

Sexually Transmitted Infections: An Evidence-Based Online Course

Module 3:
Prevention of sexually transmitted infections

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June 2026

Abbreviations and acronyms

AMR	Antimicrobial resistance
AMP	Antibody-mediated prevention
HIV	Human immunodeficiency virus
HPV	Human Papillomavirus
HSV	Herpes simplex virus
MSM	Men who have sex with men
NG	Neisseria gonorrhoeae
PEP	Post-exposure prophylaxis
PID	Pelvic inflammatory disease
POC	Point-of-Care
PrEP	Pre-exposure prophylaxis
PTB	Preterm birth
RCT	Randomized Controlled Trial
RDTs	Rapid diagnostic tests
STI	Sexually transmitted infection
TFI	Tubal factor infertility

Module objectives

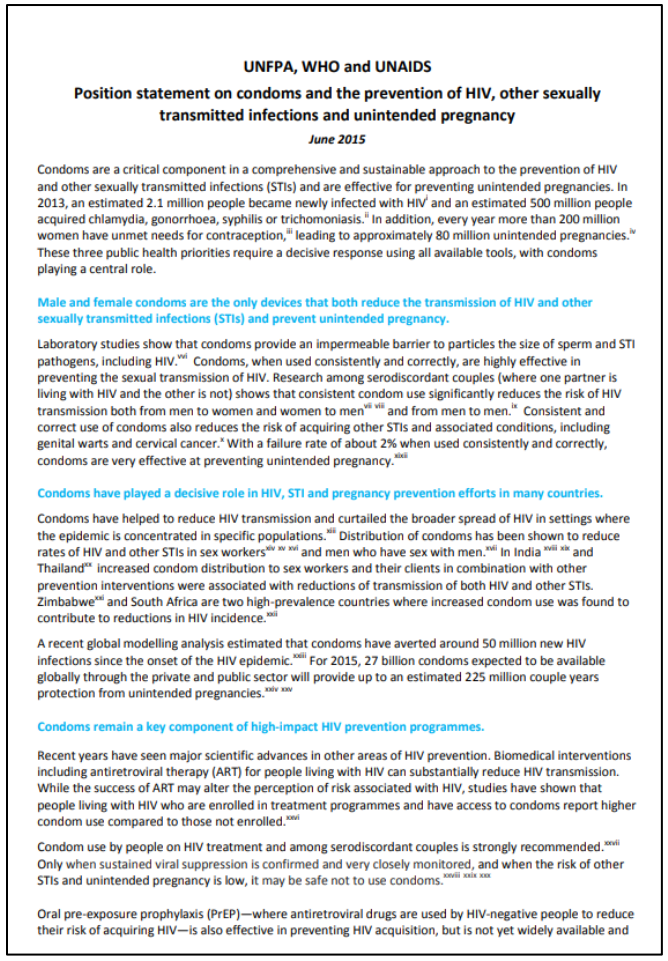
By the end of this module, the learner should be able to:

- List the main options for primary and secondary prevention of Sexually transmitted infections (STIs)
- Summarize the status of the STI vaccine field
- Describe the pros and cons of doxycycline PEP for STI prevention
- Describe the complexity of STI screening for prevention
- Understand the importance of choice in HIV (Human immunodeficiency virus) prevention options

Module outline

- **Primary prevention of STIs**
  - Condom
  - Vaccination
- **Secondary prevention of STIs**
  - Doxycycline PEP (post-exposure prophylaxis)
  - Screening for prevention
  - Partner services
- **Medication-based HIV prevention**

Primary prevention of sexually transmitted infections



UNFPA, WHO and UNAIDS

Position statement on condoms and the prevention of HIV, other sexually transmitted infections and unintended pregnancy

June 2015

Condoms are a critical component in a comprehensive and sustainable approach to the prevention of HIV and other sexually transmitted infections (STIs) and are effective for preventing unintended pregnancies. In 2013, an estimated 2.1 million people became newly infected with HIV[i] and an estimated 500 million people acquired chlamydia, gonorrhoea, syphilis or trichomoniasis.[ii] In addition, every year more than 200 million women have unmet needs for contraception,[iii] leading to approximately 80 million unintended pregnancies.[iv] These three public health priorities require a decisive response using all available tools, with condoms playing a central role.

Male and female condoms are the only devices that both reduce the transmission of HIV and other sexually transmitted infections (STIs) and prevent unintended pregnancy.

Laboratory studies show that condoms provide an impermeable barrier to particles the size of sperm and STI pathogens, including HIV.[vi] Condoms, when used consistently and correctly, are highly effective in preventing the sexual transmission of HIV. Research among serodiscordant couples (where one partner is living with HIV and the other is not) shows that consistent condom use significantly reduces the risk of HIV transmission both from men to women and women to men[vii viii] and from men to men.[ix] Consistent and correct use of condoms also reduces the risk of acquiring other STIs and associated conditions, including genital warts and cervical cancer.[x] With a failure rate of about 2% when used consistently and correctly, condoms are very effective at preventing unintended pregnancy.[xxi]

Condoms have played a decisive role in HIV, STI and pregnancy prevention efforts in many countries.

Condoms have helped to reduce HIV transmission and curtailed the broader spread of HIV in settings where the epidemic is concentrated in specific populations.[xii] Distribution of condoms has been shown to reduce rates of HIV and other STIs in sex workers[xiv xv xvi] and men who have sex with men.[xvii] In India [xviii xix] and Thailand[xx] increased condom distribution to sex workers and their clients in combination with other prevention interventions were associated with reductions of transmission of both HIV and other STIs. Zimbabwe[xxi] and South Africa are two high-prevalence countries where increased condom use was found to contribute to reductions in HIV incidence.[xxii]

A recent global modelling analysis estimated that condoms have averted around 50 million new HIV infections since the onset of the HIV epidemic.[xxiii] For 2015, 27 billion condoms expected to be available globally through the private and public sector will provide up to an estimated 225 million couple years protection from unintended pregnancies.[xxiv xxv]

Condoms remain a key component of high-impact HIV prevention programmes.

Recent years have seen major scientific advances in other areas of HIV prevention. Biomedical interventions including antiretroviral therapy (ART) for people living with HIV can substantially reduce HIV transmission. While the success of ART may alter the perception of risk associated with HIV, studies have shown that people living with HIV who are enrolled in treatment programmes and have access to condoms report higher condom use compared to those not enrolled.[xxvi]

