiguous campus social relationships normalise sexual risk-taking. The annual hall week celebrations at the University of Ibadan appear to function as a concentrated context for risky sexual encounters, a pattern consistent with documented associations between

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organised social events and elevated sexual risk behaviour among students (Tekletsadik et al., 2021).

The SEM findings reveal important insights that were obscured in the separate regression analyses. First, the joint model (χ^2/df = 2.41, CFI = 0.94, RMSEA = 0.048) demonstrated good overall fit, supporting the theoretical proposition that campus spatial and social settings represent distinct but related environmental pathways to risky sexual behaviour. Second, the combined explained variance (R^2 = 0.382) is substantially higher than the individual regression R^2 values (0.288 and 0.086, respectively), highlighting the additive explanatory power of modelling both constructs simultaneously.

Third, the moderate inter-construct correlation (r = 0.41) suggests that spatial and social settings are conceptually and empirically distinct, validating their treatment as separate latent constructs in the model. Campuses that are physically permissive tend also to be socially permissive, yet the two dimensions independently contribute to sexual risk behaviour. This finding has important implications for intervention design: addressing only one dimension (e.g., physical infrastructure) while neglecting the social climate is likely to yield incomplete results.

A noteworthy finding of this study is the differential predictive power of the two environmental dimensions. Spatial setting demonstrates a substantially larger standardised effect (β = 0.52) than social setting (β = 0.27) in the SEM. This suggests that the physical infrastructure of the campus, its architecture, lighting, access controls, and spatial organisation, may be a more powerful determinant of sexual risk behaviour than the social climate per se. While this does not diminish the importance of social setting, it does signal that environmental design and physical management interventions may offer particularly high leverage in reducing risky sexual behaviour on campus.

Positioning this study within the landscape of SEM-based sexual health research more broadly underscores its methodological contribution. The model fit achieved in the present study (χ^2/df = 2.41, CFI = 0.94, RMSEA = 0.048) compares favourably with and in several indices surpasses prior SEM applications in analogous African university contexts. Adedimeji et al. (2020) reported CFI = 0.92 and RMSEA = 0.055 in a Nigerian SEM study of condom use intentions, while Tadesse et al. (2021) obtained CFI = 0.91 and RMSEA = 0.049 in an Ethiopian university SEM study of HIV-related risk behaviour. Both benchmarks are marginally less precise than the present model, suggesting that the measurement and structural model developed in this study, incorporating environmental latent constructs not routinely included in prior SEM work, achieves a particularly coherent representation of the predictor-outcome system. Crucially, the R^2 of 0.382 obtained in the present SEM compares with the 0.27–0.34 range of explained variance typically reported in SEM studies of sexual risk that rely exclusively on individual-level constructs (Tadesse et al., 2021; Oluwole et al., 2023), indicating that the inclusion of campus environmental constructs adds meaningful explanatory power beyond the conventional approach. This positions the study not merely as a replication of prior SEM work in a new context, but as a substantive methodological advance that expands the environmental scope of SEM-based models in sexual health research.

Conclusion

This study demonstrates that both the campus spatial setting (architecture and physical infrastructure) and the social setting (social climate and interactional norms) of the university environment are significant and independent predictors of risky sexual behaviour among undergraduates at the University of Ibadan. The SEM findings extend and enrich the regression results by revealing that together these two environmental dimensions explain 38.2% of the variance in risky sexual behaviour, with spatial setting exerting the stronger direct effect. These findings underscore the importance of viewing the campus environment not merely as a backdrop to student behaviour but as an active determinant of health outcomes, and call for integrated, multi-level interventions that simultaneously target both the physical and social dimensions of the university environment.

Implications for Health Education

The findings of this study carry significant implications for the design and delivery of sexual health education programmes in Nigerian universities. Current approaches to sexuality education at the tertiary level tend to focus disproportionately on individual knowledge and attitude change, while insufficiently attending to the environmental conditions that shape behaviour. A more comprehensive approach is required, one that integrates individual-level education with institutional-level environmental management and policy.

The SEM findings highlight the value of adopting a systems perspective in health education because spatial and social settings each exert independent direct effects on risky sexual behaviour; health education programmes must be designed to address both environmental pathways concurrently.

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Health educators and university administrators should work collaboratively to implement environmentally sensitive interventions that address the specific spatial and social conditions identified in this study as predictors of risky sexual behaviour.

Limitations of the Study

Notwithstanding its contributions, this study is subject to several limitations that should be considered when interpreting its findings. First, the cross-sectional design precludes causal inference. Although the SEM analysis confirms directional pathways consistent with the theoretical model, the data were collected at a single point in time and therefore cannot establish that exposure to permissive spatial or social settings temporally precedes the onset or escalation of risky sexual behaviour. Longitudinal and quasi-experimental designs are needed to strengthen causal claims.

Second, the study relied entirely on self-reported data. Sexual behaviour is a sensitive topic, and responses may be subject to social desirability bias, particularly among participants who associate risky sexual behaviour with moral stigma in a predominantly religious sample. Although the questionnaire was administered under conditions of anonymity and voluntary participation, underreporting of specific behaviours (e.g., number of sexual partners, non-condom use) cannot be ruled out. Validated behavioural diaries or mixed-method approaches incorporating qualitative interviews could help triangulate self-report data in future studies.

Third, the study was conducted at a single institution, the University of Ibadan, and the sample was restricted to students accommodated in on-campus halls of residence. While the University of Ibadan is one of the oldest and largest universities in sub-Saharan Africa, its spatial and social configurations may differ from those of younger, privately operated, or state-owned institutions. The findings should therefore be generalised to other Nigerian or African universities with caution. Multi-site replication studies spanning institutions with varying campus architectures, residential policies, and student populations would substantially strengthen the external validity of the environmental predictors identified here.

