



The Indonesian Journal of General Medicine

The Analysis Study of Detection of Gonorrhea among HIV Infected Patients: A Comprehensive Systematic Review

¹ Ruth Bethania Dayu Hutabarat, ¹ Fauzie Ilhamsyah Megantara

¹ Faculty of Medicine, Maranatha Christian University, Bandung City,
Indonesia

Correspondence : ruthbethania2009@gmail.com

Article History :

Received date : 2023/12/26
Revised date : 2024/05/15
Accepted date : 2024/06/24
Published date : 2024/08/02



Copyright: © 2024 by the
authors. Submitted for possible
open access publication under
the terms and conditions of the
Creative Commons Attribution
(BY NC) license
(<https://creativecommons.org/licenses/by-nc/4.0/>).



ABSTRACT

Background: Sexually transmitted diseases (STDs) are one the major public health concern in the world. *Neisseria gonorrhea* is an obligate human pathogen responsible for gonorrhea as one of the commonest sexually STDs. **The aim:** The aim of this study to show about detection of gonorrhea among HIV infected patients. **Methods:** By the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020, this study was able to show that it met all of the requirements. This search approach, publications that came out between 2014 and 2024 were taken into account. Several different online reference sources, like Pubmed, SagePub, and Sciencedirect were used to do this. **Result:** Eight publications were found to be directly related to our ongoing systematic examination after a rigorous three-level screening approach. Subsequently, a comprehensive analysis of the complete text was conducted, and additional scrutiny was given to these articles. **Conclusion:** Early detection of sexually transmitted diseases is very useful for starting treatment early which will affect the outcome and prognosis of a disease such as gonorrhea, especially in patients suffering from HIV.

Keyword: HIV, sexually transmitted diseases (STDs), gonorrhea, detection.

INTRODUCTION

Around the world, over one million people are infected with some kind of Sexually Transmitted Infection (STI) every day, making them a major global health problem. The world's most populous country, China, was said to have eradicated STIs 50 years ago but is now experiencing the most precipitous increase in the prevalence of STIs and facing a huge challenge of identifying how to control HIV and STIs. *Neisseria gonorrhoeae* (NG) infections are curable sexually transmitted infections (STIs) that can have distressing symptoms and complications, though a large proportion remains asymptomatic.^{1,2}

The proportion of new HIV infections is on the rise in young gay and other MSM, making this population particularly vulnerable to other sexually transmitted diseases (STDs). There are several factors, such as the number of sexual partners, inconsistent condom use and HIV infection that are associated with increased prevalence of STDs among MSM. Individuals infected with HIV are more susceptible to other STDs because they are

immunocompromised and less capable of mounting a protective response against sexually transmitted pathogens. STDs are frequently asymptomatic, therefore, increasing the likelihood of transmitting and acquiring HIV.^{3,4}

Medical professionals are trained to communicate with patients, partners, and families to understand their chief complaints and formulate an effective and useful differential diagnosis. At the same time, taking a detailed history is mandatory, whether it occurs in a primary clinic or the emergency department. The clinician's role is to effectively communicate with the patient who presents with signs and symptoms suggestive of a previously undiagnosed sexually transmitted infection. Clinicians should be aware that all adolescents under 18 have the right to an STI screening and treatment without parental consent.⁵

Approximately 5–10% of persons receiving care at HIV clinics are infected with *Neisseria gonorrhoeae* (NG) and/or *Chlamydia trachomatis* (CT) at any given time. Detecting and treating these generally-asymptomatic infections

improves health by preventing their spread and downstream complications and may also reduce HIV transmission through 1) identifying opportunities for counseling about risky sexual behavior, and 2) decreasing mucosal inflammation and HIV RNA levels at the site of infection. Starting in 2003, the United States (US) and other countries have recommended at least annual NG/CT screening among the relatively-broad group of all sexually-active persons living with HIV (PLWH).⁶

Since publication of screening recommendations, HIV clinics in Maryland, US, and Ontario, Canada, separately reported that several-year increases in annual NG/CT testing were countered by declines in NG/CT test positivity such that overall NG/CT case detection remained constant. The failure of increased testing to increase case detection leads to questions about the utility of the broad approach to screening all sexually active PLWH as compared to a more targeted approach.⁶

METHODS

Protocol

By following the rules provided by Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020, the author of this study made certain that it was up to par with the requirements. This is done to ensure that the conclusions drawn from the inquiry are accurate.

