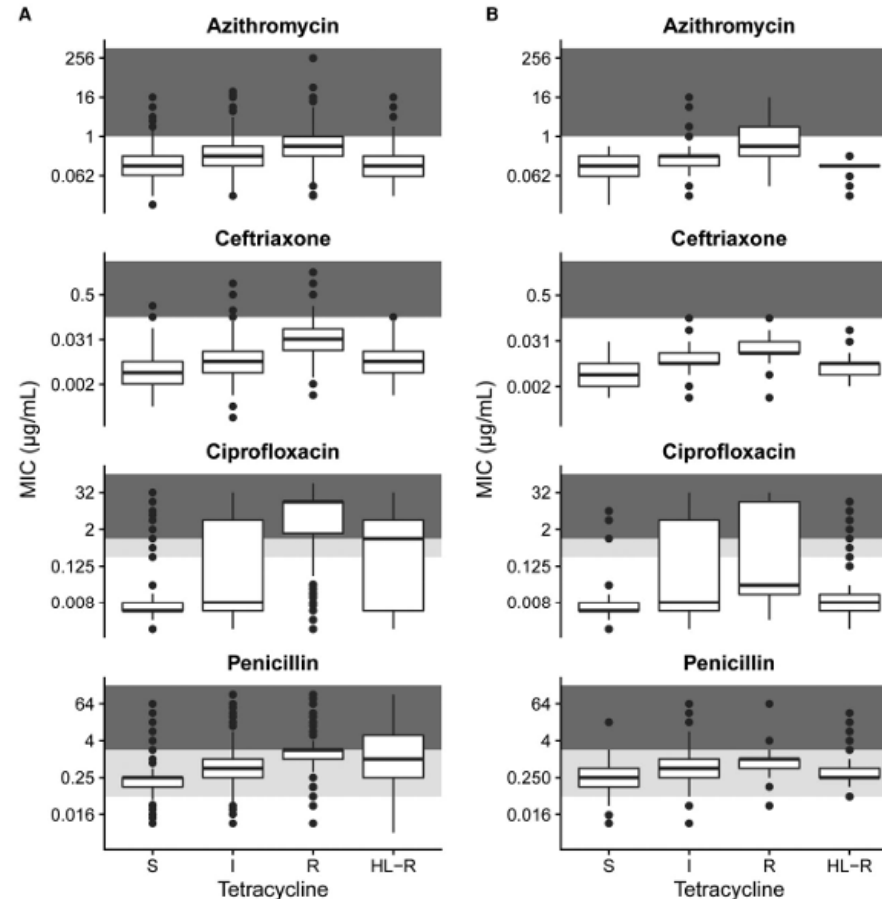


Antimicrobial Resistance – Gonorrhea

Clinical Infectious Diseases

BRIEF REPORT

A Genomic Perspective on the Near-term Impact of Doxycycline Post-exposure Prophylaxis on *Neisseria gonorrhoeae* Antimicrobial Resistance



- Risk of **resistance to tetracyclines** (doxycycline) in gonorrhea
- Risk of **cross resistance** to other antimicrobials including beta-lactams like Ceftriaxone

Antimicrobial Resistance Questions

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Journal of Antimicrobial Chemotherapy

Important considerations regarding the widespread use of doxycycline chemoprophylaxis against sexually transmitted infections

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Rates of sexually transmitted infections (STIs) continue to rise across the world and interventions are essential to reduce their incidence. Past and recent studies have indicated this may be achieved using doxycycline post-exposure prophylaxis (PEP) and this has sparked considerable interest in its use. However, many unanswered questions remain as to its long-term effects and particularly potentially negative impact on human microbiomes and antimicrobial resistance among STIs, other pathogens, and commensals. In this review, we discuss seven areas of concern pertaining to the widespread use of doxycycline PEP.

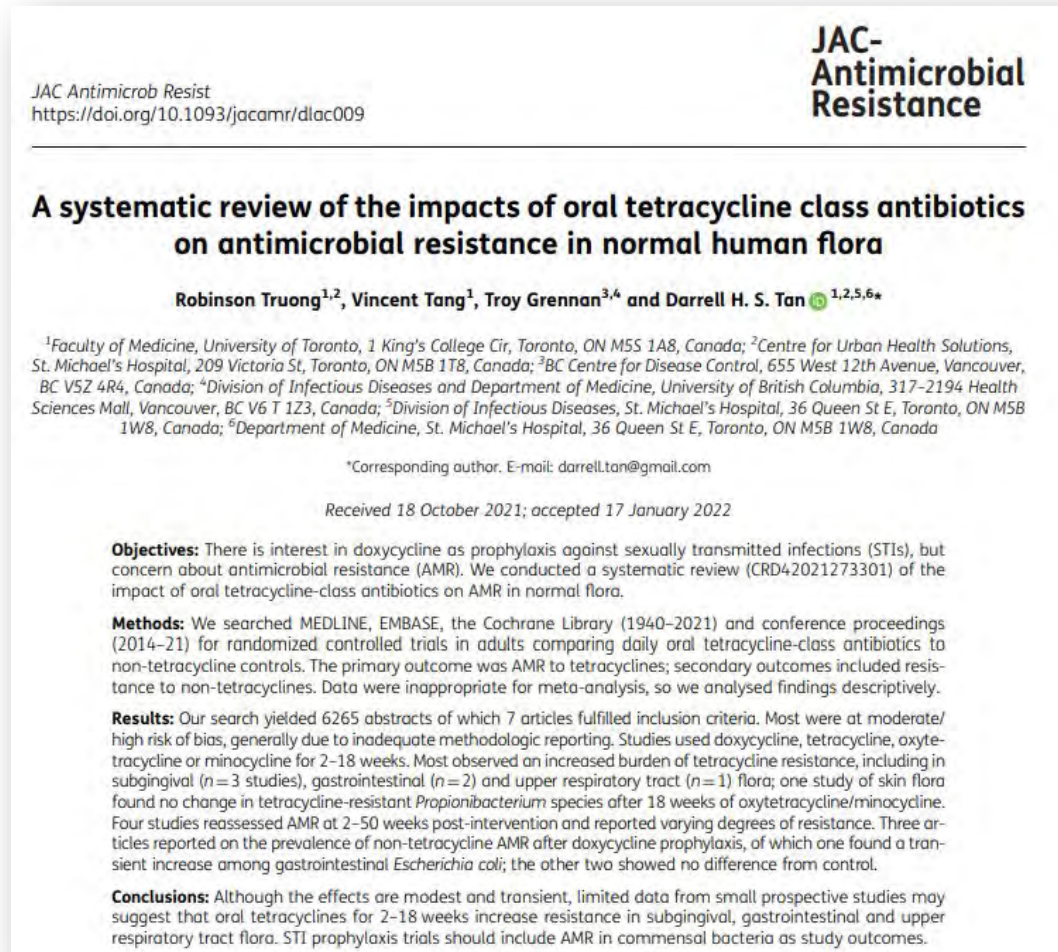
1. Antimicrobial Resistance in STIs

1. *Treponema pallidum*
2. *Chlamydia trachomatis*
3. *Mycoplasma genitalium*
4. *Neisseria gonorrhoeae*

