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Factors Associated With Follow-Up Compliance among Clients Referred By a Local Health Department for HIV Pre-Exposure Prophylaxis

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Abstract

Background: Pre-exposure prophylaxis (PrEP) for human immunodeficiency virus (HIV) is a public health strategy to limit HIV infection among at-risk populations. Local health departments (LHDs) promote PrEP initiation by referring patients to private and academic specialty care centers. However, low follow-up compliance remains a challenge in this setting. Between January 2016 and September 2018, Douglas County Health Department, a LHD in Omaha, Nebraska, externally referred 126 clients for PrEP at an academic specialty care center, and only 20 (15%) clients completed a PrEP initiation follow-up appointment. The purpose of this study is to describe the characteristics of clients referred by Douglas County STD Clinic to an academic specialty care center for HIV PrEP services and to identify factors associated with follow-up compliance within this group.

Study objective and goals: The goal of this study is to characterize the client population at Douglas County STD clinic that is externally referred for HIV pre-exposure prophylaxis at UNMC. The primary study objective is to describe demographic and behavioral characteristics of clients who were referred to University of Nebraska Medical Center (UNMC) Specialty Care Center by Douglas County STD Clinic for HIV PrEP between January 2016 and September 2018.The second study objective is to identify factors that are associated with PrEP follow-up compliance among clients referred to UNMC Specialty Care Center by Douglas County STD Clinic within this study group.

Methods: This was a cross-sectional study of clients referred to UNMC Specialty Care for HIV PrEP between January 2016 and September 2018 by Douglas County STD Clinic (n=126). Surveillance records were retrospectively queried and analyzed for this study. The primary outcome was successful follow-up compliance to PrEP initiation visit at UNMC. Continuous variables were recoded as categorical variables and between-group comparisons were made using Fisher's exact tests. Estimated odds ratios for PrEP follow-up were evaluated using

univariate logistic regression models with 95% confidence intervals (CI) and $p < 0.05$ was considered significant.

Results: A total of n=126 surveillance records were analyzed. Demographic characteristics were similar between individuals who were follow-up compliant (n=20) versus those who were not. In both groups, most individuals were male (100% compliant group versus 89% noncompliant group, p=0.21) with a median age of 28 years (p=0.75) and who identified as white (65% compliant versus 60% noncompliant, p=0.3). Frequencies of social and sexual behavioral characteristics were similar between both groups. History of confirmed positive STI test(s) was significantly associated with PrEP initiation follow-up compliance (p=0.03), and history of a sexual partner's positive STI screening was associated with PrEP initiation follow-up (p=0.02). Race- and age-adjusted odds ratios (aOR) for follow-up compliant individuals with a sexual partner who had a history of confirmed STI(s) was 4.08 (95% CI: 1.42-11.76), and for those with a personal history of STI infection was 3.72 (95% CI: 1.30-10.64).

Impact: The intended public health impact of this study is to reduce the number of new HIV infections among at-risk populations by improving HIV PrEP uptake and access in Douglas County, Nebraska.

Placement Site

My Applied Practice Experience (APEx) service hours and capstone project were completed at Douglas County Health Department (DCHD) in Omaha, Nebraska. DCHD is a local health department that serves over 560,000 residents in Douglas County, Nebraska. DCHD's mission is to promote and protect the public's health. Control and prevention of sexually transmitted diseases (STD) is a public health priority for DCHD. As part of DCHD, the STD Surveillance and Control section addresses this topic, and a multidisciplinary team supports activities and public outreach that is conducted by the STD program.

During APEx, I worked with disease intervention specialists (DIS) and STI/HIV prevention specialists. These individuals focus on outreach and surveillance activities to connect the community with STI testing and treatment resources and to promote safe sexual activity. In addition to the STD division, DCHD also maintains an onsite STI clinic that provides STI screening, treatment, and counseling for community members. Collectively, DCHD strives to protect the health of communities within Douglas County.

Introduction

Human immunodeficiency virus (HIV) remains an immense health burden among vulnerable populations living in the United States. A 2014 meta-analysis of clinical studies reported a link between sexually transmitted infections (STIs) and HIV acquisition, with pooled effect estimates revealing a nearly three-fold increase in HIV acquisition risk among those with STIs (Sexton, Garnett, & Rottingen, 2005). In the midwest region of the United States, Douglas County, Nebraska, has STI rates that are higher than national averages (DCHD, 2017). In 2017, the rates of chlamydia and gonorrhea were 658.5 and 285.1 per 100,000 population, respectively, in Douglas County (DCHD, 2017). That same year, national rates of chlamydia and gonorrhea were 528.8 and 171.9 cases per 100,000 population, respectively (CDC, 2018). Given the link between STIs and HIV, preventive measures are critical to limit new HIV infections among at-risk populations in this area.

HIV pre-exposure prophylaxis (PrEP) is a strategy to reduce new HIV infections among populations at-risk of acquiring HIV through sexual exposure, including men who have sex with men (MSM) (Grant et al., 2010). HIV PrEP involves daily use of two antiretroviral medications, tenofovir and emtricitabine (TDF/FTC), taken as a single oral tablet to prevent HIV acquisition before a potential sexual exposure occurs. In a randomized controlled trial of PrEP, there was a 44% decrease in HIV acquisition among high-risk populations who received TDF/FTC as PrEP (Grant et al., 2010).

Douglas County Health Department (DCHD) is a local health department (LHD) that serves more than 560,000 residents in Douglas County, Nebraska. DCHD uses direct STD screening at an onsite STD clinic. Services provided by the Douglas County STD clinic include administration of medication for chlamydia, gonorrhea, and syphilis treatment, patient counseling on STD risk reduction behaviors, and condom distribution. Point-of-care HIV screening is provided onsite, and an established protocol is used for external referral of clients who require follow-up HIV treatment or prevention services at the University of Nebraska Medical Center Specialty Care Center (UNMC SCC). Follow-up compliance among referred clients is limited. Only 20 (15%) clients successfully followed up after referral between 2016 and 2017. Given the established efficacy of HIV PrEP and accessibility of LHD STI services in the community, improved referral systems are critical to ensure eligible patients have access to PrEP to prevent new HIV infections.