Criteria for Eligibility

For the purpose of this literature review, we compare and contrast detection of gonorrhea among HIV infected patients. It is possible to accomplish this by researching of detection of gonorrhea among HIV infected patients. As the primary purpose of this piece of writing, demonstrating the relevance of the difficulties that have been identified will take place throughout its entirety.

In order for researchers to take part in the study, it was necessary for them to fulfil the following requirements: 1) The paper needs to be written in English, and it needs to determine about detection of gonorrhea among HIV infected patients. In order for the manuscript to be considered for publication, it needs to meet both of these requirements. 2)

The studied papers include several that were published after 2014, but before the time period that this systematic review deems to be relevant. Examples of studies that are not permitted include editorials, submissions that do not have a DOI, review articles that have already been published, and entries that are essentially identical to journal papers that have already been published.

Search Strategy

We used "detection of gonorrhea among HIV infected patients." as keywords. The search for studies to be included in the systematic review was carried out using the PubMed, SagePub, and Sciencedirect databases.

Data retrieval

After reading the abstract and the title of each study, the writers performed an examination to determine whether or not the study satisfied the inclusion criteria. The writers then decided which previous research they wanted to utilise as sources for their article and selected those studies. After looking at a number of different research, which all seemed to point to the same trend, this conclusion was drawn. All

submissions need to be written in English and cannot have been seen anywhere else.

Only those papers that were able to satisfy all of the inclusion criteria were taken into consideration for the systematic review. This reduces the number of results to only those that are pertinent to the search. We do not take into consideration the conclusions of any study that does not satisfy our requirements. After this, the findings of the research will be analysed in great detail. The following pieces of information were uncovered as a result of the inquiry that was carried out for the purpose of this study: names, authors, publication dates, location, study activities, and parameters.

Quality Assessment and Data Synthesis

Each author did their own study on the research that was included in the publication's title and abstract before making a decision about which publications to explore further. The next step will be to evaluate all of the articles that are suitable for inclusion in the review because they match the criteria set forth for that purpose in the

review. After that, we'll determine which articles to include in the review depending on the findings that we've uncovered. This criteria is utilised in the process of selecting papers for further assessment. in order to simplify the process as much as feasible when selecting papers to evaluate. Which earlier investigations were carried out, and what elements of those studies made it appropriate to include them in the review, are being discussed here.

Table 1. Search Strategy

<i>Database</i>	<i>Search Strategy</i>	<i>Hits</i>
Pubmed	(("Gonorrhea"[MeSH Subheading] OR "Risk factor"[All Fields] OR "Diagnosed" [All Fields]) AND ("HIV"[All Fields] OR "Sexual transmitted infection"[All Fields]) AND ("Diagnostic"[All Fields]) OR ("Prognosis" [All Fields]))	4917
Science Direct	(("Gonorrhea"[MeSH Subheading] OR "Risk factor"[All Fields] OR "Diagnosed" [All Fields]) AND ("HIV"[All Fields] OR "Sexual transmitted infection"[All Fields]) AND ("Diagnostic"[All Fields]) OR ("Prognosis" [All Fields]))	447
Sagepub	(("Gonorrhea"[MeSH Subheading] OR "Risk factor"[All Fields] OR "Diagnosed" [All Fields]) AND ("HIV"[All Fields] OR "Sexual transmitted infection"[All Fields]) AND ("Diagnostic"[All Fields]) OR ("Prognosis" [All Fields]))	2

