

Sexuality information completeness and risky sexual behaviour among young people in Uganda's island communities

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Abstract

Introduction: Research on risky sexual behaviour (RSB) among young people has largely focused on access to sexuality information (SI), with limited attention to the completeness of SI. We examine its association with RSB among young people in Uganda's island communities, an under-researched, high-risk population.

Methods: A cross-sectional quantitative study surveyed 569 young people aged 10-24, selected using multistage sampling, in the Busanga and Bugombe parishes of Kkoome Islands subcounty, Mukono district, Uganda, in May 2025. Completeness of SI was categorized into four levels: Low SI (exposure to ≤ 2 domains), Moderate SI (3–4 domains), High SI (5–7 domains), and Complete SI (exposure to all eight domains). Engagement in at least one of the following: early sexual debut, multiple sexual partnerships, inconsistent or incorrect condom use, transactional sex, or sex under the influence of substances; defined RSB. Socio-demographic characteristics and SI delivery modes were included as covariates. Frequencies and percentages described univariate data. Crude Odds Ratios (cOR) assessed bivariate associations, while Adjusted Odds Ratios (aOR) determined multivariate associations.

Results: Among the 569 young people interviewed, only 21 of 569 (3.7%) of participants received complete SI, while 90.3% reported at least one RSB. High SI (cOR = 0.1, 95% CI: 0.06–0.31, $p < 0.001$) and complete SI (cOR = 0.1, 95% CI: 0.02–0.15, $p < 0.001$; aOR = 0.16, 95% CI: 0.04–0.56, $p = 0.004$) were associated with lower odds of RSB. Receiving information through observation (cOR = 0.21, 95% CI: 0.09–0.50, $p < 0.001$; aOR = 0.22, 95% CI: 0.09–0.56, $p = 0.001$) was associated with reduced odds of RSB. Staying with parents, club membership, and being female had significantly ($p > 0.05$) lower odds of RSB, while employment was associated with higher odds.

Conclusions: Completeness of SI, rather than mere exposure and observational learning, is strongly linked to reduced engagement in RSB. Sexuality education initiatives should prioritise practical and complete domain coverage across families, schools, and other mentorship platforms, while integrating Comprehensive Sexuality Education (CSE) into economic empowerment strategies targeting young people.

Keywords: Sexuality information, sexuality information completeness, risky sexual behaviour, young people

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Introduction

Risky Sexual Behaviour (RSB) among young people (10–24 years) remains a global concern probed by scholars. It is more serious in sub-Saharan Africa, including Uganda. It refers to behaviours that increase vulnerability to adverse sexual and reproductive health outcomes, including early sexual debut, coerced sex, multiple sexual partnerships, inconsistent or incorrect condom use, transactional sex, and sexual activity under the influence of alcohol or drugs [1–2]. These behaviours expose young people to HIV, other sexually transmitted infections (STIs), unintended pregnancies, unsafe abortions, and broader social and economic consequences [3,4]. and other consequences beyond health. Across Africa, approximately two-thirds of young people initiate sexual activity by age 19, often under conditions that heighten these risks [5]. In Uganda, the situation is especially concerning due to the country's youthful population, persistently high teenage pregnancy rates (approximately 25%), and early marriage prevalence of about 34% [6,7].

The burden of RSB is more pronounced in Uganda's island communities, particularly those on Lakes Victoria and Albert. These settings are characterised by geographical isolation, limited access to education and health services, and high population mobility driven by fishing livelihood [8]. Such structural conditions create environments where young people are more exposed to sexual risk. Evidence shows that the median age of sexual debut in island communities is 16.1 years, lower than the national average of 16.9 years [9]. Teenage pregnancy rates in these areas reach 48.3%, nearly double the national average, while condom use remains critically low at 3.8% compared to 13.9% nationally [10]. These disparities highlight the heightened vulnerability of young people living in island contexts and underscore the need for targeted research and interventions.

Sexual behaviour does not occur in isolation; it is shaped by complex social and environmental influences. Bronfenbrenner's bioecological systems theory provides a useful framework for understanding how behaviour develops through interactions within multiple layers of influence, particularly the immediate environments in which young people live and interact [11]. These include family members, peers, teachers, and community actors who directly shape norms, attitudes, and behaviours. Complementing this, Bandura's social learning theory explains how young people acquire behaviours through observation, imitation, and interaction with others [12]. This process occurs through multiple channels, including interpersonal communication, media exposure, and educational content. Together, these theories explain both, offering a comprehensive lens for understanding how information translates into behaviour [13].

The provision of sexuality information remains a contested

issue globally, often shaped by cultural, political, and religious considerations [14–16]. Importantly, sexuality information (SI), defined as knowledge and guidance related to human sexuality, relationships, rights, and health, is frequently misunderstood and narrowly delivered as sexual and reproductive health information alone. However, sexual and reproductive health is only one component of a broader framework. According to the United Nations Educational, Scientific and Cultural Organization, comprehensive sexuality education (CSE) encompasses eight key domains: 1) healthy relationships; 2) values, rights, and culture; 3) gender; 4) violence and safety; 5) communication, negotiation and decision making; 6) the human body and development; 7) sexual and reproductive health; and 8) the sexual life cycle [17]. When sexuality information is provided in a structured, age-appropriate, culturally relevant, and scientifically accurate approach, it is considered to be comprehensive [17,18]. When young people are exposed to all eight domains, the information can be considered complete; when one or more domains are missing, it is incomplete. Completeness is therefore a foundational requirement for achieving truly comprehensive sexuality education.