2. Antimicrobial Resistance in other bacterial species

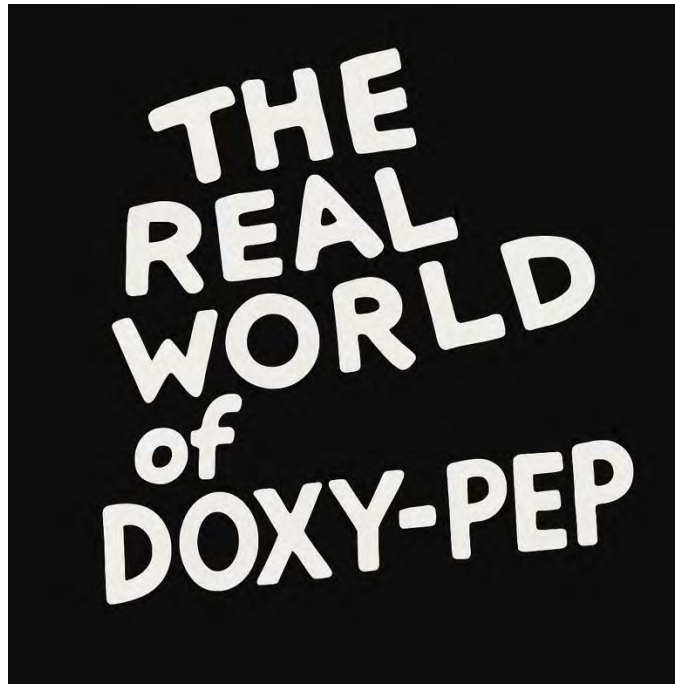
1. Commensal bacteria

Antimicrobial Resistance - Commensals



- Limited data from small prospective studies may suggest that oral tetracyclines for 2–18 weeks increase resistance in subgingival, gastrointestinal and upper respiratory tract flora

Risks: Doxy-PEP and Resistance



Antimicrobial Resistance – STI Pathogens

Study	Key Findings	Implications
Soge et al., Clin Infect Dis 2025 (King County)	Gonorrhea tetracycline resistance ↑ 27%→70%; high-level resistance ↑ 2%→65%; strongest with >3 Doxy-PEP doses/mo	Doxy-PEP likely accelerating gonorrhea resistance
Molina et al., DOXYVAC, CROI 2023 (France)	↑ tetracycline-resistant gonorrhea in Doxy-PEP arm	Confirms concern for gonorrhea resistance
Luetkemeyer et al., NEJM 2023 (DoxyPEP trial)	Gonorrhea resistance signal low; cultures limited	No strong evidence yet, but surveillance critical
Vanbaelen et al., Lancet Infect Dis 2025 (DoxyPEP trial)	Post-hoc DoxyPEP trial: tetracycline MIC correlated with cephalosporin MICs only in non-Doxy-PEP users	No evidence yet that Doxy-PEP drives ceftriaxone resistance

Antimicrobial Resistance – Commensals & Other Bacteria

Study	Key Findings	Implications
Truong et al., JAC-AMR 2022	Oral tetracyclines (2–18 wks) ↑ resistance in oral, GI, and respiratory flora	Doxy-PEP could select resistant reservoirs
Robinson et al., Sci Rep 2025	46% of commensal Neisseria resistant; linked to doxy use; high-level resistance via tetM plasmid	Reservoir for gonorrhea resistance
Args et al., Nat Med 2025	Gut resistome: tetracycline resistance genes ↑ (DNA 46→51%, RNA 4→15%); esp. in frequent users	Expands resistance gene pool
Mittelstaedt et al., J Infect Dis 2024	S. aureus: 13.7% tetracycline-nonsusceptible; co-resistance with TMP-SMX (↑4.5×) & clindamycin (↑3.6×)	Doxy resistance may co-select for multidrug resistance
Luetkemeyer et al., NEJM 2023 (DoxyPEP trial)	↑ tetracycline-resistant S. aureus among Doxy-PEP users	Off-target resistance risk confirmed
Molina et al., DOXYVAC, CROI 2023 (France)	No increase in MRSA or ESBL E. coli in Doxy-PEP arm	Reassuring for broader commensal resistance
Soge et al., Clin Infect Dis 2025	Tetracycline-resistant Staph aureus and GAS more common in Doxy-PEP users	Commensals themselves may become resistant pathogens

Antimicrobial Resistance in Doxy-PEP: Summary

- **Gonorrhea:**
 - Rapid rise in tetracycline resistance (up to 70% in King County MSM)
 - No evidence of co-resistance with Ceftriaxone
 - **Surveillance is critical**
- **Commensals as Reservoirs:**
 - Resistance emerging in commensal *Neisseria*, gut flora, *Staph aureus*, and Group A Strep
 - These organisms can both spread resistance genes and cause their own infections
 - **Need to account for this when providing empiric antibiotics**
- **Co-Selection Risk:**
 - Tetracycline resistance in *S. aureus* linked with resistance to TMP-SMX and clindamycin.
 - **Doxy-PEP may indirectly drive multidrug resistance**

Counseling on Doxy-PEP Risks

Well Known Side Effects:

- Gastrointestinal distress
- Photosensitivity
- Pill esophagitis

Growing Understanding:

- No resistance seen with chlamydia or syphilis”
- Shifts in colonization: ↓ S. aureus, ↑ GAS
- Resistance emerging in gonorrhea and commensals

Unknowns:

- Impact on M. genitalium
- Impact on microbiome
- Impact on STI diagnostics and presentations
- Potential cross-resistance with other antibiotics

Implementation: How Do I Implement Doxy-PEP In Practice?

Implementation – Who Should Get Doxy-PEP?

CDC Clinical Guidelines on the Use of Doxycycline Postexposure Prophylaxis for Bacterial Sexually Transmitted Infection Prevention, United States, 2024

Recommendation*	Strength of recommendation and quality of evidence†
<ul style="list-style-type: none">Providers should counsel all gay, bisexual, and other men who have sex with men (MSM) and transgender women (TGW) with a history of at least one bacterial sexually transmitted infection (STI) (specifically, syphilis, chlamydia or gonorrhea) during the past 12 months about the benefits and harms of using doxycycline (any formulation) 200 mg once within 72 hours (not to exceed 200 mg per 24 hours) of oral, vaginal, or anal sex and should offer doxycycline postexposure prophylaxis (doxy PEP) through shared decision-making. Ongoing need for doxy PEP should be assessed every 3–6 months.	AI High-quality evidence supports this strong recommendation to counsel MSM and TGW and offer doxy PEP.
<ul style="list-style-type: none">No recommendation can be given at this time on the use of doxy PEP for cisgender women, cisgender heterosexual men, transgender men, and other queer and nonbinary persons.	Evidence is insufficient to assess the balance of benefits and harms of the use of doxy PEP

* Although not directly assessed in the trials included in these guidelines, doxy PEP could be discussed with MSM and TGW who have not had a bacterial STI diagnosed during the previous year but will be participating in sexual activities that are known to increase likelihood of exposure to STIs.

† See Table.

Implementation – Screening

- Screen for sexually transmitted infections (STIs) as indicated:
 - HIV Testing
 - Gonorrhea/Chlamydia NAAT testing (including extra-genital)
 - Syphilis testing
 - Hepatitis testing
 - Vaccination status
 - Counsel on
 - Prevention strategies
 - Benefits and risks of Doxy-PEP
 - **As well as using it for it's intended purpose**
 - Drug-drug interactions (antacids, cations)

Implementation – Counseling

Well Known Side Effects:

- Gastrointestinal distress
- Photosensitivity
- Pill esophagitis

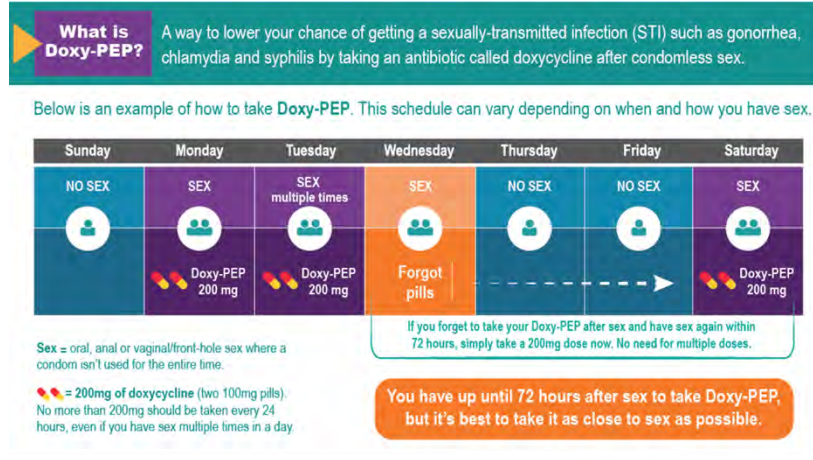
Growing Understanding:

- No resistance seen with chlamydia and syphilis
- Decreased colonization with *S. aureus* but increased GAS
- Growing resistance to Doxycycline in STIs (GC) and commensals (*S. aureus*)

Unknowns:

- Impact on *M. gen*
- Impact on the microbiome
- Impact on STI presentations
- Cross-resistance with other antibiotics

Patient Decision Aids



Doxy-PEP is not 100% effective against preventing STIs, so you will still need to get tested for STIs regularly.

