Occurrence and Associated Factors Predisposing to Vulvovaginal Candidiasis Among Female Students in A Private University, Nigeria

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Abstract- ***Vulvovaginal candidiasis (VVC) remains one of the most prevalent fungal infections affecting women of reproductive age worldwide, with a particularly high burden in low- and middle-income settings. Despite its frequency, VVC is often underreported and inadequately studied among university populations, where lifestyle, behavioral, and physiological factors may increase vulnerability. This study investigates the occurrence and associated factors predisposing to VVC among female students in a private university in Nigeria. A cross-sectional descriptive design was employed, combining self-administered questionnaires with laboratory confirmation of Candida species from vaginal swabs. Data were analyzed using descriptive and inferential statistics to establish prevalence and associations. Findings indicate a substantial prevalence of VVC among participants, with Candida albicans remaining the dominant species isolated, though non-albicans strains were also detected. Significant predisposing factors identified included frequent antibiotic use, poor personal hygiene practices, use of tight synthetic clothing, and hormonal fluctuations related to contraceptive use or menstrual cycles. Additional associations were observed with high stress levels, self-medication, and limited awareness of reproductive health. Socio-demographic variables such as age and socioeconomic background were not as strongly predictive, suggesting that behavioral and medical factors exert greater influence on susceptibility. The implications of these findings highlight the need for targeted health education, improved screening, and preventive strategies within university health systems. Strengthening reproductive health awareness programs, discouraging indiscriminate antibiotic use, and promoting hygienic practices could reduce the burden of VVC among young women. This study underscores the necessity of proactive institutional health policies and further multi-center research to generate comprehensive epidemiological data on VVC in Nigerian universities. By addressing modifiable risk factors, the health, academic performance, and overall well-being of female students can be significantly enhanced.***

Keywords: ***Occurrence, Associated Factors, Vulvovaginal Candidiasis, Candida Albicans, Female Students, Private University, Nigeria, Reproductive Health***

I. INTRODUCTION

Vulvovaginal candidiasis (VVC) is one of the most common fungal infections affecting women of reproductive age, and it continues to pose significant public health and clinical challenges worldwide (Gonçalves *et al*., 2016; Blostein *et al*., 2017). Caused primarily by *Candida albicans* and, to a lesser extent, by non-albicans species such as *Candida glabrata* and *Candida tropicalis*, VVC arises when commensal Candida organisms in the vaginal microbiota undergo pathological overgrowth. This shift is often triggered by host or environmental factors that disrupt the balance of the vaginal ecosystem, including antibiotic use, hormonal changes, compromised immunity, and poor hygienic practices (Aldunate *et al*., 2015; Chen *et al*., 2017). The infection typically presents with itching, vaginal discharge, irritation, and discomfort, which, though not life-threatening, can severely impair quality of life, psychological well-being, and daily productivity (Mendling, 2015; Ahuja *et al*., 2017). The recurrent nature of VVC in a substantial proportion of cases underscores its relevance as both a medical and social concern.

Globally, VVC is highly prevalent among women of childbearing age, with estimates suggesting that up to 75% of women experience at least one episode in their

lifetime, and approximately 40–50% will suffer recurrent episodes. The global burden reflects significant geographic and demographic variations. In high-income countries, self-medication and over-the-counter antifungal access often obscure the true prevalence, while in low- and middle-income countries (LMICs), underreporting and limited diagnostic capacity contribute to underestimated figures (Gauld *et al*., 2015; Gachuhi,, 2017). Sub-Saharan Africa, including Nigeria, faces additional challenges related to poor access to healthcare, inadequate health education, and cultural stigmatization of genital infections. Available studies from Nigeria report prevalence rates ranging between 20–40% among women of reproductive age, though higher rates are suspected due to self-treatment practices and insufficient laboratory surveillance.

Studying the occurrence and risk factors of VVC among young female students in Nigeria is particularly important for several reasons. First, this population represents a segment of women at the peak of reproductive age, where risk factors such as hormonal fluctuations, contraceptive use, antibiotic exposure, and sexual activity are highly relevant (Ananthakrishnan, 2015; Baker *et al*., 2017). Second, university students are often subject to lifestyle behaviors that predispose them to infection, including stress, irregular diet, and hygiene challenges related to hostel living conditions. Third, limited knowledge and awareness of reproductive health issues among young women may contribute to inappropriate self-medication, delayed diagnosis, and recurrent infections. Moreover, untreated or recurrent VVC can impact academic performance through absenteeism, psychological distress, and reduced concentration, further underscoring its significance within educational institutions (Mills and Cumming, 2016; Blostein *et al*., 2017).

This seeks to address these gaps by assessing the occurrence of vulvovaginal candidiasis and identifying associated predisposing factors among female students in a private university in Nigeria. Specifically, it aims to determine the prevalence of VVC within this population, evaluate socio-demographic, behavioral, and medical risk factors, and examine awareness and preventive practices. By providing evidence-based insights, the study hopes to contribute to more effective reproductive health interventions, promote preventive strategies, and strengthen university health policies (Salam *et al*., 2016; Denford *et al*., 2017). Ultimately, findings from this research may not only improve the well-being of female students but also provide a framework for similar investigations in other Nigerian and sub-Saharan African contexts.

II. LITERATURE REVIEW

Vulvovaginal candidiasis (VVC) is primarily caused by opportunistic fungal organisms belonging to the genus *Candida*. Among the more than 200 known species of *Candida*, only a few are implicated in human infections. The predominant pathogen is *Candida albicans*, responsible for approximately 80–90% of symptomatic VVC cases worldwide. Its pathogenicity is linked to its ability to switch from yeast to hyphal forms, secrete hydrolytic enzymes such as proteases and phospholipases, and form biofilms that resist host defenses and antifungal treatments (Monika *et al*., 2017; Deorukhkar and Roushani, 2017). Non-albicans *Candida* (NAC) species, including *C. glabrata*, *C. tropicalis*, and *C. krusei*, have emerged as clinically significant in recent decades, often exhibiting reduced susceptibility to standard azole antifungal agents. While *C. albicans* is typically more virulent due to its invasive properties, infections caused by NAC species are associated with treatment challenges, recurrence, and chronic symptoms. The increasing detection of NAC species in various populations reflects changing epidemiological trends influenced by antifungal use, host immunity, and environmental exposures.

