GONORRHEA & CHLAMYDIA: DIFFERING TRENDS, DIFFERENT INTERVENTIONS?

NEW AND EMERGING ISSUES IN SEXUALLY TRANSMITTED AND BLOOD BORNE INFECTIONS
2012 CONFERENCE

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Sex. It’s complicated!
*apologies to Trina Larsen
I. INTRODUCTION

- But is it complex?

  - Stoner et al. (2000): (emphasis added)
    “Maintenance and spread of STIs within populations reflect complex interactions between host susceptibility and pathogen virulence; availability and accessibility of healthcare; and sociobehavioural parameters of sexual mixing, partnership formation and healthcare-seeking responses to infection.”

  - More on this later…
SEXUALLY TRANSMITTED INFECTIONS: THE BASICS

- Sexually transmitted infections (STIs), not including HIV have been more and more recognized as important in their own right.
  - Associated with a resurgence in rates worldwide.

- Increased susceptibility to HIV & have been linked with longer term sequelae such as pelvic inflammatory disease (PID) and infertility.
  - Although primarily affects youth and young adults, effects can last lifetime.

- Tremendous financial and human costs.
SEXUALLY TRANSMITTED INFECTIONS: THE BASICS (CONT’D)

• Chlamydia (CT) and gonorrhea (GC) the most commonly reported bacterial infections in developed countries.

• In Canada, costs of treatment of CT and GC estimated at $89 M and $54, respectively (1990).

• In US (2010 USD), direct medical costs associated with STIs (excl. HIV) estimated ~ $8 billion/yr.

• Thus, prevention, early detection, and treatment remain a priority for most public health departments.
CT and GC infections have similar modes of transmission, have similar symptoms and often invoke a similar (if not the same) public health response.

But is this necessarily the correct response?

- Does one size necessarily fit all?

- Perhaps not...
- Not many answers – food for thought; generate discussion
II. SOME HINTS: CHLAMYDIA AND GONORRHEA EPIDEMIOLOGY IN THE WINNIPEG HEALTH REGION

- Analyses by the Population and Public Health Program, WRHA.
- *Data collected by Public Health Nurses & other staff
THE WINNIPEG HEALTH REGION (WHR)

- The largest health region in Manitoba (2010: ~700,000; ~64% of Manitoba population).
- Includes Winnipeg, and the rural municipalities of East St. Paul and West St. Paul.
- The WHR is divided into 12 Community Areas (Map) and 25 Neighborhood Clusters.
- The Winnipeg Regional Health Authority (WRHA) is responsible for the delivery of acute care and public health and other community services to the residents of the WHR.
CHLAMYDIA (CT) & GONORRHEA (GC): A TALE OF TWO PATHOGENS - WINNIPEG EXAMPLE

1996: ~1,300/yr or 175 per 100,000
2010: ~3,300/yr or 470 per 100,000
CHLAMYDIA (CT) & GONORRHEA (GC): A TALE OF TWO PATHOGENS - WINNIPEG EXAMPLE

GC

1996: ~400/yr or 65 per 100,000
2010: ~470/yr or 70 per 100,000
CHLAMYDIA (CT) & GONORRHEA (GC): A TALE OF TWO PATHOGENS - BY SEX

CT

Year
Overall
Female
Male

1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010

0
100
200
300
400
500
600
700
800

Age-standardized rate
CHLAMYDIA (CT) & GONORRHEA (GC): A TALE OF TWO PATHOGENS – BY SEX
CT & GC BY COMMUNITY AREA: 2010

Legend
- CT
  - 239.7 - 305.7
  - 305.8 - 401.6
  - 401.7 - 469.6
  - 469.7 - 910.9
  - 911.0 - 1592.3

Legend
- GC
  - 16.0 - 41.8
  - 41.9 - 79.0
  - 79.1 - 122.2
  - 122.3 - 254.6
  - 254.7 - 561.2
FORMALIZING INEQUALITY: GINI COEFFICIENT

Derived from Lorenz curve; Single number from 0 to 1

Perfect equality: Gini = 0
Perfect inequality: Gini = 1

Figure 1 The Lorenz curve framework (hypothetical data).