Despite this framework, most research and programming have focused primarily on access to sexuality information, with limited attention to whether the information provided is complete. In Uganda, sexuality education remains structurally partial, often emphasising abstinence while neglecting critical domains such as rights, negotiation skills, and healthy relationships [19, 20]. This imbalance may explain why many young people continue to engage in RSB despite being exposed to some form of sexuality information. While policies such as the National Sexuality Education Framework (2018) and the Adolescent Health Policy aim to promote accurate and age-appropriate information, implementation remains uneven [21]. Programmes like 'Get Up Speak Out' also attempted to improve young people's voice and access to sexuality information [22]. Empirical evidence supports this concern: for example, Kemigisha et al. (2019) found that school-based CSE improved knowledge but delivered content inconsistently across schools, indicating gaps in coverage [23]. Most existing studies assess whether young people received sexuality information, but few examine whether that information covered all required domains.

This limitation is even more pronounced in island communities, where research has largely focused on structural vulnerabilities such as poverty, transactional sex, and weak health systems [24–26]. Very few studies have examined the content and completeness of the sexuality information available to young people in these settings. Existing evidence suggests important gaps: Mugabi et al. (2023) found that while sexual and reproductive health literacy was associated with safer practices among young people living with HIV, knowledge deficits persisted in areas such as family planning and rights [4]. Similarly,

Anyanwu and Tamwesigire (2023) reported that although in-school youth were less likely to engage in RSB, many still lacked adequate knowledge of negotiation and gender norms[27]. Evaluations of sexuality education programmes have also identified insufficient coverage of critical domains such as gender equality, sexual rights, and consent [22]. Collectively, these studies suggest that partial or fragmented sexuality information may limit its protective effect, yet this dimension remains underexplored.

Focusing on the completeness of sexuality information is a critical precursor to achieving comprehensive sexuality education. While comprehensiveness emphasizes depth, skills-building, and integration across settings, it cannot be effectively realized if essential domains are missing or fragmented [17]. Completeness ensures that all eight domains are addressed, providing young people with the foundational knowledge required to make informed and safe sexual decisions. By prioritising completeness, researchers and policymakers can systematically identify gaps in content coverage, particularly in underserved or high-risk populations, thereby laying the groundwork for holistic and effective sexuality education programs [17,28].

This study addresses two key gaps. First, it responds to a measurement gap by moving beyond binary assessments of access to sexuality information and instead evaluating whether young people receive a complete package across all eight UNESCO domains. Second, it addresses a contextual gap by focusing on island communities, which remain underrepresented in sexuality education research despite their heightened vulnerability. This manuscript focuses on a specific research question within the framework of a larger ongoing study. While the parent study addresses multiple objectives, this paper presents a detailed analysis of sexuality information completeness and its association with risky sexual behaviour. By isolating this component, we provide in-depth insights that complement the broader study without duplicating its scope.

Methods

Study design

This study employed a cross-sectional analytical design to examine the association between completeness of sexuality information and RSB among young people aged 10-24 in Uganda's island communities. This design was appropriate for generating population-level estimates in a geographically isolated and under-researched setting, and for assessing variation in exposure to different domains of sexuality information at a single time point. However, causal inference is not implied.

Study setting and study population

The study was conducted in the island communities of Lake Victoria, where geographical isolation, limited health and education services, mobility, and economic vulnerability contribute to heightened sexual and reproductive health risks. These settings remain underrepresented in national surveys and programme evaluations, despite persistent disparities in access to sexuality education and reproductive health services.

The study population comprised young people aged 10–24 years, consistent with global definitions used in adolescent sexual and reproductive health research[29]. National census estimates indicate that approximately 345,000 young people reside in the Lake Victoria Island communities [30].

Sampling and participants

A multistage sampling strategy incorporating probability proportional to size (PPS) was used to enhance representativeness. Mukono District was randomly selected from the seven districts in Uganda with islands on Lake Victoria, after which Mukono District, Kkoome Subcounty, the only island subcounty, was purposively selected. Two parishes were then randomly selected, followed by the selection of villages using PPS based on estimated youth population size to ensure proportional representation of landing-site and inland settings. Within each selected village, households were identified through listing, and systematic random sampling was used to select households. Where more than one eligible participant was found in a household, one individual was selected using simple random sampling. This approach ensured coverage of key ecological strata, although findings are generalizable primarily to similar island contexts. Participants were eligible if they were aged 10–24 years, had resided in the study area for at least 6 months and provided informed consent, and assent for those less than 18 years of age.

Sample size

Sample size was determined using the Yamane and Israel formula for finite populations[31]:

$$n = \frac{N}{1 + Ne^2}$$

Where N represented the population of young people (345,000) and e the precision level (0.05). To account for clustering within geographically bounded island communities, a design effect of 1.5 was applied. A further 10% non-response adjustment yielded a target sample of 660 participants. A total of 569 young people participated, corresponding to an 86.2% response rate.

Data collection

Data were collected using structured interviewer-administered questionnaires programmed on KoboToolbox. Interviews were conducted in private settings to minimise social desirability bias and ensure confidentiality, particularly given the sensitivity of questions related to sexual behaviour and experiences of violence. Standardised data collection procedures and comprehensive interviewer training were implemented to enhance consistency and reduce information bias. Participants were informed of their right to decline participation or skip any question without consequence. Data were encrypted at the point of collection, securely stored on password-protected servers, and anonymised before analysis.