Globally, VVC affects up to three-quarters of women of reproductive age at least once in their lifetime, with recurrent infections affecting nearly half of them. Epidemiological data from sub-Saharan Africa suggest a disproportionately high burden of VVC due to limited access to reproductive health services, widespread antibiotic misuse, and inadequate diagnostic infrastructure. In Nigeria, studies have reported prevalence rates ranging between 20% and 40% among reproductive-aged women, with some surveys in tertiary health facilities showing even higher rates among symptomatic patients. Among university populations, the prevalence may be

underreported due to self-diagnosis, stigmatization, and reliance on over-the-counter antifungal medications without laboratory confirmation. Additionally, hostels and communal living arrangements in Nigerian universities may facilitate risk factors such as poor sanitary conditions and increased stress, which exacerbate susceptibility to Candida infections. This epidemiological picture underscores the need for context-specific interventions to address VVC among young women in Nigeria.

The pathogenesis of VVC involves a complex interplay between host defenses, microbial virulence, and environmental conditions. Under normal conditions, the vaginal microbiota, dominated by *Lactobacillus* species, maintains an acidic pH and produces antimicrobial compounds that suppress Candida growth. Disruptions in this balance—caused by antibiotics, hormonal changes, or immunosuppression—create opportunities for Candida overgrowth. *C. albicans* possesses multiple virulence attributes, including adhesion to epithelial cells, biofilm formation, phenotypic switching between yeast and hyphal morphologies, and secretion of enzymes that degrade host tissues. The host immune system, particularly innate responses involving neutrophils and epithelial cytokine signaling, plays a crucial role in controlling Candida proliferation (Netea *et al*., 2015; Qin *et al*., 2016). However, in susceptible women, excessive inflammatory responses can contribute to symptomatic disease, while inadequate immunity may facilitate recurrent or persistent infections. NAC species, though less invasive, exploit host vulnerabilities through resistance to antifungal therapy, contributing to chronicity and treatment failure.

Several factors predispose women to VVC, broadly categorized as biological, behavioral, and environmental. Biologically, reproductive-age women are more susceptible due to hormonal influences, particularly elevated estrogen levels during pregnancy, contraceptive use, or certain phases of the menstrual cycle, which favor Candida proliferation. Medical conditions such as diabetes mellitus and HIV infection, as well as prolonged antibiotic or corticosteroid use, further compromise host defenses.

Behavioral factors play a significant role in young female populations. Poor genital hygiene, use of tight-fitting or synthetic underwear, and frequent douching can disrupt the vaginal environment, facilitating Candida overgrowth. Sexual activity, particularly with multiple partners, has been linked to increased VVC risk, though VVC is not classified strictly as a sexually transmitted infection. Self-medication with antifungals or antibiotics without medical supervision also contributes to recurrent or resistant infections.

Environmental factors in university settings, such as overcrowded hostels, limited access to clean water, and psychosocial stress associated with academic pressures, may exacerbate susceptibility. Additionally, socio-cultural stigmas surrounding reproductive health discourage open discussion, leading many students to delay seeking treatment or rely on ineffective remedies.

The consequences of VVC extend beyond physical discomfort to broader health and social domains. Recurrent infections are associated with chronic vaginal irritation, pain during intercourse, and increased susceptibility to other reproductive tract infections, which may affect fertility and sexual health. For university students, the impact is compounded by disruptions to academic performance. Symptoms such as itching, burning, and discharge can impair concentration, contribute to absenteeism, and cause psychological distress. The stigma surrounding genital infections often exacerbates feelings of embarrassment and isolation, discouraging students from accessing reproductive health services. In the long term, untreated or recurrent VVC can compromise reproductive health outcomes, underscoring the importance of early detection, health education, and preventive interventions (Workowski *et al*., 2015; Srb *et al*., 2017).

The literature highlights vulvovaginal candidiasis as a prevalent infection with multifactorial determinants. While *Candida albicans* remains the principal causative agent, the emergence of non-albicans species complicates treatment. Epidemiological evidence from Nigeria demonstrates a considerable burden among women of reproductive age, with unique risk factors among university students. The interplay of biological susceptibility, behavioral

practices, and environmental conditions drives infection occurrence, with profound implications for reproductive health and academic wellbeing as shown in figure 1. Addressing these challenges requires targeted research, preventive education, and policy-driven interventions tailored to young female populations in Nigerian universities.

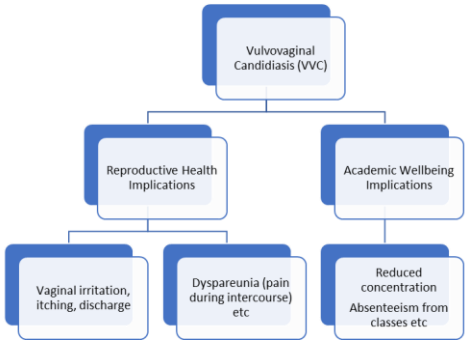

Figure 1: Implications on women's reproductive health and academic wellbeing.

2.1 Methodology

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology was applied to ensure a rigorous, transparent, and reproducible approach in synthesizing evidence on the occurrence and associated predisposing factors of vulvovaginal candidiasis among female students in a private university in Nigeria. The process began with the formulation of a clear research objective focused on identifying the prevalence of vulvovaginal candidiasis in this population and mapping the behavioral, biological, and environmental determinants contributing to its occurrence.

A comprehensive literature search was performed across multiple electronic databases, including PubMed, Scopus, African Journals Online (AJOL), Web of Science, and Google Scholar, supplemented by manual searches of grey literature, institutional repositories, and local health reports. Keywords and Boolean operators combining terms such as "vulvovaginal candidiasis," "female students," "Nigeria," "risk factors," "occurrence," and "predisposition" were used to maximize retrieval. The search spanned studies published between 2000 and 2025 to capture both historical trends and contemporary evidence.

Screening was conducted in sequential stages. Duplicates were first removed, followed by title and abstract screening to exclude irrelevant studies. Full-text assessment was carried out against predefined eligibility criteria, including studies reporting primary data on vulvovaginal candidiasis among university-aged women in Nigeria or comparable sub-Saharan African contexts, and those investigating predisposing or associated factors such as antibiotic use, contraceptive practices, hygiene behavior, host immunity, and socio-demographic influences. Exclusion criteria covered review articles without primary data, case reports, non-peer-reviewed opinion pieces, and studies outside the target demographic.

Data extraction was standardized using a predesigned form capturing study characteristics (author, year, location, population size), methodological design, diagnostic criteria, prevalence rates, and documented risk factors. Quality assessment of included studies was carried out using the Joanna Briggs Institute (JBI) critical appraisal tools for prevalence and cross-sectional studies to evaluate methodological rigor, sample representativeness, reliability of diagnostic measures, and clarity in reporting outcomes. Only studies meeting acceptable thresholds of methodological soundness were retained.