From De Maio, 2007 JECH
1. CT more dispersed; GC more concentrated in certain subgroups.
2. For CT, Gini coefficient has lowered in all age groups.
3. Gini coefficient has increased in certain age groups for GC.
CT: AGE-SPECIFIC RATES, FEMALES & MALES

Year

Age-specific rates
15-19
20-24
25-29
30-39
40-49

Females

- 15-19
- 20-24
- 25-29
- 30-39
- 40-49

Year
GC: AGE-SPECIFIC RATES, FEMALES & MALES

[Graph showing age-specific rates for females from 1996 to 2010, with age groups 15-19, 20-24, 25-29, 30-39, and 40-49 indicated by different line types and markers.]
GC: AGE-SPECIFIC RATES, FEMALES & MALES

Males

- 15-19
- 20-24
- 25-29
- 30-39
- 40-49

Year

A SUMMARY

**Epidemic “signature” differs between CT and GC**

- Rates of CT always several-fold higher.
- Although both have peaked recently, GC has been declining for several years; CT stabilizing.
- Unlike CT, for GC male rates = female rates.
- GC “extends” into middle adulthood in males moreso than CT.
- CT has expanded into all areas of the WHR, while GC is showing signs of being more concentrated in certain subgroups.
III. REASONS BEHIND HETEROGENEITY

- Can affect certain populations disproportionately

- Multilevel – reasons at the pathogen, individual and population level, including (Aral et al., 2006)

  i.e., “Drivers of Heterogeneity” (more on these later)
  - Sexual structure
  - Societal determinants (e.g., amplifiers)
  - Epidemic potential
  - Concentration/Change/Spatial mobility
III. REASONS BEHIND HETEROGENEITY

- Overlooked, but important: **Pathogen characteristics**

- GC asymptomatic in 5% males, 30-60% females; while CT asymptomatic in 25-35% of males and 65-75% in females.
BIOLOGICAL SUCCESS FACTORS*

• “Sprinters” (e.g. *N. gonorrhoeae*)
  • Highly infectious, short duration
  • Thrive in human populations where there is a high turnover of short duration sexual partnerships with minimal gaps between partnerships

• “Middle Distance” (e.g. *C. trachomatis*)
  • Moderately infectious, medium duration
  • Thrive in human populations with high turnover of sexual partnerships, but don’t need as much partner turnover or as short gaps as the “sprinters”

• “Marathoners” (e.g. HIV*)
  • Generally low infectiousness, long duration
  • Thrive where is a mix of high partner turnover and concurrency in longer term partnerships

*Courtesy of Dr. James Blanchard
INTERPLAY BETWEEN SEXUAL STRUCTURES AND PATHOGENS – A GENERAL FRAMEWORK

Pathogen Types

“Sprinters”
Short Duration, Highly Infectious
(e.g. GC, HD)

“Middle Distance”
Medium Duration, Medium Infectious
(e.g. CT)

“Marathoners”
Long Duration, Low Infectious
(e.g. HIV, HSV-2?)

Sexual Structures

“Commercial Sex”
Many partnerships, Short duration

“Serial Monogamy”
Few partnerships, Variable overlap

“Concurrency”
Fewer partnerships, Overlapping

*Courtesy of Dr. James Blanchard
BIOLOGICAL SUCCESS FACTORS

• Pathogens, fundamentally are opportunistic
  • Seek out environments where they have the best chances for survival

• Because of their characteristics, CT and GC thrive in different environments

• Both disproportionately affect the core area of the WHR

• HOWEVER: GC has less success in “escaping” the core, while CT has more success.
IDEALIZED EPIDEMICS: “LOCAL CONCENTRATED” (E.G., GC)

- Epidemic is driven by distant and local high risk “core groups” through “bridge” populations to lower risk partners

*Courtesy of Dr. James Blanchard
IDEALIZED EPIDEMICS: “GENERALIZING” EPIDEMIC (CT)

- Epidemic is driven initially by high risk “core groups”, but expands and spreads through other networks.

*Courtesy of Dr. James Blanchard
Sexual structure: including sexual network (Wylie & Jolly, 2001; Wylie et al., 2010; Stoner et al., 2000); and sexual mixing patterns (Aral 1999).

Societal determinants: CT and GC have different demographic and risk factor profiles, incl. age, ethnicity and likelihood for reinfection. (Zimmerman, HL. 1990; Van Duynoven, 1997; Gunn et al., 2000).