Doxy-PEP does not protect against HIV. It is different from STI treatment. In this case, do not take Doxy-PEP.

How to take Doxy-PEP

- Doxy may increase sun sensitivity; use sunscreen for protection.
- Take with a large glass of water and food to ease stomach upset.
- Remain upright for 30 minutes after taking to minimize stomach irritation.
- Wait 2 hours before taking dairy, calcium, vitamins, or antacids after taking doxy. Fiber intake is fine.

Tell your healthcare provider if....

- If you have symptoms of an STI, or have a partner who knows they have an STI tell your provider. In this case, do not take Doxy-PEP.
- If you are taking any other antibiotics from another provider, pharmacy or friend.

Things we are still learning about Doxy-PEP:


- The long term effects of Doxy-PEP on the bacteria we already have in our intestines and on our skin.
- Whether using Doxy-PEP will make it harder to treat bacterial infections with doxycycline in the future.

- Columbia pilot tested a visual decision aid (PDA) in two NYC sexual health clinics
- 30 participants (all AMAB; 30% living with HIV; all with ≥ 1 STI in past year)
- PDA counseling improved:
 - Familiarity with Doxy-PEP +27%
 - Comfort with Doxy-PEP +24%
 - Knowledge about Doxy-PEP +16%
- Participants rated the PDA highly acceptable, appropriate, and feasible

Patient Decision Aids

Doxy PEP – How to Take

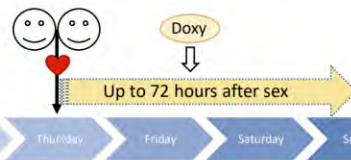
Two 100 mg pills of doxycycline ideally within 24 hours but no later than 72 hours after condomless oral, anal or vaginal sex

 = sex without a condom, including oral sex

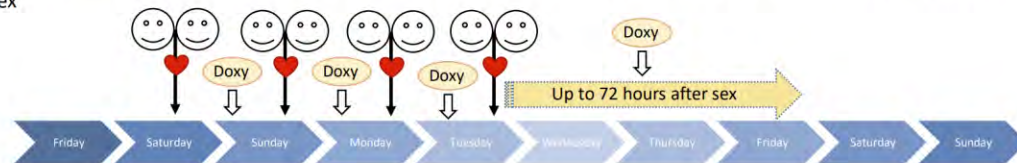
Example: Sex on Sat; take dose of doxy by Tues



Example: Sex on Thursday; take dose of doxy by Sunday



Example 2: Daily (or more) sex Sat-Tues; take daily dose of doxy and last dose within 24 hours but not later than 72 hours after last sex



No more than 200 mg every 24 hours

About Doxy-PEP



What is doxy-PEP?

- Doxy-PEP means taking the antibiotic doxycycline after sex, to prevent getting an STI. It is like a morning-after pill but for STIs. Taking doxy-PEP reduces your chance of acquiring syphilis, gonorrhea, and chlamydia by about two-thirds.

When should I take doxy-PEP?

- Two 100 mg pills of doxycycline should be taken ideally within 24 hours but no later than 72 hours after condomless sex. Condomless sex means oral, anal or vaginal/front-hole sex where a condom isn't used for the entire time.



What about when I have sex again?

- If you have sex again within 24 hours of taking doxycycline, take another dose 24 hours after your last dose. You can take doxycycline as often as every day when you are having condomless sex but don't take more than 200 mg (two 100 mg pills) every 24 hours.



How should I take doxy-PEP?

- Take doxycycline with plenty of water or something else to drink so that it does not get stuck when you swallow. If your stomach is upset by doxycycline, taking it with food may help.
- Some people are more sensitive to the sun when they take doxycycline, so wear sunscreen.
- Please do not share doxycycline with others.
- Avoid dairy products, calcium, antacids, or multivitamins 2 hours before after taking doxycycline.



What are we still learning about doxy-PEP?

- Does it affect normal ("good") bacteria in our intestines?
- Could it increase or decrease the bacteria that live on our skin, or make them resistant to doxycycline (for example staph)?
- Will doxy-PEP increase doxycycline resistance in bacteria that cause STIs?
 - Although doxycycline has been used for decades, there is not resistance to doxycycline in chlamydia or syphilis.
 - About 25% of gonorrhea in the US is already resistant to doxy; doxy-PEP may not work against these strains. The DoxyPEP study and other studies will help understand whether using doxy-PEP changes resistance in gonorrhea.



Reminders

- Call us at 628-217-6692 if you run out of doxycycline, if you are having any side effects, or if you think you may have an STI.
- Please continue to get tested for STIs every 3 months and whenever you have symptoms.
- Doxy-PEP doesn't protect against MPX (monkeypox), HIV, or other viral infections



How Do I Prescribe Doxy-PEP?

FOR _____		DATE _____	
ADDRESS _____			
		REFILL _____ TIMES	
A generically equivalent drug product may be dispensed unless the practitioner hand writes the words "Brand Necessary" or "Brand Medically Necessary" on the face of the prescription.			
R_x			
Doxycycline Monohydrate 100mg tabs			
Take 2 tabs by mouth as needed every 24 hours			
Take 2 capsules by mouth, once daily as needed (take within 72 hours of condomless sex),			
Take no more then 2 capsules in any 24-hour period. Take with water and remain upright for 30 mins after taking			
Dispense: #60 tabs			
Refills: 0			
SIGNATURE _____		DEA NO. _____	
ADDRESS _____			
Reorder Item #6120		Total Pharmacy Supply, Inc.	
		1-800-878-2822	

How Do I Prescribe Doxy-PEP?

FOR _____ DATE _____

ADDRESS _____

REFILL _____ TIMES

A generically equivalent drug product may be dispensed unless the practitioner hand writes the words "Brand Necessary" or "Brand Medically Necessary" on the face of the prescription.

Rx

Doxycycline Monohydrate 100mg tabs

Take 2 tabs by mouth as needed every 24 hours

Take 2 capsules by mouth, once daily as needed (take within 72 hours of condomless sex),

Take no more than 2 capsules in any 24 hour period. Take with water and remain upright for 30 mins after taking

Dispense: #60 tabs

Refills: 0

SIGNATURE

DEA NO.

ADDRESS _____

Reorder item #6120 Total Pharmacy Supply, Inc. 1-800-878-2822

Hyclate or Monohydrate

- Hyclate – cheaper
- Monohydrate – less GI distress

How Do I Prescribe Doxy-PEP?

- Detailed instructions

FOR _____ DATE _____

ADDRESS _____

REFILL _____ TIMES

A generically equivalent drug product may be dispensed unless the practitioner hand writes the words "Brand Necessary" or "Brand Medically Necessary" on the face of the prescription.

Rx

Doxycycline Monohydrate 100mg tabs
Take 2 tabs by mouth as needed every 24 hours

Take 2 capsules by mouth, once daily as needed (take within 72 hours of condomless sex),
Take no more than 2 capsules in any 24 hour period. Take with water and remain upright for 30 mins after taking

Dispense: #60 tabs
Refills: 0

SIGNATURE

DEA NO.

ADDRESS _____

Reorder Item #6120 Total Pharmacy Supply, Inc. 1-800-878-2822

How Do I Prescribe Doxy-PEP?