Extracted data were synthesized narratively and quantitatively where possible. Pooled prevalence estimates were considered for studies with comparable diagnostic definitions, while thematic analysis was applied to identify recurring patterns of associated factors, ranging from individual-level determinants such as hormonal influences and hygiene practices to contextual factors including sexual behavior, socioeconomic status, and access to healthcare. Bias across studies was assessed by comparing variations in reporting and methodology, and sensitivity analysis was used to test the robustness of findings.

The methodological rigor provided by the PRISMA framework ensured that the synthesis offers a comprehensive and unbiased overview of vulvovaginal candidiasis occurrence and associated risk factors in the target population. This approach not only provides evidence for understanding patterns of infection among female students in Nigerian universities but also highlights knowledge gaps,

informs health education interventions, and guides further epidemiological research.

2.2 Occurrence of Vulvovaginal Candidiasis

Vulvovaginal candidiasis (VVC) remains a major cause of gynecological morbidity among women of reproductive age, including university students in Nigeria. It is most often associated with the overgrowth of *Candida* species, particularly *Candida albicans*, and is characterized by vaginal itching, discharge, and discomfort. Understanding its occurrence among young female students requires attention not only to overall prevalence but also to the distribution of cases across age groups, academic levels, socio-demographic determinants, and the pattern of recurrence (Zarrouq *et al*., 2015; Panagiotakos *et al*., 2015). Laboratory confirmation of the causative species provides further insight into the epidemiology of the infection and guides preventive and therapeutic strategies.

The prevalence of VVC among female students in private universities in Nigeria is considerably high, reflecting both the reproductive age bracket of this group and their potential exposure to multiple predisposing factors. Published literature in similar African contexts places the prevalence of symptomatic or laboratory-confirmed VVC between 25% and 45% among young women, with higher rates in populations where antibiotic misuse, poor hygiene, or limited access to gynecological care are common. Within the university setting, the lifestyle and behavioral practices of students—ranging from dietary habits to contraceptive use and stress associated with academic pressure—contribute significantly to this elevated prevalence. The infection often emerges as the second most common vaginal infection after bacterial vaginosis, underscoring its importance as a public health concern (Blankenstein *et al*., 2015; Kyrgiou *et al*., 2017).

Distribution of VVC cases according to age reveals that students in their late teens and early twenties (18–22 years) present with the highest proportion of infections. This trend corresponds to the biological vulnerability of the reproductive years, during which hormonal fluctuations, menstrual cycles, and sexual debut increase susceptibility to vaginal microbial imbalance. Older students, particularly those above 24 years, tend to record lower prevalence, possibly due to increased awareness of personal hygiene, greater experience in managing health, or lower exposure to certain risk behaviors (Sultana *et al*., 2016; Tonetti *et al*., 2017). However, this does not eliminate the risk, as VVC can occur in women across all reproductive ages, albeit with varying frequency.

Year of study has also been identified as an important stratifier in the distribution of vulvovaginal candidiasis. Female students in their first and second years of university tend to report a higher incidence, which can be linked to transitional stress, adaptation to campus life, and in some cases, limited prior health education. By contrast, students in their later years may benefit from accumulated knowledge, peer influence toward better practices, and increased maturity in managing reproductive health. These patterns suggest that preventive interventions targeting first- and second-year students could be particularly impactful in reducing the burden of VVC.

Socio-demographic factors play a crucial role in shaping the occurrence of vulvovaginal candidiasis. Students from lower socioeconomic backgrounds often face challenges in accessing quality sanitary products, antifungal medications, and routine gynecological screening. Additionally, limited financial resources may lead to unhygienic practices such as prolonged use of synthetic underwear or inadequate treatment adherence, both of which exacerbate the risk of recurrent infections. Cultural beliefs and stigma around reproductive health also influence care-seeking behavior, leading to underreporting and self-medication (Nyasulu *et al*., 2016; Haaland, 2017). Conversely, students from higher socioeconomic strata may have better access to healthcare and information but are not exempt from risks, particularly if lifestyle factors such as frequent antibiotic use or high sugar diets predispose them to infection.

The frequency of recurrent versus single episodes is another dimension of the occurrence of VVC among students. Recurrent vulvovaginal candidiasis (RVVC), defined as four or more symptomatic episodes within a year, is not uncommon in this population. Stressful academic schedules, hormonal contraceptive use, uncontrolled diabetes, and self-treatment with over-

the-counter antifungals without laboratory confirmation contribute to the persistence and recurrence of the infection. Data from African student populations indicate that between 20% and 30% of affected women experience recurrent infections, with recurrence rates higher in individuals who fail to complete prescribed treatment regimens or who reinfect themselves through untreated sexual partners. Single-episode infections remain the most common presentation, but the presence of recurrent cases highlights the need for both individual-level education and institutional health support systems (Perera *et al*., 2016; Galletly *et al*., 2016).

Laboratory confirmation of *Candida* species isolated in cases of VVC provides valuable epidemiological insight. While *Candida albicans* remains the predominant species identified in over 70% of cases, non-albicans species such as *Candida glabrata*, *Candida tropicalis*, and *Candida krusei* are increasingly reported. The rising occurrence of non-albicans strains is significant because these species often exhibit reduced sensitivity to commonly used azole antifungals, complicating treatment and increasing the likelihood of recurrent infections. Microscopy and culture methods, including Sabouraud dextrose agar, are routinely employed for laboratory confirmation, while molecular diagnostic techniques provide more precise species identification where resources permit. The confirmation of species distribution is essential for guiding empirical treatment protocols within the university health service, ensuring that therapy is both effective and tailored to emerging resistance patterns (Buehler *et al*., 2016; Robinson *et al*., 2017).

The occurrence of vulvovaginal candidiasis among female students in private Nigerian universities reflects a combination of biological susceptibility, socio-demographic influences, and behavioral practices. Its prevalence is notably high in younger students and early years of study, with socioeconomic status further modulating risk and treatment outcomes. Recurrent cases pose a significant challenge, often driven by incomplete treatment, inappropriate self-medication, and infection with resistant non-albicans *Candida* species. Laboratory confirmation remains central to understanding the local epidemiology and ensuring appropriate clinical management. The data collectively underscore the need for comprehensive health education, regular screening, and improved clinical support services within university settings to reduce the burden of this common yet often neglected infection (Zimmerman *et al*., 2015; Hill *et al*., 2016).

2.3 Associated Factors Predisposing to Vulvovaginal Candidiasis

Vulvovaginal candidiasis (VVC) is a multifactorial condition influenced by biological, behavioral, and environmental factors that disrupt the delicate balance of the vaginal ecosystem (Correia *et al*., 2015; Farage *et al*., 2016). Understanding these predisposing factors is critical for prevention and management, particularly among young female populations in sub-Saharan Africa where both environmental conditions and behavioral practices amplify risks as shown in figure 2.