To understand gaps in the LHD referral process and to increase uptake of PrEP in Douglas County among individuals at high risk for HIV acquisition, this project will describe the characteristics of clients who are referred to UNMC SCC for HIV PrEP services by DCHD and to identify factors that are associated with follow-up compliance within this group. The overarching goal is to understand factors that contribute to low follow-up compliance for PrEP among clients receiving services at an LHD and to use this information to improve the external referral system in an LHD setting.

Problem Statement

Among individuals receiving STI preventive and treatment services at Douglas County Health Department, follow up for HIV PrEP is low. STIs are associated with HIV acquisition, and Douglas County, Nebraska, has high STI rates compared to national average. Therefore, it is important for the Douglas County STD clinic to identify characteristics of individuals referred for HIV PrEP, to develop tools to support linkage to HIV care. Currently, characteristics and factors

associated with initial appointment follow-up for PrEP have not been described for the patient populations receiving care at Douglas County Health Department.

Importance of Proposed Project

Over the past decade in Douglas County (2007-2017), Nebraska, there has been an 84% increase in chlamydia case rates from 553.5 to 658.5 cases per 100,000 population between 2007 to 2017 (DCHD, 2017). Gonorrhea case rates have increased by 65% over the past decade in Douglas County, from 185.1 cases per 100,000 in 2007 to 285.1 cases per 100,000 in 2017 (DCHD, 2017). Given the nearly three-fold increase in incidence of HIV acquisition among those with STIs, support for HIV prevention strategies like PrEP by healthcare practitioners is critical to protecting public health. To our knowledge, there are no other studies that specifically examine factors associated with PrEP follow up after external referral by an LHD. This project will offer critical information to understand characteristics among clients referred by an LHD to a specialty care center for HIV PrEP. In turn, this will inform how to devise improved patient referral processes to support follow-up for preventive services.

Literature Review

Association between STIs, HIV, and at-risk populations for HIV infection

The association between STIs and HIV acquisition and transmission is well established (Fleming & Wasserheit, 1999; Sexton et al., 2005; Wasserheit, 1992). According to the Centers for Disease Control and Prevention (CDC), STI rates have increased markedly across the U.S. Between 2013 and 2017, diagnoses of gonorrhea and primary or secondary syphilis have increased 67% and 76%, respectively (CDC, 2018). Additionally, over 1.7 million cases of chlamydia were diagnosed during this period (CDC, 2018). While the distribution of STI case

rates is not homogenous across the U.S., each geographic region has experienced similar upward trends in reportable STIs over the past decade. Men, specifically MSM, have represented a substantial proportion of STI cases reported nationally (CDC, 2016). In early the 2000s, men with reported case of rectal gonorrhea increased from 72 cases in 1994 to 273 cases in 2001, while primary and secondary syphilis cases in MSM increased to 115 total cases in 2001, after only six total cases were reported in 1998 (Ciesielski, 2003). Additionally, MSM accounted for approximately 70% of an estimated 26,200 incident cases of HIV infection in the U.S. in 2014 (CDC, 2016).

Provision of PrEP services at local health departments

Local health departments provide accessible healthcare services directly in communities. Among these services, STI screening and treatment are an important resource for at-risk populations in these settings (Leichliter et al., 2017). According to the National Profile of Local Health Departments, 65% of LHDs across the U.S. offered direct STI services to community members in 2016, including vaccination against hepatitis B and human papillomavirus (HPV), cervical cancer screening, serologic testing for syphilis, and extragenital gonorrhea and chlamydia testing (National Association for County and City Health Officials [NACCHO], 2016). The continuum of HIV care is complex and external referrals by LHDs are necessary to connect clients with comprehensive HIV services at private or academic specialty care centers (McNairy & El-Sadr, 2014).

Uptake of PrEP services among at-risk populations

To develop interventions to support HIV PrEP uptake among at-risk populations, it is critical for public health practitioners to understand factors associated with PrEP use in community settings. A retrospective analysis performed at a Rhode Island Department of Public Health STD clinic found low overall interest in PrEP initiation among MSM (Chan et al., 2016). An association between patients' perceived HIV risk and interest in PrEP initiation was identified

(adjusted OR=1.58, 95% CI 1.13, 2.22). Additional predictors of PrEP interest that approached statistical significance in a logistic regression model adjusted for age, race, and ethnicity were part STD diagnoses during lifetime, sex with an HIV-infected partner, and condomless sex (Chan et al., 2016).

HIV PrEP uptake and delivery has been evaluated in San Francisco, California. PrEP uptake at a municipal STD clinic in San Francisco was similarly low among individuals with a low perceived personal risk of acquiring HIV (Liu et al., 2014). Patient concerns surrounding PrEP medication side effects were also linked to limited uptake. Of note, client awareness about PrEP prior to receiving care at an STD clinic was associated with increased PrEP uptake. Thus, increased community engagement efforts surrounding PrEP are key in enhancing uptake (Liu et al., 2014).

Challenges of external referral in various clinical settings

Challenges surrounding initial follow-up after referral are well established. Factors associated with follow-up compliance have been described for post-discharge to outpatient care after in-patient hospital admission (Kyriacou, Handel, Stein, & Nelson, 2005; Stone et al., 2014). In the context of STI services, specifically HIV care, referral processes are utilized for access to non-occupational HIV post-exposure prophylaxis (nPEP) (Linden, Oldeg, Mehta, McCabe, & LaBelle, 2005). Unlike HIV PrEP, nPEP requires a 28-day course of antiretroviral medication to presumptively treat an individual who may have had a potential sexual exposure to an HIV-infected partner (Dominguez et al., 2016). Successful treatment outcomes require prompt initiation of medication therapy within seventy-two hours following a potential exposure. Similar to HIV pre-exposure prophylaxis, some LHDs offer initiation or referrals for nPEP.

Factors associated with patient follow up after referrals for nPEP have been studied. A retrospective cohort study examined factors associated with treatment adherence and follow up among individuals who received nPEP in a Belgian emergency department (Malinverni et al.,

2018). Individuals received a five-day course of HIV nPEP antiretroviral medication in an emergency department and were referred to an outpatient STI clinic for clinical care and to receive the remainder of the 28-day supply of medication. Risk factors associated with successful follow up compliance at an outpatient STI clinic appointment after discharge from the emergency department included previous nPEP treatment (OR: 2.36, 95% CI: 1.27, 4.39) and health insurance coverage (OR: 3.36, 95% CI 2.33, 4.86) (Malinverni et al., 2018).

