STI Guidelines: New Treatment, New Challenges

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No Disclosures
Adapted from a lecture by Kimberly Workowski, M.D.
Professor of Medicine, Division of Infectious Diseases, Emory University
Overview

• Guidelines Process

• Screening
  ○ USPSTF CT and GC
  ○ STI in MSM (early syphilis, rectal GC, LGV)

• New Directions
  ○ Emerging Issues (MG, HCV)
  ○ Treatment concerns (GC, CT)
  ○ Syphilis – NS definition, reverse testing algorithm
  ○ HPV management
  ○ Trichomonas management
• Authoritative, evidence based
• Dx, evaluation/tx, prevention, vaccination
• Wall charts, pocket guides
• Mobile App for Apple devices and Droid
• Updated guidance has been revised and is waiting CDC clearance
Clinical Prevention Guidance

- Behavioral and biologic risk assessment
  - “Five Ps” – partners, practices, prevention of pregnancy, protection, past history of STD
- High intensity behavioral counseling (USPSTF)
- Pre-exposure vaccination (HPV, HAV, HBV)
- Male latex condoms
- Male circumcision
- Microbicides
- Emergency contraception
- Preexposure prophylaxis for HIV
- Retesting after treatment
Chlamydia and Gonorrhea Screening

• Annual screening of sexually active women <25

• Screening of older women at increased risk
  o New sex partner, partner with concurrent partners or more than one partner, or partner with an STI

• Screening older women at low risk of infection not recommended

• CT screening sexually active men
  o Insufficient evidence for general screening; Consider in high prevalence (adolescent clinics, corrections, STD clinics)

• GC screening in men not recommended

USPSTF 2014
Special Populations

- Pregnant women
- Adolescents
- Children
- Persons in Correctional Facilities
- Men Who Have Sex with Men (MSM)
- Women Who Have Sex with Women (WSW)
- Transgender Men and Women
MSM

- Recent or concurrent STI and HIV infection
  - rectal gonorrhea and chlamydia (Bernstein 2010, Pathela 2013)
  - Substance abuse, multiple anonymous partners, sex partners through internet
Proportion of MSM* Attending STD Clinics with Primary and Secondary Syphilis, Gonorrhea or Chlamydia by HIV Status†, STD Surveillance Network (SSuN), 2012

*MSM = men who have sex with men.
†Excludes all persons for whom there was no laboratory documentation or self-report of HIV status.
‡GC urethral and CT urethral include results from both urethral and urine specimens.
STI Screening in MSM

- Sexually active MSM +/- HIV (at least yearly)
  - Syphilis serology
  - GC/CT NAAT* – urine

- Receptive oral
  - GC NAAT or culture

- Receptive anal
  - CT/GC NAAT

- Hepatitis A, B, C

More frequent STI screening dependent on risk (3-6 mos)

* NAAT – Nucleic Acid Amplification Test
Proposed New Section

- **Emerging Issues**
  - **Role of *Mycoplasma genitalium***
    - Evidence of role in NGU (20%); role in cervicitis and PID emerging
    - No commercially available test (in-house NAATs)
    - Treatment implications
      - Azithromycin > doxycycline
      - Conflicting data on single dose vs extended dosing
      - Emerging resistance to azithromycin
• Observational studies – DOX (7 studies); AZM (14 studies)
  o Microbiologic cure rates
  • Doxycycline (7-9 days): 37% (median); range 17-94%
  • Azithromycin (1g): 91% (median); range 69-100%

• RCTs

• Efficacy of AZM is not consistently high and declining
# Efficacy of moxifloxacin