- Dispense and refills
- 25% of patients used \geq 10 doses per month

FOR _____ DATE _____

ADDRESS _____

REFILL _____ TIMES

A generically equivalent drug product may be dispensed unless the practitioner hand writes the words "Brand Necessary" or "Brand Medically Necessary" on the face of the prescription.

Rx

Doxycycline Monohydrate 100mg tabs
Take 2 tabs by mouth as needed every 24 hours
Take 2 capsules by mouth, once daily as needed (take within 72 hours of condomless sex),
Take no more than 2 capsules in any 24 hour period. Take with water and remain upright for 30 mins after taking

Dispense: #60 tabs
Refills: 0

SIGNATURE _____ DEA NO. _____

ADDRESS _____

Reorder Item #6120 Total Pharmacy Supply, Inc. 1-800-878-2822

How Do I Prescribe Doxy-PEP?

doxycycline 100 MG Capsule ✓ Accept ✗ Cancel

Product: **DOXYCYCLINE HYCLATE 100 MG OR CAPS** [View Available Strengths](#)

Sig Method: **Specify Dose, Route, Frequency** [Taper/Ramp](#) [Combination Dosage](#) [Use Free Text](#)

Dose: 200 mg 100 mg

doxycycline 100 MG Capsule [Details](#)

↑ Single dose of 200 mg exceeds recommended maximum of 100 mg by 100% [Use 100 mg](#)

Override Reason/Comment: [Not clinically significant](#)

Calculated dose: 2 capsule

Route: [Oral](#)

Frequency: [Daily PRN](#) [Daily \(0900\)](#) [2X Day](#)

Duration: [Doses](#) [Days](#)

Starting: 9/9/2023 Ending: First fill:

Dispense: Days/Fill: [Full \(0 Days\)](#) [30 Days](#) [90 Days](#)

Quantity: 60 capsule Refill: 0

☐ Dispense As Written

Renewal Provider: ☐ Do not send renewal requests to me

Mark long-term: ☐ DOXYCYCLINE HYCLATE (TETRACYCLINES)

⚠ Patient Sig: [Take 2 capsules by mouth Daily As Needed Take within 72 hours of condomless sex and ideally within 24 hours. Take no more than 2 capsules \(200mg\) in any 24 hour period. Take with water and remain upright for 30 mins after taking.](#)

[Edit the additional information appended to the patient sig](#)

ⓘ The sig contains both discrete and free text elements. Review the final sig above.

Indications: [Antimicrobial Therapy](#)

☐ Acne Vulgaris ☐ Bacterial Infection

Indications (Free Text):

Class: [ePrescribe](#) [Normal](#) [Phone In](#) [OTC](#) [Historical Med](#)

ⓘ Next Required ✓ Accept ✗ Cancel

How Do I Follow Patients on Doxy-PEP?

Follow-up

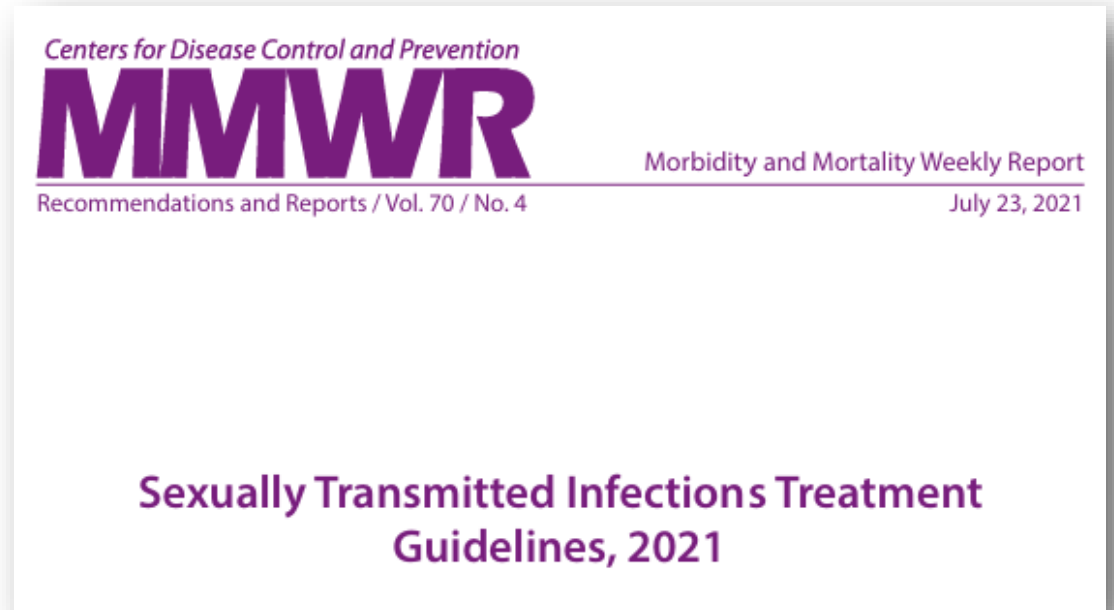
- Visits every 3-6 months
 - Repeat HIV and STI screening
 - Assess for side effects
 - Repeat counseling
 - Re-assess need for prevention modalities
 - Prescribe as appropriate

Population	Recommendations
Men who have sex with men	At least annually, test at each site of exposure (urethra, rectum) for sexually active MSM regardless of condom use or every 3-6 months <u>if at increased risk</u> .
Patients taking PrEP	All patients starting and taking oral PrEP should have genitourinary and extra-genital testing performed at baseline and every 3 months.
Persons living with HIV	For sexually active individuals, screen at first HIV evaluation and at least annually thereafter. More frequent screening might be appropriate depending <u>on individual risk behaviors</u> and local epidemiology
Non-pregnant Women	Test at least annually for sexually active women under 25 years of age and those aged 25 years and older <u>if at increased risk</u> Rectal chlamydial testing can be considered in females <u>based on sexual behaviors and exposure</u> through shared clinical decision making.
Men who have sex with women***	Consider screening young men in high prevalence clinical settings (adolescent and STI clinics and correctional facilities)
Pregnant Women	All pregnant women under 25 years of age and those aged 25 years and older <u>if at increased risk</u> . retest during 3rd trimester if under 25 years of age or at risk.

How Do I Treat Patients With STIs Taking Doxy-PEP?

Treat As Needed

- Treat as per the 2021 STI Guidelines
 - ***Exception: Consider in-person and exam and deferring empiric treatment for “exposure”***



Clinical Conundrums

- What do I do if...
 - My patient's test comes back positive for chlamydia after I've prescribed Doxy-PEP?
 - Doxycycline 100mg by mouth twice daily for 7 days
 - My patient is taking Doxy-PEP incorrectly?
 - Repeat counseling and provide documents to assist with taking it properly
 - My patient's partner was diagnosed with an STI?
 - Assess if your patient took Doxy-PEP “appropriately” after every recent encounter with that partner
 - Consider in person assessment and testing as opposed to empiric treatment

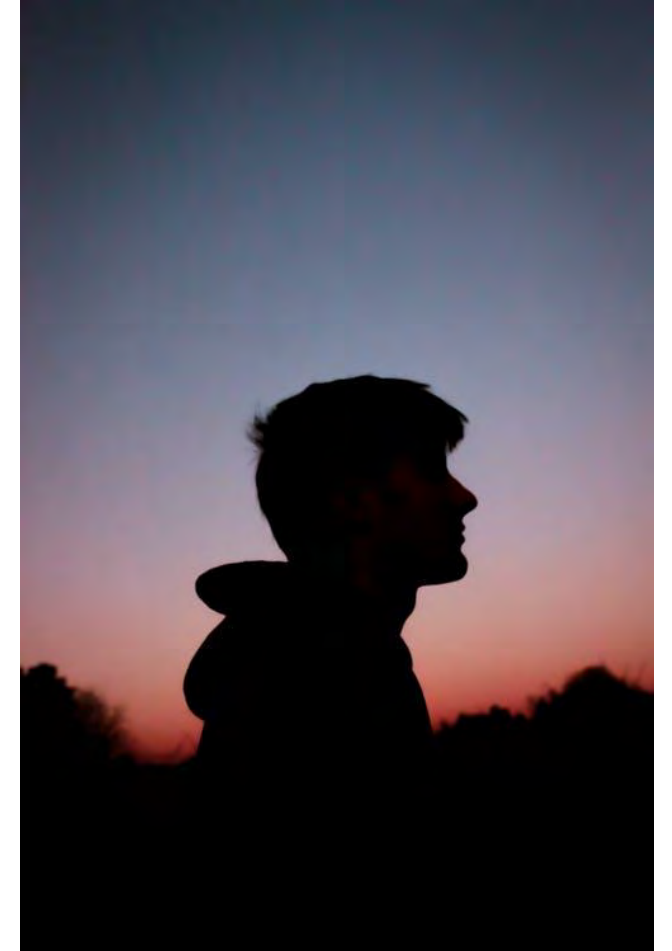
Audience Poll #5

Would you offer Marcus Doxy-PEP?