Unlike nPEP, which is completed after a short 28-day course of medication therapy, HIV PrEP requires daily use of medication continuing for months, or even years depending on a patient's risk factors for acquisition of HIV infection. Follow-up after referral for HIV PrEP has been studied in a large integrated healthcare organization in San Francisco (Volk et al., 2015). In this setting, eligible patients were referred internally to a specialized PrEP program. Nearly 80% of patients referred for PrEP completed at least one PrEP intake visit. Among individuals who chose not to initiate PrEP, the majority decided not to initiate PrEP due to perceived low risk for HIV acquisition (35%), cost concerns (15%), and not wanting to complete follow up clinical visits (10%) (Volk et al., 2015).

Goals and Objectives

The primary research question is, "What social and behavioral characteristics are linked to follow up compliance for HIV PrEP services among clients who seek STI care at Douglas County Health Department?" The short-term goal is to understand the client population at Douglas County STD clinic who are both eligible and referred for HIV pre-exposure prophylaxis. The primary study objective is to describe demographic and behavioral characteristics of clients who were referred to UNMC SCC by Douglas County STD Clinic for HIV PrEP between January 2016 and September 2018. A second study objective is to identify factors that are associated with PrEP follow-up compliance among clients referred to UNMC SCC by Douglas County STD Clinic within this study group. The long-term study goal is to use information from this study to

improve external referral systems at Douglas County Health Department STD Clinic for patients who are referred for HIV PrEP services.

Research Methods

Defined research question: What are the demographic and behavioral characteristics of all individuals who were referred for HIV PrEP at UNMC SCC by Douglas County Health Department between 2016-2018? Among those who were referred for PrEP, what are the characteristics of those who were follow-up compliant for a PrEP initiation visit at UNMC SCC, and what demographic and sexual behavior variables are associated with HIV PrEP follow-up compliance?

Study Design: This was a cross-sectional study of 126 individuals referred by DCHD STD clinic to UNMC Specialty Care Clinic for HIV PrEP services between January 2016 and September 2018. Records were retrospectively collected and analyzed from a PrEP referral surveillance database maintained by DCHD.

Study population: Males and females (≥19 years) who received STI services at Douglas County STD Clinic and who were externally referred to UNMC SCC for HIV PrEP between January 2016 and September 2018. Participants were excluded if they were referred to receive HIV PrEP at a clinical site other than UNMC SCC, or if the surveillance record was incomplete (>80% missing data). The final sample size was n=126, based on number of clients in DHCD's PrEP referral surveillance system who were referred to UNMC for follow up care.

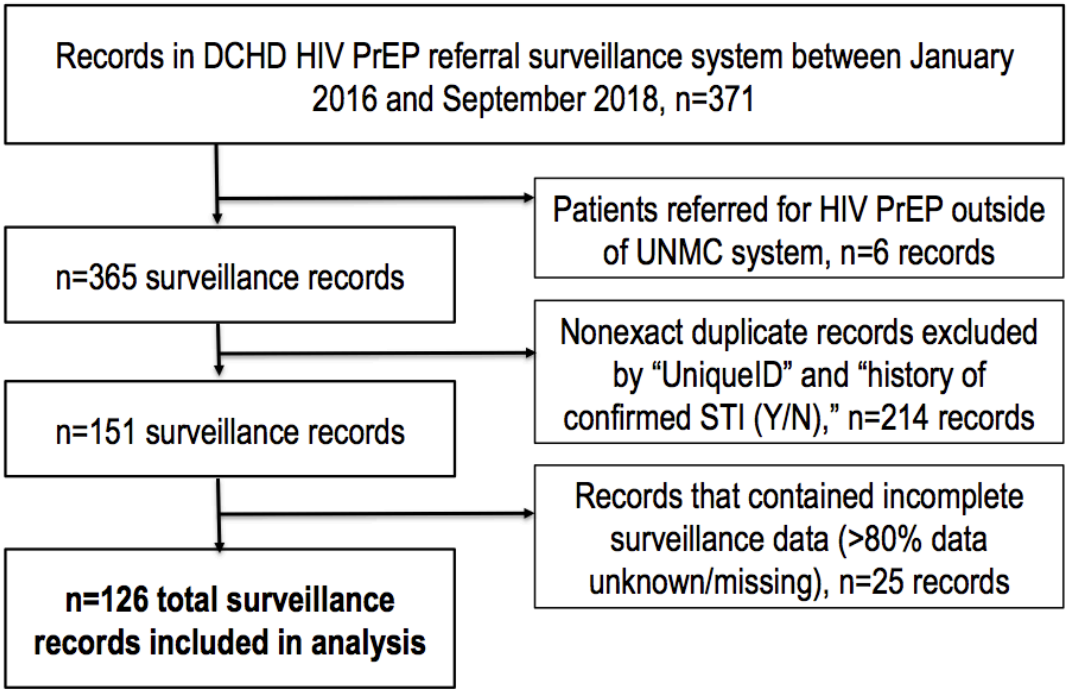

Figure 1. Flow diagram of HIV PrEP surveillance system record selection and final study sample. Abbreviations: DCHD, Douglas County Health Department; HIV, human immunodeficiency virus; PrEP, pre-exposure prophylaxis; STI, sexually transmitted infection; UNMC, University of Nebraska Medical Center.

Data source(s): Beginning in January 2016, a surveillance system of individuals receiving services at Douglas County STD clinic and externally referred for HIV PrEP was created. This dataset uses a composite of information collected from the DCHD STD program and the Douglas County STD Clinic via a CDC data management application STD Management Information System (STD*MIS version 5.2) used for maintaining STD surveillance records, and information from UNMC SCC regarding client follow up for PrEP. Records included in this surveillance dataset are from clients with nonreactive HIV screening tests and risk factors for HIV acquisition including sexual history, types of sexual partners (male or female at birth), number of partners, and past history of STIs.

