TANZANIA MEDICAL JOURNAL

Malindisa et al. TMJ V 37 No. 1. June 2026

Original Research Open Access

Non-medical Use of Phosphodiesterase 5 Inhibitors for Sexual Enhancement Among Young Healthy University Male Students in Tanzania: A Cross-sectional Study

Evangelista K. Malindisa[1*], Sarah S. Matuja[2], Elinaike Godfrey[2], Maryam Amour[3], Eva Mujuni[2], Akili Mawazo[4], Anthony Oyekunle[2]

[1]*Department of Physiology, Catholic University of Health and Allied Sciences, Mwanza, Tanzania*
[2]*Department of Internal Medicine, Catholic University of Health and Allied Sciences, Mwanza, Tanzania*
[3]*Department of Community Health, Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania*
[4]*Institute of Allied Health Sciences, Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania*

***Correspondence:** Evangelista K. Malindisa, Email: maryvianey12@gmail.com

Abstract

Background: Phosphodiesterase-5 inhibitors (PDE5i) are approved for erectile dysfunction but increasingly misused by young men without medical indications. Such non-medical use raises concerns about adverse effects, drug interactions, and risky sexual behaviours.

Objectives: To determine the prevalence and factors associated with recreational use of PDE5i among healthy male university students in Tanzania.

Methods: This was a cross-sectional study conducted at the Catholic University of Health and Allied Sciences (CUHAS) between April and July 2020, involving male undergraduate students enrolled in medicine, pharmacy, nursing, laboratory sciences, and diploma programmes.

A semi-structured online questionnaire was administered via a secure Google Forms platform, with an embedded electronic informed consent form completed before enrolment. Data collected included participant demographics, medical history, substance use, and PDE5i-related knowledge and practices. Logistic regression was used to determine independent factors of PDE5i use.

Results: A total of 196 male undergraduate students were enrolled, with a mean age of 24±2.2 years, and 7.7% (15/196) reported PDE5i use. Most accessed drugs without prescription (60%), mainly sildenafil (73.3%). Common side effects included headache (53.3%) and dizziness (46.7%). Older age, cigarette smoking, alcohol consumption, and having a sexual partner were associated with use in crude analysis, but only older age (AOR 4.04, 95% CI 1.20–13.61) and cigarette smoking (AOR 6.8, 95% CI 1.17–39.4) remained independent predictors.

Conclusions: Non-medical PDE5i use for sexual enhancement was present among university students, associated with older age and cigarette smoking. These findings highlight the need for awareness of the risks of misuse and stricter regulation of non-prescription access.

Keywords*:* Phosphodiesterase 5 inhibitors (PDE5i), Erectile dysfunction (ED), Recreational use, University students.

Introduction

Phosphodiesterase 5 inhibitors (PDE5i) are a group of medications approved by the Food and Drug Administration (FDA) in the United States mainly for the treatment of erectile dysfunction (ED) (1). These medications work by inhibiting the enzyme phosphodiesterase and therefore enhance sexual activity through the release of nitric oxide, a potent vasodilator (2). There are currently four medications approved, including sildenafil, tadalafil, vardenafil and the newest avanafil available in the market.

Notably, these medications are now popularly being used by many young healthy men without ED for sexual enhancement (3). Reports in high-income countries (HIC) have identified an increasing use of PDE5i for sexual enhancement without prescription (medical indications) in males, with a proportion range between 10 to 20% (4,5). Studies in low and middle-income countries (LMICs) have reported a slightly higher proportion compared to the HIC, where PDE5i use among healthy young men has ranged from 20 to 30% (6).