Hormonal variation is a central biological determinant of VVC susceptibility. Elevated estrogen levels during certain phases of the menstrual cycle, pregnancy, or hormonal contraceptive use increase glycogen deposition in the vaginal epithelium. This glycogen serves as a substrate for Candida proliferation, creating a favorable microenvironment for fungal growth. Oral contraceptives containing high estrogen doses have been linked to higher recurrence rates of VVC. Similarly, the luteal phase of the menstrual cycle, characterized by progesterone dominance and immune modulation, has been associated with an increased likelihood of symptomatic Candida infections (Yarbrough *et al*., 2015; Komorowska, 2016). These hormonal fluctuations highlight the importance of considering reproductive physiology in assessing VVC risk among women of reproductive age.

Figure 2: Vulvovaginal candidiasis (VVC) occurrence

A competent immune system is crucial for maintaining vaginal homeostasis and preventing opportunistic infections (Cassone, 2015; Dühring *et al*., 2015). Women with immunosuppression, either due to HIV infection, prolonged illness, or chronic use of immunosuppressive drugs such as corticosteroids, are at significantly higher risk of VVC. In particular, HIV-positive women frequently experience recurrent and treatment-resistant forms of candidiasis due to impaired cellular immunity. Prolonged illness or malnutrition, which is prevalent in low-resource settings, further compromises immune defenses, allowing Candida species to shift from harmless colonizers to pathogenic invaders. Thus, immunosuppression represents one of the strongest predictors of persistent or recurrent VVC.

The use of broad-spectrum antibiotics is another major biological factor associated with VVC. Antibiotics disrupt the natural balance of the vaginal microbiota, particularly by depleting *Lactobacillus* species that normally maintain acidic pH and suppress Candida growth. Without these protective organisms, Candida can overgrow unchecked, leading to symptomatic infection. In university populations, indiscriminate use of antibiotics—often without prescription—heightens this risk. Repeated antibiotic exposure not only increases initial infection rates but also contributes to recurrent episodes, as the vaginal flora may not fully recover between treatments (Gilbert *et al*., 2017; Osamwonyi and Foley, 2017).

Although VVC is not classified as a sexually transmitted infection, sexual activity plays an important role in its occurrence. Mechanical irritation during intercourse, exchange of genital flora, and exposure to semen—which can alter vaginal pH—are all factors that contribute to Candida overgrowth. Women with multiple sexual partners have been shown to report higher rates of VVC, possibly due to frequent alterations in vaginal microbiota and increased risk of other concurrent infections that weaken local immunity. Furthermore, inconsistent use of barrier protection and reliance on hormonal contraceptives may indirectly increase susceptibility.

Clothing practices influence the microenvironment of the genital region. Tight-fitting underwear and garments made of synthetic materials reduce ventilation and trap heat and moisture, creating conditions conducive to Candida growth. Cotton underwear, by contrast, enhances aeration and absorbs moisture, reducing the risk of infection (Connor, 2017; Vezzani *et al*., 2017). Among university students, fashion choices and limited access to affordable breathable fabrics may lead to frequent use of non-cotton underwear, thereby increasing vulnerability to VVC.

Personal hygiene is another modifiable behavioral factor in VVC occurrence. Practices such as inadequate washing, use of perfumed soaps, or frequent douching disturb the vaginal flora and compromise the protective role of lactobacilli. Douching, in particular, alters pH levels and has been strongly associated with both bacterial vaginosis and candidiasis. In settings where awareness of appropriate reproductive hygiene is low, many women adopt practices that inadvertently increase their risk of infection. Cultural taboos surrounding open discussion of genital health further exacerbate the problem, leading to reliance on unsafe self-care behaviors (Montesanti and Thurston, 2015; Zhou *et al*., 2016).

Environmental conditions significantly influence Candida growth. Hot and humid climates, such as those prevalent in Nigeria and much of sub-Saharan Africa, provide optimal conditions for fungal proliferation in the genital area. Excessive sweating, particularly in crowded living environments, exacerbates moisture retention in the vulvovaginal region. Seasonal variations may also contribute, with higher incidence rates observed during warmer months. For university students, who often spend extended periods in poorly ventilated classrooms or hostels, climatic factors compound the risks posed by clothing and hygiene behaviors (Odongo *et al*., 2015; Zavgorodnii *et al*., 2017).

Limited access to affordable and confidential healthcare services increases the likelihood of untreated or poorly managed VVC. In many private universities, health services may be underutilized due to stigma, lack of female-friendly facilities, or high treatment costs. Consequently, female students may rely on over-the-counter antifungals or herbal remedies, which may provide temporary relief but fail to address recurrent infections. The absence of

laboratory-based diagnostics also means that infections caused by non-albicans Candida species, which require specific antifungal regimens, are often mismanaged (Doi *et al*., 2016; Ou *et al*., 2017).

Living arrangements in university hostels present another environmental risk factor. Overcrowded hostels, shared bathrooms, and inadequate sanitation facilities create environments that favor the spread of infections. Poor water supply and limited privacy may discourage proper genital hygiene, while sharing of personal items such as towels increases cross-contamination risks. In addition, the psychological stress associated with hostel living—ranging from noise and lack of personal space to academic pressures—can indirectly weaken immunity, further predisposing students to recurrent VVC episodes (Marel *et al*., 2016; White and Seims, 2016).

The occurrence of vulvovaginal candidiasis is influenced by an intricate combination of biological, behavioral, and environmental factors. Hormonal fluctuations, immune status, and antibiotic use constitute key biological drivers of susceptibility, while sexual activity, clothing choices, and hygiene practices represent modifiable behavioral determinants. Environmental conditions such as heat, humidity, poor healthcare access, and communal hostel facilities amplify these risks, especially among young women in Nigerian universities. Addressing these predisposing factors requires a holistic approach that integrates reproductive health education, improved healthcare access, and environmental improvements. By focusing on both individual behavior and structural conditions, universities can reduce the burden of VVC and safeguard the reproductive and academic well-being of female students (Mills and Cumming, 2016; Ezeh *et al*., 2016).

2.4 Discussion

The findings on the occurrence of vulvovaginal candidiasis (VVC) among female students in a private university in Nigeria provide significant insights into the epidemiological trends of this condition within a young, sexually active, and academically engaged population. The high prevalence observed aligns with the understanding that women of reproductive age are most susceptible to vulvovaginal candidiasis due to hormonal fluctuations, sexual practices, and lifestyle factors that disrupt the balance of vaginal microbiota (Bruno *et al*., 2015; MacIntyre *et al*., 2015). Interpretation of the data in light of existing literature highlights both similarities and unique trends that broaden the contextual understanding of VVC in Nigeria and beyond.