Data collection methods: Surveillance database records were retrospectively queried and analyzed for this study. Study inclusion criteria were HIV uninfected patients aged 19 years or older who were externally referred by Douglas County STD Clinic to UNMC SCC for HIV PrEP between January 2016 and September 2018. Records were excluded if surveillance record was not complete (missing data for >80% of variables included for analysis). Demographic information abstracted from the surveillance system included age, sex assigned at birth, and race/ethnicity for the study group. The primary outcome measure was initial appointment follow-up compliance among clients referred for HIV PrEP, defined as completion of initial follow up appointment at UNMC Specialty Care Center within one month following referral by DCHD. Covariates were selected based on potential relationship with the outcome of appointment follow-up for PrEP and were based on literature review and data availability in the PrEP referral surveillance system. Independent variables selected for analysis include history of intravenous drug use (IDU), type of sex partner (men, women, both), maximum number of reported sex partners over a 12-month period during lifetime (1-10 or 10 or more partners), history of confirmed STI diagnosis (chlamydia, gonorrhea, syphilis) at any anatomical site. A single bacterial STI at more than one anatomical site was considered as one infection, whereas infection of one anatomical site with multiple STIs was counted as multiple infections (Volk et al., 2015).

Statistical analysis

Continuous variables were reported as median (interquartile range). Categorical data were reported as frequencies and percentages. Descriptive statistics were used to characterize the study group and included age at referral, race/ethnicity, and sex assigned at birth. Continuous variables were compared between groups using the Wilcoxon rank sum test. Categorical variables were compared between groups using Fisher's exact test to determine which variables were associated with follow up compliance. The primary outcome variable was

categorized as a binary variable (PrEP follow-up compliant, yes = 1; no = 0). Variables associated with the outcome were added to a univariate logistic regression model to estimate crude odds ratios for PrEP follow-up. Odds ratios were presented with 95% confidence intervals (CI) and $p < 0.05$ was considered to be statically significant. Statistical analysis was conducted using SAS software version 9.2 (SAS Institute Inc., Cary, North Carolina).

Ethics

All study activities were reviewed and approved by the University of Nebraska Medical Center Institutional Review Board prior to project initiation.

Results

A total of 126 patient records were evaluated. Among all individuals referred by DCHD for HIV PrEP between January 2016 and September 2018, most were male (91%) and aged 35 years or older (77%). A complete listing of demographic variables and covariates evaluated are listed in **Table 1.**

Table 1. Patient demographics and behavioral characteristics from Douglas County Health Department Pre-exposure Prophylaxis Referral Surveillance System 2016-2018, n=126

Characteristic	Followed up, n=20 (16%)	Did not follow up, n=106 (84%)	p-value[a]
Median age (IQR), yr	29 (26, 39)	28 (23, 37)	0.75
Sex at birth, n (%)			
Male	20 (100%)	94 (89%)	0.21
Female	0 (0%)	11 (11%)	
Missing/unknown	0	1	
Ethnicity, n (%)			
Hispanic	3 (15%)	23 (22%)	0.56
Non-Hispanic	16 (80%)	73 (69%)	
Missing/unknown	1	10	
Race, n (%)			
Black	4 (20%)	31 (29%)	0.30
White	13 (65%)	64 (60%)	
Other[b]	2 (10%)	5 (5%)	
Missing/unknown	1	6	
Type of sex partner			
Male at birth	15 (45%)	44 (42%)	0.75
Female at birth	0 (0%)	4 (4%)	
Both partners	2 (10%)	8 (8%)	
Missing/unknown	3	50	
Lifetime IDU history			
≥1 time(s) reported use	0 (0%)	3 (3%)	1.00
No IDU reported	17 (85%)	57 (54%)	
Missing/unknown	3	46	
Lifetime STI history[c]			
≥1 confirmed STI	18 (90%)	92 (87%)	0.67
No infection	2 (10%)	8 (8%)	
Missing/unknown	0	6	
STI history by diagnosis[d]			
Chlamydia	12 (60%)	60 (57%)	0.81
Gonorrhea	14 (70%)	56 (53%)	0.22
Syphilis[e]	4 (20%)	16 (15%)	0.73
Missing/unknown	0	6	
Maximum no. sex partners reported during 12-mo period[f]			
>10 partners	12 (60%)	45 (42%)	0.73
1 – 10 partner(s)	4 (20%)	11 (10%)	
Missing/unknown	4 (20%)	50 (47%)	
Reason for linkage with STI services			
Sex partner with STI	9 (45%)	20 (19%)	0.02[a]

Positive STI screening test	13 (65%)	40 (38%)	0.03[a]
Case report	8 (40%)	33 (31%)	0.45
STD clinic walk-in	0	1 (1%)	1.00
Referred by a sex partner with past or current STI	0	2 (2%)	1.00

Abbreviations: IDU, injection drug use; STI/D, sexually transmitted infection/disease

[a]Between-group comparisons made using Wilcoxon rank sum test for continuous variables and Fisher's exact test for categorical variables; statistically significant at $p<0.05$.
[b]Includes Hawaiian and Pacific Islander (n=1), Asian (n=2)
[c]Includes chlamydia, gonorrhea, and syphilis infections at any anatomical site.
[d]Frequencies reported reflect coinfection in individual patients; each type of STI counted one time only, regardless of site of infection or reinfection.
[e]Includes early, late, and unknown latent; primary and secondary syphilis.
[f]Includes both male and female sexual partners.

Table 2. Odds ratios (OR) and 95% Confidence Intervals (95% CI) of select patient characteristics and follow-up compliance from Douglas County Health Department Pre-exposure Prophylaxis Referral Surveillance System 2016-2018, n=126

Characteristic[a]	Follow-up compliance outcome, OR (95% CI)
Ethnicity, Non-Hispanic	1.68 (0.45-6.29)
Hispanic	1.00
Race, white	1.17 (0.43-3.18)
Black, other[b]	1.00
non-Hispanic white	1.95 (0.74-5.18)
Hispanic white	1.00
History of confirmed STI at any point during lifetime	0.78 (0.15-3.99)
No confirmed STI during lifetime	1.00
Reason for linkage with STI services	
Sex partner with STI	3.52 (1.29-9.62)
Did not have sex with partner with STI	1.00
Positive STI screening test	3.06 (1.13-8.32)
No positive STI screening test	1.00

