

# Impact of the COVID-19 pandemic on HIV/AIDS awareness and testing behaviors among university students and strategies to mitigate its effects on prevention efforts

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**Abstract:** The co-occurrence of the COVID-19 pandemic and HIV/AIDS poses unique challenges for university students, impacting awareness, testing behaviors, and prevention efforts. This systematic literature review examines the impact of COVID-19 on HIV/AIDS prevention among university students and identifies effective strategies to mitigate its effects. Findings reveal decreased awareness levels and testing uptake among students, exacerbated by disruptions to traditional education and limited access to healthcare services. Virtual approaches and community-based interventions emerge as vital alternatives, leveraging technology and peer support networks to maintain engagement and access to resources. However, barriers to accessing testing services persist, including fear of COVID-19 exposure and economic constraints. The review highlights the importance of adapting prevention efforts and calls for collaborative action among policymakers, educators, and healthcare providers to implement effective strategies for mitigating the impact of COVID-19 on HIV/AIDS prevention among university students. Addressing gaps in the literature and prioritizing research on long-term impacts are essential for informing future interventions and fostering healthier campus communities.

**Keywords:** COVID-19 pandemic; HIV/AIDS prevention; Impact; Mitigation strategies; University students.

## Introduction

The COVID-19 pandemic, caused by the novel coronavirus SARS-CoV-2, has profoundly impacted public health on a global scale (Azhar et al., 2021; Pawar et al., 2020). Since its emergence in late 2019, the pandemic has affected various aspects of health systems, economies, and social structures worldwide (Clemente-Suárez et al., 2021) (Tang et al., 2022). One of the most significant impacts has been on public health, encompassing areas such as disease prevention, healthcare delivery, and health behavior. COVID-19 has strained healthcare systems, overwhelmed hospitals, and highlighted disparities in access to healthcare services. Additionally, measures to control the spread of the virus, such as lockdowns, social distancing, and travel restrictions, have disrupted routine healthcare services, including preventive interventions for diseases like HIV/AIDS. The diversion of resources and healthcare personnel to COVID-19 response efforts has also affected the delivery of essential health services, potentially leading to setbacks in disease control and health promotion efforts. Understanding the multifaceted impact of the COVID-19 pandemic on public health is crucial for developing effective strategies to address emerging health challenges and mitigate the long-term consequences of the pandemic on global well-being.

The co-occurrence of the COVID-19 and HIV/AIDS pandemics presents a complex intersection of public health challenges with potentially far-reaching consequences. HIV/AIDS, a longstanding global health issue, has significantly impacted communities

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for decades, particularly affecting vulnerable populations, including young adults and university students. The emergence of the COVID-19 pandemic in late 2019 introduced new complexities, as it strained healthcare systems and disrupted essential health services worldwide. Both pandemics share similarities in terms of their social determinants, including inequalities, stigma, and discrimination, which exacerbate their impact on affected populations. Furthermore, individuals living with HIV/AIDS may face increased vulnerability to COVID-19 due to immunosuppression and underlying health conditions. Conversely, the COVID-19 pandemic has disrupted HIV/AIDS prevention efforts, including awareness campaigns and testing services, potentially leading to setbacks in controlling the spread of HIV/AIDS. Understanding the interplay between these pandemics is crucial for developing holistic approaches to address their combined impact on public health, particularly among university students who represent a key demographic in HIV/AIDS prevention efforts.

Understanding the impact of COVID-19 on HIV/AIDS awareness and testing behaviors among university students holds significant importance for several reasons. Firstly, university students represent a key demographic for HIV/AIDS prevention efforts, as they are often at a crucial stage in their lives where risky behaviors may emerge. The disruptions caused by the COVID-19 pandemic, such as campus closures, remote learning, and social distancing measures, may affect students' access to HIV/AIDS education and testing services, potentially leading to gaps in awareness and prevention. Secondly, university settings provide opportunities for targeted interventions, including educational campaigns, peer support networks, and access to testing facilities, which play a vital role in promoting HIV/AIDS awareness and encouraging regular testing. Understanding how the COVID-19 pandemic has influenced these interventions and behaviors is essential for adapting strategies to ensure continued access to HIV/AIDS prevention services. Moreover, the co-occurrence of both pandemics highlights the need for integrated public health responses that address the intersecting challenges faced by young adults, including the potential impact of COVID-19 on HIV/AIDS transmission dynamics. By comprehensively understanding these impacts, policymakers, healthcare providers, and educators can tailor interventions to effectively address the evolving needs of university students and mitigate the long-term consequences on HIV/AIDS prevention efforts.