In sub-Saharan Africa (SSA), and Tanzania in particular, these medications are sold over the counter without a prescription and are readily available in community pharmacies (7,8). The use of PDE5i has been associated with changes in sexual behaviour in youth, including men having sex with men in other studies (9). However, such findings should be interpreted with caution, as those studies recruited a majority of men who have sex with men and cannot be generalised to all populations. When PDE5i are used by men without erectile dysfunction (ED) for sexual enhancement, several potential problems arise. First, misuse increases the likelihood of adverse drug reactions such as headache, dizziness, blurred vision, stomach pain, and priapism. Second, concurrent use with alcohol or cigarettes, which are common among young males, can potentiate systemic vasodilation, leading to hypotension and dangerous drug-to-drug interactions. Third, repeated non-medical use may alter psychological and sexual functioning, fostering dependence on the drug for performance and undermining natural erectile confidence. Finally, such practices can catalyse high-risk sexual behaviours, thereby increasing vulnerability to sexually transmitted infections, including HIV, especially in endemic areas like Tanzania. These risks highlight that non-medical sexual enhancement use is not benign and underscore the need for awareness campaigns and regulatory measures to restrict unsupervised access. Given the growing non-medical use of PDE5i and the absence of local data, examining their use among Tanzanian university students is critical to understanding the scope of the problem. Such practices carry risks of adverse drug reactions, harmful interactions, psychological dependence, and risky sexual behaviours that heighten vulnerability to HIV and other infections. This study therefore sought to determine the prevalence and identify factors associated with PDE5i use for sexual enhancement among male university students in Tanzania, providing evidence to guide awareness campaigns and regulatory measures.

Methods

Study design and population

This was a cross-sectional study, conducted between April and July 2020. The study involved male undergraduate students enrolled in medicine, pharmacy, nursing, laboratory sciences, and diploma programmes.

Study area

This study was conducted at the Catholic University of Health and Allied Sciences (CUHAS), Mwanza, Tanzania. Mwanza is situated on the shoreline of Lake Victoria in northwest Tanzania. CUHAS offers various undergraduate programmes, including Doctor of Medicine, Bachelor of Pharmacy, Bachelor of Medical Imaging and Radiology, Bachelor of Nursing, and Bachelor of Medical Laboratory Sciences and diploma courses. CUHAS enrols approximately 800 undergraduate students per year.

Sampling technique

A convenience sampling approach was employed, with voluntary participation. The target population comprised all male undergraduate students enrolled at CUHAS during the study period. Any male student aged 18 years and above, and provided an informed consent was eligible. Students with a prior formal diagnosis of ED were excluded. The study link was disseminated through class representatives and shared in official student WhatsApp groups, ensuring access across programmes and levels. No random or stratified sampling was performed.

Sample size and study power

A total of 196 participants were enrolled. The study was exploratory in nature and did not calculate sample size a priori. Post-hoc power estimation indicated that with 15 PDE5i users in the sample, the study had approximately 80% power to detect moderate associations (OR ≥4.0) with behavioural risk factors at $\alpha=0.05$. While sufficient to identify independent predictors of PDE5i use, the study was not powered to detect small effect sizes, and findings should be interpreted as hypothesis-generating.

Study Variables

The dependent variable was the ever use of PDE5i for non-medical purposes and independent variables included: age, sexual relationship status, study course, study year, use of alcohol, smoking history, history of hypertension or antihypertensive use, history of diabetes mellitus or antidiabetics use, history of cardiac disease, history of ED, HIV infection status and ART use, use of illicit medication and knowledge on PDE5i.

Data Collection

A semi-structured online questionnaire was administered to participants via a secure Google Form link, which included an electronic consent form before enrolment. The questionnaire was specifically developed for this study, drawing on items adapted from previously validated instruments assessing drug use and sexual health behaviours, and organized into three domains: demographic data, past medical and drug use history, and use of PDE5i.

Socio-demographic information included age, marital/relationship status, religion, study course, year of study, alcohol use (type and frequency), and tobacco smoking. Past medical and drug use history captured chronic diseases (hypertension, diabetes mellitus, cardiac disease, HIV infection) and use of illicit medications. To assess the history of ED, participants were asked whether they had ever received a formal medical diagnosis of ED. In addition, a screening question was included to allow self-report of ED features (difficulty in achieving or maintaining an erection sufficient for satisfactory sexual performance), recognising that in this setting, self-medication is common, and formal diagnosis may not always be sought.