<table>
<thead>
<tr>
<th>Study</th>
<th>Reason for treatment</th>
<th>Moxifloxacin dose</th>
<th>Micro Cure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bradshaw 2006</td>
<td>AZM 1g treatment failures</td>
<td>400mg x 10 days</td>
<td>9/9 (100%)</td>
</tr>
<tr>
<td>Ross 2006</td>
<td>PID</td>
<td>400mg x 14 days</td>
<td>3/3 (100%)</td>
</tr>
<tr>
<td>Jernberg 2008</td>
<td>STD sx, or partner sx or MG+ or CT+</td>
<td>400mg x 7 days</td>
<td>3/3 (100%)</td>
</tr>
<tr>
<td>Bradshaw 2008</td>
<td>AZM 1g treatment failures</td>
<td>400mg x 14 days</td>
<td>8/8 (100%)</td>
</tr>
<tr>
<td>Terada 2012</td>
<td>Cervicitis</td>
<td>400mg x 7 days</td>
<td>38/42 (91%)</td>
</tr>
<tr>
<td>Twin 2012</td>
<td>AZM 1g treatment failures</td>
<td>400mg x 10 days</td>
<td>77/77 (100%)</td>
</tr>
<tr>
<td>Walker 2013</td>
<td>AZM 1g treatment failures</td>
<td>400mg x 10 days</td>
<td>3/3 (100%)</td>
</tr>
<tr>
<td>Anagrius 2013</td>
<td>AZM 1g treatment failures</td>
<td>400mg x 7 days</td>
<td>9/9 (100%)</td>
</tr>
<tr>
<td>Manhart 2013</td>
<td>Treatment failures (AZM1g, DOX, both)</td>
<td>400mg x 7 days</td>
<td>17/20 (85%)</td>
</tr>
</tbody>
</table>
Emerging Issues

• Sexually acquired HCV
  o Unprotected receptive anal intercourse
  o Rough or poorly lubricated unprotected anal penetration (fisting)
  o Ulcerative STIs (syphilis, LGV)

• Annual screening
  o MSM +/- HIV infection
  o Yearly testing with repeat test (HCV prevalence, high risk behavior, ulcerative sti or sti-related proctitis)

• Acute HCV may be HCV Ab negative (CD4 <200)
  o HCV RNA with new LFT elevation
Urethritis

- GC (5-20%)
- Chlamydia 15-40%
- M. genitalium 5-25%
- Ureaplasma 0-20%
- Trichomoniasis 5-20%
- HSV 15-30%
- Adenovirus
- Enterics, Candida
Urethritis

- Diagnosis of urethritis
  - Discharge
  - POC (gram stain ≥ 2 WBCs, methylene blue or gentian violet) or LE on first void urine
  - IF POC not available
    - those who meet at least one criteria for urethritis should have NAAT testing and be treated for GC & CT
  - Sx but no signs of inflammation, NAAT testing may identify infection
    - GC or CT treat per recommendations
    - Empiric tx for high risk or unlikely follow-up
Gonorrhea
Criteria for GC Treatment Recommendations

- Antimicrobial resistance surveillance (GISP)
  - Change in antimicrobial if resistance prevalence >5% (MMWR 1987)

- GC treatment efficacy
  - >95% and 95% CI lower bound 90% (HHH, 1992)
  - >95% and 95% CI lower bound 95% (Moran, 1995)

- Pharmacokinetic/pharmacodynamic factors
  - Serum concentration at least 4x MIC90 x 10 hr after peak (Jaffe 1987)
  - At least twice the minimum efficacious dose

- Other factors
  - Mechanism of action
  - Side effects and safety
  - Cost
Percentage of Isolates with Elevated Cefixime MICs (≥0.25 μg/ml), United States, 2009–2013*

2010 Treatment Guidelines (Dec): Dual treatment recommended

2012 Update (August): Cefixime no longer recommended

* Preliminary data
Percentage of Isolates with Elevated Ceftriaxone MICs (≥0.125 μg/ml), 2009–2013*

* Preliminary data
Uncomplicated Gonococcal Infections of Cervix, Urethra & Rectum

Ceftriaxone 250 mg as a single intramuscular dose

PLUS

Azithromycin 1 g orally

Alternative:
If Ceftriaxone is not available:
Cefixime 400 mg PLUS azithromycin 1 gram
Proportion of GISP Isolates with Tetracycline Resistance or Elevated Azithromycin MICs (≥2 μg/ml), 2009-2013