1. Yes
2. No

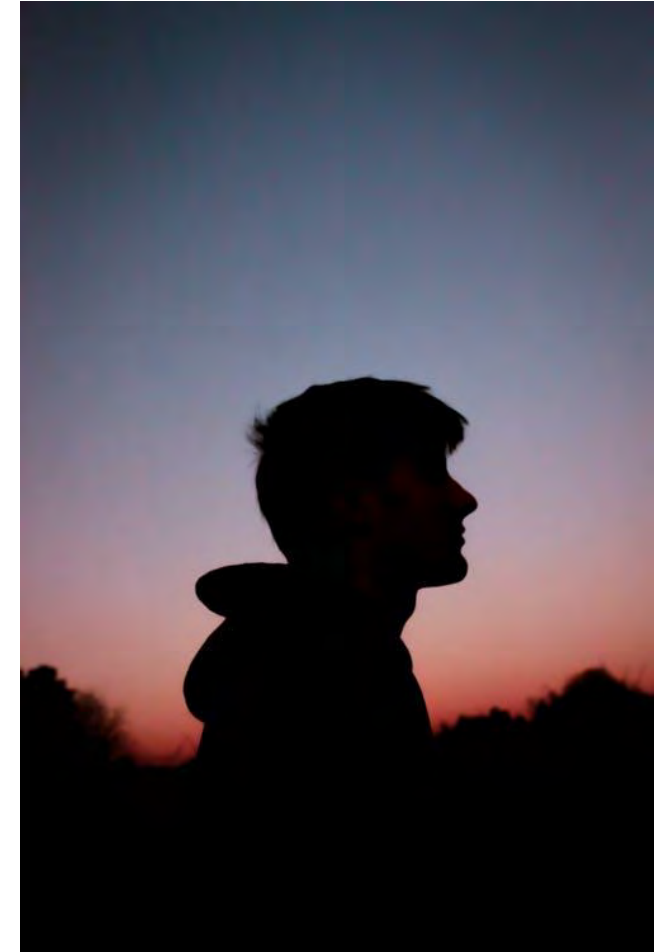
Marcus

- Marcus decides to start Doxy-PEP



Marcus Comes Back

- Return to clinic 4 weeks later
- “It hurts when I pee, and I have a lot of green discharge”
- Labs repeated
 - Plus, gonorrhea culture
- Treated with Gentamicin and Azithromycin



Marcus's Results

Lab results:

HIV Ab/Ag - Negative

Urine GC/CT – GC positive

Pharyngeal GC/CT – GC positive

Rectal GC/CT – negative

RPR – 1:16

- 1:128 – 10 weeks ago, 1:32 4 weeks ago



Marcus's Gonorrhea Culture

Lab results:

Azithromycin – susceptible (MIC 0.125)

Ciprofloxacin – resistant (MIC 1)

Ceftriaxone – susceptible (MIC 0.016)

Cefixime – Susceptible (48mm)

Tetracycline – resistant (MIC 12)



Tetracycline Resistant Gonorrhea

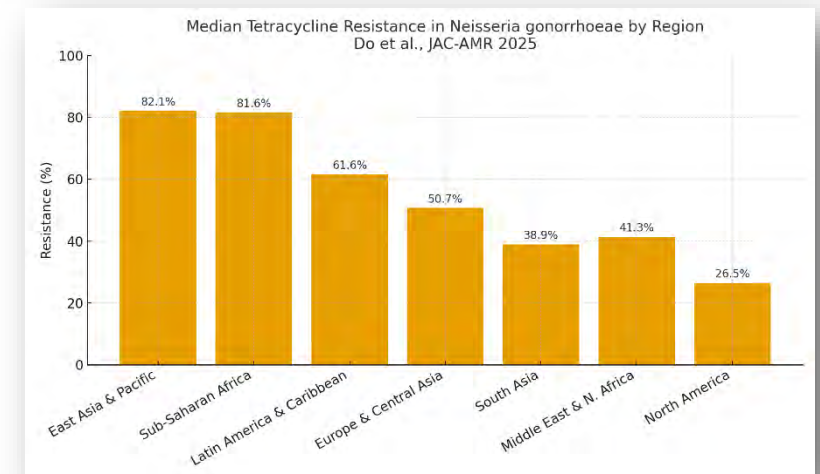
- Will it work for prophylaxis?

Global Tetracycline Resistance in *NG*

- Systematic review:
 - 67 studies
 - 51 countries
 - 80,645 isolates (1996–2023)
- Global median resistance = 54% (range 4–100%)
- Regional variation:
 - East Asia & Pacific: 82%
 - Sub-Saharan Africa: 82%
 - Europe & Central Asia: 51%
 - Latin America: 62%
 - North America: 26% (but 4-fold increase since 2009)
- Few data from MSM, women, or oropharyngeal isolates → major surveillance gaps

Tetracycline-resistant *Neisseria gonorrhoeae* global estimates—impacts on doxycycline post-exposure prophylaxis implementation and monitoring: a systematic review

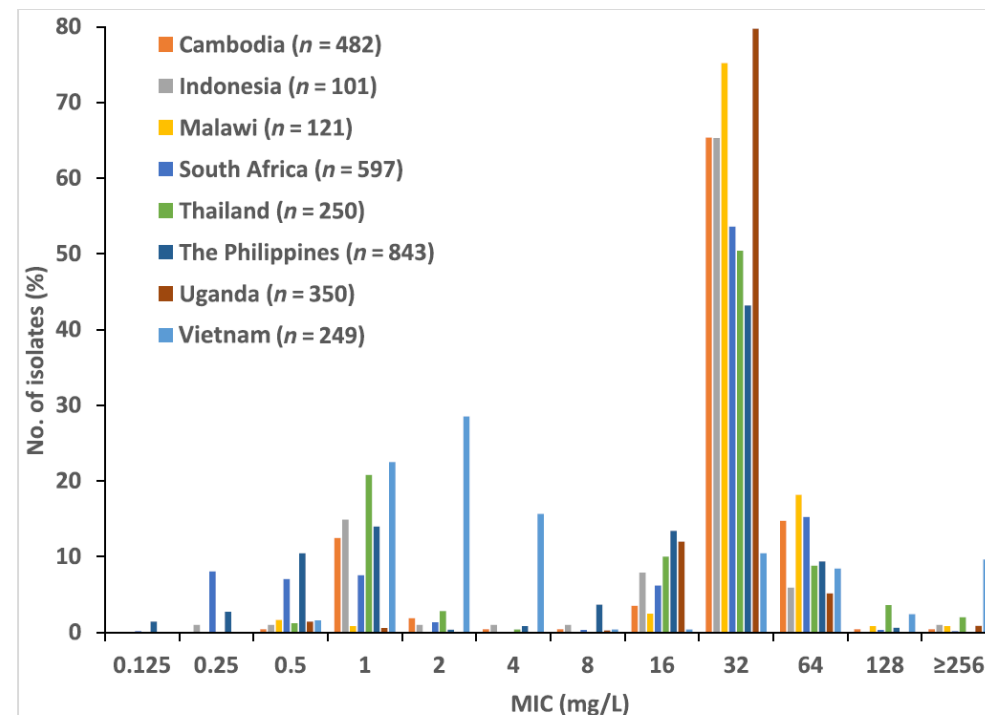
Kim Do¹, Magnus Unemo^{2,3}, Chris Kenyon^{4,5}, Jane S. Hocking⁶ and Fabian Yuh Shiong Kong^{1,6*}