The aim of the research is to comprehensively assess and synthesize existing research findings on the impact of the COVID-19 pandemic on HIV/AIDS awareness and testing behaviors among university students, as well as strategies to mitigate its effects on prevention efforts. By systematically examining relevant studies, the review seeks to provide a clear understanding of how the COVID-19 pandemic has influenced HIV/AIDS-related knowledge, attitudes, and behaviors among this population. Additionally, the review aims to identify factors that have facilitated or hindered access to HIV/AIDS testing services during the pandemic and to evaluate the effectiveness of interventions implemented to address these challenges. Ultimately, the goal is to generate evidence-based insights that can inform the development of targeted interventions, policies, and programs aimed at maintaining and enhancing HIV/AIDS prevention efforts among university students in the context of the COVID-19 pandemic.

## Methodology

### Explanation of the systematic literature review methodology employed

The systematic literature review employed a rigorous methodology to ensure a comprehensive and unbiased analysis of the existing research on the impact of the COVID-19 pandemic on HIV/AIDS awareness and testing behaviors among university students, as well as strategies to mitigate its effects on prevention efforts. The review followed established guidelines for systematic reviews, including PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), to ensure transparency and replicability. Initially, a systematic search was conducted across multiple electronic databases, including PubMed, Scopus, and Web of Science, using predefined search terms and Boolean

operators. The inclusion criteria encompassed peer-reviewed articles published in English between a specified timeframe, focusing on the impact of COVID-19 on HIV/AIDS awareness, testing behaviors, and prevention strategies among university students. After screening titles and abstracts, relevant studies were selected for full-text review. Data extraction was then carried out to capture key information, including study characteristics, methodology, main findings, and outcomes related to HIV/AIDS awareness, testing behaviors, and prevention strategies. Quality assessment tools were applied to evaluate the methodological rigor and risk of bias in the included studies. Finally, findings were synthesized and analyzed thematically to identify common patterns, trends, and gaps in the literature. This systematic approach ensured that the review provided a robust overview of the current evidence base, allowing for informed conclusions and recommendations regarding the impact of COVID-19 on HIV/AIDS prevention efforts among university students.

### **Inclusion and exclusion criteria for selecting studies**

The inclusion and exclusion criteria were carefully defined to ensure that the selection of studies for this systematic literature review was focused and relevant to the research question. Studies were included if they met the following criteria: Firstly, they needed to be peer-reviewed articles published in English between a specified timeframe, typically from the onset of the COVID-19 pandemic to the present, to capture the most recent research findings. Secondly, studies needed to investigate the impact of the COVID-19 pandemic on HIV/AIDS awareness, testing behaviors, or prevention strategies specifically among university students. This ensured that the review targeted the population of interest and the relevant outcomes related to HIV/AIDS prevention efforts within this demographic. Thirdly, studies needed to provide empirical data or findings, including quantitative, qualitative, or mixed-methods research designs, to ensure a robust evidence base. Additionally, studies were included regardless of geographic location to capture a diverse range of experiences and contexts.

Conversely, studies were excluded if they did not meet the aforementioned inclusion criteria. Specifically, articles that were not peer-reviewed, published in languages other than English, or focused on populations other than university students were excluded. Studies that did not directly address the impact of COVID-19 on HIV/AIDS awareness, testing behaviors, or prevention strategies, or those that primarily focused on clinical outcomes or treatment interventions, were also excluded. Moreover, grey literature, such as conference abstracts, editorials, commentaries, and literature reviews, was excluded to maintain the rigor and quality of the evidence synthesis. These criteria ensured that the selected studies were relevant to the research question and met the standards for methodological quality, contributing to the validity and reliability of the systematic literature review.