Study variables definition and operationalisation

Sexuality information completeness was assessed using the eight domains outlined in the UNESCO International Technical Guidance on Sexuality Education[17], Table 1: healthy relationships; values, rights, and sexuality; gender equality; violence and safety (including bodily integrity and privacy); skills for health and well-being (including communication, negotiation, and decision-making); human body and development; sexuality and sexual behaviour (including pregnancy, HIV, and sexually transmitted infections); and sexual and reproductive health across the lifecycle. Participants were classified as having complete sexuality information if they reported exposure to all eight domains (8/8) and incomplete information if one or more domains were missing.

The variable was further classified as: Low completeness: information received in ≤ 2 domains, Moderate completeness: information received in 3–4 domains, High completeness: information received in 5–7 domains all and completeness for all 8 domains. This operationalisation provides a stringent measure of full curriculum exposure, while considering differences among those who had incomplete information and ensures strong content validity, as it captures the breadth of domains defined by an internationally recognised framework. However, recognising that this threshold may underestimate partial but meaningful exposure, domain-specific coverage was also examined descriptively. Validity claims are therefore made cautiously, acknowledging that while the measure demonstrates acceptable internal consistency and strong content coverage.

Risky sexual behaviour (RSB) was operationalised as a composite binary outcome derived from multiple indicators reflecting exposure to sexual health risks. These included: (i) early sexual debut (defined as sexual intercourse before the age of 18 years), (ii) non-use or inconsistent use of condoms, (iii) having multiple sexual partners, (iv) engagement in transactional sex, and (v)

substance use during sexual activity. Each indicator was coded as binary (1 = presence; 0 = absence), and participants reporting at least one indicator were classified as engaging in RSB. This approach prioritises sensitivity in identifying individuals exposed to any form of sexual risk or vulnerability. The RSB composite was treated as a formative index, as the included indicators represent distinct dimensions of risk that are not expected to be interchangeable or highly correlated. As such, internal consistency measures are interpreted cautiously. The composite measure RSB demonstrated acceptable internal consistency, with an overall Cronbach's alpha of 0.764. Most items exhibited moderate (0.2–0.6) inter-item correlations, indicating they measure related aspects of RSB. Exploratory factor analysis supported a unidimensional structure, with a single factor explaining 88% of the variance. These results suggested an appropriate composite RSB measure. To support content validity, the indicators were selected based on established literature and public health frameworks capturing diverse pathways of sexual risk. To minimise the risk of circularity and inflated associations, variables used to construct the RSB outcome were not included in the sexuality information completeness measure.

Covariates included age, sex, education level, schooling status, employment status, living arrangements, religion, residence type, and modes of receiving sexuality information. Modes of sexuality information delivery were assessed by asking participants whether they had received sexuality-related information through specific channels, including verbal communication, observation, reading materials, and digital media such as videos or games. Each mode of delivery was operationalised as a binary variable, with responses coded to indicate whether the participant had been exposed to sexuality information through that particular channel. These variables were selected based on theoretical relevance, particularly bioecological and social learning perspectives, as well as prior empirical evidence. To minimise overfitting, only variables with theoretical justification and evidence of association at the bivariate level were included in the final models.

Pretesting and instrument refinement

The questionnaire was pretested among 10 young people aged 10–24 years in Katosi landing site, stratified by age and sex. The pretest assessed comprehension, cultural appropriateness, and sensitivity. Terminology related to sexual and reproductive health was simplified to improve clarity, particularly for younger adolescents. One additional behavioural dimension was incorporated to capture transactional and coercive contexts better. The final instrument demonstrated good internal consistency (Cronbach's alpha = 0.82) and required approximately 20–25 minutes to complete.

Table 1. Sexuality Information Domains as per UNESCO (2018)

Domain	Content
1. Healthy Relationships	• Families • Friendships, love, and romantic relationships • Tolerance, inclusion, and respect • Long-term commitments and parenting
2. Sexual Values, Rights, and Practices	• Values • Human rights • Culture and society
3. Gender Equality and Equity	• Social construction of gender and gender norms • Gender equality, stereotypes, and bias • Gender-based violence
4. Violence and Staying Safe	• Violence • Consent, privacy, and bodily integrity • Safe use of information and communication technology
5. Communication, Negotiation, and Decision Making	• Norms and peer influence on sexual behaviour • Decision-making • Communication, refusal, and negotiation skills • Media literacy and sexuality • Finding help and support
6. Human Body and Development	• Anatomy and physiology • Puberty • Reproduction • Body image
7. Pregnancy, HIV, and STIs (Sexual and Reproductive Health)	• Pregnancy and pregnancy prevention • HIV and AIDS stigma, care, treatment, and support • Understanding, recognizing, and reducing the risk of STIs, including HIV
8. Sexual Lifecycle and Response	• Sex and the sexual life cycle • Sexual response

Data analysis

Data were analysed using Stata (version 19). Descriptive statistics were used to summarise participant characteristics and key study variables. To examine factors associated with RSB, a multivariable logistic regression model was fitted with RSB specified as a binary outcome variable. Explanatory variables included socio-demographic characteristics (sex, schooling status, employment status, belonging to a club, and living arrangements), social participation (club membership), and sexuality information-related variables, which had a significant ($p < 0.05$) bivariate association with RSB. All categorical variables were included using indicator (dummy) coding with appropriate reference categories.

Given the multistage sampling design and the potential for

intra-cluster correlation among individuals within the same parish, cluster-robust standard errors were applied at the parish level to obtain valid statistical inference. Results are presented as odds ratios (ORs) with 95% confidence intervals (CIs).

Model calibration was assessed using the Hosmer–Lemeshow goodness-of-fit test based on deciles of predicted probabilities. Model discrimination was evaluated using the area under the receiver operating characteristic (ROC) curve (AUC). Predicted probabilities were generated from the fitted model to construct the ROC curve. To assess robustness, alternative model specifications were explored and yielded substantively similar results, indicating stability of the estimated associations.