Year

Percentage

2009 2010 2011 2012 2013

Tetracycline Resistance

Elevated Azi MICs

0.6%
GC Treatment

- No clinical data to support increasing dose of ceftriaxone or azithromycin as part of dual therapy
- Higher ceftriaxone and/or azithromycin doses recommended outside US (UK, Japan) based on modeling not clinical data
- Ceftriaxone treatment failures rare - all outside US
- Azithromycin monotherapy effective not recommended - ease of resistance
- Test of cure not needed after treatment for urogenital or rectal infection (recommended/alternative); recommended for pharynx (alternative)
New Possible Future Treatment Options

- NIH sponsored RCT (Kirkaldy, CID 2014)
  - Gentamicin 240 mg IM + azithromycin 2 g PO, OR
  - Gemifloxacin 320 mg PO + azithromycin 2 g PO

- Rationale
  - Additive effect, gentamicin and azithromycin *in vitro*
  - Gemifloxacin more active against cipro resistance or GyrA and ParC mutations

<table>
<thead>
<tr>
<th>Location</th>
<th>Gentamicin / Azithromycin</th>
<th>Gemifloxacin / Azithromycin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>% (L 95% CI)</td>
</tr>
<tr>
<td>Urethra/Cervix</td>
<td>202/202</td>
<td>100% (98.5%)</td>
</tr>
<tr>
<td>Pharynx</td>
<td>10/10</td>
<td>100%</td>
</tr>
<tr>
<td>Rectum</td>
<td>1/1</td>
<td>100%</td>
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</table>
Suspect Treatment Failures

- Most treatment failure likely due to reinfection
- If tx failure suspect, obtain culture/susceptibility test
- Treatment
  - If reinfection likely (ceftriaxone/azi); Rx ceftriaxone 250 mg + azithromycin 1 gram
  - If reinfection likely (cefixime/azi), Rx ceftriaxone 250 mg + azithromycin 2 gram
  - If tx failure suspected, Rx gemifloxacin 320 mg +azithromycin 2 g or gentamicin 240 IM + azithromycin 2g
- Report to local or state health department
- Test of cure 7-14 days after retreatment (culture/AST preferred with NAAT)
- Ensure partner tx
Chlamydia
Chlamydia Treatment

• Effectiveness of azithromycin < doxycycline
  ○ Data from one NGU trial and several rectal infection studies

• Doxycycline delayed release 200 mg tablets (Doryx)
  ○ 200 mg daily for 7 days

• Amoxicillin moved to alternative regimen in pregnancy
  ○ In vitro studies demonstrate PCN induces persistent viable noninfectious *Chlamydia* forms that revert to infectious forms after PCN removal (Wyrick)
  ○ Earlier amoxicillin Rx studies in CT in pregnancy had major limitations
  ○ RCT by Kacmar et al. showed higher TOC by LCR w/ azithro vs. amox (95% vs. 80%)
Azithro vs. Doxy RCTs using NAAT

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<tr>
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<tbody>
<tr>
<td>Efficacy (99%)</td>
<td>96%</td>
<td>77%</td>
<td>86%</td>
</tr>
<tr>
<td>Azithromycin</td>
<td>95%</td>
<td>90%</td>
<td></td>
</tr>
<tr>
<td>Doxycycline</td>
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</tr>
</tbody>
</table>
Azithro or Doxy for Rectal CT using Nucleic Acid Amplification Tests NAAT