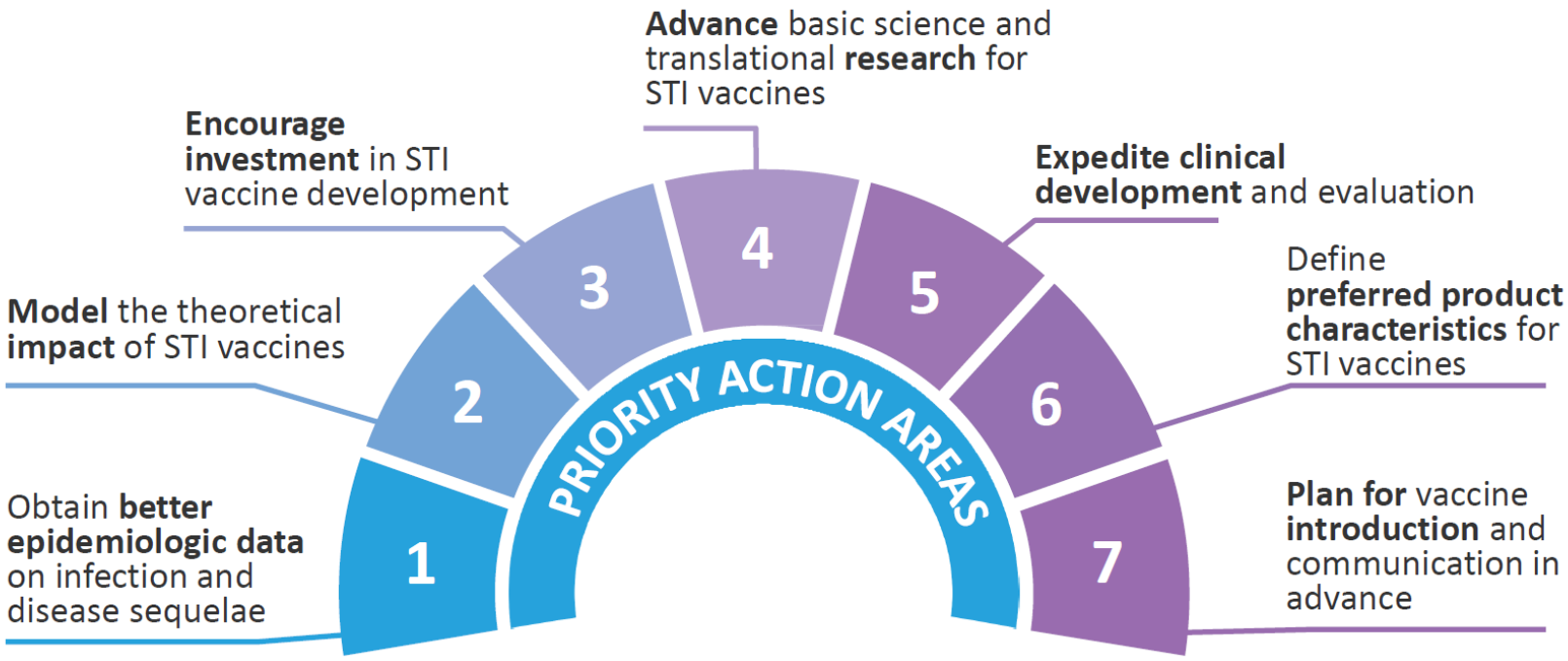
Condom use by people on HIV treatment and among serodiscordant couples is strongly recommended.[xxvii] Only when sustained viral suppression is confirmed and very closely monitored, and when the risk of other STIs and unintended pregnancy is low, it may be safe not to use condoms.[xxviii xxix xxx]

Oral pre-exposure prophylaxis (PrEP)—where antiretroviral drugs are used by HIV-negative people to reduce their risk of acquiring HIV—is also effective in preventing HIV acquisition, but is not yet widely available and

- **When used correctly and consistently, condoms are**
  - Very effective for STIs transmitted via genital fluids
  - Partial protective for infections spread by skin-to-skin contact (risk reduction)
- **Condom innovations to “revive” the field**
  - Improved comfort and sensation; ‘smart condoms’; etc.

Advancing STI vaccine development for global use

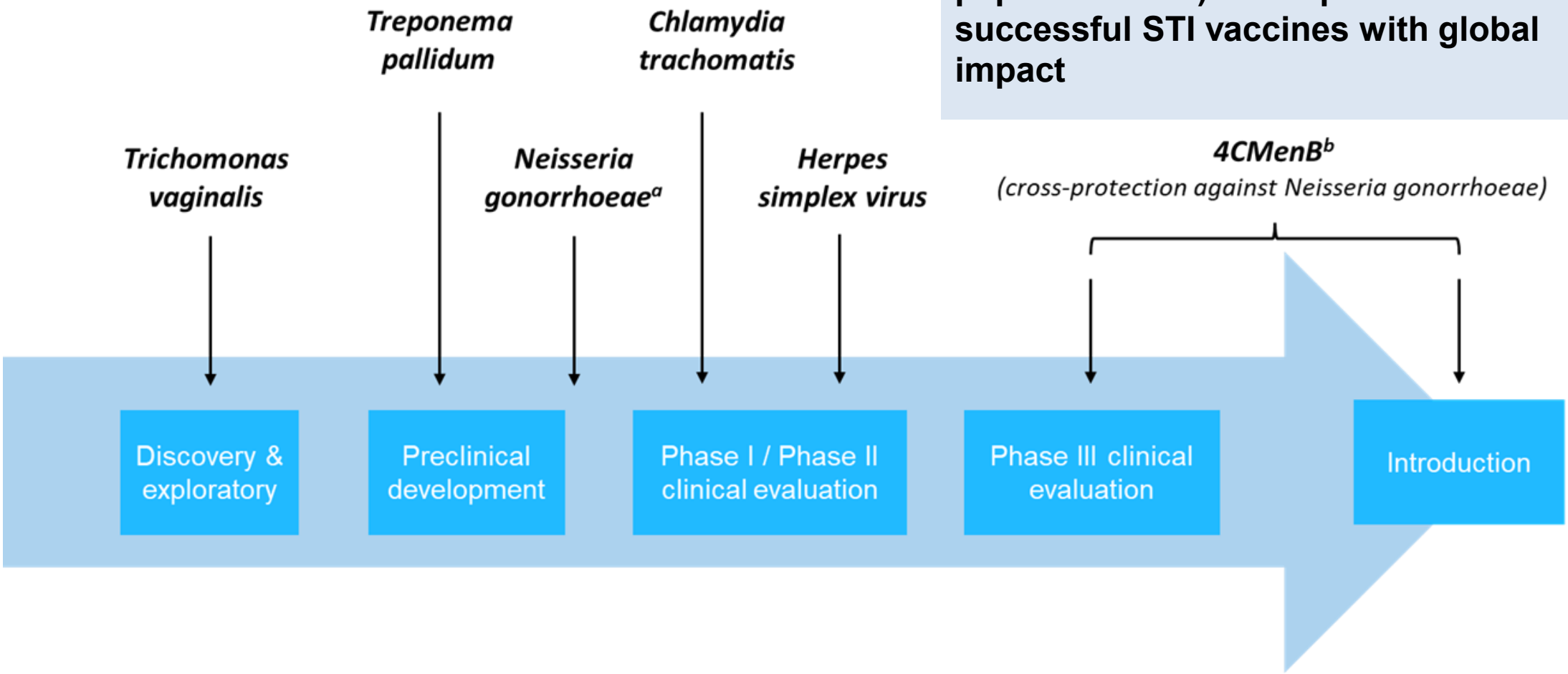
Global roadmap to advance STI vaccine development



Gottlieb SL et al. Vaccine 2016

STI vaccine landscape

Proof-of-principle: HPV (human papillomavirus) and mpox as successful STI vaccines with global impact



Peters RPH et al. J Int AIDS Soc 2026

Treponema pallidum vaccine (preclinical phase)

Use Case

Public health goals
- Prevent congenital syphilis and adverse birth outcomes
- Interrupt sexual transmission in high-incidence populations
- Decrease morbidity and complications from late-stage syphilis

Target populations
- High risk sexually active adolescents and adults
- Pregnant women if maternal vaccine developed

Limitations of current interventions
- Penicillin shortages affecting treatment access globally
- Lack of treatment options in pregnancy

Other Impact
- Relieve pressure on health systems including ANC
- Reduce HIV co-infection

Status

- Preferred product characteristics not yet defined
- Vaccine development has not progressed beyond the preclinical phase
- *Treponema pallidum* biology necessitates multiple antigen targets and affects stability of membrane proteins
- Limited funding

Chlamydia trachomatis vaccine (phase I/II)

Use Case

Public health goals
- Prevent infection and reinfection
- Interrupt sexual transmission
- Prevent reproductive sequelae (e.g., PID, infertility)

Target populations
- Adolescents and young adults, ideally before sexual debut

Limitations of current interventions
- Most infections are asymptomatic and remain untreated
- Current screening tests not affordable for use at scale