Ethical considerations

Ethical approval for the study was obtained from a relevant ethics committee, and the study was registered by the Uganda National Council of Science and Technology with permit number SS3785ES, after ethical approval by the TASO Research Ethics Committee, number TASO-2025-323. Written informed consent was obtained from participants aged 18–24 years, while participants aged 10–17 years provided assent alongside parental or guardian consent. Given the sensitivity of questions related to sexual behaviour and violence, all surveys were conducted in private settings to ensure confidentiality and comfort. Participants were informed of their right to skip any question or withdraw from the study at any point without consequence. Any disclosures of violence, including forced sex, were handled through referral to appropriate local safeguarding and health services, with the guidance of a child safeguarding protocol. To maintain confidentiality, data were collected in a de-identified format, stored securely in password-protected systems, and access was restricted to authorised members of the research team only.

Results

Socio-demographic and contextual characteristics of young people who participated in the study

A total of 569 young people participated in the study, with nearly equal representation from Bugombe (49.2%) and Busanga (50.8%) parishes. Young people's ages ranged from 10 to 24 years, with a mean of 16.4 years (SD = 3.16); the largest age group was 18–24 years (37.6%), followed by 10–14 years (31.3%) and 15–17 years (31.1%). The sample was gender-balanced, with females comprising 51.3% and males 48.7%. Most participants resided in peri-urban areas (83.5%), and the majority identified as Christian (88.4%). Nearly all participants (98.2%) had completed at least primary education, though 61.0% were not currently attending school. More than half of the respondents were unemployed (56.2%), while 43.8% reported some form of employment. Social engagement was relatively common, as 59.4% of participants belonged to a youth club or group. Living arrangements varied considerably: 40.3% lived alone, 17.8% with biological parents, 16.3% with a spouse, and 25.7% with other relatives or guardians (Table 2) [32].

The most common channels for receiving sexuality information were verbal communication (75.6%) and observation (65.6%). Only 5.5% of participants reported receiving information through reading, and virtually none (0.2%) through videos or games.

Completeness of sexuality information among young people in Uganda's Island communities

Findings show variations in the coverage of sexuality information across the eight UNESCO-recommended domains (Table 3). The most frequently reported domain was healthy relationships, with just over half of participants reporting exposure (295; 51.8%). This was followed by pregnancy, HIV, and sexually transmitted infections, which was reported by 220 respondents (38.6%), and communication, negotiation, and decision-making,

Table 2. Sociodemographic and Contextual Profile of Young People in Uganda's Island Communities, May 2025

Variables	n (%)
Biodata	
Parish	
Bugombe	280 (49.2)
Busanga	289 (50.8)
Age (years)	
Mean age (SD)	16.4 ± 3.12
10–14	178 (31.3)
15–17	177 (31.1)
18–24	214 (37.6)
Sex	
Female	292 (51.3)
Male	277 (48.7)
Residence	
Rural	94 (16.5)
Peri-urban	475 (83.5)
Religion	
Christian	503 (88.4)
Non-Christians	66 (11.6)
Schooling status	
No	347 (61.0)
Yes	222 (39.0)
Education	
None	10 (1.8)
≥Primary	559 (98.2)
Employment	
No	320 (56.2)
Yes	249 (43.8)
Belong to a club/group	
No	231 (40.6)
Yes	338 (59.4)
Living arrangements	
Alone	229 (40.3)
Biological parent	101 (17.8)
Spouse	93 (16.3)
Other	146 (25.7)
Mode of Receiving Sexuality Information	
Receiving SI by observation	
No	139 (24.4)
Yes	430 (75.6)
Receiving SI verbally	
No	196 (34.5)
Yes	373 (65.6)
Receiving SI by reading	
No	538 (94.6)
Yes	31 (5.5)

reported by 215 participants (37.7%). Coverage of the human body and development was similarly limited, reaching only about one-third of respondents (196; 34.4%).

Table 3. Completeness of Sexuality Information among Young People in Uganda's Island Communities, May 2025

Sexuality Information Domain	Coverage, n (%)
Domain 1: Healthy relationships	295 (51.8)
Domain 7: Pregnancy, HIV, and STIs	220 (38.6)
Domain 5: Communication, negotiation, and decision making	215 (37.7)
Domain 6: Human body and development	196 (34.4)
Domain 3: Gender equality and equity	161 (28.3)
Domain 2: Sexual values, rights, and practices	140 (24.6)
Domain 4: Privacy, bodily integrity, and safety	139 (24.4)
Domain 8: Sexual lifecycle and response	129 (22.6)
Sexuality Information Completeness	n (%)
Low	302 (53.1)
Moderate	203 (35.7)
High	43 (7.5)
Complete	21 (3.7)

Note: Adapted from Kirwana et al. (2025) with permission [74].

Only 161 participants (28.3%) reported receiving information on gender equality and equity, while exposure to sexual values, rights, and practices was reported by fewer than one-quarter of respondents (140; 24.6%). Similarly, privacy, bodily integrity, and safety, which are essential for safeguarding and violence prevention, were reported by 139 respondents (24.4%). The least covered domain was sexual lifecycle and response, reported by only 129 participants (22.6%).

Most young people lacked complete sexuality information. Over half of the respondents (53.1%) reported low completeness, 35.7% fell within the moderate category, only a small minority of participants demonstrated higher-quality information exposure: 7.5% had high completeness, while just 3.7% reported fully complete sexuality information.