<table>
<thead>
<tr>
<th>REF</th>
<th>CT + Cohort</th>
<th>Rx</th>
<th>TEST</th>
<th>TOC</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drummond</td>
<td>85 MSM</td>
<td>Azithro</td>
<td>PCR</td>
<td>21-372 days</td>
<td>-Retrospective</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-45% tested &gt;12 wks</td>
</tr>
<tr>
<td>Steedman</td>
<td>68 MSM</td>
<td>Azithro</td>
<td>PCR</td>
<td>Rec &gt;21 days</td>
<td>-Retrospective</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-Most repeat CT+ sex after Rx</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-1/3 repeat CT+ tested &lt; 21 days</td>
</tr>
<tr>
<td>Elgalib</td>
<td>165 MSM</td>
<td>Doxy</td>
<td>SDA/TMA</td>
<td>Median 45d IQR 34-88d</td>
<td>-Retrospective</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-Long post-Rx test interval</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-Majority rectal CT pts excluded</td>
</tr>
<tr>
<td>Hathorn</td>
<td>82 MSM/women</td>
<td>42 Azithro</td>
<td>TMA</td>
<td>Rec 42 days</td>
<td>-High lost-to-f/u (~50%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40 Doxy</td>
<td></td>
<td></td>
<td>-Treatment bias in doxy Rx phase</td>
</tr>
<tr>
<td>Khosropour*</td>
<td>89 MSM</td>
<td>69 Azithro</td>
<td>Culture/TMA (majority culture)</td>
<td>21-42 days</td>
<td>-Retrospective, prelim data (unpublished)</td>
</tr>
<tr>
<td>(Unpublished)</td>
<td></td>
<td>20 Doxy</td>
<td></td>
<td></td>
<td>-Culture less sensitive assay</td>
</tr>
</tbody>
</table>

*Analysis shown restricted to 21-42 day interval (study included testing up to 180 days)
**Treatment of Genital Chlamydia Infection**

*Hocking et al (University of Melbourne)*

- **Meta-analysis** of 23 RCTs (through 2012): 1065 individuals treated with azithromycin, 850 with doxycycline
- **Pooled cure rates**: doxy 97.5%, azithro 94.4%
- Pooled estimate favored doxy (2.2% - 2.7% more efficacious) especially in **men**
- **Conclusion**: doxy **marginally** superior to azithro
- **Caveats in interpreting and comparing RCTs**:
  - Differences in when endpoint was measured
  - Only 4 studies were double blind:
  - 20 RCTS – no sample size calculations
  - Most studies performed in high-risk population (generalizability?)

ISSTDR 2013
Syphilis
Primary and Secondary Syphilis—Rates by Sex and Male-to-Female Rate Ratios, United States, 1990–2012

Rate (per 100,000 population)

Year

Rate Ratio (log scale)

Male-to-Female Rate Ratio

Male Rate

Total Rate

Female Rate
Of the reported male cases of primary and secondary syphilis, 17.4% were missing sex of sex partner information.

†MSM = men who have sex with men; MSW = men who have sex with women only.

*Of the reported male cases of primary and secondary syphilis, 17.4% were missing sex of sex partner information.

†MSM = men who have sex with men; MSW = men who have sex with women only.
• No *T. pallidum* detection tests available

• Serological response to tx (Sena 2011)
  - Stage (earlier stage more likely to decrease 4x)
  - Titer (low titer less to decline than higher titer)

• Time between Benz pcn doses
  - <9 days is best based on limited PK (nonpregnant)
  - 7 days in pregnant women
    - 40% are below treponemicidal levels after 9 days
    - If a dose is missed, the entire series must be restarted
If incubating or primary syphilis is suspected, treat with benzathine penicillin G 2.4 million units IM x 1 and/or repeat in 2-4 weeks.

If at risk for syphilis, repeat RPR in 2 to 4 weeks.

Evaluate clinically, determine if treated for syphilis in the past, assess risk of infection, and administer therapy according to guidelines if not previously treated.
Discordant Results from Reverse Sequence Syphilis Screening — Five Laboratories, United States, 2006–2010

<table>
<thead>
<tr>
<th>Population</th>
<th>Test</th>
<th>Total</th>
<th>Reactive EIA/CIA</th>
<th>Nonreactive RPR</th>
<th>Nonreactive confirmatory treponemal test*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>n</td>
<td>% total</td>
<td>n EIA/CIA+</td>
</tr>
<tr>
<td>Overall</td>
<td>Various</td>
<td>140,176</td>
<td>4,834</td>
<td>3.4</td>
<td>2,743</td>
</tr>
<tr>
<td>Low prevalence (Kaiser x 3)</td>
<td>Trep-Chek, LIAISON, Trep-Sure</td>
<td>127,402</td>
<td>2,984</td>
<td>2.3</td>
<td>1,807</td>
</tr>
<tr>
<td>High prevalence (New York, Chicago)</td>
<td>Trep-Chek, Trep-Sure</td>
<td>12,774</td>
<td>1,850</td>
<td>14.5</td>
<td>936</td>
</tr>
</tbody>
</table>
HIGH EIA/CIA INDEX VALUES MAY CORRELATE WITH TP-PA POSITIVITY