Spatial clustering: GC more spatially concentrated (Zimmerman, HL. 1990 (Colorado Springs); Schleihaufl, E., 2009 (New South Wales); Law, DC., 2004 (N. Carolina))

Sum of research suggests that GC is more concentrated in specific areas, and those with GC infections (and in turn, their sex partners) tend to display higher risk behaviours.
From Low et al. (2006):
STIs affect individuals, who are part of partnerships that larger sexual networks, and in turn populations

Proposed a multilevel framework to examine the impact of STI interventions:

- Individual
- Population
- Bridging/Partnership
# MATRIX OF INTERVENTIONS

From Low et al., 2006

## Key message: It Depends!

![Matrix of Interventions](image)

**Figure 2: Effectiveness of interventions for controlling sexually transmitted infections.**

- *De*-discharge, *HPV*-Human papillomavirus, *STI*-sexually transmitted infection. *Includes only interventions to prevent sexually transmitted HIV and hepatitis B.*
- *Evidence for absence of benefit of syndromic management for vaginal discharge when prevalence of sexually transmitted infections is low.*
- *Rapid diagnostic tests being assessed by STD Diagnostics Initiative.*
- *Interventions include treating male partner of women with trichomoniasis to prevent reinfection in the woman, and suppressive valaciclovir to index case in HSV-2 discordant couples.*
- *Evidence is categorised as level 2, because level 1 evidence is available only for prevention of pelvic inflammatory disease in individuals.*

From Low et al., 2006
EXAMPLE 1: SCREENING FOR CT

- Proactive vs. opportunistic
- Who to target – opportunity costs
SCREENING (CONT’D)

Who to target

Figure: Effect of chlamydia screening uptake on prevalence
**SCREENING (CONT’D)**

Where to place resources

<table>
<thead>
<tr>
<th>Prevalence after 10 years (%)</th>
<th>Start of programme</th>
<th>Screen women only</th>
<th>Screen women and men</th>
</tr>
</thead>
<tbody>
<tr>
<td>35% uptake in all sexual activity groups</td>
<td>4.4%</td>
<td>3.9%</td>
<td>3.5%</td>
</tr>
<tr>
<td>64% uptake in all sexual activity groups</td>
<td>4.4%</td>
<td>3.6%</td>
<td>3.0%</td>
</tr>
<tr>
<td>100% uptake in highest activity group, no screening in rest of population</td>
<td>4.4%</td>
<td>3.8%</td>
<td>3.0%</td>
</tr>
<tr>
<td>100% uptake in highest activity group plus 35% in rest of population</td>
<td>4.4%</td>
<td>3.6%</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

*Table: Effect of general population and targeted screening on chlamydia prevalence*
EXAMPLE 2: INTENSIVE GC EFFORTS

• From Zimmerman et al. (1990):
  • Colorado Springs, Col.
  • Intensive GC efforts decreased cases from 2000 to 1000 from 1977 to 1988; but at the same time, the proportion of non-Whites increased from 39% to 67%

NB:
- Flexible
- Watch for unintended consequences
A FINAL WORD: COMPLICATED VS. COMPLEX

• This is complicated.
COMPLICATED VS. COMPLEX

• This is complex.

Nahmias & Nahmias, 2011
What conditions are created that maximize the specific ability for CT and GC to find their ecological niches?

**E.g., what is the ecology that GC finds itself best suited for?**

- Relatively symptomatic -> networks with high turnover, or comprised of those whose socio-economic positioning may deter from health-seeking behaviour.
- Society creates the conditions (e.g., sexual structures like sexual networks, structural amplifiers like inequalities) that GC/CT best thrives in.
  - View the existence of GC/CT as intimately and intricately embedded within its determinants, and what emerges are population/aggregate patterns.
SUMMARY*

- **Know the pathogen**
  - Epidemiology of STIs to determine burden and temporal trends
  - In which settings will it thrive?

- **Know the population**
  - Where should programs and services be targeted?
  - Sexual structure, transmission dynamics

*After Blanchard et al.*
SUMMARY

• Try to understand the complex interactions of the pathogens and populations

• Not just a tale of two pathogens, but two different (if not interlinked) systems in which these pathogens thrive.

• Reframing the epidemiology of CT/GC – does it reframe our response?
  • Broadens the scope of public health
**DISCUSSION: MIX OF INTERVENTIONS**

- Does it make sense to **not** distinguish between CT and GC?
  - So far, little differentiation
  - Screening/Social marketing campaigns/e-notifications/expedited partner therapy: equally effective?

- What would programming look like if there were a distinct focus on reducing GC in hardest hit areas?

- For example:
  - Can we live with an “acceptable” amount of CT, and target GC?
  - Can we target CT primarily in the same core groups as GC and worry less about CT outside of the core groups?
  - Can we use one main strategy for GC (ie, partner notification) and a different main strategy for CT (ie, screening)?
• Thank you!

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