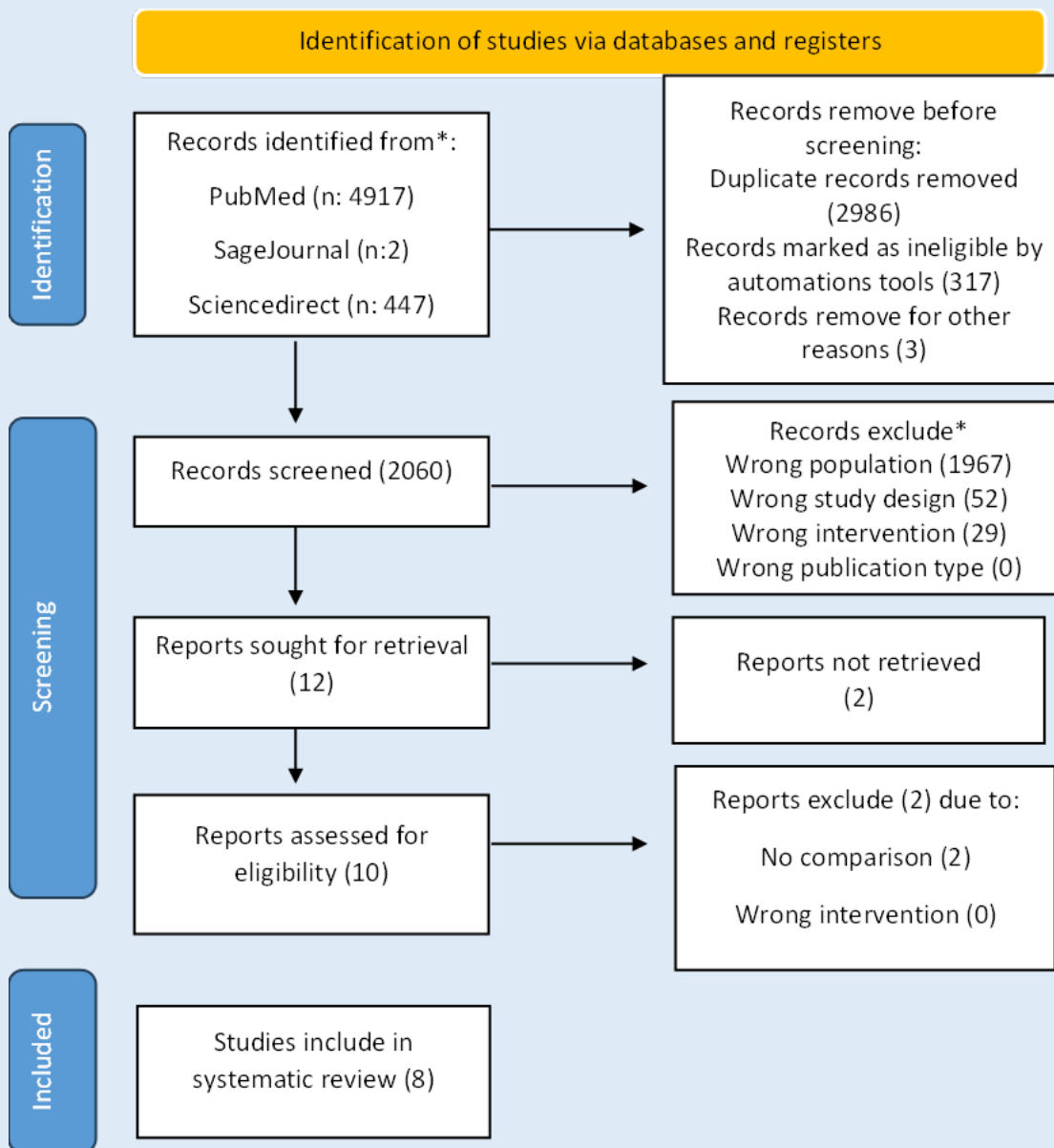


Figure 1. Article search flowchart

Table 2. Critical appraisal of Study

Parameters	(Ghasabi, F et al., 2018)	(Skinner, JM et al., 2014)	(Castron, JG & Alcaide, ML., 2016)	(Luca, J et al., 2018)	(Yumori, C et al., 2021)	(Klein, PW et al., 2014)	(Odom, JD et al., 2018)	(Barbee, LA et al., 2016)
1. Bias related to temporal precedence								
Is it clear in the study what is the “cause” and what is the “effect” (ie, there is no confusion about which variable comes first)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Bias related to selection and allocation								
Was there a control group?	Yes	Yes	Yes	No	Yes	Yes	No	Yes
3. Bias related to confounding factors								
Were participants included in any comparisons similar?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4. Bias related to administration of intervention/exposure								
Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	No.	No.	No.	No.	No.	No.	No.	No.
5. Bias related to assessment, detection, and measurement of the outcome								
Were there multiple measurements of the outcome, both pre and post the intervention/exposure?	No.	No.	No.	No.	No.	No.	No.	No.
Were the outcomes of participants included in any comparisons measured in the same way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Were outcomes measured in a reliable way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6. Bias related to participant retention								
Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7. Statistical conclusion validity								
Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