Risky sexual behaviour among young people in Island communities

More than half (57.5%) of the respondents reported early sexual debut (Table 4). Slightly over one quarter (27.4%) had ever used a condom, but only 20.9% reported consistent condom use. About 67.5% reported having multiple sexual partners. Substance use during sex was relatively rare at 5.4%. Nearly three-quarters (73.3%) reported having exchanged sex for money, gifts, or favours.

Overall, RSB was very high at 90.3% among study participants.

Bivariate association between social demographic characteristics, mode of sexuality information provision, sexuality information completeness, and sexual behaviour of young people

The results of the bivariate analysis conducted to examine the unadjusted associations between selected socio-demographic, behavioural, and information-related factors and RSB. Only sex, religion, schooling status, education level, employment status, belonging to a club, living arrangement, receiving SI by observation, and sexuality information completeness were significantly ($p > 0.05$) associated with RSB (Table 5).

Female young people were significantly less likely to engage in RSB compared to males ($cOR = 0.19$, 95% CI: 0.09–0.39, $p < 0.001$). Young people currently in school were significantly less likely to engage in RSB compared to those who were out of school ($cOR = 0.25$, 95% CI: 0.14–0.45, $p < 0.001$). Employed young people were more likely to engage in RSB compared to those not employed ($cOR = 6.10$, 95% CI: 2.71–13.74, $p < 0.001$). Young people belonging to a club were less likely to engage in RSB ($cOR = 0.51$, 95% CI: 0.27–0.95, $p = 0.032$). Young people living with biological parents had significantly lower odds of risky sexual behaviour compared to those

Table 4. Risky Sexual Behaviour among Young People in Uganda's Island Communities, May 2025

Variables	n (%)
Early sex	
No (safe)	242 (42.5)
Yes (risky)	327 (57.5)
Ever used a condom	
Yes (safe)	156 (27.4)
No (risky)	450 (79.1)
Consistent use of a condom	
Yes (safe)	119 (20.9)
No (risky)	413 (72.6)
Number of sexual partners	
One partner (safe)	185 (32.5)
Multiple partners (risky)	384 (67.5)
Alcohol and substance use during sexual activity	
No (safe)	538 (94.6)
Yes (risky)	31 (5.4)
Transactional sex	
No (safe)	152 (26.7)
Yes (risky)	417 (73.3)
Overall sexual behaviour	
Safer	55 (9.7)
Risky	514 (90.3)

Note: Cronbach's alpha = 0.764; moderate inter-item correlation (0.2–0.6). Exploratory factor analysis explained 88% of variance.

Table 5. Bivariate Association between Socio-demographics, Mode of Sexuality Information, Sexuality Information Completeness, and Sexual Behaviour of Young People in Uganda's Island Communities, May 2025

Variable	Risky sexual behaviour, n (%)		CoR [95% CI]	p-value
	Safer	Risky		
Age group				
10–14 years	12 (6.7)	166 (93.3)	Reference	
15–17 years	16 (9.0)	161 (91.0)	0.7 [0.33–1.59]	0.423
18–24 years	27 (12.6)	187 (87.4)	0.5 [0.25–1.02]	0.057
Sex				
Male	10 (3.4)	282 (96.6)	Reference	
Female	42 (15.6)	227 (84.4)	0.2 [0.09–0.39]	< 0.001*
Residence				
Rural	9 (9.6)	85 (90.4)	Reference	
Peri-urban	46 (9.7)	429 (90.3)	0.9 [0.47–2.09]	0.974
Religion				
Christian	53 (10.5)	450 (89.5)	Reference	
Non-Christian	2 (3.0)	64 (97.0)	3.8 [0.90–15.84]	0.070
Schooling status				
No	17 (4.9)	330 (95.1)	Reference	
Yes	38 (17.1)	184 (82.9)	0.3 [0.14–0.45]	< 0.001*
Education level				
≤ Primary	20 (8.4)	217 (91.6)	Reference	
> Primary	35 (10.5)	297 (89.5)	0.8 [0.44–1.39]	0.403
Employment status				
No	48 (15.0)	272 (85.0)	Reference	
Yes	7 (2.8)	242 (97.2)	6.1 [2.71–13.74]	< 0.001*
Belonging to a club				
No	15 (6.4)	218 (93.6)	Reference	
Yes	40 (11.9)	296 (88.1)	0.5 [0.27–0.95]	0.032*
Living arrangement				
Alone	13 (5.7)	216 (94.3)	Reference	
Biological parent	31 (30.7)	70 (69.3)	0.1 [0.07–0.27]	< 0.001*
Spouse	7 (7.5)	86 (92.5)	0.7 [0.29–1.92]	0.534
Other	4 (2.7)	142 (97.3)	2.1 [0.68–6.68]	0.192
Receiving sexuality information by observation				
No	6 (3.1)	190 (96.9)	Reference	
Yes	49 (13.1)	324 (86.9)	0.2 [0.09–0.50]	< 0.001*
Receiving sexuality information verbally				
No	14 (10.1)	125 (89.9)	Reference	
Yes	41 (9.5)	389 (90.5)	1.0 [0.56–2.01]	0.852
Receiving sexuality information by reading				
No	53 (9.8)	485 (90.2)	Reference	
Yes	2 (6.5)	29 (93.6)	1.6 [0.37–6.83]	0.537
Receiving sexuality information through video or games				
No	5 (9.1)	509 (90.9)	Reference	
Yes	1 (100.0)	0 (0.0)	1	1
Sexuality information completeness				
Low	17 (5.6)	285 (94.4)	Reference	
Moderate	14 (6.9)	189 (93.1)	0.8 [0.39–1.67]	0.561
High	13 (30.2)	30 (69.8)	0.1 [0.06–0.31]	< 0.001*
Complete	11 (52.4)	10 (47.6)	0.1 [0.02–0.15]	< 0.001*

Note: CoR = crude odds ratio; CI = confidence interval. *Statistically significant at 95% confidence level.

living alone (cOR = 0.14, 95% CI: 0.07–0.27, $p < 0.001$), while no significant differences were observed for those living with a spouse or in other arrangements. Receiving information through observation was significantly associated with reduced odds of RSB (cOR = 0.21, 95% CI: 0.09–0.50, $p < 0.001$). However, no significant associations were observed for verbal communication,

reading materials, or digital media exposure.