N=79 individuals with CIA index value >12.0; 100% were TP-PA positive

OD values vary among different treponemal assays

Park IU et al. JID 2011
Syphilis Treatment
Primary, Secondary, Early Latent

• Penicillin treatment of choice +/- HIV
  o Benz Pcn 2.4 mu IM x 1
• No benefit of additional therapy (Rolfs 1997)
  o Enhanced (IM+oral)
• PCN alternatives
  o Doxycycline, ceftriaxone
  o Azithromycin 2 gm (A2058G mutation/tx failure)
    - MSM>MSW (Su, STD 2012)
    - Do not use in MSM or pregnancy
Clinical signs (neurologic, ocular, auditory, meningitis, stroke) warrant investigation

CNS invasion in early syphilis +/- HIV is common
- CSF abnormalities
- Unknown clinical significance in absence of signs or sx

Neurosyphilis: Diagnosis depends on a combination of tests:
- CSF tests (Cell count or protein, and a reactive CSF VDRL)
- With reactive blood tests for symptoms and
- Neurologic signs/sx

LP: neuro/ocular sx, serologic treatment failure, tertiary
- Some studies in HIV+ showed association with CSF abnormalities*
  - RPR ≥ 1:32 and/or CD4 ≤350
- Unless neurologic signs/sx, value of LP unknown.

* Marra 2004; Libois A, STD 2007; Ghanem CID; Marra CID 2008
Lymphogranulomavirus venereum

- Outbreaks of protocolitis among HIV+ MSM
- MSM presenting with protocolitis should be tested with rectal NAATs (chlamydia)
  - Can do PCR based genotyping LGV vs non LGV strains but results not available in real time
  - Protocolitis +/- perianal ulcers should receive presumptive tx for LGV (doxy 100 mg bid x 21 d)
    - Painful perianal ulcers or mucosal ulcers (anoscopy) presumptive therapy for HSV
Genital Herpes

• Increasing proportion of anogenital infections HSV-1 (young females, MSM)

• IgM testing not useful

• Type specific serologic tests
  o HerpeSelect HSV-2 ELISA may be false + at low index values (1.2-3.5)- confirmed with Biokit or WB
  o HerpeSelect HSV-1 ELISA insensitive for HSV-1 (80%)
  o Head to head comparison of type specific assays vs WB

• No change in recommended therapy
HSV-1 seroprevalence in U.S. by time period and age: NHANES, 1999–2010
HPV Infection

• ACIP* HPV vaccine recommendations (MMWR, 2014, Vol 63)

• Podophyllin resin 10-25% (alternative) NO LONGER RECOMMENDED
  o Case reports of serious systemic toxicity (including death)
  o No clear efficacy benefit when compared with podophyllotoxin

• Case reports of inflammatory responses to imiquimod
  o Worsened inflammatory and autoimmune skin disease
    - psoriasis, vitiligo, and lichenoid dermatoses

• Imiquimod (3.75%) applied daily for genital warts

* Advisory Committee on Immunization Practices
Risk to Healthcare Workers Treating Genital Warts

- HPV DNA can be found in smoke plumes after laser or electrosurgical therapy on EGW, CIN, common warts
- 2 case reports of laryngeal papillomas reported in HCW exposed to smoke plumes during treatment of GW
- Appropriate infection control to prevent possible transmission for anogenital warts and anogenital intraepithelial neoplasias (e.g. CIN) with CO2 laser or electrosurgical procedures (local exhaust ventilation-smoke evacuator)
Anal Cancer Screening

- HPV vaccination of MSM (ACIP 2014)
- Some clinical centers perform anal cytology in high risk populations
- Data are insufficient to recommend routine anal cancer screening with anal cytology
  - More evidence on best screening methods
  - Safety and response to treatment
  - Programmatic considerations
- High risk HPV tests not clinically useful for anal cancer screening (high prevalence of anal HPV infection)
Trichomonas Epidemiology