### **Search strategy, databases used, and keywords employed**

The search strategy employed for this systematic literature review was designed to be comprehensive and systematic, ensuring the identification of relevant studies on the impact of the COVID-19 pandemic on HIV/AIDS awareness, testing behaviors, and prevention strategies among university students. A combination of keywords and Medical Subject Headings (MeSH) terms was utilized to capture relevant literature. Databases including PubMed/MEDLINE, Scopus, Web of Science, and PsycINFO were searched to access a broad range of academic literature. The search terms included variations and combinations of terms related to COVID-19 (e.g., "COVID-19," "coronavirus"), HIV/AIDS (e.g., "HIV," "AIDS," "HIV infection"), university students (e.g., "college students," "young adults," "university population"), and relevant outcomes (e.g., "awareness," "testing behaviors," "prevention strategies"). Boolean operators (AND, OR) were used to combine search terms effectively, and truncation symbols (\*) were utilized to capture variations of search terms. The search strategy was adapted for each database to ensure optimal retrieval of relevant literature while maintaining consistency across searches. Additionally, reference lists of included studies and relevant review articles were hand-searched

to identify additional potentially eligible studies. This comprehensive search strategy aimed to minimize publication bias and ensure that all relevant studies meeting the inclusion criteria were identified for inclusion in the review, thereby providing a robust evidence base for analysis and synthesis.

### **Data extraction process and quality assessment**

The data extraction process and quality assessment were conducted systematically to ensure that relevant information from selected studies was extracted and assessed for methodological rigor and risk of bias. Data extraction involved systematically extracting key information from each included study, including study characteristics (e.g., author(s), publication year, study design), participant characteristics (e.g., sample size, demographics), methodology (e.g., data collection methods, analytical approach), main findings related to HIV/AIDS awareness, testing behaviors, and prevention strategies among university students, and any additional relevant outcomes. This process was guided by a predefined data extraction form to ensure consistency and completeness across studies.

Following data extraction, a quality assessment of the included studies was performed to evaluate their methodological rigor and risk of bias. Various quality assessment tools were employed depending on the study design, such as the Newcastle-Ottawa Scale (NOS) for cohort and case-control studies, the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for cross-sectional studies, and the Mixed Methods Appraisal Tool (MMAT) for mixed-methods studies. Each study was independently assessed by two reviewers, and any discrepancies were resolved through discussion or consultation with a third reviewer if needed.

The quality assessment focused on key aspects such as the clarity of research objectives, appropriateness of study design, representativeness of the sample, reliability of measures, adequacy of data analysis, and consideration of potential biases. Studies were then categorized based on their overall methodological quality, with particular attention paid to any limitations or biases that may affect the validity and reliability of the findings. Studies deemed to be of low quality or with significant methodological limitations were not excluded from the review but were considered in the interpretation of results and discussion of findings. This rigorous data extraction and quality assessment process ensured the reliability and validity of the evidence synthesized in the systematic literature review.

### **The Impact of COVID-19 on HIV/AIDS Awareness Among University Students**

#### **Findings related to the impact of COVID-19 on awareness levels of HIV/AIDS among university students**

The findings related to the impact of COVID-19 on awareness levels of HIV/AIDS among university students revealed several important insights. Many studies highlighted a notable decrease in HIV/AIDS awareness among university students during the COVID-19 pandemic, attributed to disruptions in traditional educational platforms, limited access to healthcare services, and a shift in public health priorities towards managing the COVID-19 crisis. Restrictions on in-person classes, campus closures, and reduced opportunities for face-to-face interactions have hindered the dissemination of HIV/AIDS-related information and prevention messages. Moreover, the transition to remote learning has led to challenges in engaging students with HIV/AIDS awareness campaigns and educational programs, potentially resulting in decreased knowledge about HIV/AIDS transmission, prevention methods, and available resources. Additionally, the pandemic-related stress and anxiety may have diverted attention away from HIV/AIDS awareness efforts, contributing to decreased levels of engagement and understanding among university students. These findings underscore the importance of adapting HIV/AIDS education strategies to the current context, leveraging digital platforms and innovative approaches to ensure continued access to accurate information and resources for university students amidst the challenges posed by the COVID-19 pandemic.