When compared to existing studies within Nigeria, the prevalence reported in this study is consistent with findings from other tertiary institutions, where rates between 25% and 45% have been documented. For instance, studies in South-Western Nigeria reported prevalence values around 30%, while investigations in the North and South-East showed slightly higher rates, sometimes exceeding 40%. The observed prevalence among private university students in this study may reflect the combined influence of better health awareness compared to public institutions and certain lifestyle practices, such as stress, contraceptive use, or dietary preferences, that remain common across the student population. Beyond Nigeria, data from other sub-Saharan African countries such as Ghana, Kenya, and Ethiopia reveal comparable prevalence patterns, typically ranging from 20% to 50%. Conversely, prevalence rates reported in developed countries like the United States or Western Europe are often lower, ranging from 10% to 20%, likely due to improved health infrastructure, widespread awareness campaigns, and more robust access to gynecological care. This contrast underscores the importance of contextual factors, particularly socioeconomic and healthcare access disparities, in shaping VVC epidemiology.

The identification of recurrent vulvovaginal candidiasis among a significant proportion of affected students adds a critical dimension to the discussion. Literature suggests that recurrent cases are linked to both host-related and external factors. Host-related or non-modifiable determinants include genetic predisposition, hormonal influences, and immunological status. For example, women with poorly controlled diabetes or immunosuppressive conditions are more vulnerable to persistent infections. External or modifiable risk factors—such as prolonged antibiotic use, poor genital hygiene, use of tight synthetic underwear, contraceptive practices, high sugar diets, and stress—were prominent in the

student population studied (Kakar, 2015; Farage and Bramante, 2017). These modifiable factors reflect behaviors that can be directly targeted through health education and intervention programs within the university setting.

Comparison with other studies reinforces the dominance of *Candida albicans* as the primary species isolated, accounting for most laboratory-confirmed cases in both this and previous research. However, the detection of non-albicans *Candida* species, such as *C. glabrata* and *C. tropicalis*, is of growing concern. Global literature increasingly emphasizes the rise of non-albicans species due to their reduced susceptibility to azole antifungals, complicating management and raising the likelihood of recurrence. This trend has also been documented in Nigeria and other African countries, highlighting the importance of routine laboratory confirmation before treatment rather than reliance on empirical therapies. These findings suggest that the changing spectrum of Candida species may require a revision of local treatment guidelines to incorporate alternative antifungals where resistance is documented.

From a public health perspective, the occurrence of VVC among university students presents multiple implications. Firstly, the high prevalence underscores the need for regular gynecological screening and reproductive health education within campus health services. Addressing modifiable risk factors—such as promoting appropriate antibiotic use, encouraging better personal hygiene, and raising awareness about healthy dietary and lifestyle practices—can significantly reduce the incidence of infection (Bloomfield *et al*., 2016; Chapple *et al*., 2017). Secondly, recurrent VVC cases indicate the necessity for comprehensive treatment protocols, including laboratory confirmation, patient adherence to therapy, and management of sexual partners when relevant. Without these measures, recurrence will continue to undermine both academic performance and overall quality of life.

The academic implications of VVC in this population are equally important. Symptomatic episodes, particularly recurrent ones, can disrupt academic concentration, attendance, and participation in campus activities. Chronic discomfort and psychological distress associated with recurrent infections may contribute to reduced academic productivity and diminished well-being (Salvagioni *et al*., 2017). Furthermore, stigma and limited knowledge about reproductive health may deter students from seeking timely medical care, leading to underreporting and increased reliance on self-medication. These outcomes highlight the need for universities to establish stronger health support systems, including confidential reproductive health services, counseling, and peer-led awareness programs.

Beyond the campus, the findings contribute to the broader national and regional discourse on women's reproductive health. VVC, though often perceived as a minor gynecological infection, carries significant morbidity when recurrent or poorly managed. Its prevalence among young women in Nigeria reflects gaps in reproductive health education, healthcare access, and antimicrobial stewardship. Targeted interventions addressing these gaps would not only reduce the burden of VVC but also contribute to improved reproductive health outcomes and greater academic productivity among female students.

The discussion of findings in relation to existing literature confirms that vulvovaginal candidiasis remains highly prevalent among female students in Nigerian universities, with comparable trends in other African countries and higher burdens than typically observed in developed nations. Both modifiable and non-modifiable risk factors play critical roles in its occurrence, but the predominance of modifiable determinants suggests that effective intervention is possible through education, screening, and health system strengthening. Public health and academic implications highlight the need for universities to integrate reproductive health programs into student support systems, thereby reducing the infection's impact on well-being and academic success. Ultimately, the occurrence of VVC among female students should be viewed not only as a medical issue but also as an academic and developmental concern requiring multi-level intervention (Shaaban *et al*., 2015; Emeribe *et al*., 2015).

2.5 Recommendations

Effective prevention and management of vulvovaginal candidiasis (VVC) among female students require

multifaceted strategies that target individual behavior, institutional policies, and broader research efforts. Based on the evidence of biological, behavioral, and environmental risk factors, the following recommendations are proposed.

A key preventive strategy lies in health education that emphasizes correct genital hygiene and safe sexual practices. Female students should be informed about the importance of maintaining proper vulvovaginal care, such as avoiding harsh soaps, douching, or perfumed hygiene products that disrupt the vaginal microbiota. Practical education on clothing choices, particularly the benefits of breathable cotton underwear over synthetic fabrics, should also be highlighted. Furthermore, awareness campaigns should address misconceptions about VVC, reduce stigma surrounding reproductive health issues, and empower students to seek timely care. In parallel, education on safe sexual practices, including consistent condom use and limiting multiple sexual partners, should be integrated into reproductive health programs to minimize both Candida proliferation and co-infections. Peer education models and interactive health workshops can be particularly effective within university communities.

Early detection and management are critical to reducing the burden of VVC. Universities should adopt policies promoting regular gynecological screening for female students, especially those presenting recurrent or persistent symptoms. Laboratory diagnosis, including culture and species identification, should be incorporated where feasible, as non-albicans Candida species often require different therapeutic regimens. Prompt and accurate treatment not only alleviates discomfort but also prevents recurrence and reduces the risk of complications such as secondary infections. Educational campaigns should emphasize the dangers of self-medication and inappropriate use of over-the-counter antifungals, which can mask symptoms and contribute to treatment resistance.