RESULT

Using reputable resources like Science Direct, PubMed, and SagePub, our research team first gathered 5366 publications. A thorough three-level screening strategy was used to identify only eight papers as directly relevant to our ongoing systematic evaluation. Next, a thorough study of the entire text and further examination of these articles were selected. Table 1 compiles the literature that was analyzed for this analysis in order to make it easier to view.

Table 3. The litelature include in this study

Author	Origin	Method	Sample	Result
Ghassabi, F et al., 2018 ⁷	Iran	This retrospective study was performed from 2004 to 2013, on HIV patients who were tested for detection of gonorrhea and syphilis infection at Shiraz HIV/AIDS Research Center. ELISA technique was used for preliminary detection of HIV and confirmed by a Western Blotting test. Gonorrhea was routinely diagnosed using direct Gram-staining and culturing on selective agar.	806	Of the 806 HIV patients, 39 (2.6%) cases had co-infection with gonorrhea. Compared with mono-HIV infected patients, gonorrhea was significantly more likely among the males (69.4% vs. 92.3%, P=0.002). History of addiction and prison seems to be a significant risk factor for gonorrhea infection (P<0.05). Also, the mean of CD4+lymphocyte was higher among gonorrhea infected patients (368±238 vs. 415±328). Logistic regression analysis showed that sexual contact increased risk of gonococcal infection about 4 fold (OR: 4, CI: 1.7-9.39, P=0.001). None of the HIV patients had syphilis co-infection.
Skinner, JM et al., 2014 ⁸	USA	We compiled all HIV/AIDS cases diagnosed from 1998 to 2008 that were reported in Arizona and syphilis or gonorrhea cases diagnosed from 1998 to 2008 in Arizona. We used deterministic matching to identify individuals who were diagnosed with HIV and one or more STDs, and calculated time intervals between diagnoses.	23940	Of 23,940 people with HIV/AIDS reported from 1998 to 2008, 1,899 (2.6%) had at least one syphilis or gonorrhea diagnosis from 1998 to 2008. Approximately 85% of these cases reported male-to-male sexual contact. Among males with syphilis, HIV coinfection increased from 0.5% in 1998 to 29.1% in 2008. Among males with gonorrhea, HIV coinfection

				increased from 2.0% in 1998 to 3.1% in 2008. Among HIV cases diagnosed from 2004 to 2008 and reported with at least one syphilis or gonorrhea diagnosis, the majority of syphilis cases (76.1%) were diagnosed at or after HIV diagnosis, whereas a majority of gonorrhea cases (54.9%) were diagnosed prior to HIV diagnosis.
Castro, JG & Alcaide, ML., 2016⁹	USA	This was a retrospective review of medical records of individuals attending the Miami-Dade County Health Department STI clinic from March 2012 to May 2012. Demographic and clinical information was abstracted and transferred to an electronic database. Consecutive age-matched HIV-infected and HIV-uninfected patients were identified during the study period.	175	A total of 175 medical records were reviewed (89 HIV-infected patients and 86 HIV-uninfected patients). The median age was 37 years. A history of STIs, including syphilis, was more common in HIV-infected than in HIV-uninfected patients. Individuals with a prior diagnosis of HIV were more likely to be older (older than 37 years of age, $\chi^2= 15.3, P < 0.01$), male ($\chi^2= 4.74, P = 0.05$), to have a new STI ($\chi^2= 5.83, P = 0.01$), to have a new diagnosis of syphilis ($\chi^2= 5.15, P = 0.01$), and to be under medical care ($\chi^2= 31.19, P < 0.001$) than those newly diagnosed as having HIV.
Lucar, J et al., 2018¹⁰	USA	We evaluated the incidence and demographic factors associated with chlamydia, gonorrhea, and syphilis among HIV-infected persons enrolled at 13 DC Cohort sites from 2011 to 2015. Using Poisson regression, we assessed covariates of risk for incident STIs. We also examined HIV viral loads (VLs) at the time of STI diagnosis as a proxy for HIV transmission risk.	11235	Six point seven percent (451/6672) developed an incident STI during a median follow-up of 32.5 months (4% chlamydia, 3% gonorrhea, 2% syphilis); 30% of participants had 2 or more STI episodes. The incidence rate of any STIs was 3.8 cases per 100 person-years (95% confidence interval [CI], 3.5–4.1); age 18–34 years, 10.8 (95% CI, 9.7–12.0); transgender women, 9.9 (95% CI, 6.9–14.0); Hispanics, 9.2 (95% CI, 7.2–11.8); and men who have sex with men (MSM), 7.7 (95% CI, 7.1–8.4). Multivariate Poisson regression showed younger age,