Other Impact
- Reduce antibiotic use and resistance pressure
- Decrease risk of HIV acquisition and transmission

Status

- Preferred product characteristics not yet defined
- Limited long-term immunity following natural infection and lack of clear clinical endpoints are important challenges
- **CTH522/CAF01** (Statens Serum Institut) showed safety and immunogenicity in phase I trial (NCT02787109; NCT03926728)
- *Chlamydia trachomatis* **mRNA vaccine** (Sanofi) has entered phase I/II trials with results expected in 2028 (NCT06891417)

Herpes simplex virus (phase I)

Use Case

Public health goals
- Prevent primary and recurrent genital herpes
- Prevent neonatal herpes
- Reduce transmission

Target populations
- Adolescents pre-sexual debut (prophylactic)
- Symptomatic GUD (therapeutic)

Limitations of current interventions
- Limited access to antiviral drugs in LMICs
- Condoms do not provide complete protection

Other Impact
- Decrease risk of HIV acquisition and transmission
- Reduce stigma and mental health burden
- Reduced clinic visits burden and costs

Status

Name	Platform & Antigen	Development Phase	Findings & Next Steps	Therapeutic/ prophylactic
BioNTech BNT163	Trivalent mRNA encoding HSV-2 glycoproteins	Phase 1	Awaiting safety and immunogenicity results 2026	Prophylactic and therapeutic
mRNA-1608 (Moderna)	Trivalent mRNA encoding HSV-2 glycoproteins	Phase 1/2	Strong preclinical response; results expected 2025.	Therapeutic

- Prophylactic (primary prevention) and therapeutic vaccines (prevent recurrences of latent infection) have different health goals
- Several vaccine candidates discontinued after phase II or III
- Two candidate vaccines currently in clinical development: **BNT163** (BioNTech; NCT05432583) and **mRNA-1608** (Moderna; NCT06033261)

Vaccines against *Neisseria gonorrhoea*

Use Case

Public health goals
- Prevent infection, reinfection and disease
- Interrupt sexual transmission
- Reduce antimicrobial resistance

Target Population
- Adolescents and young adults (pre-sexual debut)
- High-risk groups: MSM, sex workers, PLHIV

Limitations of current interventions
- Asymptomatic infections remain untreated
- Recurrent infections are common
- No natural immunity
- Current screening tests not affordable at scale

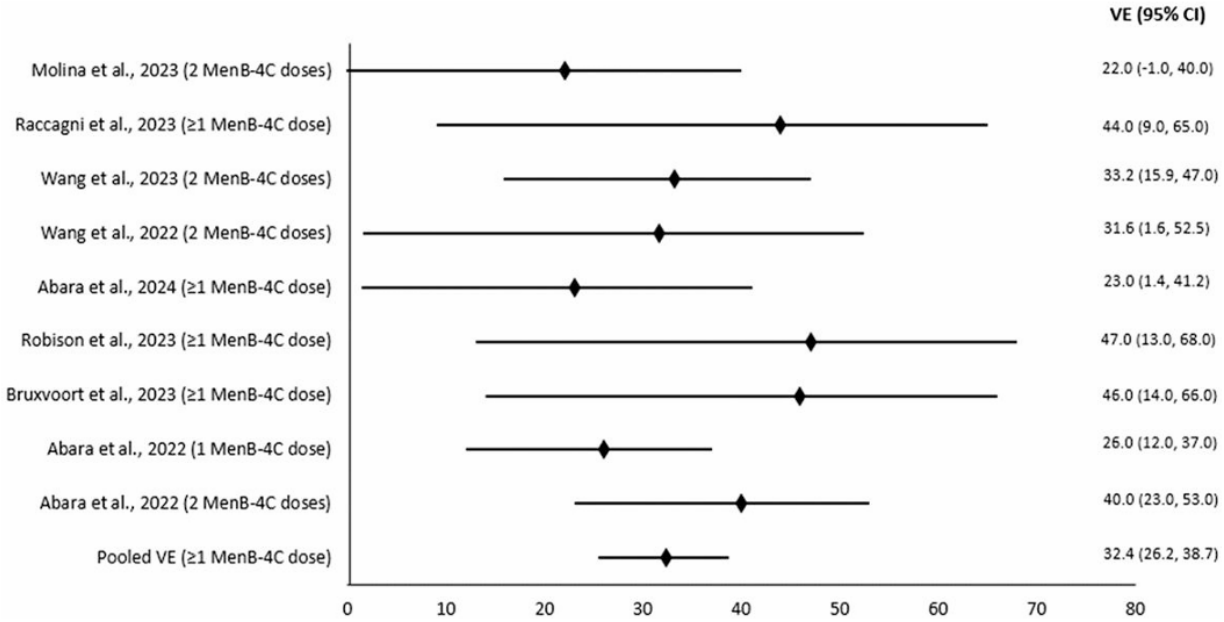
Other Impact:
- Direct and indirect healthcare costs due to treatment failures and complications
- Could be used as combined vaccine for meningitis

Status

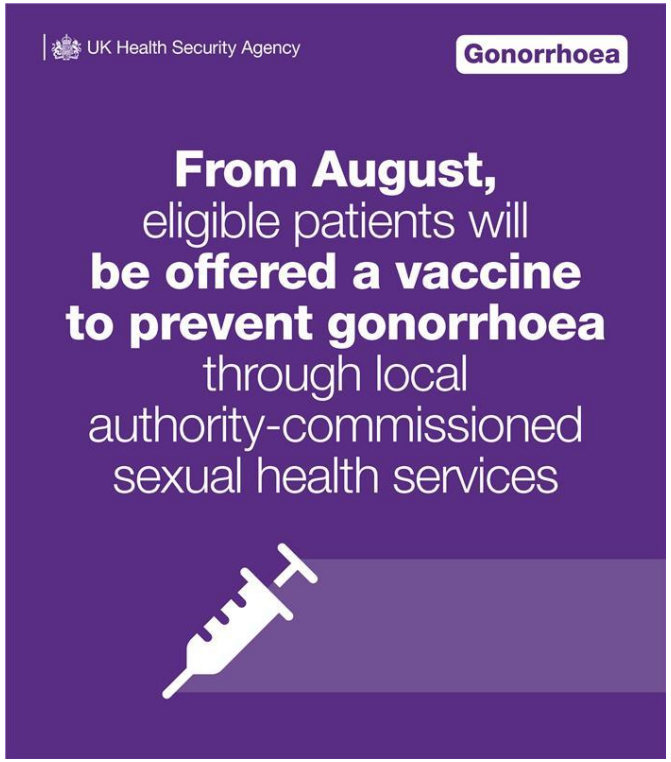
- GSK conducted phase I/II trial of a *Neisseria gonorrhoeae* GMMA investigational vaccine (**NgG**; NCT05630859); results and next steps awaited
- Currently, no other gonorrhoea-specific vaccine candidates in clinical phase of development

Does 4CMenB vaccine protect against *Neisseria gonorrhoeae*?