The section on PDE5i use assessed participants' knowledge and practices, which included: awareness of PDE5i as medications for erectile dysfunction, recognition of common brand names available in Tanzania, understanding of appropriate indications for use, and basic knowledge of dosing and potential adverse effects. In addition, participants were asked about prior use, reasons for use, frequency of use, accessibility of the medications, and adverse effects experienced

Data Analysis

Data were exported from the secure Google Forms platform, that were automatically stored in an encrypted Google Drive file into SPSS version 20.0 for analysis. Continuous variables were summarized as means with standard deviations (SD) when normally distributed or median interquartile ranges (IQR) when not normally distributed, and compared using independent samples t-tests (for two groups) or one-way ANOVA (for more than two groups). Categorical variables were summarized as frequencies with percentages, with comparisons made using Pearson's Chi-square or Fisher's exact test where appropriate. Multivariable logistic regression was applied to determine factors associated with PDE5i use; variables with $p<0.2$ in univariable analysis were entered into the multivariable model, and $p<0.05$ was considered statistically significant.

Ethics

Ethical clearance was obtained from the CUHAS/BMC Joint Ethics and Review Committee (approval number 1498/2020). The study was conducted in accordance with the Declaration of Helsinki. Informed consent was obtained from all participants before enrolment. Confidentiality was maintained throughout the study: data were anonymized at the point of collection, stored securely in password-protected files, and accessible only to the research team. During and after the study, no personal identifiers were linked to the dataset. Participants who reported adverse effects or expressed concerns during the survey were provided with information and referral to appropriate health services at Bugando Medical Centre. All data were handled in compliance with institutional data protection policies, and anonymized datasets were used for analysis to ensure privacy.

Results

A total of 196 male undergraduate students were enrolled, with a mean age of 24±2.2 years. More than half (108; 55.1%) reported having no sexual partners. Most were registered in the Bachelor of Medicine programme (74; 37.8%), and the majority were in their third or fourth year of study (121; 61.7%). None reported a prior diagnosis of chronic medical conditions requiring medication. Alcohol use was reported by 62 (31.6%) participants, of whom 28 (45.2%) drank wine. Only 10 (5.1%) reported smoking. Overall, 15 students (7.7%) reported prior use of PDE5i. Table 1.

Table 1: Relationship between PDE5i use and the demographic characteristics of Health College students at CUHAS (mention year of study), n=196 A comparison of baseline characteristics among PDE5i users and non-users

Variable	Categories	PDE5i USE			P value
		Total N=196, n (%)	Yes N=15 (%)	No N=181 (%)	
Mean Age±SD		24±2.2	25.8±2.6	23.8±2.1	0.001
Relationship status	Single	108 (55.1)	7 (6.5)	101 (93.5)	
	Partnered (in sexual relationship, married, unspecified)	88 (44.9)	8 (9.1)	80 (90.9)	0.88
Religion	Christian	170 (86.7)	9 (5.3)	161 (94.7)	0.01
	Muslims	26 (13.3)	6 (23.1)	19 (76.9)	
Course of the study	Medicine	74 (37.8)	5 (6.8)	69 (93.2)	0.486
	Pharmacy	62 (31.6)	7 (11.3)	55 (88.7)	
	Medical lab	14 (7.1)	0 (0)	14 (100.0)	
	Nursing	17 (8.7)	1 (5.9)	16 (94.1)	
	Diploma Students	29 (14.8)	2 (6.9)	27 (93.1)	
Year of the study	1st and 2nd	62 (31.6)	5 (8.1)	57 (91.9)	0.522
	3rd and 4th	121 (61.7)	8 (6.6)	113 (93.4)	
	5th	13 (6.6)	2 (15.4)	11 (84.6)	
Alcohol consumption	Yes	62 (31.6)	12 (19.4)	50 (80.6)	0.0001
Smoking	Yes	10 (5.1)	4 (40.0)	6 (60.0)	0.004

Awareness of PDE5i was high: 169 (86.2%) had heard of the drugs, and nearly half (89; 45.4%) acquired this information after joining the university. Among PDE5i users, sildenafil was the most used (11; 73.3%), followed by tadalafil (2; 13.3%). The main motivation was to impress or

satisfy a partner (9; 60%), and most accessed the drugs through community pharmacies without a prescription (9; 60%). Two-thirds (10; 66.7%) expressed willingness to use PDE5i again. The following were the most common adverse effects reported among users: headache (8; 53.3%), dizziness (7; 46.7%), and blurred vision (3; 20%), with occasional stomach pain (2; 16.7%) and one case of prolonged erection (6.7%), Table 2.