				Hispanic ethnicity, MSM risk, and higher nadir CD4 counts to be strongly associated with STIs. Among those with an STI, 41.8% had a detectable VL within 1 month of STI diagnosis, and 14.6% had a VL ≥ 1500 copies/mL.
Yumori, C et al., 2021¹¹	USA	An electronic sexual health dashboard was used to identify patient encounters with a positive gonorrhea, chlamydia, and/or RPR test between January 1, 2019 and August 23, 2019 at a large urban academic medical center. A retrospective chart review was performed to assess HIV testing, completeness of STI screening, and HIV prevention discussion; inadequate screening was defined as no HIV test in 12 months prior to STI diagnosis.	856	815 patients with 856 patient encounters were included. Patients were predominantly female (64.4%); median age was 24 (range 18–85). The most common test and most common positive test was the genitourinary (GU) gonorrhea/chlamydia nucleic acid amplification test. Multi-site testing was rare (7.5% of patient encounters) and performed more frequently in men than in women (20.3% vs. 0.36%). Women were also more likely to be inadequately screened for HIV (15.1% vs. 25.8%).
Klein, PW et al., 2014¹²	USA	We examined concurrent HIV-STD testing in a suburban academic ED with a targeted, expanded HIV testing program. Patients aged 18–64 years who were tested for syphilis, gonorrhea, or chlamydia in 2009 were evaluated for concurrent HIV testing.	2395	Only 28.3% of patients tested for syphilis, 3.8% tested for gonorrhea, and 3.8% tested for chlamydia were concurrently tested for HIV during an ED visit. Concurrent HIV-syphilis testing was more likely among younger patients aged 25–34 years (adjusted odds ratio [AOR] = 0.36, 95% confidence interval [CI] 0.78, 2.10) and patients with STD-related chief complaints at triage (AOR=11.47, 95% CI 5.49, 25.06). Concurrent HIV-gonorrhea/chlamydia testing was more likely among men (gonorrhea: AOR=3.98, 95% CI 2.25, 7.02; chlamydia: AOR=3.25, 95% CI 1.80, 5.86) and less likely among patients with STD-related chief complaints at triage (gonorrhea: AOR=0.31, 95% CI 0.13, 0.82;

				chlamydia: AOR=0.21, 95% CI 0.09, 0.50).
Odom, JD et al., 2018¹³	USA	Screening rates and test positivity for chlamydia, gonorrhea, syphilis and trichomoniasis were determined per calendar year in this retrospective cohort study of women in care at an urban HIV clinic in Birmingham, Alabama, 2013–2015. Chlamydia, gonorrhea, and trichomonas infection were detected by molecular diagnostics and syphilis by serology.	745	Among 745 women with HIV, median age was 46.8 years, 78.8% were Black and 61% were sexually active. In 2015, 83.7% of women were tested for STI. Test positivity was 1.0% for chlamydia, 0.5% for gonorrhea, 1.6% for syphilis, and 13.3% for trichomoniasis. Independent predictors of STI-3 were recent chlamydia or gonorrhea (OR 3.7, 95% CI 1–13.4, p=0.047), public insurance compared to private (OR 3.5, CI 1–11.8, p=0.048) and sex after drugs/alcohol (OR 3.0, CI 1.2–8.0, p=0.025). Women age ≥50 were less likely to have STI (OR 0.3, CI 0.1–1, p=0.040).
Barbee, LA et al., 2016¹⁴	USA	We implemented an STI self-testing program at a large, urban HIV care clinic, and evaluated its effectiveness and acceptability. We compared measures obtained during the first year of the STI Self-testing Program (Intervention Year, April 1, 2013 – March 31, 2014) to Baseline Year (January 1, 2012 – December 31, 2012) to determine: 1) overall clinic change in STI testing coverage and diagnostic yield and; 2) program-specific outcomes including appropriate anatomic site screening, and patient-reported acceptability.	1510	Overall, testing for gonorrhea and chlamydia increased significantly between Baseline and Intervention year, and 50% more gonococcal and 47% more chlamydial infections were detected. Syphilis testing coverage remained unchanged. Nearly 95% of 350 men who participated in the STI Self-testing program completed site-specific testing appropriately based on self-reported exposures, and 92% rated their self-testing experience as “good” or “very good”.