Observational studies suggest moderate protection



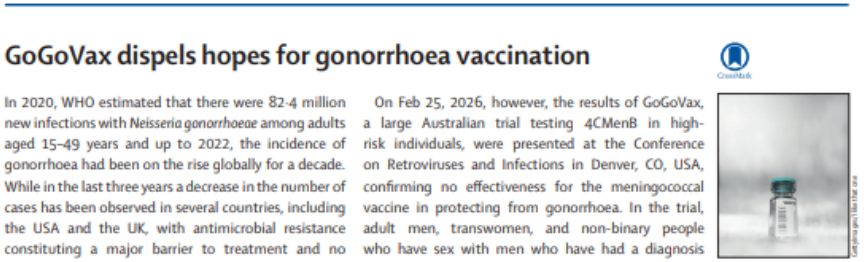
Vaccine effectiveness: 32% (95% CI: 26%-39%)



Programme implementation (2025)

Abara WE et al. J Infect Dis 2025

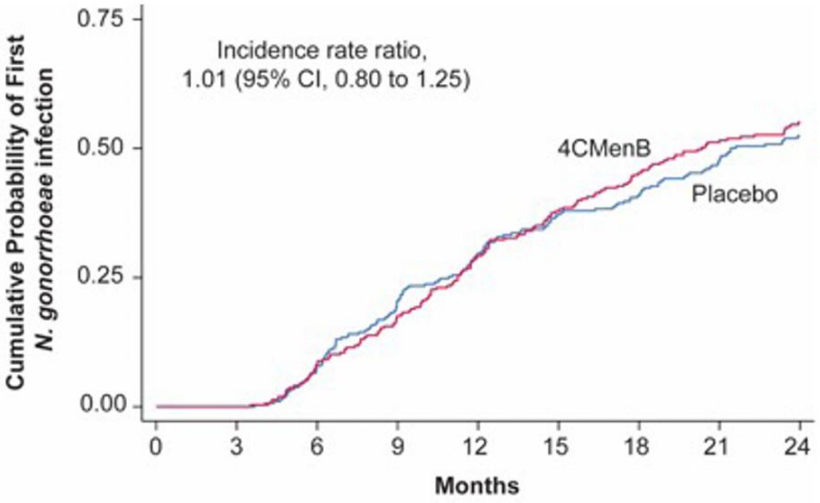
Does 4CMenB vaccine protect against *Neisseria gonorrhoeae*?



GoGoVax dispels hopes for gonorrhoea vaccination

In 2020, WHO estimated that there were 82·4 million new infections with *Neisseria gonorrhoeae* among adults aged 15–49 years and up to 2022, the incidence of gonorrhoea had been on the rise globally for a decade. While in the last three years a decrease in the number of cases has been observed in several countries, including the USA and the UK, with antimicrobial resistance constituting a major barrier to treatment and no

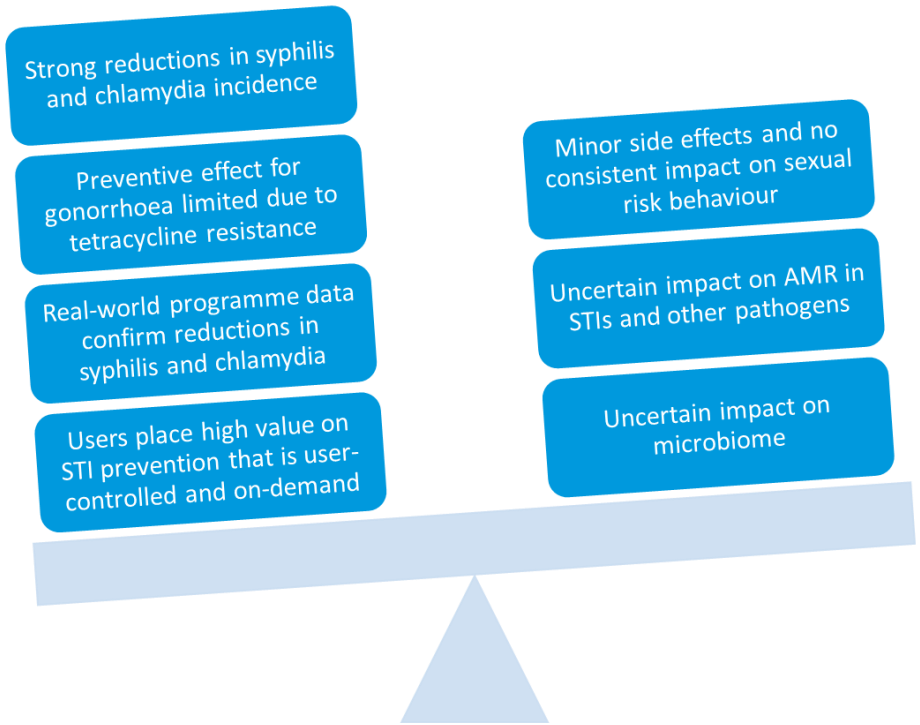
On Feb 25, 2026, however, the results of GoGoVax, a large Australian trial testing 4CMenB in high-risk individuals, were presented at the Conference on Retroviruses and Infections in Denver, CO, USA, confirming no effectiveness for the meningococcal vaccine in protecting from gonorrhoea. In the trial, adult men, transwomen, and non-binary people who have sex with men who have had a diagnosis



- **GoGoVax trial: no evidence of protection against gonorrhoea among MSM and trans women**
  - Incidence Rate Ratio = 1.01
  - Results aligned with DOXYVAC and MenGO trials
- **Potential explanations**
  - Confounders in observational studies
  - High rates of prior infection
  - Mucosal immunity required
- **BIYELA, MAGI and Hong Kong trials ongoing**
  - Different effect in women and lower-risk men?

Seib KL et al. CROI 2026

Doxycycline prophylaxis for STI prevention



Doxycycline PEP: Doxycycline taken within 24 hours (max 72 hours) after condomless sex

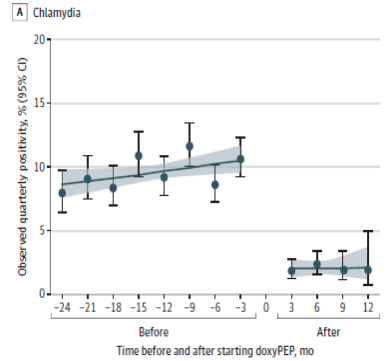
Doxycycline PEP may be offered to men who have sex with men and transgender women for the prevention of bacterial STIs

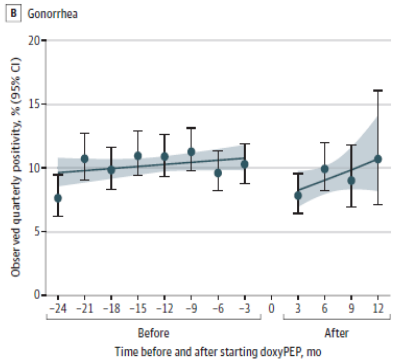
(Conditional recommendation; moderate certainty of evidence)

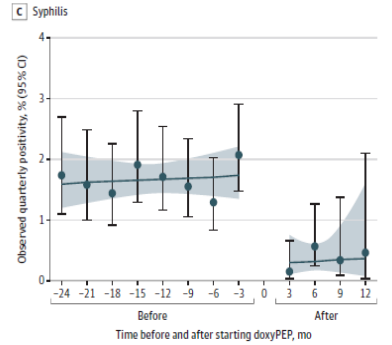
Remarks

- Doxycycline PEP should be provided as part of a **comprehensive sexual health approach**, complementing other prevention strategies such as condom use
- Men who have sex with men and transgender women with **recent or recurrent STI – especially syphilis – and those in high-incidence sexual networks or settings should be prioritized**
- **Context-appropriate monitoring of AMR** (antimicrobial resistance) is strongly encouraged as part of doxycycline PEP policy. Ideally, trends in both AMR and antibiotic use should be monitored

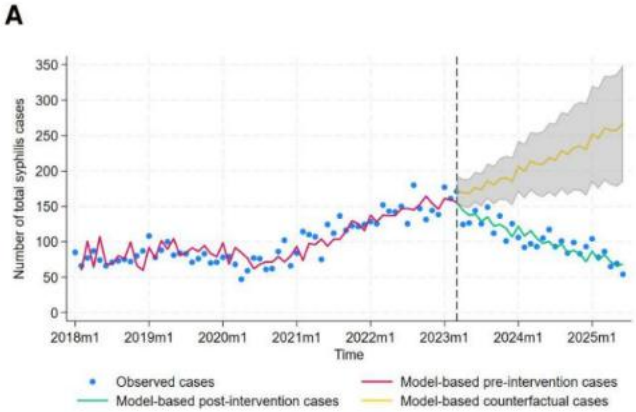
Does doxycycline PEP work?