Table 2: Reported details of the PDE5i used

Variable	Categories	N (%)
Type of PDE5i	I don't know	2 (13.3)
	Sildenafil	11 (73.3)
	Tadalafil	2 (13.3)
Frequency of PDE5iuse during intercourse	Rarely (less than half the time)	11 (73.3)
	Sometimes (half the time)	2 (13.3)
	Often (more than half the time)	2 (13.3)
Knowledge about PDE5i	Yes	8 (53.3)
	No	7 (46.7)
Motivation for PDE5i use	To increase erectile sensation	2 (13.3)
	To enhance self-esteem	3 (20.0)
	To impress or satisfy a partner	9 (60.0)
	To increase the refractory phase	1 (6.7)
Easy access to PDE5 inhibitor	Yes	13 (86.7)
Source of PDE5i acquisition	A friend	4 (26.7)
	Night clubs	2 (13.3)
	Pharmacy outlet	9 (60)
Perceived experience about PDE5i use	Useless	2 (13.3)
	Satisfactory	9 (60)
	Good	4 (26.7)
	Wish to use PDE5i again	10 (66.7)
Perceived common side effects	Headache	8 (53.3)
	Dizziness	7 (46.7)
	Blurred vision	3 (20)
	Stomach pain	2 (16.7)
	Prolonged erection	1 (6.7)

Each side effect was a separate question with a yes/no response

In crude analysis, older age, cigarette smoking, alcohol consumption, and having a sexual partner were associated with PDE5i use. However, in the multivariable model, only older age (AOR 4.04, 95% CI 1.20–13.61) and cigarette smoking (AOR

6.8, 95% CI 1.17–39.4) remained independent predictors.

Table 3: Multivariable logistic regression analysis of relationship between PD5Ei use and participants demographic variables

Variable	Categories	Cor	P-value	AOR	P-value
Age groups	≥ 25 years	3.93 (1.29-12.01)	0.016	4.04 (1.20 -13.61)	0.024
	<25 years	1		1	
Relationship status	Has a sexual partner	0.14 (0.01- 1.67)	0.12	0.36 (0.02 - 5.58)	0.466
	Has no sexual partner	1		1	
Level of study	Bachelor	1.14 (0.24 - 5.33)	0.868		
	Diploma	1			
Smoking	Yes	10.6 (2.6 - 43.2)	0.001	6.8 (1.17 - 39.4)	0.032
	No	1		1	
Alcohol	Yes	10.5 (2.8 - 38.7)	<0.001	1.43 (0.33 - 2.1)	0.832
	No	1		1	
Knowledge of PDE5i	Yes	1.04 (0.22 - 4.89)	0.959		
	No	1			

All variables with P value of 0.2 or less in univariable model were included in a multivariable model

Discussion

This study aimed to investigate the prevalence and correlates of non-medical use of PDE5i for sexual enhancement among young, healthy male university students in Tanzania. In this study, 7.7% of students reported ever using PDE5i for sexual enhancement, a prevalence comparable to reports from Ethiopia (5.5%) (10), and Brazil (9%) (1). This demonstrates that recreational PDE5i use is present in diverse settings and is not confined to high-income countries. These findings are alarming since the use of PDE5i is mainly for the treatment of ED, a disorder commonly encountered in the older population, since most users reported no history of being diagnosed with ED (11). The non-medical use of PDE5i to enhance sexual performance has an overall impact on a person's sexual function, self-esteem and sexual relationships with partners, especially at such a young age (10).

In the current study, Sildenafil was the most used PDE5i, accounting for more than two-thirds of reported use. Most students obtained the drugs from community pharmacies without a prescription, and a smaller proportion from nightclubs (13.3%). This pattern mirrors findings

from Ethiopia (10) and aligns with reports from sub-Saharan Africa, where sildenafil is widely available (12), often dispensed without prescription (7,8). In Tanzania, Kagashe et al (13) documented that many medications are purchased without a prescription, underscoring the risk of inappropriate use and dosing errors (14).

Older age and cigarette smoking emerged as independent predictors of PDE5i use in multivariable analysis, while alcohol consumption lost significance after adjustment. This finding is consistent with Gebreyohannes et al. (10). suggesting that lifestyle behaviours, particularly smoking, may play a stronger role in driving recreational use.