• Do K, Unemo M, Kenyon C, Hocking JS, Kong FYS. JAC-AMR. 2025

Tetracycline Resistance - NG

- 2,993 gonorrhea isolates from 8 WHO EGASP countries
- Tetracycline resistance:
 - 92% (EUCAST breakpoint >0.5 mg/L)
 - 81% (CLSI breakpoint >1 mg/L)
 - Higher thresholds: 74–77% resistant
- Resistance nearly universal in some countries:
 - Uganda ≥98%
 - Malawi ≥97%
 - Cambodia ≥99%
- **Doxy-PEP unlikely to reduce gonorrhea in these regions; risk of selecting MDR/XDR strains**



Tetracycline Resistant Gonorrhea

- Will it work for prophylaxis?
- What else can you offer him?

Vaccination to Prevent GC Infection and Resistance

World-first gonorrhoea vaccine rollout begins in UK as infection rates soar

3 August 2025

Share Save

Josh Parry
LGBT & Identity Reporter



Gonorrhoea vaccines will be widely available from Monday in sexual health clinics across the UK, in a bid to tackle record-breaking levels of infections.

The jabs will first be offered to those at highest risk – mostly gay and bisexual men who have a history of multiple sexual partners or sexually transmitted infections.

NHS England say the roll out is a world-first, and predict it could prevent as many as 100,000 cases, potentially saving the NHS almost £8m over the next decade.

The Terrence Higgins Trust, who campaigns for the vaccine to be introduced in the UK, told the BBC it was "a huge win" for sexual health.

- The roll-out of the NHS's world-first routine vaccination for gonorrhea...is a real step forward for sexual health and I know health service staff, alongside local authority colleagues, have been working hard to hit the ground running.
- This vaccine is already used to protect against Men B and **is proven to be effective against gonorrhea**, preventing the spread of infection and reducing the rising rates of antibiotic-resistant strains.

Vaccination to Prevent Infection and Resistance

- Meningococcal serogroup B (MenB)-4C vaccine
 - 57 proteins were predicted to be surface expressed (outer membrane proteins [OMPs])
 - Majority of OMPs showed high sequence identity between the 2 bacterial species

Clinical Infectious Diseases

MAJOR ARTICLE



The Serogroup B Meningococcal Vaccine Bexsero Elicits Antibodies to *Neisseria gonorrhoeae*

Evgeny A. Semchenko,¹ Aimee Tan,¹ Ray Borrow,² and Kate L. Seib^{1*}

¹Institute for Glycomics, Griffith University, Gold Coast, Queensland, Australia; and ²Vaccine Evaluation Unit, Public Health England, Manchester Royal Infirmary, United Kingdom

Background. *Neisseria gonorrhoeae* and *Neisseria meningitidis* are closely-related bacteria that cause a significant global burden of disease. Control of gonorrhoea is becoming increasingly difficult, due to widespread antibiotic resistance. While vaccines are routinely used for *N. meningitidis*, no vaccine is available for *N. gonorrhoeae*. Recently, the outer membrane vesicle (OMV) meningococcal B vaccine, MeNZB, was reported to be associated with reduced rates of gonorrhoea following a mass vaccination campaign in New Zealand. To probe the basis for this protection, we assessed the cross-reactivity to *N. gonorrhoeae* of serum raised to the meningococcal vaccine Bexsero, which contains the MeNZB OMV component plus 3 recombinant antigens (*Neisseria* adhesin A, factor H binding protein [fHbp]-GNA2091, and *Neisseria* heparin binding antigen [NHBA]-GNA1030).

Methods. A bioinformatic analysis was performed to assess the similarity of MeNZB OMV and Bexsero antigens to gonococcal proteins. Rabbits were immunized with the OMV component or the 3 recombinant antigens of Bexsero, and Western blots and enzyme-linked immunosorbent assays were used to assess the generation of antibodies recognizing *N. gonorrhoeae*. Serum from humans immunized with Bexsero was investigated to assess the nature of the anti-gonococcal response.

Results. There is a high level of sequence identity between MeNZB OMV and Bexsero OMV antigens, and between the antigens and gonococcal proteins. NHBA is the only Bexsero recombinant antigen that is conserved and surfaced exposed in *N. gonorrhoeae*. Bexsero induces antibodies in humans that recognize gonococcal proteins.

Conclusions. The anti-gonococcal antibodies induced by MeNZB-like OMV proteins could explain the previously-seen decrease in gonorrhoea following MeNZB vaccination. The high level of human anti-gonococcal NHBA antibodies generated by Bexsero vaccination may provide additional cross-protection against gonorrhoea.

Keywords. STI; gonorrhea; *Neisseria gonorrhoeae*; immune response; meningococcal vaccine.

Gonorrhea Vaccine Does Not Need to Be Perfect

A Gonococcal Vaccine Has the Potential to Rapidly Reduce the Incidence of *Neisseria gonorrhoeae* Infection Among Urban Men Who Have Sex With Men

[Ben B Hui](#)^{1,✉}, [Thilini N Padeniya](#)¹, [Nic Rebuli](#)¹, [Richard T Gray](#)¹, [James G Wood](#)², [Basil Donovan](#)¹, [Qibin Duan](#)^{1,3}, [Rebecca Guy](#)¹, [Jane S Hocking](#)⁴, [Monica M Lahra](#)^{5,6}, [David A Lewis](#)^{7,8,9}, [David M Whiley](#)¹⁰, [David G Regan](#)^{1,2}, [Kate L Seib](#)^{11,2}

- 100% efficacy, 30% vaccine coverage of MSM
 - 94% reduction in GC within 2 years
- 50% efficacy, 30% vaccine coverage of MSM
 - 62% reduction in GC within 2 years
- Elimination of gonorrhea is possible within 8 years with vaccines of $\geq 50\%$ efficacy lasting 2 years, providing a booster vaccination is available every 3 years on average.

Does 4CMenB Vaccine Prevent Gonorrhea?

ORIGINAL STUDY

Meningococcus B Vaccination Effectiveness Against *Neisseria gonorrhoeae* Infection in People Living With HIV: A Case-Control Study

Angelo Roberto Raccagni, MD,* Laura Galli, MSc,† Vincenzo Spagnuolo, MD,† Elena Bruzzesi, MD,* Camilla Muccini, MD,† Simona Bossolasco, MD,† Martina Ranzenigo, MD,* Nicola Gianotti, MD,† Riccardo Lolatto, MSc,† Antonella Castagna, MD,*† and Silvia Nozza, MD†

Pop: MSM living with HIV

Efficacy: 44% (9-65%)

Location: Italy

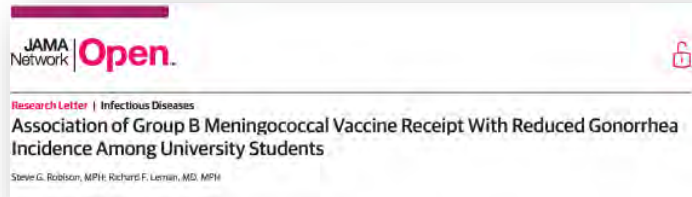
Effectiveness of a serogroup B outer membrane vesicle meningococcal vaccine against gonorrhoea: a retrospective observational study

Winston E Abara, Kyle T Bernstein, Felicia M T Lewis, Julia A Schillinger, Kristen Feemster, Preeti Parthela, Susan Hanji, Aras Islam, Michael Eberhart, Iris Cheng, Alexandra Terrier, Jennifer Sanderson Slutsker, Sarah Mbaeyi, Robbie Madera, Robert D Kirkcaldy