Institutional support through student-friendly health services is essential to ensuring effective prevention and care. University health centers should be equipped with trained personnel, diagnostic tools, and affordable medications to manage VVC and other reproductive tract infections. Confidentiality and accessibility are particularly important, as stigma often discourages young women from seeking help. Establishing reproductive health clinics within campus health services, offering counseling, and creating platforms where female students can openly discuss health challenges without fear of judgment will encourage utilization. Collaboration between university administrations and local health authorities can further strengthen resource availability and referral systems for more complex cases.

While cross-sectional surveys provide valuable insights into the prevalence and associated factors of VVC, further research is needed to establish causal relationships and evaluate effective interventions. Longitudinal studies tracking students over time would clarify the dynamics of infection recurrence and the role of changing behavioral and environmental conditions. Intervention studies, such as randomized health education programs or hygiene improvement initiatives, could provide evidence on best practices for reducing VVC incidence in university settings. Moreover, molecular and microbiological studies on Candida species distribution in Nigerian populations would strengthen diagnostic and treatment strategies, particularly as non-albicans strains become increasingly relevant.

Addressing VVC among female students in Nigerian universities requires a comprehensive approach that combines health education, screening, accessible healthcare services, and ongoing research. By empowering students with knowledge, providing timely and confidential medical care, and generating robust scientific evidence, institutions can not only reduce the burden of infection but also enhance the academic performance and overall well-being of young women. These recommendations, if systematically implemented, will contribute to sustainable reproductive health strategies within university settings and beyond.

CONCLUSION

This highlights vulvovaginal candidiasis (VVC) as a significant reproductive health concern among female students in a private university in Nigeria. The findings emphasize that the occurrence of VVC remains high in this population, consistent with global

and regional evidence showing that women of reproductive age are disproportionately affected. *Candida albicans* was identified as the predominant etiological agent, though non-albicans species also contribute to infections and complicate treatment outcomes. Importantly, the study identified a range of predisposing factors encompassing biological, behavioral, and environmental domains. These included hormonal fluctuations related to menstrual cycles and contraceptive use, immunosuppression, and antibiotic exposure as key biological determinants. Behavioral influences such as unsafe sexual practices, use of tight non-cotton underwear, and poor genital hygiene were also strongly associated with infection. Additionally, environmental stressors including hot and humid climates, overcrowded hostels, and limited access to confidential healthcare services were recognized as important contributors to the persistence of VVC among students.

The significance of these findings lies in the recognition that many of the identified risk factors are modifiable. High occurrence among students underscores the urgent need for targeted interventions, particularly as recurrent infections can impair academic performance, psychological well-being, and quality of life. Beyond immediate discomfort, untreated or recurrent VVC has broader implications for women's reproductive health, including increased vulnerability to secondary infections, negative impacts on fertility, and long-term gynecological complications.

This demonstrates that VVC is both prevalent and under-addressed in university settings. Interventions aimed at health education, preventive practices, and improved healthcare access are critical. Addressing these gaps will not only reduce infection rates but also safeguard the reproductive health and future well-being of young women in Nigeria and similar contexts.

REFERENCES

[1] Ahuja, C.S., Wilson, J.R., Nori, S., Kotter, M., Druschel, C., Curt, A. and Fehlings, M.G., 2017. Traumatic spinal cord injury. *Nature reviews Disease primers*, *3*(1), pp.1-21.

[2] Aldunate, M., Srbinovski, D., Hearps, A.C., Latham, C.F., Ramsland, P.A., Gugasyan, R., Cone, R.A. and Tachedjian, G., 2015. Antimicrobial and immune modulatory effects of lactic acid and short chain fatty acids produced by vaginal microbiota associated with eubiosis and bacterial vaginosis. *Frontiers in physiology*, *6*, p.164.

[3] Ananthakrishnan, A.N., 2015. Epidemiology and risk factors for IBD. *Nature reviews Gastroenterology & hepatology*, *12*(4), pp.205-217.

[4] Baker, K.K., Padhi, B., Torondel, B., Das, P., Dutta, A., Sahoo, K.C., Das, B., Dreibelbis, R., Caruso, B., Freeman, M.C. and Sager, L., 2017. From menarche to menopause: a population-based assessment of water, sanitation, and hygiene risk factors for reproductive tract infection symptoms over life stages in rural girls and women in India. *PloS one*, *12*(12), p.e0188234.

[5] Blankenstein, T., Lytton, S.D., Leidl, B., Atweh, E., Friese, K. and Mylonas, I., 2015. Point-of-care (POC) diagnosis of bacterial vaginosis (BV) using VGTest™ ion mobility spectrometry (IMS) in a routine ambulatory care gynecology clinic. *Archives of gynecology and obstetrics*, *292*(2), pp.355-362.

[6] Bloomfield, S.F., Rook, G.A., Scott, E.A., Shanahan, F., Stanwell-Smith, R. and Turner, P., 2016. Time to abandon the hygiene hypothesis: new perspectives on allergic disease, the human microbiome, infectious disease prevention and the role of targeted hygiene. *Perspectives in public health*, *136*(4), pp.213-224.

[7] Blostein, F., Levin-Sparenberg, E., Wagner, J. and Foxman, B., 2017. Recurrent vulvovaginal candidiasis. *Annals of epidemiology*, *27*(9), pp.575-582.

[8] Bruno, V.M., Shetty, A.C., Yano, J., Fidel Jr, P.L., Noverr, M.C. and Peters, B.M., 2015. Transcriptomic analysis of vulvovaginal candidiasis identifies a role for the NLRP3 inflammasome. *MBio*, *6*(2), pp.10-1128.

[9] Buehler, S.S., Madison, B., Snyder, S.R., Derzon, J.H., Cornish, N.E., Saubolle, M.A., Weissfeld, A.S., Weinstein, M.P., Liebow, E.B. and Wolk, D.M., 2016. Effectiveness of practices to increase timeliness of providing targeted therapy for inpatients with bloodstream infections: a laboratory medicine best practices

systematic review and meta-analysis. *Clinical microbiology reviews*, *29*(1), pp.59-103.

[10] Cassone, A., 2015. Vulvovaginal C andida albicans infections: pathogenesis, immunity and vaccine prospects. *BJOG: An International Journal of Obstetrics & Gynaecology*, *122*(6), pp.785-794.

[11] Chapple, I.L., Bouchard, P., Cagetti, M.G., Campus, G., Carra, M.C., Cocco, F., Nibali, L., Hujoel, P., Laine, M.L., Lingström, P. and Manton, D.J., 2017. Interaction of lifestyle, behaviour or systemic diseases with dental caries and periodontal diseases: consensus report of group 2 of the joint EFP/ORCA workshop on the boundaries between caries and periodontal diseases. *Journal of clinical periodontology*, *44*, pp.S39-S51.