DISCUSSION

HIV is primarily a sexually transmitted infection (STI). A single sexual encounter between an HIV-positive partner and an HIV-negative partner (a serodifferent/serodiscordant couple) has a low probability of HIV transmission. When transmission occurs, a single viral variant (the transmitted founder virus) is detected 80% of the time, and usually only a maximum of two or three viral variants are transmitted. The transmission of HIV is generally relatively inefficient, and predicted to require hundreds of exposures in the case of penile-vaginal intercourse and dozens of exposures for penile-rectal exposure.¹⁵

In addition, several factors could amplify HIV transmission. Among the most important amplifying factors are the “classical STIs,” loosely defined bacterial and viral infections that cause genital ulcers and genital mucosal inflammation. Classical STIs are among the most common acute conditions worldwide and have increased in recent years; the World Health Organization (WHO) estimates more than one million

incident curable STIs worldwide each day.¹⁵

Among patients attending HIV clinics, the prevalence of *Neisseria gonorrhoeae* (NG) and/or *Chlamydia trachomatis* (CT) is approximately 10%, and the majority of cases are asymptomatic. Detecting and treating NG and CT among persons living with HIV (PLWH) may decrease HIV transmission by prompting counseling to modify sexual behaviors and by reducing genital fluid inflammation and HIV RNA levels. In 2003, the Centers for Disease Control and Prevention (CDC) began recommending at-least-annual NG/CT screening for most PLWH.^{16–18}

Gonorrhoea is an STI caused by infection

with *N. gonorrhoeae* bacterium.

Typical symptoms include vaginal or penile discharge, dysuria, and bleeding between periods for women. If the infection ascends to the upper genital tract, it may cause pelvic inflammatory disease and epididymo-orchitis.^{19,20}

The Florida surveillance database allowed us to retrospectively identify over 328,000 women who

had an STI reported and calculate their risk of a subsequent diagnosis and report of HIV. After having an STI, the rate of being diagnosed with HIV infection was 95 per 100,000 person-years, 3.2 times the rate for other women in the same age range in Florida and 10 times the rate for women of all ages in the United States. Rates were high for older women, black women and women who were diagnosed as having syphilis or gonorrhoea. Black women aged 30–59 years who lived in high-risk areas and had syphilis were subsequently diagnosed as having HIV infection at a rate of 1625.3 per 100,000 person-years.²¹

In many settings, mostly in less-resourced areas (in which frequently the prevalence of gonorrhoea is the highest), the diagnosis, testing, case reporting and prevention of gonorrhoea remain suboptimal. Thus, it is important to widely implement the use of cost-effective, appropriate and quality-assured nucleic acid amplification tests (NAATs). If required, these NAATs can be performed in centralized reference laboratories for cost-effectiveness and to maintain a high level of quality

assurance. In addition, rapid, appropriate Point-of-care tests (POCTs) for the diagnosis of gonorrhoea and other STIs are urgently needed. Gonococcal POCTs should ideally simultaneously predict AMR to inform treatment.^{22,23}