Pop: Age 16 - 23

Efficacy: 40% (23-53%)

Location: USA (East Coast)



Pop: College students

Efficacy: 47% (13%-68%)

Location: Australia



Pop: Teens and Young Adults

Efficacy: 46% (24-66%)

Location: USA (West Coast)

DoxyVac Study Published

Doxycycline prophylaxis and meningococcal group B vaccine to prevent bacterial sexually transmitted infections in France (ANRS 174 DOXYVAC): a multicentre, open-label, randomised trial with a 2 × 2 factorial design

Jean-Michel Molina, Beatrice Bercot, Lambert Assoumou, Emma Rubenstein, Michele Algarde-Genin, Gilles Plaloux, Christine Katlama, Laure Sargers, Cécile Bèthoux, Nicolas Dupin, Moussa Ouattara, Laurence Slama, Juliette Pavie, Claudine Duvalier, Benedicte Loze, Lauriane Goldwirt, Severine Gibowski, Manon Ollivier, Jade Ghosn, Dominique Costagliola, for the ANRS 174 DOXYVAC Study Group*

Summary

Background Increased rates of sexually transmitted infections (STIs) are reported among men who have sex with men (MSM) and new interventions are needed. We aimed to assess whether post-exposure prophylaxis (PEP) with doxycycline could reduce the incidence of chlamydia or syphilis (or both) and whether the meningococcal group B vaccine (4CMenB) could reduce the incidence of gonorrhoea in this population.

Methods ANRS 174 DOXYVAC is a multicentre, open-label, randomised trial with a 2 × 2 factorial design conducted at ten hospital sites in Paris, France. Eligible participants were MSM aged 18 years or older, HIV negative, had a history of bacterial STIs within the 12 months before enrolment, and who were already included in the ANRS PREVENIR study (a cohort of MSM using pre-exposure prophylaxis with tenofovir and emtricitabine for HIV prevention). Participants were randomly assigned (2:1) to doxycycline PEP (two pills of 100 mg each orally within 72 h after condomless sex, with no more than three doses of 200 mg per week) or no PEP groups and were also randomly assigned (1:1) to the 4CMenB vaccine (GlaxoSmithKline, Paris, France; two intramuscular injections at enrolment and at 2 months) or no vaccine groups, using a computer-generated randomisation list with a permuted fixed block size of four. Follow-up occurred for at least 12 months (with visits every 3 months) up to 24 months. The coprimary outcomes were the risk of a first episode of chlamydia or syphilis (or both) after the enrolment visit at baseline for the doxycycline intervention and the risk of a first episode of gonorrhoea starting at month 3 (ie, 1 month after the second vaccine dose) for the vaccine intervention, analysed in the modified intention-to-treat population (defined as all randomly assigned participants who had at least one follow-up visit). This trial is registered with ClinicalTrials.gov, NCT04597424 (ongoing).

Findings Between Jan 19, 2021, and Sept 19, 2022, 556 participants were randomly assigned. 545 (98%) participants were included in the modified intention-to-treat analysis for the doxycycline PEP and no PEP groups and 544 (98%) were included for the 4CMenB vaccine and no vaccine groups. The median follow-up was 14 months (IQR 9–18). The median age was 40 years (34–48) and all 545 participants were male. There was no interaction between the two

Lancet Infect Dis 2024; 24:1093–104

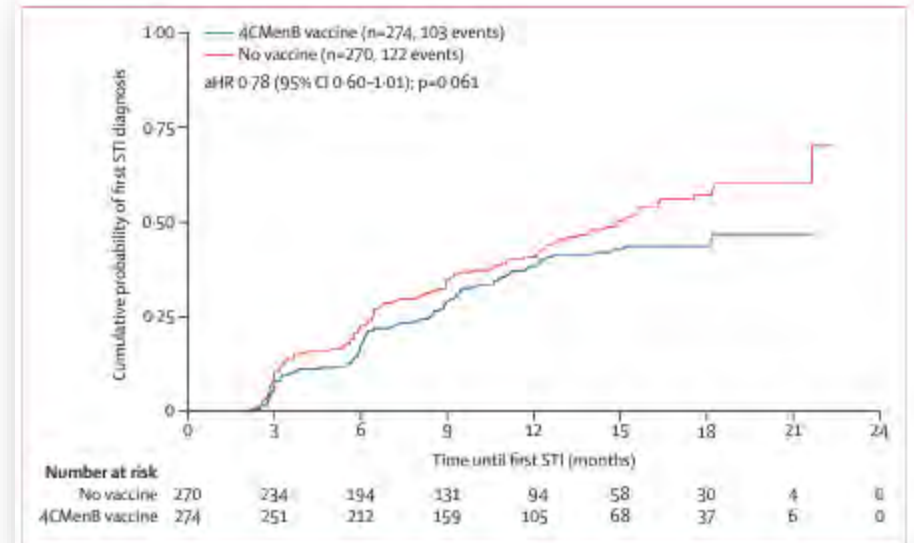
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May 23, 2024
[https://doi.org/10.1016/S1473-3099\(24\)00236-6](https://doi.org/10.1016/S1473-3099(24)00236-6)

See Comment page 1061

For the French translation of this abstract see Online for appendix 1 (p 1)

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“...we did not show efficacy of the 4CmenB vaccine for gonorrhoea.”

What About Vaccination For Gonorrhea?

The Journal of Infectious Diseases

REVIEW

IDSA
Infectious Diseases Society of America

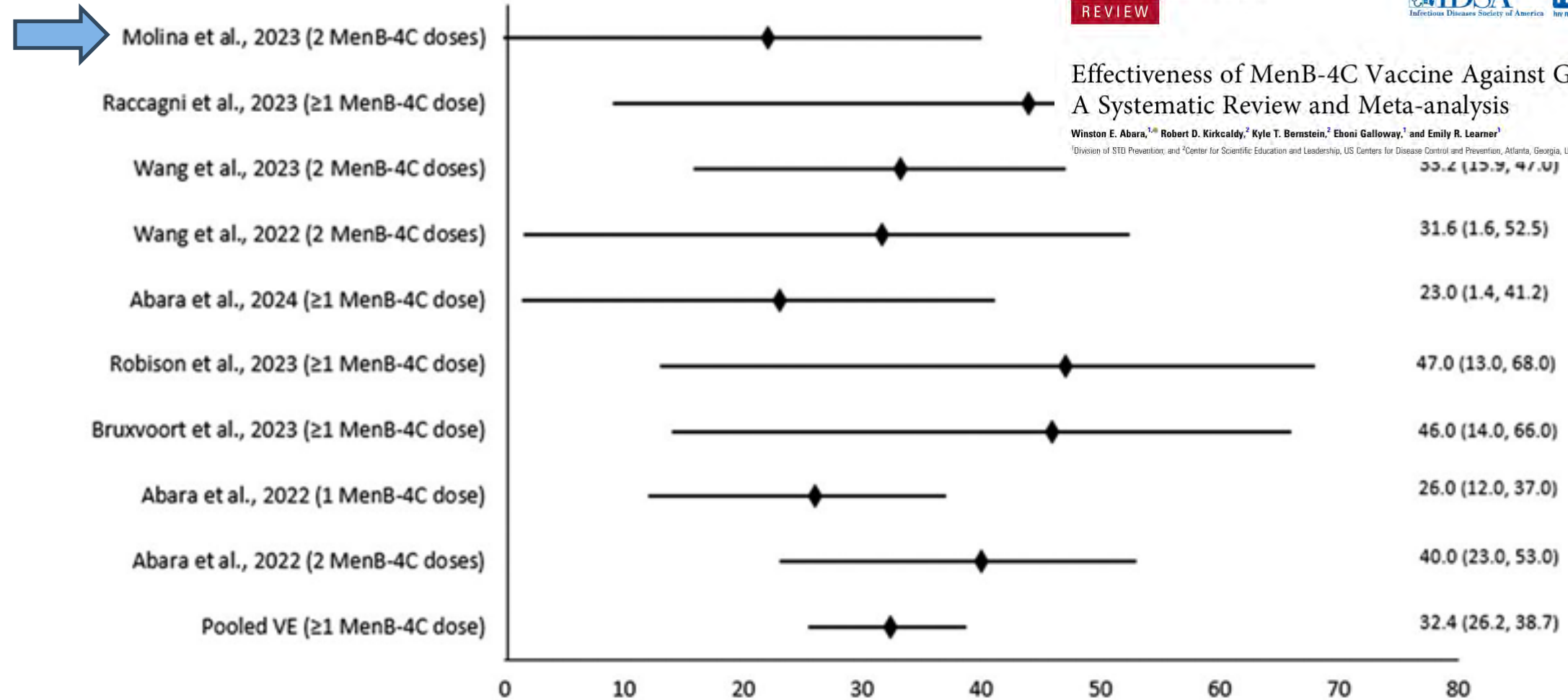
hivma
HIV Medicine Association

OXFORD

Effectiveness of MenB-4C Vaccine Against Gonorrhea: A Systematic Review and Meta-analysis