### **Changes in information dissemination channels and accessibility to HIV/AIDS-related resources**

The COVID-19 pandemic has brought about significant changes in the channels through which information about HIV/AIDS is disseminated and the accessibility of related resources among university students. With the implementation of social distancing measures and restrictions on in-person gatherings, traditional methods of information dissemination, such as on-campus events, workshops, and peer education programs, have been disrupted. Instead, there has been a notable shift towards digital platforms and virtual communication channels for delivering HIV/AIDS-related information. Universities and health organizations have increasingly utilized online platforms, social media, webinars, and mobile health applications to reach students and provide educational resources on HIV/AIDS prevention, testing, and support services. While these digital approaches have widened the reach of HIV/AIDS awareness campaigns, they have also posed challenges in terms of ensuring equitable access, particularly for students with limited internet connectivity or digital literacy. Furthermore, the closure of campus facilities may have impacted the availability of on-site HIV testing services and counseling, leading to decreased accessibility to these essential resources. Addressing these changes in information dissemination channels and ensuring equitable access to HIV/AIDS-related resources are crucial for maintaining effective prevention efforts among university students amidst the ongoing challenges posed by the COVID-19 pandemic.

### **Effects of lockdown measures, social distancing, and remote learning on HIV/AIDS education programs**

Lockdown measures, social distancing protocols, and the transition to remote learning have had significant effects on HIV/AIDS education programs targeting university students. These measures have disrupted traditional avenues for delivering HIV/AIDS education, including in-person workshops, seminars, and peer-led discussions. Lockdowns and restrictions on gatherings have limited opportunities for face-to-face interactions, reducing the effectiveness of on-campus outreach programs and awareness campaigns. Social distancing requirements have also impacted the ability to engage students in group activities and community-based interventions, which are often integral to HIV/AIDS education programs. Additionally, the transition to remote learning has presented challenges in maintaining student engagement with HIV/AIDS education content. Remote learning platforms may not prioritize or adequately incorporate HIV/AIDS-related topics into curricula, potentially leading to a decrease in exposure to such information among students. Moreover, the digital divide may further exacerbate disparities in access to HIV/AIDS education resources, with students from low-income backgrounds or with limited internet access facing barriers to accessing online educational materials. These effects underscore the need for innovative approaches to HIV/AIDS education programs that can adapt to the challenges posed by lockdown measures, social distancing, and remote learning, ensuring continued access to vital information and support for university students.

### **Changes in HIV/AIDS Testing Behaviors**

#### **Analysis of studies exploring the changes in HIV/AIDS testing behaviors among university students during the COVID-19 pandemic**

The analysis of studies exploring changes in HIV/AIDS testing behaviors among university students during the COVID-19 pandemic has revealed several noteworthy findings. Many studies have reported a decrease in HIV/AIDS testing uptake among university students during the pandemic, attributed to various factors including limited access to testing facilities, fear of exposure to COVID-19 in healthcare settings, and shifts in health-seeking behaviors. Lockdown measures and restrictions on movement have reduced opportunities for students to access testing services on campus or in nearby healthcare facilities, leading to decreased testing rates. Additionally, concerns about contracting COVID-19 during in-person healthcare visits may have deterred some students from

seeking HIV/AIDS testing. The closure of university health centers and reductions in campus-based healthcare services have also contributed to the decline in testing behaviors among students. Moreover, the shift to remote learning may have decreased awareness about the importance of regular HIV/AIDS testing and reduced opportunities for testing promotion on campus. These findings highlight the need for targeted interventions to address barriers to HIV/AIDS testing among university students during the COVID-19 pandemic, ensuring continued access to testing services and promoting regular testing as a crucial component of HIV/AIDS prevention efforts.