NAAT prevalence of TV, CT, and GC infections among 7593 U.S. women age 18–89, by age group

Ginocchio CC *Journal of clinical microbiology*. Aug 2012
**T vaginalis**

- Consider screening of those receiving care in high prevalence settings (STD clinics, corrections) or asymptomatic persons at high risk of infection (multiple sex partners)
  - Lack data on screening/tx to reduce adverse events or disparities
  - Screening decisions informed by epidemiology

- **NAATs for diagnostic testing**
  - APTIMA *T vaginalis*; BD Probe Tec TV QX amplified DNA Assay
  - A molecular test-resolved algorithm (negative wet prep followed by NAAT - Aptima TV - sensitivity 87.5–96.6%, specificity of 97.7–100% (Nye)

- **Retesting 3 mo after treatment**

- Tx Metronidazole 2 g or Tinidazole 2 gm

- Nitroimidazole resistance 4-10% (Kirkaldy 2012, Schwebke 2006)
Trichomonas vaginalis and HIV in Women

**TV is an independent risk factor for HIV acquisition**

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Odds Ratio (CI)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increases probability of acquiring HIV</td>
<td>OR 2.6 (CI:1.4–4.7)</td>
<td>Hughes, 2012</td>
</tr>
<tr>
<td>More likely to test positive for HIV</td>
<td>HR 2.1 (CI:1.1–4.0)</td>
<td>Mavedzenge, 2010</td>
</tr>
<tr>
<td>Associated with incident HIV</td>
<td>OR 2.7 (CI:1.3–6.0)</td>
<td>Van der Pol, 2008</td>
</tr>
</tbody>
</table>

**Maternal TV is a risk factor for vertical transmission**

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Risk Ratio (CI)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increases HIV vertical transmission risk</td>
<td>RR 1.7 (CI:1.0–2.9)</td>
<td>Gumbo, 2010</td>
</tr>
</tbody>
</table>
Women with HIV infection should receive screening at entry to care and annually if sexually active

- Associated with PID (Moodley 2002)
- Treatment reduces genital HIV shedding (Kissinger 2009, Anderson 2012)

Longer treatment course better in HIV+ women

- Metronidazole 500mg BID x7d (vs. 2g) - less TV at TOC/3 mo RR 0.46, CI: 0.21–0.98 (Kissinger, 2010)
- Potential factors - BV infection, ARV, changes in vaginal ecology

No data to recommend extended treatment in men

Retesting 3 mo after treatment
Bacterial Vaginosis

- **Treatment** - metronidazole oral or gel, clindamycin cream

- **Recurrent BV**
  - Biweekly suppressive MTZ gel (RCT) for 4-6 mo
  - Oral metronidazole followed by boric acid and suppressive metrogel
  - Metronidazole (10-14 days with vaginal gel or oral tablets) or a weeklong course of oral tinidazole (limited data)
  - No data on suppressive tinidazole, oral clindamycin/vaginal cream
  - No support of any available probiotic as adjunctive or replacement therapy to antibiotics in BV

- **Awaiting more data**
  - Vitamin D deficiency; contraceptives and BV risk
  - *L. crispatus* vaginal capsule (LACTIN-V) for BV prevention
Sexual Assault in Adults

• Initial exam individualized
  o NAAT for GC, CT; NAAT or POC test for trichomonas
  o HIV, syphilis, hepatitis B

• Prophylaxis
  o Empiric tx for GC, CT, trichomonas
  o Emergency contraception
  o Post exposure hepatitis B vaccination
  o HPV vaccination
  o HIV PEP individualized according to risk (algorithm)
Resources

CDC 2010 STD Treatment Guidelines

Check CDC website soon for the 2015 guidelines

Maryland Department of Health and Mental Hygiene
Center for Sexually Transmitted Infection Prevention
http://phpa.dhmh.maryland.gov/OIDPCS/CSTIP/SitePages/cstip-for-healthcare-providers.aspx

Disease Reporting in Maryland
http://phpa.dhmh.maryland.gov/SitePages/reportable-diseases.aspx
E-mail questions for the presenters to:
maphtc@jhu.edu