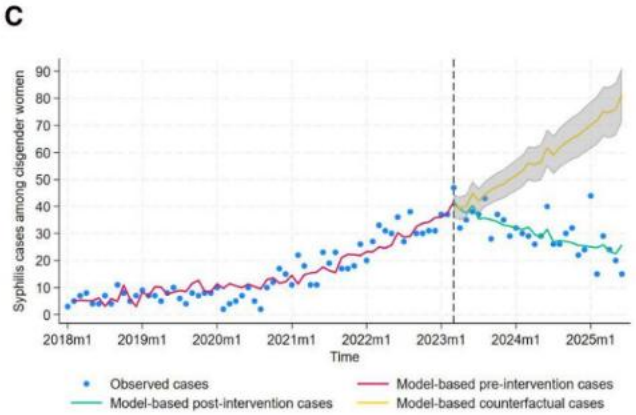






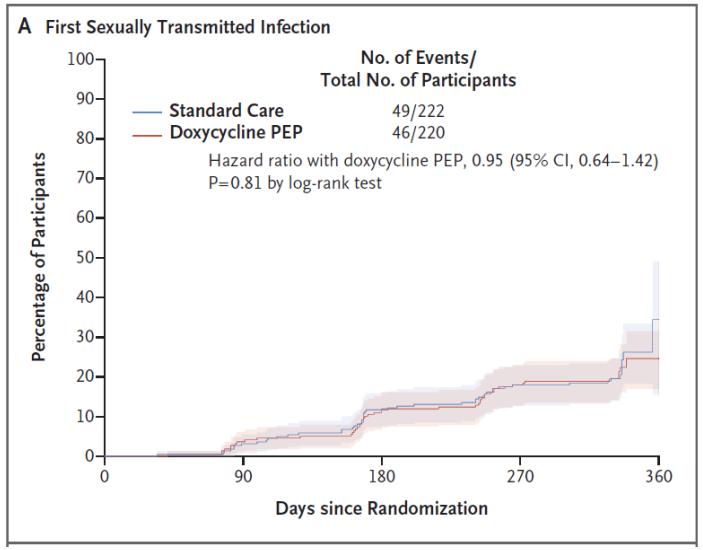
- **Real-world data broadly consistent with trial efficacy among MSM (men who have sex with men) and transgender women**
- **Preventive effect against gonorrhoea limited**
  - Selective effect combined with high prevalence of tetracycline resistance globally
- **Early signals of possible indirect effects on syphilis in cisgender women and men who have sex with women (evidence remains limited)**
- **Evolving field**
  - Implementation models
  - Impact on STI screening strategies
  - PrEP – PEP continuum



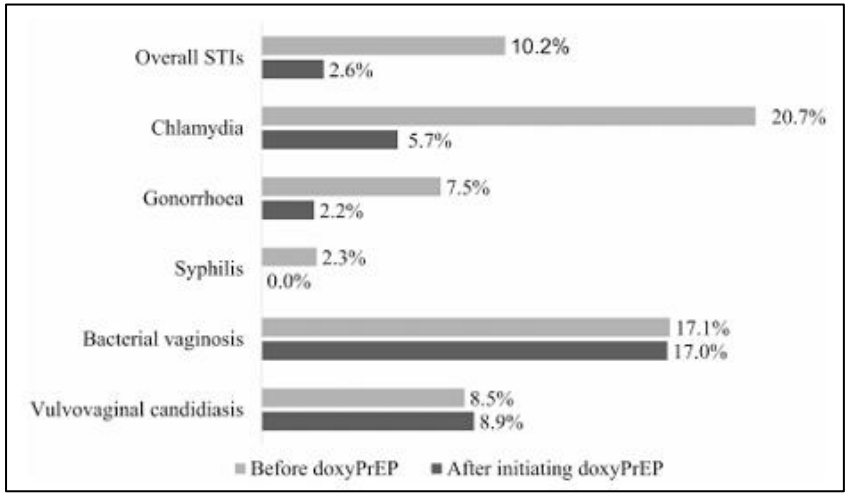


Traeger M et al. JAMA Intern Med 2025
Menza TW et al. Clin Infect Dis 2026

Insufficient evidence for doxycycline PEP in cisgender women



- Doxycycline PEP did not prevent STIs among Kenyan women
- Likely driven by low adherence and/or biological differences



- Doxycycline PEP reduced STI rates in Japanese female sex workers in a small, non-randomised before-after study (n=40)

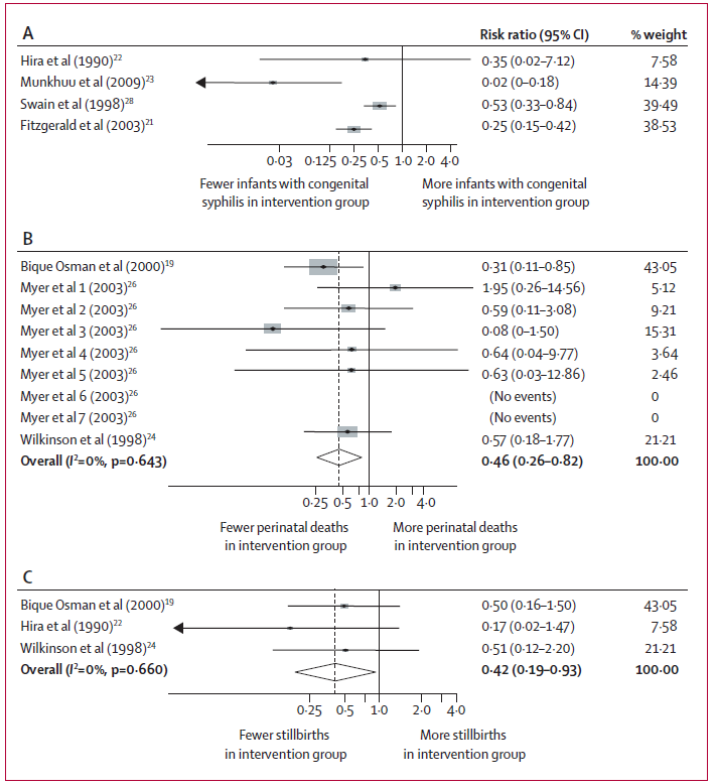
Further trials are ongoing

- Doxycycline PEP with intensified adherence support
- Weekly doxycycline

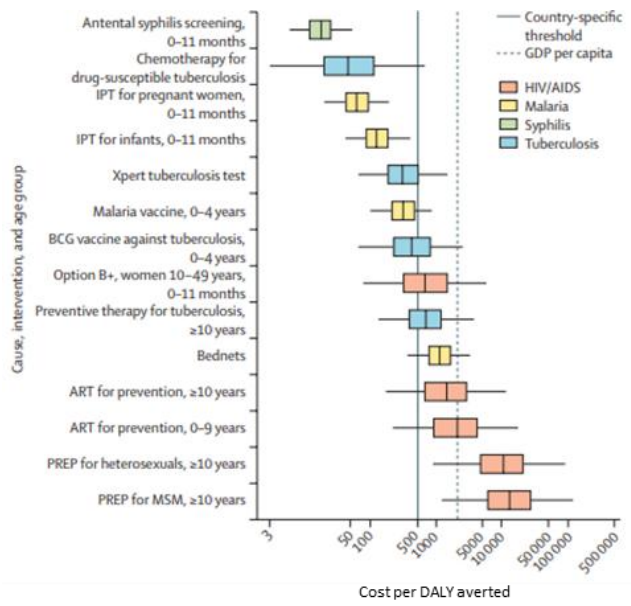
Stewart J et al. N Engl J Med 2023
Abe S et al. JAC Antimicrob Resist 2025

STI screening as prevention

Does syphilis screening in pregnancy prevent morbidity?