Abbreviations: STI, sexually transmitted infection
[a]The following characteristics were not analyzed due to cell counts = 0: Sex, Type of sex partner; Maximum no. sex partners reported during 12-mo period; Lifetime IDU history; STI history by diagnosis
[b]Includes Hawaiian and Pacific Islander (n=1), Asian (n=2)

The median (IQR) patient age of all participants was 28 years (24-37 years) and was similar between those who were follow-up compliant versus noncompliant (p=0.75). The majority of all participants identified as non-Hispanic white (58%). Demographic characteristic distributions were similar between follow-up compliant (n=20) and non-compliant (n=106) groups (p>0.05). Individuals who were follow-up compliant were all male (100%), 35 years of age or older (95%) who identified as non-Hispanic white (60%). Frequencies of social and sexual behavioral characteristics were similar between both groups. Among those who were follow-up compliant, none reported a history of intravenous drug use, whereas 3% of those who were follow-up noncompliant reported a history of intravenous drug use (p=0.30). Ninety-percent of follow-up compliant individuals had a history of at least one confirmed STI, compared to 87% of non-compliant individuals (p=0.67). History of chlamydia infection was similar between both groups (60% of follow-up compliant group vs 57% of noncompliant group, p=0.81). Gonorrheal infection history was also similar between groups (70% of follow-up compliant group vs 53% of noncompliant group, p=0.22). Sixty-percent and 57% of compliant and noncompliant patients, respectively, had a history of at least one chlamydial infection (p=0.81); 70% and 53% of compliant and noncompliant patients, respectively, had a history of at least one gonorrheal infection (p=0.22). Most individuals had a history of more than ten sexual partners during a 12-month period in both follow-up compliant (60%) and noncompliant (42%) groups (p=0.73), and sexual partners were primary male between the compliant (45%) and noncompliant (42%) groups (p=0.75). **Table 2** summarizes results of univariate logistic regression analysis of select variables to identify any associations between variables and outcome of follow-up compliance. Among the variables with adequate counts for analysis, the odds of each variable were similar between follow-up compliant and non-compliant adults. Among social and behavioral covariates analyzed, two types of referrals for general STD services were significantly associated with the outcome. The most common reason for referral to STD care was a history of personal positive STI screening test(s) in compliant (65%) and noncompliant groups (38%); this covariate was

significantly associated with follow-up compliance for HIV PrEP (OR: 3.52, 95% CI: 1.29-9.62, p=0.03). Having a sex partner with confirmed STI was the second most common reason for linkage to STI services for compliant (45%) and noncompliant patients (19%) and was similarly associated with follow-up compliance (OR: 3.06, 95% CI: 1.13-8.32, p=0.02).

The variables "having a sex partner with confirmed STI" and "having a history of personal positive STI screening" were evaluated in univariate logistic regression models (**Table 3**). Potential confounders evaluated in each model included age, and race, both as binary categorical variables. After adjusting for race, the difference between crude and race-adjusted odds ratios for both models was >10% and race-adjusted odds ratios were reported for both univariate models.

Table 3. Univariate logistic regression models for HIV pre-exposure prophylaxis follow-up compliance (primary outcome) and type of referral to STD services at DCHD, n=126

Variable	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)[a]	p-value
Individual had sex partner with confirmed STI [b]	3.52 (1.29-9.62)	0.01	4.08 (1.42-11.76)	0.01
Individual had history of personal positive STI screening[c]	3.06 (1.13-8.32)	0.02	3.72 (1.30-10.64)	0.01

Abbreviations: OR, odds ratio; STI/D, sexually transmitted infection/disease

[a]Race- and age-adjusted using race variable recoded as binary variable (white, black/other).
[b]Connected with Douglas County STD clinic for STI services due to sexual partner with STI.
[c]Connected with Douglas County STD clinic for STI services due to personal positive STI screening test.

After adjusting for age and race, the adjusted odds ratio (aOR) of follow-up compliance among individuals with a sexual partner who had a history of confirmed STI(s) was four times the odds of individuals who did not have a partner with confirmed STI history (aOR: 4.08, 95% CI: 1.42-11.76). Additionally, after adjusting for race, the adjusted odds ratio for individuals who had a personal history of STI infection was three times the odds of follow-up compliance compared to individuals who did not have a history of STI infection (aOR: 3.72, 95% CI: 1.30-10.64).

Anticipated program development interventions

A systematic review of interventions for chronic disease management found that multi-modal strategies are most impactful to support PrEP uptake among at-risk populations (Marcus et al., 2014). These interventions include simple interventions like patient HIV and PrEP education, or telephone calls to support patients after PrEP is initiated. Therefore, findings from the current project may be used to tailor these approaches based on described client demographic and behavioral characteristics and enhance PrEP initiation following referral from an LHD setting.

Discussion

Local health departments are a critical resource for health services within communities. The urgency of increasing STI rates across the U.S. has further shed light on the importance of health department-based STD clinics. Given the connection between STD clinics and populations at increased risk infections acquired through sexual transmission, LHDs are ideal for linking clients with strategies to prevent STIs, including HIV pre-exposure prophylaxis. A survey among LHDs in North Carolina found the majority (70%) of statewide LHDs considered external client referral for HIV PrEP services to be an important tool for supporting PrEP delivery among at-risk populations (Zhang et al., 2018). Nationally, over one hundred LHDs use referral processes to connect at-risk patients with PrEP (Weiss et al., 2018). Therefore, improving efficiency and quality of external referral systems used by LHDs for HIV PrEP are of critical public health importance.

This study described demographic and behavioral characteristics of individuals who receive STI services at Douglas County Health Department and are referred for external HIV PrEP services. Furthermore, we described the characteristics of individuals who successfully follow-up for PrEP initiation at the UNMC Specialty Care Center after referral. Of note, after

adjustment for race and age, individuals with a history of confirmed positive STI screening had higher odds of following up for PrEP services than those without a confirmed positive STI screening test (aOR: 3.72; 95% CI: 1.30-10.564). Additionally, individuals with a sexual partner who had a confirmed STI history also had higher odds of follow-up compliance for PrEP than those who did not have a partner with confirmed STI history (aOR: 4.08; 95% CI: 1.42-11.76). The increased odds of follow-up are likely associated with perception of HIV acquisition risk among these individuals. These findings align with those from previous studies in STD clinic settings, in which patient interest in HIV PrEP initiation was associated with perceived risk of HIV acquisition (Chan et al., 2016; Liu et al., 2014).