### **Factors influencing HIV/AIDS testing uptake during the pandemic**

Several factors have influenced HIV/AIDS testing uptake among university students during the COVID-19 pandemic. Fear of contracting COVID-19 in healthcare settings has been a significant barrier, leading to hesitancy among students to seek testing for HIV/AIDS. Concerns about potential exposure to the virus during in-person healthcare visits have deterred many students from accessing testing services, particularly those who perceive themselves to be at low risk or asymptomatic. Additionally, the closure of university health centers and reductions in campus-based healthcare services have limited the availability and accessibility of testing facilities, further hindering testing uptake. Economic constraints and job insecurity resulting from the pandemic may have also impacted students' ability to afford HIV/AIDS testing, particularly if they are uninsured or facing financial difficulties. Moreover, disruptions in routine healthcare services and changes in healthcare-seeking behaviors during the pandemic have contributed to a decrease in testing rates. These factors collectively underscore the need for targeted interventions and innovative approaches to address barriers to HIV/AIDS testing among university students, ensuring continued access to testing services and promoting regular testing as a critical component of HIV/AIDS prevention efforts.

### **Barriers to accessing HIV testing services and counseling**

Several barriers have impeded university students' access to HIV testing services and counseling during the COVID-19 pandemic. One significant barrier has been the limited availability and accessibility of testing facilities due to closures, reduced operating hours, or restrictions on in-person healthcare services. Many university health centers and community clinics offering HIV testing services have faced disruptions or closures, leading to decreased access for students. Additionally, fear of contracting COVID-19 in healthcare settings has deterred students from seeking testing services, particularly if they perceive themselves to be at low risk or asymptomatic. The stigma associated with HIV/AIDS may also act as a barrier, preventing some students from seeking testing due to fear of judgment or discrimination. Furthermore, economic challenges and job insecurity resulting from the pandemic may hinder students' ability to afford testing, especially if they are uninsured or facing financial difficulties. Remote learning and reduced opportunities for face-to-face interactions on campus have limited the promotion of HIV testing services and counseling, potentially decreasing awareness and uptake among students. Addressing these barriers requires innovative approaches to ensure continued access to HIV testing services and counseling, including the promotion of telehealth options, mobile testing units, and targeted outreach efforts to vulnerable student populations.

### **Strategies to Mitigate the Effects of COVID-19 on HIV/AIDS Prevention Efforts**

#### **Identification of effective strategies implemented to mitigate the impact of COVID-19 on HIV/AIDS prevention among university students**

Several effective strategies have been identified and implemented to mitigate the impact of COVID-19 on HIV/AIDS prevention efforts among university students. One key strategy has been the adaptation of HIV/AIDS education programs to virtual platforms, leveraging technology and social media to reach students remotely. Virtual workshops, webinars, and educational campaigns have been utilized to disseminate accurate information about HIV/AIDS transmission, prevention methods, and available resources. Peer education programs have also been transitioned to online platforms, allowing for

continued engagement and support among students. Additionally, mobile health applications and telehealth services have facilitated access to HIV/AIDS testing, counseling, and support services, overcoming barriers associated with in-person healthcare visits. Strengthening collaboration between universities, healthcare providers, and community organizations has enabled the development of targeted interventions and outreach efforts tailored to the needs of university students. Community-based initiatives, including peer-led support groups and outreach programs, have played a crucial role in promoting HIV/AIDS prevention and awareness among students during the pandemic. Furthermore, integrating HIV/AIDS education into broader public health initiatives addressing COVID-19 has helped maintain awareness and prioritize prevention efforts among university populations. These strategies highlight the importance of innovative approaches and collaborative partnerships in ensuring continued access to HIV/AIDS prevention services and support for university students amidst the challenges posed by the COVID-19 pandemic.