Screening prevents congenital syphilis, perinatal death and still birth



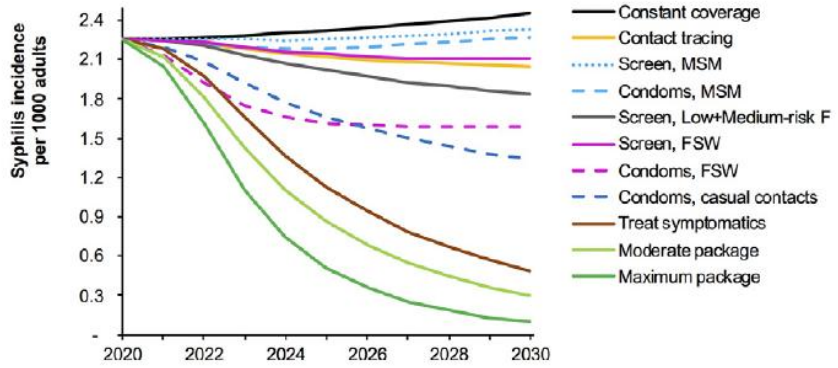
Syphilis screening in pregnancy is among the most cost-effective interventions

- Accelerated through introduction of syphilis RDTs (rapid diagnostic tests)
- Limited impact of screening pregnant women on adult population incidence of syphilis
- Innovation in syphilis rapid diagnostic tests ongoing

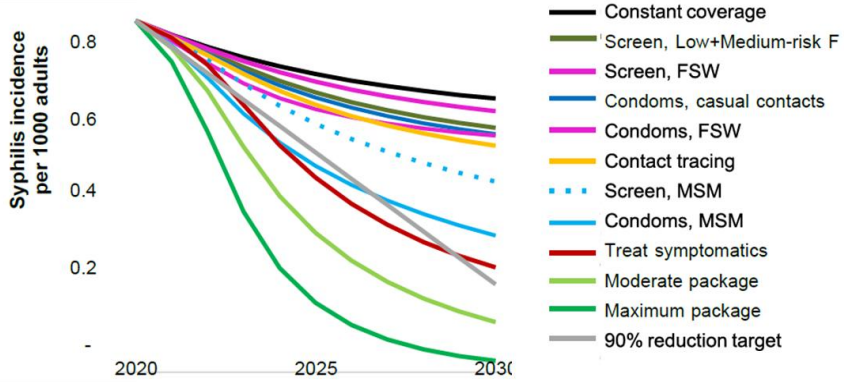
Hawkes S et al. Lancet 2011
Silke F et al. Lancet Global Health 2024
Peters RPH et al. Sex Transm Dis 2026

Syphilis screening as part of comprehensive prevention package

Papua New Guinea



Peru



- **SITE model projections of syphilis incidence**
  - Efficacy and focus of prevention and screening efforts differs between epidemics archetypes
  - Impact of condom programmes highlighted

- **Consistent high efficacy of treatment of individuals with symptomatic syphilis**
  - Treating early-stage infections reduced incidence by **52% in Peru** and **84% in Papua New** Guinea by 2030 in this model

Impact of screening depends on coverage, frequency, linkage to treatment and epidemic context

Machekera S, Infect Dis Model 2021
WHO PAHO, 2021

STI screening as prevention

Chlamydia and gonorrhoea screening: who and why to screen, and how often?

Adolescent girls and young women

PID and tubal-factor infertility (TFI)

- RCT (Randomized Controlled Trial) data: modest reduction in PID largely among women with prevalent infection
- NECCST (observational): PID risk associated with symptomatic but not asymptomatic chlamydia
- Observational studies suggest TFI risk ↑ associated with chlamydia
- Limited impact on population burden of infection
- No data from high-incidence settings → Gates-funded trials

Pregnant women

Adverse pregnancy outcomes

- Pooled analysis of observational studies: 2-3x risk ↑
- WANTAIM trial: no effect on composite outcome but effect in NG-infected sub-group
- Philani Ndiphile trial: no effect on composite outcome but effect on PTB (preterm birth) in two-time screening group
- Limited impact on population burden of infection
- PROMISE trial to provide required evidence on this approach

Men who have sex with men

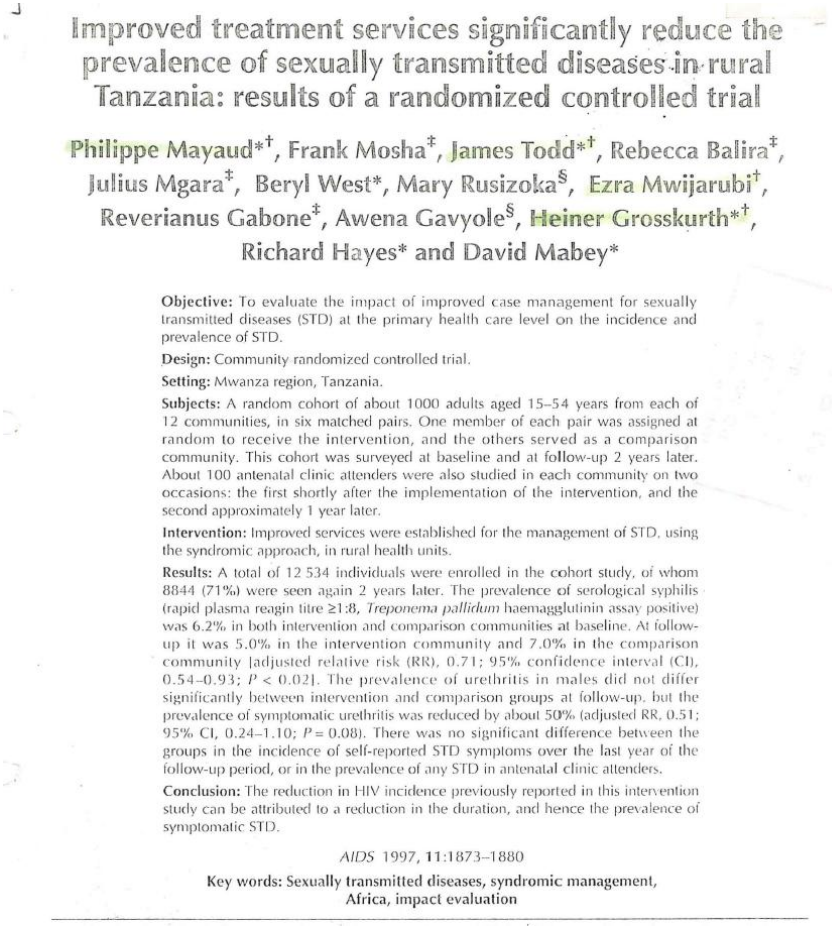
New (symptomatic) infections

- Limited direct clinical benefit for the individual but potential public health benefit through reduced transmission
- Limited direct evidence of population-level impact
- Impact on antimicrobial resistance of repeat screening and treatment

Impact on HIV transmission and acquisition?

- NECCST (Netherlands Chlamydia Cohort Study)
- WANTAIM trial (Women and Newborn Trial of Antenatal Interventions and Management)

STI treatment as prevention



Improved treatment services significantly reduce the prevalence of sexually transmitted diseases in rural Tanzania: results of a randomized controlled trial

Philippe Mayaud*†, Frank Mosha‡, James Todd*†, Rebecca Balira‡, Julius Mgara‡, Beryl West*, Mary Rusizoka§, Ezra Mwijarubi†, Reverianus Gabone‡, Awena Gavyole§, Heiner Grosskurth*†, Richard Hayes* and David Mabey*

Objective: To evaluate the impact of improved case management for sexually transmitted diseases (STD) at the primary health care level on the incidence and prevalence of STD.