Compared to participants with low completeness, those with high (cOR = 0.14, 95% CI: 0.06–0.31, $p < 0.001$) and complete (cOR = 0.05, 95% CI: 0.02–0.15, $p < 0.001$) levels of information were significantly less likely to engage in RSB.

Multivariate association between socio-demographics, sexuality information sources, completeness, and sexual behaviour of your people in Uganda's Island communities.

Multicollinearity among independent variables significant at the bivariate level was assessed using Variance Inflation Factors (VIF), shown in Table 6. All VIF values ranged from 1.24 to 2.54, with a mean VIF of 1.74, indicating no evidence of problematic multicollinearity [33].

Table 6. Multicollinearity Check of the Variables in the Multivariate Model

Variable	VIF	1/VIF
Schooling status	2.54	0.394
Employment status	2.12	0.472
Sex	1.98	0.505
Receiving SI by observation	1.62	0.618
Belonging to a club	1.38	0.727
SI completeness	1.29	0.774
Living arrangement	1.24	0.807
Mean VIF	1.74	

Note: VIF = variance inflation factor. Values < 5 indicate no significant multicollinearity concern.

Multivariable (adjusted) logistic regression results indicated that sex, schooling status, employment, club membership, living arrangement, mode of information delivery, and sexuality information completeness were significantly associated with RSB (Table 7). Females had significantly lower odds of engaging in risky sexual behaviour compared to males (aOR = 0.42, 95% CI: 0.38–0.47, $p < 0.001$). Employment was associated with increased odds of risky behaviour (aOR = 4.19, 95% CI: 1.29–13.66, $p = 0.017$), although the wide confidence interval suggests some instability in the estimate. Receiving sexuality information through observation was associated with substantially reduced odds of risky behaviour (aOR = 0.22, 95% CI: 0.09–0.56, $p = 0.001$). A gradient effect was observed for sexuality information completeness, with those receiving complete information exhibiting significantly lower odds of risky behaviour (aOR = 0.16 95% CI: 0.04–0.56, $p = 0.004$). Other variables, including schooling status, club membership, and living arrangement, were not significantly associated with the outcome. Notably, estimates for living arrangements showed wide confidence intervals, indicating potential instability due to sparse data.

The model demonstrated good calibration, as indicated by the Hosmer–Lemeshow test ($\chi^2(8) = 10.000$, $p = 0.265$), and strong discriminatory ability (AUC = 0.837), Figure 1. These findings suggest that the model performs well in distinguishing individuals with and without risky sexual behaviour within the study sample. However, given the composite nature of the outcome and the cross-sectional

design, these results should be interpreted with caution, as model performance may be influenced by outcome definition and has not been externally validated.

Discussion

This study should be interpreted as exploratory and hypothesis-generating, with bivariate findings treated as the primary analytical lens and multivariable results considered supplementary. Within this framing, the results point to a clear and internally consistent pattern: higher levels of sexuality information completeness are associated with lower odds of risky sexual behaviour RSB. The observed gradient suggests that moving from low to complete sexuality information corresponds to incremental reductions in risk, reinforcing the idea that fragmented sexuality information may be insufficient for meaningful behavioural change. This aligns with evidence that CSE is most effective when delivered as an integrated package covering cognitive, relational, and normative domains [33,35].

However, existing literature has largely operationalised exposure as binary, limiting its usefulness in interpreting these graded effects. The present findings extend this evidence base by suggesting that completeness may function as a threshold condition, below which information does not translate into safer behaviour. From a theoretical perspective, Social Learning Theory provides a relevant lens, as it emphasises that behaviour change depends on coherent, reinforced learning rather than isolated informational inputs [12]. At the same time, the literature offers limited explanation for why partial exposure may fail so consistently. This study contributes by indicating that incomplete information may leave critical gaps in decision-making capacity, particularly in domains such as consent, negotiation, and gender norms, which are central to real-world sexual interactions.

The findings on mode of information delivery, again interpreted primarily at the bivariate level, suggest that observational learning is associated with lower odds of RSB, while verbal, written, and digital modes show no clear association. This is consistent with evidence that participatory and experiential approaches are more effective than passive information delivery in influencing adolescent sexual behaviour [36–38]. It also aligns with the modelling and reinforcement mechanisms described in Social Learning Theory. However, the broad categorisation of “observation” limits interpretability. It remains unclear whether this reflects parental modelling, peer influence, or exposure to the consequences of risky behaviour.