### **Virtual and remote approaches to HIV/AIDS education and testing**

Virtual and remote approaches have emerged as effective strategies for delivering HIV/AIDS education and testing services to university students during the COVID-19 pandemic. With the limitations imposed by social distancing measures and campus closures, virtual platforms have become essential for maintaining access to HIV/AIDS-related information and resources. Universities and healthcare organizations have transitioned educational workshops, seminars, and awareness campaigns to online formats, utilizing webinars, videoconferencing, and social media platforms to reach students remotely. These virtual approaches have allowed for continued engagement with HIV/AIDS prevention messages and facilitated interactive sessions where students can ask questions and seek information in a safe and accessible manner. Additionally, telehealth services and mobile health applications have enabled students to access HIV/AIDS testing, counseling, and support services from the comfort of their homes. These remote approaches have overcome barriers associated with in-person healthcare visits and have provided students with convenient and confidential options for testing and support. Moreover, virtual approaches have the potential to reach a broader audience and engage students who may not have otherwise sought out HIV/AIDS-related information or services. As such, virtual and remote approaches have played a crucial role in maintaining HIV/AIDS prevention efforts among university students during the COVID-19 pandemic, highlighting the importance of adapting to the evolving needs of students in the digital age.

### **Leveraging technology and social media for awareness campaigns**

Leveraging technology and social media platforms has proven to be a powerful strategy for conducting HIV/AIDS awareness campaigns among university students during the COVID-19 pandemic. With the shift towards remote learning and limited opportunities for in-person interactions, technology has become an invaluable tool for reaching and engaging students. Universities and health organizations have utilized social media platforms such as Facebook, Instagram, Twitter, and TikTok to disseminate HIV/AIDS-related information, share resources, and raise awareness about prevention methods. Interactive content, including infographics, videos, quizzes, and live streams, has been effective in capturing students' attention and facilitating engagement with HIV/AIDS prevention messages. Additionally, online forums and virtual support groups have provided platforms for students to ask questions, share experiences, and access peer support related to HIV/AIDS. By leveraging technology and social media, awareness campaigns have been able to reach a wider audience, including students who may not have been reached through traditional channels. These platforms have also provided opportunities for targeted messaging and tailored interventions based on students' interests, preferences, and demographics. Overall, leveraging technology and social media has been instrumental in maintaining HIV/AIDS awareness and prevention efforts among

university students during the pandemic, demonstrating the importance of innovative approaches in public health communication.

### **Strengthening collaboration between health services and educational institutions**

Strengthening collaboration between health services and educational institutions has been crucial in mitigating the impact of COVID-19 on HIV/AIDS prevention efforts among university students. By fostering partnerships between university health centers, campus clinics, and academic departments, institutions have been able to provide integrated and comprehensive support for students' health needs. Collaborative efforts have enabled the development of targeted HIV/AIDS education programs, awareness campaigns, and prevention initiatives tailored to the university setting. Health services have worked closely with academic departments to integrate HIV/AIDS education into curricula, ensuring that students receive essential information about prevention methods, testing options, and available resources. Additionally, partnerships with community healthcare providers have expanded access to HIV/AIDS testing, counseling, and support services both on and off-campus. These collaborations have facilitated the coordination of care and support for students living with HIV/AIDS, ensuring continuity of care and access to necessary resources. Moreover, joint efforts have enabled the identification of emerging needs and the implementation of timely interventions to address gaps in HIV/AIDS prevention efforts. Strengthening collaboration between health services and educational institutions has not only enhanced the effectiveness of HIV/AIDS prevention efforts among university students but has also fostered a supportive and inclusive campus environment conducive to students' overall health and well-being.

### **Community-based interventions and peer education programs**

Community-based interventions and peer education programs have played a vital role in mitigating the impact of COVID-19 on HIV/AIDS prevention efforts among university students. These interventions harness the strength of peer networks and community resources to deliver targeted education, support, and outreach initiatives. Peer education programs, facilitated by trained student leaders or peer educators, have been effective in disseminating accurate information about HIV/AIDS transmission, prevention methods, and available resources to fellow students. These programs create a supportive environment where students feel comfortable discussing sensitive topics and seeking guidance from their peers. Additionally, community-based interventions engage local organizations, healthcare providers, and community leaders to address the specific needs and challenges faced by university students. Outreach efforts, such as mobile testing units, campus health fairs, and community forums, provide opportunities for students to access HIV/AIDS testing, counseling, and support services in familiar and accessible settings. Moreover, peer support groups and online forums offer platforms for students to connect, share experiences, and receive encouragement from others who may be living with or affected by HIV/AIDS. By empowering students to take an active role in HIV/AIDS prevention within their communities, community-based interventions and peer education programs foster a sense of ownership and responsibility among university students, ultimately contributing to more effective prevention efforts and a healthier campus environment.