Winston E. Abara,^{1,*} Robert D. Kirkcaldy,² Kyle T. Bernstein,² Eboni Galloway,¹ and Emily R. Learner¹

¹Division of STD Prevention, and ²Center for Scientific Education and Leadership, US Centers for Disease Control and Prevention, Atlanta, Georgia, USA



Vaccination

Table 2 Recommended Adult Immunization Schedule by Medical Condition or Other Indication, United States, 2024

Always use this table in conjunction with Table 1 and the Notes that follow. Medical conditions or indications are often not mutually exclusive. If multiple medical conditions or indications are present, refer to guidance in all relevant columns. See Notes for medical conditions or indications not listed.

VACCINE	Pregnancy	Immunocompromised (excluding HIV infection)	HIV infection CD4 percentage and count		Men who have sex with men	Asplenia, complement deficiency	Heart or lung disease	Kidney failure, End-stage renal disease or on dialysis	Chronic liver disease; alcoholism*	Diabetes	Healthcare Personnel†	
			<15% or <200mm ³	≥15% and ≥200mm ³								
COVID-19		See Notes										
IIIV4 or RIV4	1 dose annually											
LAIV4						1 dose annually if age 19–49 years		1 dose annually if age 19–49 years				
RSV	Seasonal administration. See Notes	See Notes			See Notes							
Tdap or Td	Tdap: 1 dose each pregnancy	1 dose Tdap, then Td or Tdap booster every 10 years										
MMR	*											
VAR	*		See Notes									
RZV		See Notes										
HPV	*	3 dose series if indicated										
Pneumococcal												
HepA												
Hep B	See Notes									Age ≥ 60 years		
MenACWY												
MenB												
Hib		HSCT: 3 doses*				Asplenia: 1 dose						
Mpox	See Notes					See Notes						

Recommended for all adults who lack documentation of vaccination, OR lack evidence of immunity

Not recommended for all adults, but recommended for some adults based on either age OR increased risk for or severe outcomes from disease

Recommended based on shared clinical decision-making

Recommended for all adults, and additional doses may be necessary based on medical condition or other indications. See Notes.

Precaution: Might be indicated if benefit of protection outweighs risk of adverse reaction

Contraindicated or not recommended *Vaccinate after pregnancy, if indicated

No Guidance/Not Applicable

Specific Recommendations

- Hepatitis A/B
- HPV
- Men ACYW
- Mpox



• <https://www.cdc.gov/vaccines/schedules/downloads/adult/adult-combined-schedule.pdf>

Audience Poll #6

Would you offer Marcus Men B vaccination?

1. Yes
2. No

STI Prevention Summary

- We are in an era of STI prevention choice and patients should be aware of their options
- Doxy-PEP
 - Real-world data supports clinical trials confirming effectiveness for syphilis/chlamydia, mixed for gonorrhea
 - Works to prevent syphilis and chlamydia in MSM and TGW, with or without HIV
 - Did not work in women in the dPEP study
 - Doxy-PEP reduces STIs but drives tetracycline resistance in gonorrhea and commensals, with risks of co-selection for multidrug resistance
 - There remain unknowns about the overall impact, risks, and unintended consequences of Doxy-PEP that potential users should be aware of (**Shared Decision Making**)
- 4CMenB
 - Observational studies suggest modest protection
 - Randomized controlled trials did not show a significant reduction in gonorrhea incidence
- Flexibility is key, management will change as we learn more
- **Surveillance and Research is needed to understand long-term risks, benefits, and optimize prevention combinations**

Additional Information

National STD Curriculum
A free educational website from the University of Washington STD Prevention Training Center.

[ABOUT](#) [CONTRIBUTORS](#)

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Centers for Disease Control and Prevention
Cooperative Agreement (CDC-RFA-PS20-2004)

Lessons 3rd Edition
Two options to access the same content:
Quick Reference – Browse content or search to quickly get information
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Chlamydial Infections QUICK REFERENCE • SELF STUDY CNE/CME	Gonococcal Infections QUICK REFERENCE • SELF STUDY CNE/CME
Syphilis QUICK REFERENCE • SELF STUDY CNE/CME	Syphilis During Pregnancy and Congenital Syphilis QUICK REFERENCE • SELF STUDY CNE/CME
Genital Herpes QUICK REFERENCE • SELF STUDY CNE/CME	Human Papillomavirus Infection QUICK REFERENCE • SELF STUDY CNE/CME
Pelvic Inflammatory Disease QUICK REFERENCE • SELF STUDY CNE/CME	Vaginitis QUICK REFERENCE • SELF STUDY CNE/CME
Mpox QUICK REFERENCE • SELF STUDY CNE/CME	Mycoplasma genitalium QUICK REFERENCE • SELF STUDY CNE/CME

**National Network of
PTC Clinical
Consultation Warmline**
Clinical guidance
regarding STD cases; no
identifying patient data is
submitted

<https://www.stdccn.org/>

**CLINICIANS,
Got a Tough
STD Question?**

GET FREE EXPERT STD CLINICAL
CONSULTATION AT YOUR FINGERTIPS

Ask your question • National STD experts review • Response within 1-5 business days, depending on urgency

GO

NYC STI/HIV Prevention Training Center (PTC)

The CDC-funded NYC STI/HIV Prevention Training Center at Columbia University provides a continuum of education, resources, consultation and technical assistance to health care providers, and clinical sites. *Region: Ohio, Indiana, Michigan, New York, New Jersey, Puerto Rico & the US Virgin Islands*

<https://www.publichealth.columbia.edu/nycptc>

Didactic Presentations

Webinars, conferences, trainings and grand rounds presentations to enhance and build knowledge

Technical Assistance

Virtual and on-site technical assistance regarding quality improvement, clinic implementation and best practices around sexual health provision

For more information please contact:
nycptc@cumc.columbia.edu

Clinical Consultation Warmline

Clinical guidance regarding STD cases; no identifying patient data is submitted

www.stdccn.org

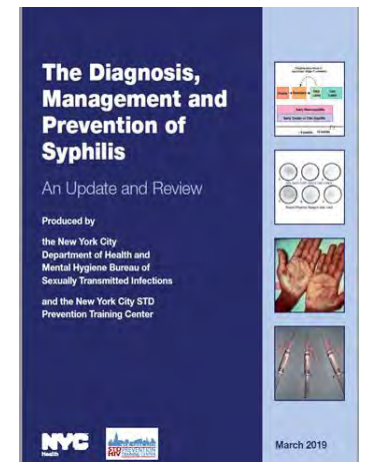
Resources

Clinical guidance tools regarding the STD treatment guidelines, screening algorithms and knowledge books, such as the **Syphilis Monograph**.

To download a copy please visit:
<https://www.publichealth.columbia.edu/file/15568/download?token=exDNYpJ->



National Network of
STD Clinical Prevention
Training Centers



Questions