Complications specific to males include epididymitis, prostatitis, and proctitis. Immune-mediated, systemic complications following gonorrhea infection can result in the triad of reactive arthritis, urethritis, and conjunctivitis. Gonorrheal infection can complicate obstetrical delivery by infecting newborns via eye contact with genital secretions during the puerperal period and can result in gonococcal conjunctivitis that can progress to blindness. Gonorrheal infection increases the risk of sexual transmission of HIV-AIDS.²⁴

Thus, it is important to remember the principles of routine STI testing in the era of HIV disease. The initial visit to establish care should include a syphilis serology, nucleic acid amplification tests (NAATs) for *C. trachomatis* and gonococcal infections at exposed sites, testing for trichomoniasis (via NAAT or antigen detection) and

cervical Papanicolaou testing for women, and testing for hepatitis A, B, and C virus infections. More-frequent testing should be performed based on risk behaviors, including for individuals with a new sex partner, a partner who has concurrent partners, more than 1 partner, or a partner who engages in behaviors that put them at high risk for STIs.²⁵

CONCLUSION

In conclusion, early detection of sexually transmitted diseases is very useful for starting treatment early which will affect the outcome and prognosis of a disease such as gonorrhea, especially in patients suffering from HIV.

REFERENCES

1. Zhao Y, Luo T, Tucker JD, Wong WCW. Risk factors of HIV and other sexually transmitted infections in China: A systematic review of reviews. *PLoS One*. 2015;10(10):1–15.
2. Ngetsu CJ, Heymann MW, Thiong'o A, Wahome E, Mwambi J, Karani C, et al. Rectal gonorrhoea and chlamydia among men who have sex with men in coastal Kenya. *Wellcome Open Res*. 2020;4:1–25.
3. Cunha CB, Friedman RK, De Boni RB, Gaydos C, Guimarães MRC, Siqueira BH, et al. Chlamydia trachomatis, Neisseria gonorrhoeae and syphilis among men who have sex with men in Brazil *Infectious Disease epidemiology*. *BMC Public Health* [Internet]. 2015;15(1):1–9. Available from: <http://dx.doi.org/10.1186/s12889-015-2002-0>
4. Chirenje ZM, Gundacker HM, Richardson B, Rabe L, Gaffoor Z, Nair GL, et al. Risk Factors for Incidence of Sexually Transmitted Infections among Women in a Human Immunodeficiency Virus Chemoprevention Trial: VOICE (MTN-003). *Sex Transm Dis*. 2017;44(3):135–40.
5. Garcia MR, Leslie SW, Wray AA. Sexually Transmitted Infections [Internet]. *StatPearls*. 2024. Available

- from:
<http://www.ncbi.nlm.nih.gov/pubmed/26475947>
6. Raifman JR, Gebo KA, Mathews WC, Korthuis PT, Ghanem KG, Aberg JA, et al. Gonorrhea and Chlamydia Case Detection Increased When Testing Increased in a Multisite US HIV Cohort, 2004–2014. *JAIDS J Acquir Immune Defic Syndr* [Internet]. 2017 Dec 1;76(4):409–16. Available from:
<https://journals.lww.com/0012-6334-201712010-00010>
 7. Ghassabi F, Malekzadegan Y, Ebrahim-Saraie HS, Heidari H, Sabet M, Bagheri A, et al. Gonorrhea and syphilis co-infection and related risk factors in HIV patients from Shiraz, South of Iran. *Casp J Intern Med*. 2018;9(4):397–402.
 8. Skinner JM, Distefano J, Warrington J, Bailey SR, Winscott M, Taylor MM. Trends in reported syphilis and gonorrhea among HIV-infected people in Arizona: implications for prevention and control. *Public Health Rep* [Internet]. 2014;129 Suppl(Suppl 1):85–94. Available from:
<http://www.ncbi.nlm.nih.gov/pubmed/24385654>
 9. Castro JG, Alcaide ML. High Rates of STIs in HIV-Infected Patients Attending an STI Clinic. *South Med J*. 2016;109(1):1–4.
 10. Lucar J, Hart R, Rayeed N, Terzian A, Weintrob A, Siegel M, et al. Sexually transmitted infections among HIV-infected individuals in the district of Columbia and estimated HIV transmission risk: Data from the DC Cohort. *Open Forum Infect Dis*. 2018;5(2):1–9.
 11. Yumori C, Zucker J, Theodore D, Chang M, Carnevale C, Slowikowski J, et al. Women Are Less Likely to Be Tested for HIV or Offered Preexposure Prophylaxis at the Time of Sexually Transmitted Infection Diagnosis. *Sex Transm Dis* [Internet]. 2021 Jan;48(1):32–6. Available from:

- <https://journals.lww.com/10.1097/OLQ.0000000000001265>
12. Klein PW, Martin IBK, Quinlivan EB, Gay CL, Leone PA. Missed opportunities for concurrent HIV-STD testing in an academic emergency department. Public Health Rep [Internet]. 2014;129 Suppl(Suppl 1):12–20. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24385644>
13. Dionne-Odom J, Westfall AO, Van Der Pol B, Fry K, Marrazzo J. Sexually Transmitted Infection Prevalence in Women With HIV: Is There a Role for Targeted Screening? Sex Transm Dis [Internet]. 2018 Nov;45(11):762–9. Available from: <https://journals.lww.com/00007435-201811000-00009>
14. Barbee LA, Tat S, Dhanireddy S, Marrazzo JM. Implementation and Operational Research. JAIDS J Acquir Immune Defic Syndr [Internet]. 2016 Jun 1;72(2):e26–31. Available from: <https://journals.lww.com/00126334-201606010-00010>
15. Cohen MS, Council OD, Chen JS. Sexually transmitted infections and HIV in the era of antiretroviral treatment and prevention: the biologic basis for epidemiologic synergy. J Int AIDS Soc. 2019;22(S6).
16. Berry SA, Ghanem KG, Mathews WC, Korthuis PT, Yehia BR, Agwu AL, et al. Brief Report. JAIDS J Acquir Immune Defic Syndr [Internet]. 2015 Nov 1;70(3):275–9. Available from: <https://journals.lww.com/00126334-201511010-00009>
17. Kenyon C, Herrmann B, Hughes G, de Vries HJC. Management of asymptomatic sexually transmitted infections in Europe: towards a differentiated, evidence-based approach. Lancet Reg Heal - Eur [Internet]. 2023;34:100743. Available from: <https://doi.org/10.1016/j.lanep e.2023.100743>

18. Chan PA, Robinette A, Montgomery M, Almonte A, Cu-Uvin S, Lonks JR, et al. Extragenital Infections Caused by Chlamydia trachomatis and Neisseria gonorrhoeae: A Review of the Literature. Infect Dis Obstet Gynecol [Internet]. 2016;2016:1–17. Available from: <http://www.hindawi.com/journals/ido/2016/5758387/>
19. Mitjà O, Suñer C, Giacani L, Vall-Mayans M, Tiplica GS, Ross JDC, et al. Treatment of bacterial sexually transmitted infections in Europe: gonorrhoea, Mycoplasma genitalium, and syphilis. Lancet Reg Heal - Eur [Internet]. 2023;34:100737. Available from: <https://doi.org/10.1016/j.lanep.2023.100737>
20. Van Ommen CE, Malleson S, Grennan T. A practical approach to the diagnosis and management of chlamydia and gonorrhea. C Can Med Assoc J. 2023;195(24):E844–9.
21. Peterman TA, Newman DR, Maddox L, Schmitt K, Shiver S. Risk for HIV following a diagnosis of syphilis, gonorrhoea or chlamydia: 328,456 women in Florida, 2000–2011. Int J STD AIDS [Internet]. 2015 Feb 8;26(2):113–9. Available from: <http://journals.sagepub.com/doi/10.1177/0956462414531243>
22. Unemo M, Seifert HS, Hook EW, Hawkes S, Ndowa F, Dillon JAR. Gonorrhoea. Nat Rev Dis Prim. 2019;5(1).
23. Caruso G, Giammanco A, Virruso R, Fasciana T. Current and future trends in the laboratory diagnosis of sexually transmitted infections. Int J Environ Res Public Health. 2021;18(3):1–17.
24. Springer C, Salen P. Gonorrhea [Internet]. StatPearls. 2024. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/27366021>
25. Dunne DW. Sexually transmitted infections in the context of HIV disease: Clinical implications. Top

Antivir Med. 2016;24(3):111–
4.