Although our study did not assess sexual performance outcomes directly, the concurrent use of PDE5i with substances such as nicotine raises concerns about adverse effects, including headache, dizziness, and priapism. Moreover, non-medical use among young men may contribute to risky sexual behaviours (9), which is particularly concerning in Tanzania, where HIV prevalence among young adults remains high (15). Therefore, efforts should be centred on promoting awareness of the potential side effects associated with the misuse of PDE5i in people with no medical indication; similarly, strategies for restricting easy access to the medications without a medical indication should be in place.

Although this study is among the few that have explored the non-medical use of PDE5 inhibitors among young university students and has demonstrated its prevalence in this population, several limitations should be noted. First, due to the cross-sectional design, causality cannot be inferred. Second, the study was conducted at a single centre with a modest sample size, which limits generalizability and statistical power; future studies should calculate sample size a priori to ensure adequate power. Third, sexual performance itself was not assessed, and other mental health conditions, such as anxiety and depression, which may influence sexual behaviour and PDE5i use, were not measured and could act as confounders. These limitations highlight the need for larger, multi-centre studies with a comprehensive assessment of psychosocial and behavioural factors to better understand the drivers of non-medical PDE5i use in this population.

Conclusion

This study demonstrates that non-medical recreational use of PDE5i for sexual enhancement is present among young male university students in Tanzania, with a prevalence of 7.7%. Sildenafil, being the most used drug, is often obtained without a prescription from community pharmacies. Older age and cigarette smoking are independent predictors of use, highlighting behavioural and lifestyle factors associated with misuse. Although our study was limited by its cross-sectional design, modest sample size, and single-centre setting, the findings underscore the need to address inappropriate access and use of PDE5i in this population.

Given the observed prevalence of recreational PDE5i use among young male university students in Tanzania, with sildenafil being the most accessed drug without prescription, strengthening regulatory enforcement is recommended to limit over-the-counter sales, alongside targeted awareness campaigns within universities to highlight risks of misuse and drug interactions. Student health services should integrate counselling on substance use, particularly smoking, given its independent association with PDE5i use, while future multicentre research should explore psychosocial drivers and sexual behaviour outcomes to inform comprehensive prevention strategies aligned with national HIV/AIDS control efforts.

Authors contributions

SSM and EG designed the study, EG wrote the proposal, collected data and analysed data under SSM supervision. SSM, EG and EKM drafted the manuscript. MA, AM, EM, and AO reviewed and edited the manuscript and approved the final version.

Funding

This study did not receive any funding.

Acknowledgements

Our sincere gratitude goes to the study participants for taking part in this study.

Consent for publication

All participants provided informed consent for participation in the study. No identifiable personal data are published, and all authors consent to the publication of this manuscript.

Availability of data and materials

Data are available from the corresponding author on reasonable request.

Competing interests

We declare no competing interests.

Figure legends

Figure 1: The proportion of participants who had ever used PDE5i

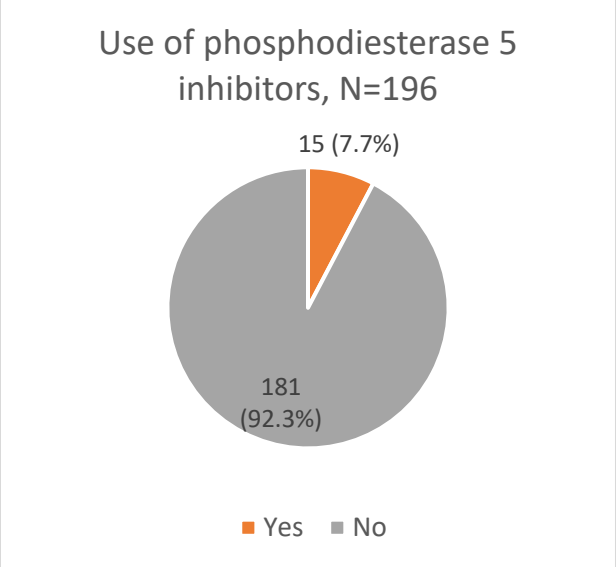
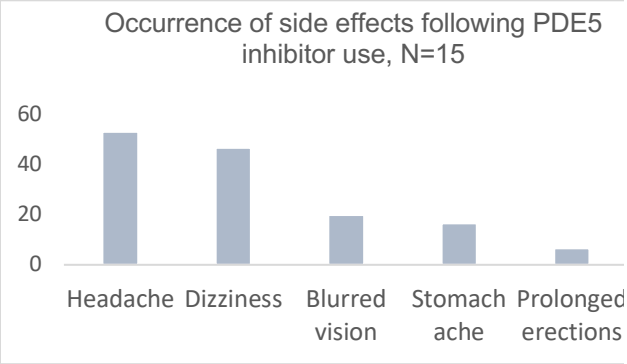