This ambiguity is not well addressed in existing literature and represents an important gap. Notably, the absence of a detectable association for digital information contrasts with the growing emphasis on digital sexuality education

Table 7. Multivariate Associates of Sexual Behaviour among Young People in Uganda's Island Communities

Variable	aOR [95% CI]	p-value
Sex		
Male	Reference	
Female	0.4 [0.38–0.47]	< 0.001*
Schooling status		
No	Reference	
Yes	1.5 [0.78–3.04]	0.209
Employment status		
No	Reference	
Yes	4.2 [1.29–13.66]	0.017*
Belonging to a club		
No	Reference	
Yes	1.3 [0.74–2.44]	0.339
Living arrangement		
Alone	Reference	
Biological parent	0.6 [0.01–32.61]	0.804
Spouse	0.6 [0.06–5.26]	0.610
Other	1.3 [0.07–20.76]	0.887
Receiving sexuality information by observation		
No	Reference	
Yes	0.2 [0.09–0.56]	0.001*
Sexuality information completeness		
Low	Reference	
Moderate	0.9 [0.51–1.55]	0.688
High	0.3 [0.09–1.05]	0.059
Complete	0.16 [0.04–0.56]	0.004*

Note: aOR = adjusted odds ratio; CI = confidence interval. *Statistically significant at 95% confidence level.

[39–41]. In this context, the finding should not be over-interpreted but rather seen as indicative of potential limitations in access, engagement, or content quality, particularly in resource-constrained or high-risk settings. It highlights the need for more rigorous evaluation of how digital platforms function within specific socio-ecological environments, rather than assuming effectiveness.

Gender differences were also evident, with females reporting lower odds of RSB than males in both crude and adjusted analyses. This pattern is consistent with studies linking male risk-taking to dominant norms around masculinity and peer influence [42,43]. However, interpretation should remain cautious due to potential gendered reporting biases, where males may overreport, and females underreport sexual behaviour [44,45]. The literature is therefore helpful in explaining the direction of the association but less conclusive in distinguishing behavioural differences from reporting effects. In this study, gender should be understood as operating within a broader system of norms, expectations, and disclosure patterns, rather than as a purely behavioural determinant.

Factors such as schooling status, club membership, and living with biological parents appeared protective in bivariate analysis but did not retain statistical significance in the multivariable model. This divergence underscores

the interdependence of social and structural factors and cautions against interpreting bivariate associations as independent effects. Similar patterns have been reported in studies examining the social determinants of adolescent health, where apparent protective factors often operate through indirect pathways [46,47]. In this study, these variables may reflect underlying mechanisms such as supervision, social support, or access to information, rather than exerting direct effects on behaviour. Their loss of significance in adjusted models should therefore not be interpreted as the absence of influence but as evidence of confounding and mediation, reinforcing the need for pathway-based analytical approaches.

Specifically, the importance of family context, particularly living arrangements. Young people living with biological parents were less likely to engage in RSB at the bivariate level, while living with a spouse remained protective in adjusted models. These patterns are consistent with ecological systems theory, which emphasises the role of the immediate social environment in shaping behaviour [11]. Recent studies in Uganda and similar contexts show that parental monitoring and communication are associated with reduced sexual risk [48–50]. However, the literature also highlights a critical limitation: many parents lack the capacity or confidence to provide complete and accurate sexuality information [53–53]. This creates a gap between

presence and effectiveness. The present findings suggest that parental presence alone is protective, but its impact could be significantly enhanced if parents are equipped to deliver comprehensive and coherent sexuality education.

The findings also suggest that structured social environments, specifically schooling and club participation, are associated with lower odds of RSB. Young people currently in school were substantially less likely to engage in RSB compared to those out of school, and a similar, though less pronounced, protective pattern was observed for club membership. Interpreted primarily at the bivariate level, these results point to the role of institutional attachment, routine, supervision, and peer regulation in shaping behaviour. Existing literature is broadly helpful in interpreting these findings. Studies across sub-Saharan Africa consistently show that school attendance is associated with delayed sexual debut, reduced number of partners, and increased uptake of protective behaviours [20,54,55]. Similarly, participation in youth clubs and organised groups has been linked to improved sexual health outcomes through peer support, mentorship, and access to information [41,56,57].

However, much of this literature treats schooling and social participation as independent protective factors, without sufficiently interrogating the mechanisms through which they operate. The Bioecological Model is useful here, as it situates schools and clubs within the microsystem, where regular interaction, social norms, and supervision directly influence behaviour [11]. At the same time, Social Learning Theory helps explain how peer norms, role modelling, and reinforcement within these settings shape behavioural choices [12,36]. The strong crude associations observed here did not persist in adjusted models, suggesting that schooling and club membership may not exert independent effects but rather operate through intermediary pathways, such as improved access to sexuality information, exposure to pro-social norms, or reduced idle time.

This distinction is often underexplored in prior studies, which tend to report adjusted associations without examining why effects attenuate. In this sense, the current findings add to the literature by highlighting that the protective value of schooling and clubs may depend on what is transmitted within them, including the completeness and quality of sexuality information, the nature of peer interactions, and the presence of supportive adult guidance. This is a meaningful contribution, particularly in high-risk contexts, because it shifts the focus from mere participation to the content and dynamics of participation. The magnitude of the protective effect of schooling at the bivariate level is notably strong. While the direction of the association is consistent with prior evidence, the strength may reflect context-specific dynamics, such as the stark contrast between in-school and out-of-school youth in island communities. Those out of

school may be more exposed to economic activities, mobility, and transactional relationships, all of which increase risk [58–60]. This suggests that schooling may function not only as a site of learning but also as a protective buffer against high-risk environments.

In fact, employment was associated with higher odds of RSB in both bivariate and multivariable analyses, although the adjusted estimate was characterised by a wide confidence interval, indicating substantial statistical uncertainty. This pattern is consistent with evidence from high-mobility settings, including fishing communities, where income, autonomy, and mobility increase exposure to transactional relationships and high-risk social networks [58,61–65]. The present findings support these contextual explanations, suggesting that economic participation in such environments may expand opportunity structures for risk, particularly in the absence of protective informational and social mechanisms. However, given the imprecision of the estimate, this association should be interpreted cautiously and viewed as indicative rather than conclusive.