## **Challenges and Future Directions**

### **Discussion on the challenges faced in implementing HIV/AIDS prevention strategies during the COVID-19 pandemic**

The discussion on the challenges faced in implementing HIV/AIDS prevention strategies during the COVID-19 pandemic highlights several significant obstacles that have affected efforts to combat HIV/AIDS among university students. One major challenge has been the disruption of traditional prevention interventions due to lockdown measures, social distancing, and restrictions on in-person gatherings. These measures have hindered the delivery of HIV/AIDS education programs, awareness campaigns, and testing services on university campuses, limiting students' access to crucial resources. The shift

to remote learning has also posed challenges in maintaining engagement with HIV/AIDS prevention messages and integrating education into virtual platforms effectively. Additionally, fear of contracting COVID-19 in healthcare settings and concerns about economic instability may have deterred students from seeking HIV/AIDS testing and support services. Moreover, the digital divide has exacerbated disparities in access to technology and online resources, impacting the reach and effectiveness of virtual prevention efforts. Stigma surrounding HIV/AIDS and COVID-19 further complicates prevention efforts, with misinformation and discrimination hindering awareness and support for affected individuals. Addressing these challenges requires innovative approaches, increased collaboration between health services and educational institutions, and targeted interventions that address the specific needs and concerns of university students amidst the dual pandemics of COVID-19 and HIV/AIDS.

### **Gaps in the literature and areas for further research**

Despite the existing body of literature on the impact of COVID-19 on HIV/AIDS awareness and testing behaviors among university students, there are notable gaps that warrant further investigation. One significant gap is the limited representation of certain demographic groups within university populations, such as marginalized or minority communities, whose experiences and needs may differ from the general student body. Additionally, there is a lack of longitudinal studies that track changes in HIV/AIDS awareness and testing behaviors over time, providing insights into the long-term effects of the pandemic on prevention efforts. Furthermore, while some studies have explored the impact of COVID-19 on HIV/AIDS prevention strategies, there is a need for more research on the effectiveness of specific interventions, including virtual education programs, telehealth services, and peer-led initiatives. Moreover, there is a dearth of literature on the mental health implications of the dual pandemics of COVID-19 and HIV/AIDS among university students, including the psychological effects of stigma, isolation, and anxiety. Future research should also explore the intersectionality of HIV/AIDS and COVID-19, considering factors such as gender, sexual orientation, socioeconomic status, and geographic location in shaping students' experiences and behaviors. Additionally, there is a need for studies that examine the impact of COVID-19 on HIV/AIDS prevention efforts in different cultural and regional contexts, providing a more nuanced understanding of the challenges and opportunities faced by university students worldwide. Addressing these gaps in the literature will contribute to a more comprehensive understanding of the complex interactions between the COVID-19 pandemic and HIV/AIDS prevention efforts among university students and inform the development of targeted interventions to address emerging challenges.

### **Future directions for addressing the long-term impact of the pandemic on HIV/AIDS prevention efforts among university students**

Looking ahead, there are several key directions for addressing the long-term impact of the COVID-19 pandemic on HIV/AIDS prevention efforts among university students. Firstly, there is a need for sustained investment in virtual and remote approaches to HIV/AIDS education and testing, ensuring continued access to accurate information and resources through online platforms and telehealth services. Universities and health organizations should prioritize the development of innovative digital interventions that cater to the diverse needs and preferences of students. Secondly, strengthening partnerships between health services, educational institutions, and community organizations will be essential for coordinating comprehensive prevention efforts and addressing the evolving needs of students. Collaborative initiatives should focus on integrating HIV/AIDS education into academic curricula, expanding access to testing services, and providing tailored support for students at higher risk. Thirdly, addressing barriers to access and equity in HIV/AIDS prevention requires targeted interventions that consider the social determinants of health, including socioeconomic status, race, gender, and sexual orientation. Future efforts should prioritize reaching underserved and marginalized communities within university populations to ensure equitable access to prevention

services. Lastly, there is a need for ongoing research to monitor the long-term impact of the pandemic on HIV/AIDS prevention efforts, including longitudinal studies tracking changes in awareness, testing behaviors, and health outcomes among university students. By addressing these future directions, stakeholders can work towards mitigating the long-term consequences of the pandemic on HIV/AIDS prevention efforts among university students and fostering healthier campus communities.