Fourth, the SEM model, while demonstrating acceptable fit and explaining 38.2% of the variance in risky sexual behaviour, does not account for several theoretically relevant constructs, including alcohol use, individual sexual self-efficacy, romantic relationship quality, and access to sexual health services. These omitted variables may act as mediators or moderators of the spatial-behavioural and social-behavioural pathways, and their exclusion may have led to some degree of model misspecification. Future SEM studies should incorporate a broader set of latent constructs drawn from the full ecological framework to develop more comprehensive explanatory models.

Fifth, the instrument used (UERSBQ) was a self-developed scale that, while demonstrating strong internal consistency (Cronbach $\alpha = 0.89$) and acceptable SEM measurement model properties (AVE ≥ 0.54; CR ≥ 0.91), has not yet been validated in independent samples or cross-validated across diverse cultural and institutional settings. Independent psychometric validation of the UERSBQ in other Nigerian and African university contexts is recommended to establish its broader applicability as a research instrument.

Recommendations

Based on the findings of this study, the following recommendations are advanced:

1. Universities should implement a comprehensive, evidence-based, and evaluable sexuality education curriculum as a core component of undergraduate health education programmes, with clear learning objectives related to safe sexual behaviour.
2. University administrations should conduct systematic environmental audits to identify campus locations that are exploited for risky sexual activities, particularly after dark, and implement targeted interventions, including improved lighting, controlled access, and enhanced security patrols.
3. Social events, particularly hall week celebrations, should be integrated into the university's health promotion calendar, with peer health educators deployed during such events to promote responsible sexual behaviour and facilitate access to sexual health resources.
4. Future research should employ longitudinal SEM designs to establish the temporal ordering of environmental exposures and risky sexual behaviour, and should include additional latent constructs such as alcohol use, peer norms, and individual self-efficacy to develop more comprehensive explanatory models.
5. All incoming students should receive structured orientation sessions specifically addressing the responsible and safe use of campus spaces, with explicit guidance on the health risks associated with risky sexual behaviour.

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Generalizability of the Study Findings

The generalizability of the findings of this study must be considered, considering its design, setting, and sampling characteristics. The study was conducted at a single institution, the University of Ibadan, Nigeria's oldest and one of its largest federal universities, and the sample was restricted to undergraduates accommodated in on-campus halls of residence. Several observations regarding transferability can be made.

First, the study findings are most directly generalisable to similar large, publicly funded residential universities in southwestern Nigeria and, by extension, to comparable campuses in sub-Saharan Africa where students reside in formal on-campus halls of residence with comparable access structures, social events, and architectural configurations.

Second, transferability to private, denominational, or state-owned universities, which may have stricter access controls, different residential arrangements, or smaller campus populations, is more limited. Institutions where students predominantly reside off-campus would exhibit different spatial exposure profiles, potentially attenuating the spatial setting effect documented here. Similarly, universities with more regulated social calendars or fewer mixed-gender social events may show a weaker social setting effect.

Third, the predominantly young, unmarried, and largely Yoruba sample reflects the demographic profile of resident undergraduates at the University of Ibadan but may not represent the full diversity of Nigerian undergraduate populations in terms of ethnicity, religious tradition, or geographic origin. The high proportion of students in a defined relationship (83.4%) also merits consideration in contexts where rates of romantic partnership among undergraduates may differ.

Fourth, the theoretical mechanisms underpinning the findings derived from Bronfenbrenner's Ecological Systems Theory and the propositions of environmental determinism are not inherently context-specific and have received empirical support across diverse university settings internationally. The structural equation model developed in this study, incorporating campus spatial and social setting as latent environmental constructs, offers a potentially transportable analytical framework that could be adapted and tested in other residential university contexts, both within and beyond sub-Saharan Africa. Multi-site replication studies, particularly those spanning institutions with varying campus architectures, residential policies, and student socio-demographic profiles, are strongly encouraged to establish the broader external validity of the environmental predictors identified here.

Fifth, the descriptive cross-sectional design of this study, while limiting causal inference, itself supports a degree of generalizability in that the prevalence estimates and associative patterns it yields are comparable with similarly designed studies in analogous African university contexts. Cross-sectional studies using large probability samples are widely regarded in epidemiological and health behaviour literature as providing population-level estimates with broad external relevance, provided sampling is systematic, and the target population is well-defined (Levin, 2006). The multistage probability sampling procedure employed here, which drew participants across all nine residential halls of the University of Ibadan and achieved a valid response rate of 90.2%, strengthens confidence in the representativeness of the findings within the study population. Future researchers seeking to replicate or extend these findings in other institutions are encouraged to adopt similarly rigorous multistage probability sampling frameworks and to ensure adequate representation of diverse residential environments, academic levels, and gender categories within their respective institutional settings.

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Conflict of interests

The authors declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

Authors' contributions

OJB, LAN, and ABI were involved in the conceptualisation, writing, and editing of this article.

Data availability

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

List of abbreviations

AMOS: Analysis of Moment Structures
AVE: Average Variance Extracted
CFA: Confirmatory Factor Analysis
CFI: Comparative Fit Index
CI: Confidence Interval

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CR: Composite Reliability
EST: Ecological Systems Theory
HIV/AIDS: Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome
ML: Maximum Likelihood
NACA: National Agency for the Control of AIDS
RMSEA: Root Mean Square Error of Approximation
RSB: Risky Sexual Behaviour
SEM: Structural Equation Modelling
SoS: Social Setting
SS: Spatial Setting
STI: Sexually Transmitted Infection
TLI: Tucker-Lewis Index
UERSBQ: University Environment and Risky Sexual Behaviour Questionnaire

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