Figure 2: Adverse effects following PDE5i use



References

1. Korkes F, Costa-Matos A, Gasperini R, Reginato PV, Perez MDC. Recreational use of PDE5 inhibitors by young healthy men: recognizing this issue among medical students. *J Sex Med*. 2008;5(10):2414–8.
2. Boolell M, Gepi-Attee S, Gingell JC, Allen MJ. Sildenafil, a novel effective oral therapy for male erectile dysfunction. *Br J Urol*. 1996;78(2):257–61.
3. Bechara A, Casabé A, De Bonis W, Helien A, Bertolino MV. Recreational use of phosphodiesterase type 5 inhibitors by healthy young men. *J Sex Med*. 2010;7(11):3736–42.
4. Aldridge J, Measham F. Sildenafil (Viagra) is used as a recreational drug in England. *BMJ*. 1999;318:669.
5. Lee JH, Park OR, Yang YJ, Han JH, Jung EJ, Kim NS, et al. Detection of 94 PDE-5is and their analogs including N-desmethylthiosildenafil in various formulations of dietary supplements and food samples using HPLC and LC-Q-TOF/MS. *J Chromatogr Sci*. 2022;60(10):953–62.
6. Attia AAA, Abdel-Hameed AKS, Amer MAEM, Mamdouh H, Gamal El Din SF, El-Moslemany HEDGM. Study of the prevalence and patterns of phosphodiesterase type 5 inhibitor use among sexually active Egyptian males: a national cross-sectional survey. *Andrologia*. 2019;51(9):e13352.
7. Bekele R. A matter of sexual confidence: young men's non-prescription use of Viagra in Addis Ababa, Ethiopia. *Cult Health Sex*. 2016;18(5):495–508.
8. Erku DA, Mekuria AB, Surur AS, Gebresillassie BM. Extent of dispensing prescription-only medications without a prescription in community drug retail outlets in Addis Ababa, Ethiopia: a simulated-patient study. *Drug Healthc Patient Saf*. 2016;8:65–70.
9. Swearingen SG, Klausner JD. Sildenafil use, sexual risk behavior, and risk for sexually transmitted diseases, including HIV infection. *Am J Med*. 2005;118(6):571–7.
10. Gebreyohannes EA, Bhagavathula AS, Gebresillassie BM, Tefera YG, Belachew SA, Erku DA. Recreational use of phosphodiesterase 5 inhibitors and its associated factors among undergraduate male students in an Ethiopian university: a cross-sectional study. *World J Mens Health*. 2016;34(3):186–92.
11. Huang SA, Lie JD. Phosphodiesterase-5 (PDE5) inhibitors in the management of erectile dysfunction. *PT*. 2013;38(7):407–19.
12. Khalaf I, Levinson I. Erectile dysfunction in the Africa/Middle East region: epidemiology and experience with sildenafil citrate (Viagra). *Int J Impot Res*. 2003;15(Suppl 1):S1–2.
13. Kagashe GA, Minzi OM, Matowe LK. An assessment of dispensing practices in private pharmacies in Dar-es-Salaam, Tanzania. *Int J Pharm Pract*. 2011;19(1):30–5.
14. Smith KM, Romanelli F. Recreational use and misuse of phosphodiesterase 5 inhibitors. *J Am Pharm Assoc*. 2005;45(1):63–76.
15. Tanzania Commission for AIDS (TACAIDS). Tanzania HIV Impact Survey (THIS): a population-based HIV impact assessment. 2019. p. 1–6