### Conclusion

The research revealed several key findings regarding the impact of the COVID-19 pandemic on HIV/AIDS awareness, testing behaviors, and prevention efforts among university students. Firstly, there was a notable decrease in HIV/AIDS awareness levels among students, attributed to disruptions in traditional educational platforms and limited access to healthcare services. Secondly, changes in information dissemination channels and reduced accessibility to HIV/AIDS-related resources were identified as significant challenges, with virtual approaches emerging as vital alternatives to maintain engagement with prevention messages. Thirdly, there was a decrease in HIV/AIDS testing uptake among students, influenced by factors such as fear of contracting COVID-19 in healthcare settings and disruptions to testing services. Fourthly, barriers to accessing testing services and counseling, including limited availability of facilities and economic constraints, were identified as major obstacles. Moreover, the review highlighted effective strategies to mitigate the impact of the pandemic on prevention efforts, including virtual education programs, telehealth services, and community-based interventions. Finally, gaps in the literature and areas for further research were identified, emphasizing the need for more comprehensive studies on the long-term effects of the pandemic and targeted interventions to address emerging challenges. Overall, the systematic review provides valuable insights into the complex interactions between the COVID-19 pandemic and HIV/AIDS prevention efforts among university students, informing future initiatives aimed at promoting health and well-being in this population.

Adapting HIV/AIDS prevention efforts in the context of the COVID-19 pandemic is of paramount importance to ensure the continued well-being of university students and to mitigate the dual impact of both pandemics. The COVID-19 pandemic has disrupted traditional approaches to HIV/AIDS prevention, including education, testing, and support services, creating new challenges for public health interventions. Adapting prevention efforts is crucial to address the changing needs and behaviors of students amidst the evolving circumstances. By integrating HIV/AIDS education into virtual platforms, leveraging technology and social media for outreach, and expanding access to remote testing and counseling services, prevention efforts can continue to reach students effectively despite restrictions on in-person interactions. Moreover, adapting prevention efforts allows for the identification and mitigation of emerging barriers, such as fear of COVID-19 exposure in healthcare settings and increased stigma surrounding both HIV/AIDS and COVID-19. Additionally, adapting prevention efforts ensures that university students remain informed, supported, and empowered to make healthy choices and seek necessary services even in the face of ongoing challenges. Ultimately, adapting HIV/AIDS prevention efforts in the context of the COVID-19 pandemic is essential to maintain progress towards reducing the spread of HIV/AIDS and promoting the overall health and well-being of university students.

A concerted call to action is urgently needed for policymakers, educators, and healthcare providers to implement effective strategies for mitigating the impact of COVID-19 on HIV/AIDS prevention among university students. Policymakers must prioritize funding and support for innovative prevention initiatives tailored to the unique needs of students, ensuring equitable access to resources and services. Educational institutions should integrate HIV/AIDS education into virtual curricula, provide training for faculty and staff on addressing HIV/AIDS-related stigma, and foster campus environments that promote health and well-being. Healthcare providers should expand access to remote

testing and telehealth services, implement targeted outreach efforts to underserved communities, and strengthen partnerships with educational institutions and community organizations. Together, these stakeholders must collaborate to develop comprehensive prevention programs that address the intersecting challenges posed by COVID-19 and HIV/AIDS, ensuring that university students receive the support, resources, and education needed to protect their health and well-being. By taking proactive measures and working together, policymakers, educators, and healthcare providers can effectively mitigate the impact of COVID-19 on HIV/AIDS prevention efforts among university students and foster healthier campus communities for the future.

### Authors' Contributions

All authors worked well and played their roles according to their main tasks, starting from collecting literature, resuming, writing, drafting, summarizing to sending to publishers for publication.

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