At the same time, the attenuation of this effect in multivariable analysis indicates that it is not schooling per se, but the broader constellation of factors associated with being in school, that drives the relationship. This mixed pattern, strong in crude analysis, diminished when adjusted, is both similar to and different from existing literature. It is similar in that schooling is consistently protective; it is different in that this study explicitly demonstrates the fragility of that effect under adjustment, pointing to confounding and interdependence. This may be due to differences in population (high-mobility island communities), sample composition, or the inclusion of variables such as sexuality information completeness, which are often omitted in other studies.

The multivariable model, while useful for exploring adjusted relationships, should be interpreted as supplementary due to methodological constraints, particularly the low events-per-variable (EPV) ratio, which increases the risk of overfitting and unstable estimates. This limitation may inflate measures of model performance, including discrimination, and reduce the reliability of adjusted effect sizes. As such, the multivariable findings are best understood as exploratory extensions of the bivariate patterns rather than confirmatory evidence.

Limitation

Several limitations should be considered. The cross-sectional design limits causal inference and precludes assessment of temporal relationships between sexuality information and behaviour. Future research should prioritise longitudinal designs to establish causal pathways and examine how exposure to comprehensive information translates into behavioural change over time. The reliance on self-reported data introduces potential

recall and social desirability biases, particularly for sensitive behaviours. The study also did not explicitly model causal pathways or mediating mechanisms, such as peer influence, alcohol use, or autonomy, which may link factors like employment and schooling to RSB.

Future studies should incorporate causal pathway analysis to better understand these relationships. Additionally, while digital media exposure was assessed, its lack of association may reflect measurement limitations. Given the increasing role of technology, a more detailed investigation into digital sexuality education is warranted. The focus on island communities, while contextually important, limits generalizability. Comparative studies across different settings are needed to assess the transferability of findings and identify context-specific versus universal drivers of behaviour. Finally, small subgroup sizes in some categories contributed to unstable estimates, highlighting the need for larger and more balanced samples in future research.

Conclusions

Taken together, these exploratory findings point to the importance of completeness, coherence, and the mode through which that information is transmitted within young people's immediate social environments, other than just exposure to sexuality information. The consistent gradient between sexuality information completeness and reduced RSB, reinforced by the protective signal from observational learning, suggests that fragmented or passive approaches are unlikely to produce meaningful behavioural change. Instead, behaviour appears to be shaped through integrated, socially embedded learning processes, operating across families, schools, and peer networks.

At the same time, the attenuation of several associations in multivariable analysis, combined with statistical uncertainty due to low events-per-variable, underscores that these relationships are interdependent rather than independent, and should be interpreted as hypothesis-generating rather than causal. Within this framing, the study adds value by shifting the focus from access to sexuality education toward the completeness of content, its quality, delivery, and contextual embedding of that education, particularly in high-risk, resource-constrained settings such as island communities.

From a policy and programmatic perspective, the implications are direct but demanding. First, investments should move beyond expanding coverage of sexuality education to ensuring completeness and integration across cognitive, relational, and normative domains, with explicit attention to consent, negotiation, and gender dynamics. Second, delivery strategies should prioritise participatory and observational approaches, including mentorship, and parent-child engagement, rather than relying

predominantly on didactic or digital formats whose effectiveness remains uncertain in such contexts. Third, schools and youth clubs should be leveraged not merely as access points but as active platforms for structured, high-quality engagement, with clear standards for content and facilitation. Fourth, family-based interventions are critical: strengthening parental capacity to communicate accurate and comprehensive sexuality information could significantly amplify the protective effect of co-residence.

Finally, given the suggestive link between employment and increased risk, programmes in high-mobility economies should integrate economic empowerment with targeted risk-reduction and social protection strategies, rather than treating livelihoods and sexual health as separate domains. Future research should prioritise longitudinal and pathway-based designs, as well as rigorous evaluation of digital and hybrid delivery models, to move from exploratory associations to causally credible and context-sensitive interventions.

What is Already Known About this Topic

- Access to sexuality information is associated with safer sexual behaviour, including delayed sexual debut, negotiation of safe practices, and reduced unintended pregnancies [17,66].
- Many adolescents receive fragmented or incomplete sexuality education, leaving gaps in critical domains such as sexual rights, consent, gender equity, and bodily integrity [66,68].
- Parental presence and support are protective, providing supervision, guidance, and normative reinforcement that reduce engagement in risky sexual behaviour [47,48].
- Schooling and economic participation are not uniformly protective; without complete, skills-based sexuality information, education and employment may increase exposure to risk networks and multiple sexual partnerships [69,70].

What This Study Adds

- Moves the field from “access” to “completeness” of sexuality information as per the UNESCO (2018) guidelines. Most studies treat sexuality education as a binary exposure, received vs not received.
- This study introduces and empirically supports information completeness as a graded and potentially threshold concept, showing that partial exposure may be insufficient for behavioural change

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Authors' Contributions

Venantius Bbaale Kirwana conceptualized the study, collected and analyzed the data, interpreted the results, and wrote the manuscript. Dr. Patricia Ndugga, Dr. Cyprian Misinde, Dr. Allen Kabagenyi, Dr. Christian Kakuba, and Dr. Stephen Wandera contributed to writing and proofreading the manuscript. All authors read and approved the final manuscript.

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Conflict of Interest Statement

The authors of this work declare no competing interests.

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