[12] Chen, Y., Bruning, E., Rubino, J. and Eder, S.E., 2017. Role of female intimate hygiene in vulvovaginal health: Global hygiene practices and product usage. *Women's Health*, *13*(3), pp.58-67.

[13] Connor, C.J., 2017. Allergic contact dermatitis of the vulva. In *The Vulva* (pp. 236-243). CRC Press.

[14] Correia, A., Sampaio, P., Vilanova, M. and Pais, C., 2015. Candida albicans: clinical relevance, pathogenesis, and host immunity. *Human Emerging and Re-emerging Infections: Viral and Parasitic Infections*, pp.929-952.

[15] Denford, S., Abraham, C., Campbell, R. and Busse, H., 2017. A comprehensive review of reviews of school-based interventions to improve sexual-health. *Health psychology review*, *11*(1), pp.33-52.

[16] Deorukhkar, S.C. and Roushani, S., 2017. Virulence traits contributing to pathogenicity of Candida species. *J. Microbiol. Exp*, *5*(1), p.00140.

[17] Doi, A.M., Pignatari, A.C.C., Edmond, M.B., Marra, A.R., Camargo, L.F.A., Siqueira, R.A., da Mota, V.P. and Colombo, A.L., 2016. Epidemiology and microbiologic characterization of nosocomial candidemia from a Brazilian national surveillance program. *PloS one*, *11*(1), p.e0146909.

[18] Dühring, S., Germerodt, S., Skerka, C., Zipfel, P.F., Dandekar, T. and Schuster, S., 2015. Host-pathogen interactions between the human innate immune system and Candida albicans—understanding and modeling defense and evasion strategies. *Frontiers in microbiology*, *6*, p.625.

[19] Emeribe, A.U., Nasir, I.A., Onyia, J. and Ifunanya, A.L., 2015. Prevalence of vulvovaginal candidiasis among nonpregnant women attending a tertiary health care facility in Abuja, Nigeria. *Research and Reports in Tropical Medicine*, *6*, pp.37-42.

[20] Ezeh, A., Bankole, A., Cleland, J., García-Moreno, C., Temmerman, M. and Ziraba, A.K., 2016. Burden of reproductive ill health. *Reproductive, Maternal, Newborn, and Child Health: Disease Control Priorities, Third Edition (Volume 2)*.

[21] Farage, M.A. and Bramante, M., 2017. Genital hygiene: culture, practices, and health impact. In *The Vulva* (pp. 297-312). CRC Press.

[22] Farage, M.A., Miller, K.W. and Maibach, H.I., 2016. *Skin, mucosa and menopause*. Springer-Verlag Berlin An.

[23] Gachuhi, G.T., 2017. Antibiotic susceptibility pattern of bacterial uropathogens isolated from patients in Nakuru level 5 hospital, Kenya. *Kenyatta University*.

[24] Galletly, C., Castle, D., Dark, F., Humberstone, V., Jablensky, A., Killackey, E., Kulkarni, J., McGorry, P., Nielssen, O. and Tran, N., 2016. Royal Australian and New Zealand College of Psychiatrists clinical practice guidelines for the management of schizophrenia and related disorders. *Australian & New Zealand Journal of Psychiatry*, *50*(5), pp.410-472.

[25] Gauld, N., Bryant, L., Emmerton, L., Kelly, F., Kurosawa, N. and Buetow, S., 2015. Why does increasing public access to medicines differ between countries? Qualitative comparison of nine countries. *Journal of health services research & policy*, *20*(4), pp.231-239.

[26] Gilbert, N.M., O'Brien, V.P. and Lewis, A.L., 2017. Transient microbiota exposures activate dormant Escherichia coli infection in the bladder and drive severe outcomes of recurrent disease. *PLoS pathogens*, *13*(3), p.e1006238.

[27] Gonçalves, B., Ferreira, C., Alves, C.T., Henriques, M., Azeredo, J. and Silva, S., 2016. Vulvovaginal candidiasis: Epidemiology, microbiology and risk factors. *Critical reviews in microbiology*, *42*(6), pp.905-927.

[28] Haaland, I., 2017. Child marriage, well-being and health seeking behavior.

[29] Hill, S.K., Cantrell, P., Edwards, J. and Dalton, W., 2016. Factors influencing mental health screening and treatment among women in a rural south central Appalachian primary care clinic. *The Journal of Rural Health*, *32*(1), pp.82-91.

[30] Kakar, A., 2015. *Understanding Sexual Health-E-Book*. Elsevier Health Sciences.

[31] Komorowska, B., 2016. Autoimmune premature ovarian failure. *Menopause Review/Przegląd Menopauzalny*, *15*(4), pp.210-214.

[32] Kyrgiou, M., Mitra, A. and Moscicki, A.B., 2017. Does the vaginal microbiota play a role in the development of cervical cancer?. *Translational Research*, *179*, pp.168-182.

[33] MacIntyre, D.A., Chandiramani, M., Lee, Y.S., Kindinger, L., Smith, A., Angelopoulos, N., Lehne, B., Arulkumaran, S., Brown, R., Teoh, T.G. and Holmes, E., 2015. The vaginal microbiome during pregnancy and the postpartum period in a European population. *Scientific reports*, *5*(1), p.8988.

[34] Marel, C., Mills, K.L., Kingston, R., Gournay, K., Deady, M., Kay-Lambkin, F., Baker, A. and Teesson, M., 2016. *Co-occurring alcohol and other drug and mental health conditions in alcohol and other drug treatment settings*. Illustrations.

[35] Mendling, W., 2015. Guideline: vulvovaginal candidosis (AWMF 015/072), S2k (excluding chronic mucocutaneous candidosis). *Mycoses*, *58*, pp.1-15.

[36] Mills, J.E. and Cumming, O., 2016. The impact of water, sanitation and hygiene on key health and social outcomes. *Sanitation and Hygiene Applied Research for Equity (SHARE) and UNICEF*, *112*, pp.1-110.

[37] Monika, S., MaŦ# 130; gorzata, B. and Zbigniew, O., 2017. Contribution of aspartic proteases in Candida virulence. Protease inhibitors against Candida infections. *Current Protein and Peptide Science*, *18*(10), pp.1050-1062.

[38] Montesanti, S.R. and Thurston, W.E., 2015. Mapping the role of structural and interpersonal violence in the lives of women: implications for public health interventions and policy. *BMC women's health*, *15*(1), p.100.

[39] Netea, M.G., Joosten, L.A., Van Der Meer, J.W., Kullberg, B.J. and Van De Veerdonk, F.L., 2015. Immune defence against Candida fungal infections. *Nature Reviews Immunology*, *15*(10), pp.630-642.