Limitations: While this study provides information to support future development and improvement of referral processes at Douglas County Health Department, a number of limitations were encountered through the study design. Patient record availability was limited to early 2016 through 2018 only due to the recent implementation of a PrEP referral surveillance system by DCHD. Additionally, men who have sex with men are predominantly identified as being at increased risk for acquiring HIV infection and are the majority of individuals who are referred for HIV PrEP. Thus, generalizability of findings to women who are at risk for HIV through sexual partners is limited. Additionally, full multivariable logistic regression to adjust for confounding variables and to explore interacting terms was not feasible due to sample size limitations. Variables evaluated were obtained primarily through patient self-report in a clinical setting; thus, information bias, specifically misclassification of exposure status, may have been present if patients did not answer questions about number of partners and sexual behaviors truthfully. Missing data impacted a number of variables evaluated in this study, including the type of sex partners reported for over half of participants included (54%). This may lead to selection bias. Additionally, this reduces the power of the current study to identify true differences in select variables between the two groups. Additionally, surveillance bias may have

impacted study population, as those who had an active STI and were referred for HIV PrEP were more closely monitored due to current STI status, as compared to adults that were referred for PrEP by DCHD without documentation of an active STI by DCHD. Using covariates derived from laboratory reports and clear exposure definitions reduced these biases. Finally, while associations between patient risk behaviors and demographic characteristics were associated with PrEP initiation follow-up, this study design does not permit causal inferences between covariates and the study outcome, and no data were available regarding participants' perception of individual HIV acquisition risk, or knowledge of HIV PrEP prior to referral from DCHD.

Policy analysis, interventions and program development recommendations: Based on the study findings, the current protocol established by DCHD for HIV PrEP referral may be modified by increasing phone follow-up and frequency among at-risk populations to improve follow-up for PrEP after referral. Kyriakou et al. reported that follow-up compliance rates were 59% among patients discharged from an emergency department to outpatient care if the follow-up appointments were arranged at the time of discharge by a staff member, as compared to providing patients with verbal instructions to follow-up with outpatient care after leaving the emergency department without staff member assistance ($p<0.001$) (Kyriacou, Handel, Stein, & Nelson, 2005). At Douglas County STD clinic, a protocol for HIV PrEP referral at UNMC SCC is established. Part of referral procedures include providing patients with a PrEP-related informational packet. Patients are contacted by telephone by a UNMC SCC clinical staff member to schedule a PrEP initiation visit after the patient completes the visit at DCHD. Consideration may be given to encouraging STD clinic staff members to contact UNMC SCC directly when patients who are identified as being eligible for HIV PrEP are at Douglas County STD clinic, and scheduling the follow-up PrEP initiation visit at UNMC SCC before the patient leaves the STD clinic. Multi-modal strategies are most impactful for supporting PrEP initiation

among at-risk populations (Marcus et al., 2014). These interventions include simple approaches like HIV and PrEP education, or telephone calls to support patients during use of PrEP. Therefore, based on findings from the current study, consideration may be given to intensified patient counseling strategies, specifically by prioritizing telephone reminders by UNMC SCC staff prior to a scheduled PrEP initiation visit and based on a patient's personal or sexual partner STI history, according to the association between this variable and follow-up compliance identified by this study. This study suggests that intensified follow-up by clinicians may be best directed toward individuals who are identified as being at high risk for HIV acquisition and who do not have a past history of a partner or personal STI history. Based on previous studies of PrEP adherence, factors that may be evaluated in future studies include investigating client perceptions of HIV risk and PrEP knowledge to fully understand patterns of follow-up compliance among individuals at risk of HIV among adults in the midwest United States.

While LHDs are critical for providing STI services to at-risk patient populations, many LHDs have limited resources, including staffing limitations. This study suggests that follow-up compliance for HIV PrEP following LHD referral may be an important area to focus continued quality improvement efforts. Therefore, prioritizing individuals with factors associated with PrEP follow-up compliance as mentioned above may support efficient use of LHD resources.

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APEx Reflection

Prior to completion of Applied Practical Experience (APEx) service learning and capstone projects, I had limited knowledge about the structure and function of the local health

department. I also had minimal awareness of activities performed specifically within the Division of STD Control and Prevention to control and prevent sexually transmitted infections. The most significant learning experience was exploring the history, structure, and mission of a strategy to control and prevent STI transmission called Partner Services. Briefly, Partner Services are a voluntary, evidence-based strategy that focuses on connecting sexual partners of "index cases," or individuals recently diagnosed with either viral or bacterial STIs, with support and medical treatment. Disease intervention specialists lead partner services by tracing and connecting with index cases through interviews and identifying sexual partners or other social contacts who may have been exposed to an STI. Disease intervention specialists coordinate appropriate treatment and follow up. My introduction to Partner Services was supported by completing a series of hours-long CDC online training modules, followed by hands-on experiences shadowing disease intervention specialists at DCHD. Tracing sexual partners is a time consuming and challenging activity, and it demands both a working knowledge of pathogenicity and treatment of common STIs, as well as excellent communication skills to connect with patients and healthcare providers. These communication skills are critical for communicating confidential health information to clients and partners. While I felt I was able to support the outreach efforts of the STD clinic during APEx due to my prior training in infectious diseases and clinical care, I learned a great deal of additional information surrounding STIs and healthcare service delivery through a local health department setting. This was valuable training that supported my continued development into a competent public health professional.

It is critical for all health department staff to interface with the public effectively for purposes of sharing test results, referring partners to the clinic for treatment, and entering communities to educate families on health and disease prevention. Additionally, staff must be aware of a variety of potential challenges surrounding handling sensitive or protected health information collected for patients. As I explore opportunities for a role as an epidemiologist in a local health department, I will continue to develop and apply these skills in interprofessional

collaboration, communication with the public, life-long learning, and evidence-based treatment and management approaches to protect the health of communities.

I developed two "products" to support my placement site during APEx. These products are as follows:

1. Antimicrobial Resistant Gonorrhea presentation (Appendix B): This was a presentation to the Douglas County Health Department STD Division staff. There were 12 staff members in attendance, including disease intervention specialists, epidemiologists, supervisors, and community health workers. This presentation covered the topic of Antimicrobial Resistant Gonorrhea in the community.