Design: Community randomized controlled trial.

Setting: Mwanza region, Tanzania.

Subjects: A random cohort of about 1000 adults aged 15–54 years from each of 12 communities, in six matched pairs. One member of each pair was assigned at random to receive the intervention, and the others served as a comparison community. This cohort was surveyed at baseline and at follow-up 2 years later. About 100 antenatal clinic attenders were also studied in each community on two occasions: the first shortly after the implementation of the intervention, and the second approximately 1 year later.

Intervention: Improved services were established for the management of STD, using the syndromic approach, in rural health units.

Results: A total of 12 534 individuals were enrolled in the cohort study, of whom 8844 (71%) were seen again 2 years later. The prevalence of serological syphilis (rapid plasma reagin titre ≥1:8, *Treponema pallidum* haemagglutinin assay positive) was 6.2% in both intervention and comparison communities at baseline. At follow-up it was 5.0% in the intervention community and 7.0% in the comparison community [adjusted relative risk (RR), 0.71; 95% confidence interval (CI), 0.54–0.93; $P < 0.02$]. The prevalence of urethritis in males did not differ significantly between intervention and comparison groups at follow-up, but the prevalence of symptomatic urethritis was reduced by about 50% (adjusted RR, 0.51; 95% CI, 0.24–1.10; $P = 0.08$). There was no significant difference between the groups in the incidence of self-reported STD symptoms over the last year of the follow-up period, or in the prevalence of any STD in antenatal clinic attenders.

Conclusion: The reduction in HIV incidence previously reported in this intervention study can be attributed to a reduction in the duration, and hence the prevalence of symptomatic STD.

AIDS 1997, **11**:1873–1880

Key words: Sexually transmitted diseases, syndromic management, Africa, impact evaluation

- Well-documented for HIV (U=U) and HSV(Herpes simplex virus) suppressive therapy --> focus on service delivery models for maximal impact
- RCT evidence that strengthening STI case management can reduce STI burden
- Important innovations in optimizing STI case management may reduce STI transmission
  - Low-cost POC (Point-of-Care) STI tests
  - Differentiated service delivery models
  - AI tools for diagnostic and risk stratification

- U=U (undetectable=untransmissible)

RPH Peters et al. Lancet 2025

How about sexual partners?

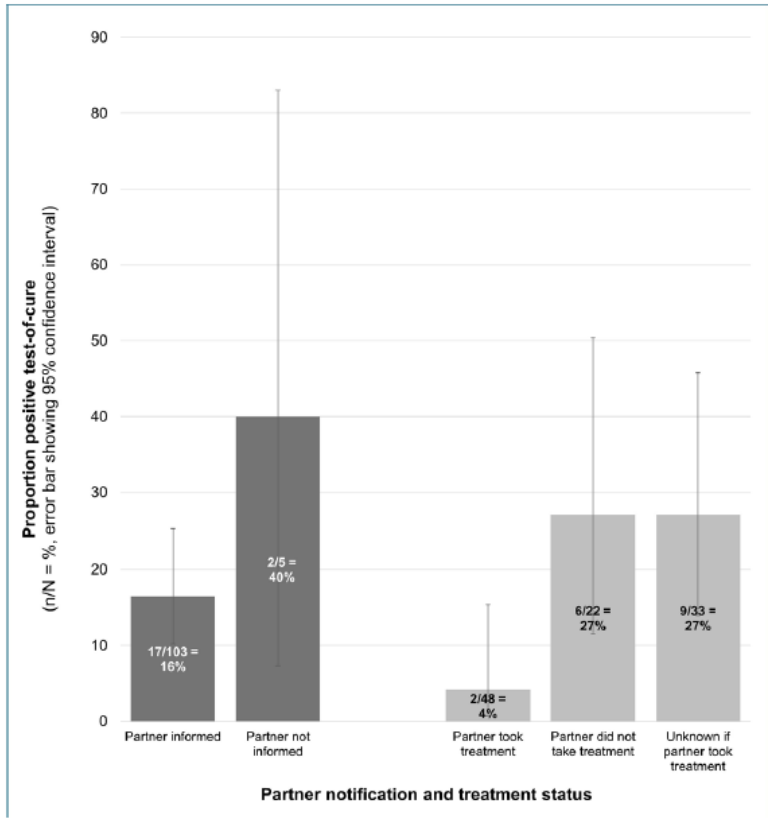


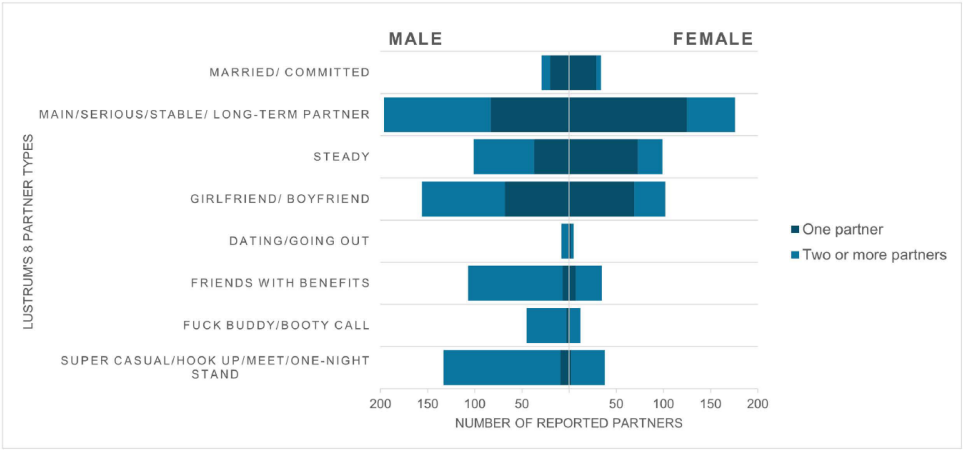
Figure 1 Overview of reported partner treatment versus participant's sexually transmitted infection outcome status.

Partner services are recommended

- Strongest evidence for reducing reinfection at individual level
- Limited evidence on population incidence
- Impact related to infection stage in syphilis

However, not all partners are the same..

- Effectiveness varies by partnership type and network structure
- Given resource limitations: how to optimize strategies for impact?



De Vos L et al. PLoS One 2025
Mdingi MM et al. Sex Transm Infect 2026

How about sexual partners?