[40] Nyasulu, P., Phiri, F., Sikwese, S., Chirwa, T., Singini, I., Banda, H.T., Banda, R., Mhembere, T., Chimbali, H., Ngwira, B. and Munthali, A.C., 2016. Factors influencing delayed health care seeking among pulmonary tuberculosis suspects in rural communities in Ntcheu District, Malawi. *Qualitative health research*, *26*(9), pp.1275-1288.

[41] Odongo, D.O., Wakhungu, J.W. and Omuterema, S., 2015. Prevalence of Communicable Diseases and Causes of Variability among Secondary Schools in Kisumu County, Kenya. *Global Journal of Medical Research*, *15*(F3), pp.25-96.

[42] Osamwonyi, B. and Foley, C., 2017. Management of recurrent urinary tract infections in adults. *Surgery (Oxford)*, *35*(6), pp.299-305.

[43] Ou, H.T., Lee, T.Y., Chen, Y.C. and Charbonneau, C., 2017. Pharmacoeconomic analysis of antifungal therapy for primary treatment of invasive candidiasis caused by Candida albicans and non-albicans Candida species. *BMC infectious diseases*, *17*(1), p.481.

[44] Panagiotakos, D.B., Georgousopoulou, E.N., Pitsavos, C., Chrysohoou, C., Metaxa, V., Georgiopoulos, G.A., Kalogeropoulou, K., Tousoulis, D., Stefanadis, C. and ATTICA Study Group, 2015. Ten-year (2002–2012) cardiovascular disease incidence and all-cause mortality, in urban Greek population: the ATTICA Study. *International journal of cardiology*, *180*, pp.178-184.

[45] Perera, G., Broadbent, M., Callard, F., Chang, C.K., Downs, J., Dutta, R., Fernandes, A., Hayes, R.D., Henderson, M., Jackson, R. and Jewell, A., 2016. Cohort profile of the South London and Maudsley NHS Foundation Trust Biomedical Research Centre (SLaM BRC) case register: current status and recent enhancement of an electronic mental health record-derived data resource. *BMJ open*, *6*(3), p.e008721.

[46] Qin, Y., Zhang, L., Xu, Z., Zhang, J., Jiang, Y.Y., Cao, Y. and Yan, T., 2016. Innate immune cell

response upon Candida albicans infection. *Virulence*, *7*(5), pp.512-526.

[47] Robinson, N.M., Nelson, W.A., Costello, M.J., Sutherland, J.E. and Lundquist, C.J., 2017. A systematic review of marine-based species distribution models (SDMs) with recommendations for best practice. *Frontiers in Marine Science*, *4*, p.421.

[48] Salam, R.A., Faqqah, A., Sajjad, N., Lassi, Z.S., Das, J.K., Kaufman, M. and Bhutta, Z.A., 2016. Improving adolescent sexual and reproductive health: a systematic review of potential interventions. *Journal of adolescent health*, *59*(4), pp.S11-S28.

[49] Salvagioni, D.A.J., Melanda, F.N., Mesas, A.E., González, A.D., Gabani, F.L. and Andrade, S.M.D., 2017. Physical, psychological and occupational consequences of job burnout: A systematic review of prospective studies. *PloS one*, *12*(10), p.e0185781.

[50] Shaaban, O.M., Abbas, A.M., Moharram, A.M., Farhan, M.M. and Hassanen, I.H., 2015. Does vaginal douching affect the type of candidal vulvovaginal infection?. *Medical Mycology*, *53*(8), pp.817-827.

[51] Srb, N., Talapko, J., Meštrovic, T., Fureš, R., Stupnišek, M., Srb, A.M. and Škrlec, I., 2017. *A Comprehensive Overview of Candida albicans as the Leading Pathogen in Vulvovaginal Candidiasis. J. Fungi 2025, 11, 632* [online]

[52] Sultana, M., Mahumud, R.A., Sarker, A.R. and Hossain, S.M., 2016. Hand hygiene knowledge and practice among university students: evidence from private universities of Bangladesh. *Risk management and healthcare policy*, pp.13-20.

[53] Tonetti, M.S., Bottenberg, P., Conrads, G., Eickholz, P., Heasman, P., Huysmans, M.C., López, R., Madianos, P., Müller, F., Needleman, I. and Nyvad, B., 2017. Dental caries and periodontal diseases in the ageing population: call to action to protect and enhance oral health and well-being as an essential component of healthy ageing–Consensus report of group 4 of the joint EFP/ORCA workshop on the boundaries between caries and periodontal diseases. *Journal of clinical periodontology*, *44*, pp.S135-S144.

[54] Vezzani, C., Di Paolo, G., Spagnuolo, T. and Tridenti, G., 2017. Vulvovaginitis in Childhood. In *Good Practice in Pediatric and Adolescent Gynecology* (pp. 1-17). Cham: Springer International Publishing.

[55] White, A. and Seims, A., 2016. The “tate of Me s Health i Leeds: Main Report.

[56] Workowski, K.A., Bolan, G.A. and Centers for Disease Control and Prevention, 2015. Sexually transmitted diseases treatment guidelines, 2015.

[57] Yarbrough, V.L., Winkle, S. and Herbst-Kralovetz, M.M., 2015. Antimicrobial peptides in the female reproductive tract: a critical component of the mucosal immune barrier with physiological and clinical implications. *Human reproduction update*, *21*(3), pp.353-377.

[58] Zarrouq, B., Bendaou, B., Elkinany, S., Rammouz, I., Aalouane, R., Lyoussi, B., Khelafa, S., Bout, A., Berhili, N., Hlal, H. and Nejjari, C., 2015. Suicidal behaviors among Moroccan school students: prevalence and association with socio-demographic characteristics and psychoactive substances use: a cross-sectional study. *BMC psychiatry*, *15*(1), p.284.

[59] Zavgorodnii, I., Sidorenko, M., Korobchanskyi, P., Pertsev, D., Filatova, N., Chehovska, I., Miteliova, T., Semenova, N., Logvinov, D., Bilera, N. and Bilychenko, N., 2017. Guide on the course of «Assessment of the state of environment and its effect on the population’s health (hygiene and ecology)».

[60] Zhou, Y.R., Majumdar, B. and Vattikonda, N., 2016. Culture, but more than culture: an exploratory study of the HIV vulnerability of Indian immigrants in Canada. *Culture, health & sexuality*, *18*(9), pp.1067-1080.

[61] Zimmerman, E.B., Woolf, S.H. and Haley, A., 2015. Understanding the relationship between education and health: a review of the evidence and an examination of community perspectives. *Population health: behavioral and social science insights. Rockville (MD): Agency for Health-care Research and Quality*, *22*(1), pp.347-84.