Benefit of Product to Partner Organization: Local health departments like Douglas County Health Department provide critical sexually transmitted infection screening and treatment to members of the community. A growing public health concern is antimicrobial resistant gonorrhea. Gonorrhea is the second most commonly reported notifiable infectious disease in the U.S. Recently, reduced susceptibility of gonorrhea to the last effective class of antimicrobial agents, cephalosporins, has been noted globally. While capacity of Douglas County Health Department is limited regarding antimicrobial susceptibility and gonorrhea infections, it is important for staff to be aware of this issue so appropriate follow up can be completed for cases of gonorrhea infection that might be detected by DHCD staff. This presentation provided a brief overview of drug resistance, national gonorrhea surveillance, and current treatment modalities that are relevant in controlling and preventing gonorrhea.

2. **Disease Investigation Protocol updates (Appendix C):** I helped compile and update disease investigation protocols in preparation for initial accreditation procedures by Public Health Accreditation Board at Douglas County Health Department. In addition to a protocol for gonorrhea case investigations, I also compiled disease investigation protocols for salmonellosis, West Nile virus, campylobacteriosis, and hepatitis A.

Benefit of Product to Partner Organization: Local health departments like Douglas County Health Department are moving toward receiving accreditation through the Public Health Accreditation Board (PHAB). Accreditation is important to establish consistent, actionable goals to coordinate the practices of local health departments across the country. Protocols for disease investigation are critical to guide staff in the context of unexpected and potentially urgent disease outbreaks or isolated cases of uncommon diseases. These protocols have been updated to meet PHAB standards and will be provided for accreditation purposes.

Acknowledgements

I would like to acknowledge the support provided by Dr. Leah Casanave and the staff at Douglas County Health Department to support my learning and professional development. I would also like to thank my MPH committee members, Dr. Smith and Dr. Minhas, for their continued support throughout the development and completion of this project.

Appendix A: STD*MIS 5.0 release data dictionary

Full document available at: https://www.cdc.gov/std/std-mis/std-mis-doc.htm

Field	Type	Length	Description
SEX	C	1	Patient's birth sex 1 = MALE 2 = FEMALE 9 = UNKNOWN
RACE	C	1	Patient's race 1 = AMER. INDIAN/ALASKAN 2 = ASIAN 3 = BLACK/AFRICAN AMER. 4 = WHITE 5 = HAWAIIAN/PAC. ISLANDER 7 = MULTIPLE RACES 8 = OTHER 9 = UNKNOWN 0 = REFUSED
GENDER	C	1	Patient's gender 1 = MALE 2 = FEMALE 3 = MTF 4 = FTM 5 = REFUSED 9 = UNKNOWN
ETHNICITY	C	1	Patient's ethnicity 1 = HISPANIC 2 = NON-HISPANIC 9 = UNKNOWN 0 = REFUSED
ENG_SPEAK	C	1	English speaking? Y = YES N = NO U = UNKNOWN
PRIM_LANG	C	15	Primary language? - free text
TEMP_DOB	D	8	Calculated DOB based on age (used if true DOB unknown)
STATUS	C	1	Patient's status L = LIVING D = DECEASED U = UNKNOWN
DEATH_DT	D	8	Date of death if patient deceased.
IS_900	L	1	Patient 900 positive? T = YES F = NO
AGE	N	3	Patient's age at event
HEIGHT	C	8	Patient's height – free text
SIZE	C	8	Patient's physical size – free text
HAIR	C	8	Patient's hair color – free text
COMPLEXION	C	8	Patient's complexion – free text
MARITAL_ST	C	1	Patient's marital status C = COHABITATION D = DIVORCED M = MARRIED P = SEPARATED

			R = REFUSED S = SINGLE U = UNKNOWN W = WIDOWED
LIVING_WH	C	20	Patient living with? – free text
RES_TYPE	C	1	Patient's residence type A = APARTMENT B = MOBILE HOME C = MIGRANT CAMP D = DORM G = GROUP HOME H = HOUSE/CONDO J = JAIL M = HOTEL/MOTEL N = HOMELESS O = OTHER P = PRISON Q = MENTAL HLTH. CENTER R = REHAB. CENTER U = UNKNOWN X = DRUG RX/DETOX CENTER
TIME_ADDR	N	2	Patient's time at address
TIME_AD_UN	C	1	Time at address units W = WEEKS M = MONTHS Y = YEARS
TIME_STATE	N	2	Patient's time in state
TIME_ST_UN	C	1	Time at address units
TIME_CNTRY	N	2	Patient's time in country
TIME_CN_UN	C	1	Time at address units W = WEEKS M = MONTHS Y = YEARS
IN_INSTIT	C	1	Patient institutionalized? Y = YES N = NO U = UNKNOWN
INSTIT_NAME	C	40	Institution Name – free text
INSTIT_TYPE	C	1	Institution Type G = GROUP HOME J = JAIL O = OTHER P = PRISON Q = MENTAL HLTH. CENTER R = REHAB. CENTER U = UNKNOWN X = DRUG RX/DETOX CENTER Y = JUVENILE DETENTION
STATUS_900	C	2	900 status 1 = NEGATIVE 2 = NEWLY DIAGNOSED 3 = PRIOR-POS. - NOT PREVIOUSLY KNOWN 4 = PRIOR-POS. - NEW STD OR PREGNANCY 5 = PRIOR-POS. - CONTACT TO STD/HIV CASE 6 = OTHER 9 = UNKNOWN
PRE_HIV	C	1	Previous HIV test? Y = YES N = NO R = REFUSED U = UNKNOWN D = NOT ASKED