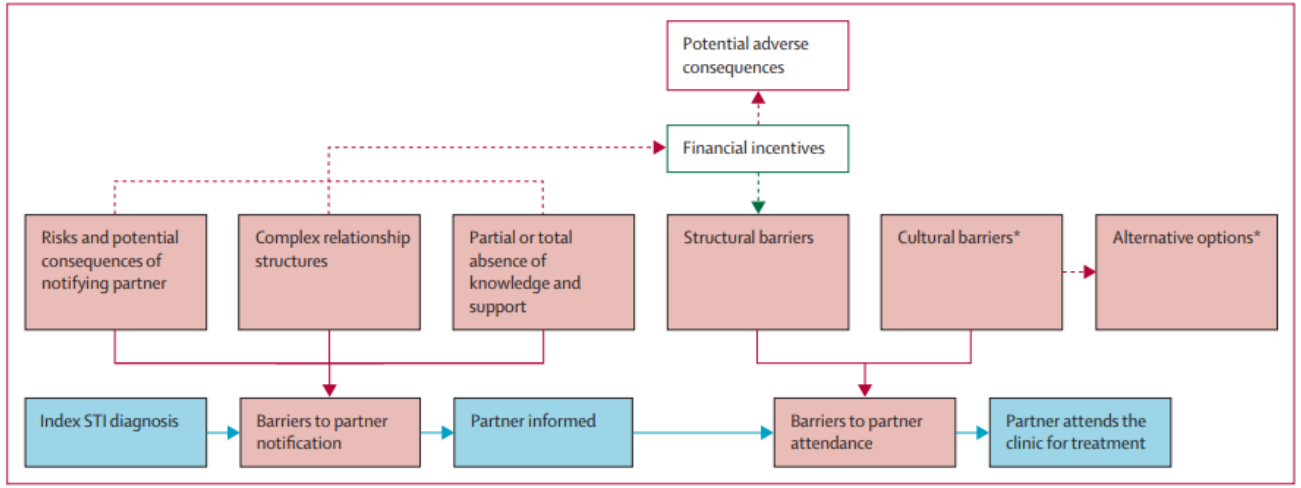


Table 3 STI testing preferences of the 'average' individual

Variables	OR (95% CI)	P value
How STI samples should be taken		
No sampling	1	
HCP	0.99 (0.90 to 1.09)	0.845
Self-sampling	1.47 (1.27 to 1.71)	<0.001
How and when results are given		
Same day after 2 hours	1	
Same day after 4 hours	0.82 (0.73 to 0.92)	0.000
1–7 days' time via SMS/online	1.05 (0.95 to 1.16)	0.301
How and when treatment is given		
Same day in clinic	1	
Clinic follow-up on appointment	0.91 (0.81 to 1.01)	0.077
Pharmacy near patient	1.06 (0.99 to 1.13)	0.110
How partners are notified of an STI		
Expedited partner treatment	1	
Contact slip from index patient	0.93 (0.87 to 0.99)	0.028
HCP-initiated notification	0.83 (0.77 to 0.89)	0.000

HCP, healthcare professional; SMS, short messaging service.

- Multitude of barriers and challenges along the partner services system
- Financial incentives do not seem to overcome barriers

- Expedited partner therapy as important but underutilized opportunity

Martin K et al. Lancet Glob Health 2025
Iwuji C et al. Sex Transm Infect 2024

HIV prevention: the importance of choice

Daily oral PrEP

- High efficacy of daily oral TDF-based PrEP (pre-exposure prophylaxis)
- Flexible dosing regimens for MSM and transgender women (incl. event-driven PrEP)
- Adherence is key to effectiveness and limits real-world public health impact
- **Innovation:** differentiated service delivery models focusing on preference and choice

Long-acting PrEP

- Lenacapavir subcutaneous (6 months) and cabotegravir IM (2 months) injection
- Superior to daily oral PrEP and background HIV incidence
- WHO recommends CAB-LA and lenacapavir as part of HIV prevention toolkit
- **Innovations:** longer-acting formulations (e.g. yearly); differentiated service delivery models

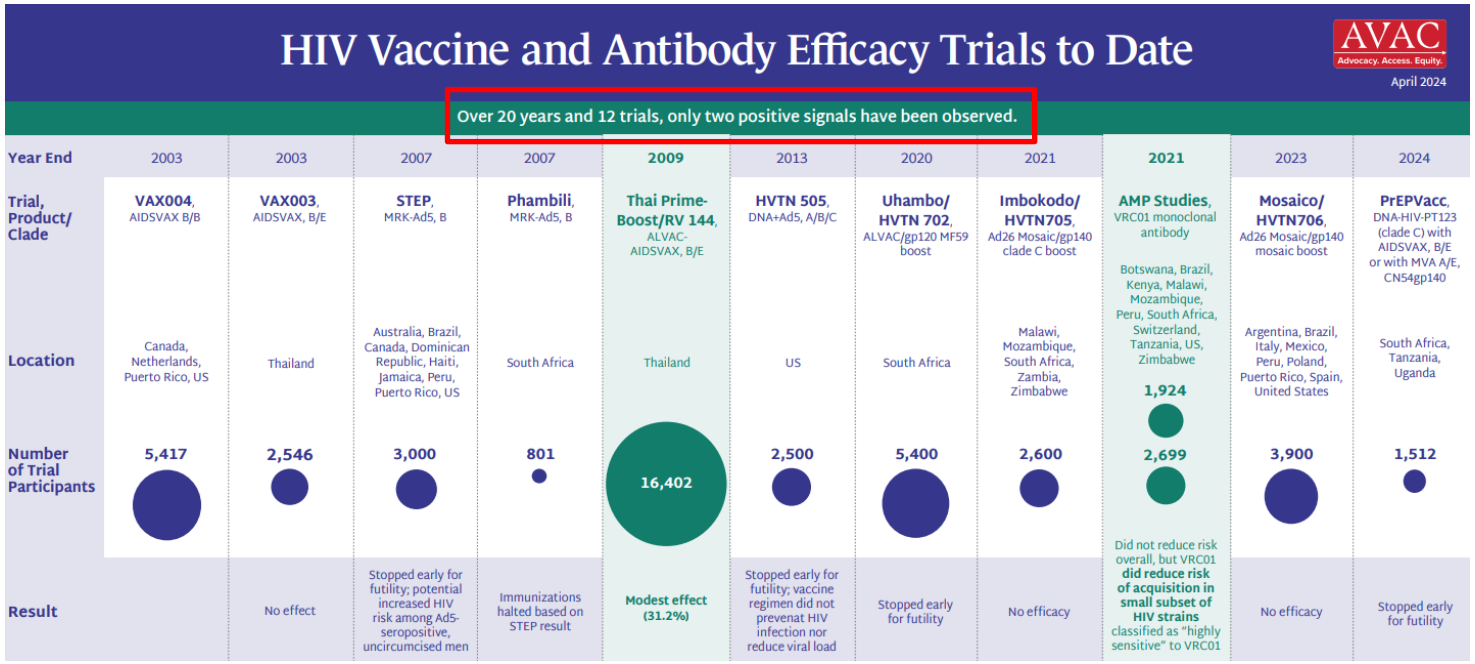
Other options

- Dapivirine vaginal ring: efficacy lower than daily oral and long-acting PrEP but may be preferable to certain women (female-controlled)
- **Innovation:** once-monthly oral tablet (MK-8527): EXPrESSIVE 10/11 trials start this year
- **Innovation:** multi-purpose prevention options (HIV, STI and pregnancy prevention)

- TDF (Tenofovir Disoproxil Fumarate)
- CAB-LA (long-acting cabotegravir)

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HIV vaccine: elusive but new technology emerging



- AMP –(Antibody-mediated prevention)
- bNABs (Broadly neutralizing antibodies)
- mRNA (messenger RNA)

- Lessons learnt from 7 people cured of HIV to date through stem cell transplantation (not scalable)
- 12 trials but no effective vaccine yet
- AMP trials suggest promise of bNABs (proof-of-principle)
- New approaches using mRNA and bNABs technology
- Novel approaches to rapid initial evaluation of candidate vaccines

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Key messages

- **Primary prevention of STIs**
  - Condoms work well if used consistently but do not fully protect against some STIs
  - STI vaccine pipeline is limited, and vaccine use cases differ
  - Impact of 4CMenC vaccine for gonorrhoea prevention is uncertain
- **Secondary prevention of STIs**
  - Doxycycline PEP is very effective for STI prevention among MSM and transgender women
  - Screening for prevention has limited individual- and population-level benefits
  - Partner services are crucial to reduce STI burden
- **Medication-based HIV prevention**
  - Choice is a crucial aspect of effective HIV prevention
  - Focus is shifting from daily oral tablets to long-acting options

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Thank you!