PRE_HIV_DT	D	8	Date of previous HIV test
PRE_NAME	C	8	Name of previous HIV test provider Foreign key - PROVIDER->PROV_ID
PRE_CNSL	C	1	Pre-test counseled? Y = YES N = NO U = UNKNOWN
HIV_TEST	C	1	HIV tested at this event? Y = YES N = NO R = REFUSED U = UNKNOWN D = NOT ASKED
POST_CNSL	C	1	Post-test counseled? Y = YES N = NO U = UNKNOWN
CUR_HIV	C	1	Current HIV test results 1 = POSITIVE/REACTIVE 3 = NEGATIVE 4 = INDETERMINATE 5 = INVALID 6 = NO RESULT 9 = UNKNOWN
CUR_NAME	C	10	Name of current HIV test provider Foreign key - PROVIDER->PROV_ID
ENROLL_PS	C	2	Enrolled in 900 partner services? 01 = ACCEPTED 02 = REFUSED
RETROV_YR	C	1	Anti-retrovirals in past year? Y = YES N = NO R = REFUSED U = UNKNOWN
RETROV_EVR	C	1	Anti-retrovirals ever? Y = YES N = NO R = REFUSED U = UNKNOWN
STD_HX	C	1	History of previous STDs? Y = YES N = NO R = REFUSED U = UNKNOWN
GEND_PART	C	1	Gender of sex partners M = MALE F = FEMALE B = BOTH R = REFUSED U = UNKNOWN
TOT_PART	N	4	Total number sex partners past 12 months
INTNT_PART	C	1	Met sex partners via Internet? Y = YES N = NO R = REFUSED D = DID NOT ASK
PART_YR_FQ	C	1	Female sex partners in past year Y = YES N = NO R = REFUSED U = UNKNOWN
PART_YR_FT	N	3	Total number female sex partners past year
PART_YR_MQ	C	1	Male sex partners in past year Y = YES N = NO R = REFUSED

			U = UNKNOWN
PART_YR_MT	N	3	Total number male sex partners past year
PART_YR_TQ	C	1	Transgender sex partners in past year Y = YES N = NO R = REFUSED U = UNKNOWN
PART_YR_TT	N	3	Total number transgender sex partners past year
PLACE_MEET	C	1	Identify places to meet sex partners? Y = YES N = NO R = REFUSED D = DID NOT ASK
PLACE_HAVE	C	1	Identify places to have sex? Y = YES N = NO R = REFUSED D = DID NOT ASK
SEXMALE_12	C	1	Sex w/ male past 12 months? Y = YES, VAGINAL OR ANAL O = YES, ORAL ONLY U = YES, UNSPECIFIED N = NO (cont'd) R = REFUSED D = DID NOT ASK
SEXFEM_12	C	1	Sex w/ female past 12 months? Y = YES, VAGINAL OR ANAL O = YES, ORAL ONLY U = YES, UNSPECIFIED N = NO R = REFUSED D = DID NOT ASK
SEXTRAN_12	C	1	Sex w/ transgender past 12 months? Y = YES, VAGINAL OR ANAL O = YES, ORAL ONLY U = YES, UNSPECIFIED N = NO R = REFUSED D = DID NOT ASK
SEXANON_12	C	1	Sex w/ anonymous partner past 12 months? Y = YES, VAGINAL OR ANAL O = YES, ORAL ONLY U = YES, UNSPECIFIED N = NO R = REFUSED D = DID NOT ASK
SEXCOND_12	C	1	Sex w/o condom past 12 months? Y = YES, VAGINAL OR ANAL O = YES, ORAL ONLY U = YES, UNSPECIFIED N = NO R = REFUSED D = DID NOT ASK
SEXIDU_12	C	1	Sex w/ IDU past 12 months? Version 5.0 coding (VERSION = 50): Y = YES, VAGINAL OR ANAL O = YES, ORAL ONLY U = YES, UNSPECIFIED N = NO R = REFUSED D = DID NOT ASK
SEXHIGH_12	C	1	Sex while high/intoxicated past 12 months? Y = YES, VAGINAL OR ANAL O = YES, ORAL ONLY U = YES, UNSPECIFIED N = NO R = REFUSED

			D = DID NOT ASK
SEXEXCH_12	C	1	Exchanged drugs/money for sex past 12 months? Y = YES, VAGINAL OR ANAL O = YES, ORAL ONLY U = YES, UNSPECIFIED N = NO R = REFUSED D = DID NOT ASK
SEXMSM_12	C	1	Sex w/ MSM past 12 months? Y = YES, VAGINAL OR ANAL O = YES, ORAL ONLY U = YES, UNSPECIFIED N = NO R = REFUSED D = DID NOT ASK
EVENT_900	C	1	900 Status at Event? P = POSITIVE N = NEGATIVE E = EQUIVOCAL U = UNKNOWN R = REFUSED D = DID NOT ASK
INJECT_12	C	1	Used injection drugs past 12 months? Y = YES N = NO R = REFUSED D = DID NOT ASK
SHARE_12	C	1	Shared injection equipment past 12 months? Y = YES N = NO R = REFUSED D = DID NOT ASK
INCARC_12	C	1	Incarcerated in past 12 months? Y = YES N = NO R = REFUSED D = DID NOT ASK
NODRUG_USE	C	1	No drug use in past 12 months? Y = YES N = NO R = REFUSED D = DID NOT ASK
CRACK	C	1	Crack use past 12 months? Y = YES N = NO R = REFUSED D = DID NOT ASK
METH	C	1	Meth. use past 12 months? Y = YES N = NO R = REFUSED D = DID NOT ASK
COCAINE	C	1	Cocaine use past 12 months? Y = YES N = NO R = REFUSED D = DID NOT ASK
NITRATES	C	1	Nitrate use past 12 months? Y = YES N = NO R = REFUSED D = DID NOT ASK
HEROIN	C	1	Heroin use past 12 months? Y = YES N = NO R = REFUSED D = DID NOT ASK

Appendix B: Antimicrobial Resistant Gonorrhea presentation

Student's name: Lauren Cirrincione
Date completed: Sept. 11, 2018
Summary of Product: This was a presentation to the Douglas County Health Department STD Division staff. There were 12 staff members in attendance, including disease intervention specialists, epidemiologists, supervisors, and community health workers. This presentation covered the topic of Antimicrobial Resistant Gonorrhea in the community.

Benefit of Product to Partner Organization: Local health departments like Douglas County Health Department provide critical sexually transmitted infection screening and treatment to members of the community. A growing public health concern is antimicrobial resistant gonorrhea. Gonorrhea is the second most commonly reported notifiable infectious disease in the U.S. Recently, reduced susceptibility of gonorrhea to the last effective class of antimicrobial agents, cephalosporins, has been noted globally. While capacity of Douglas County Health Department is limited regarding antimicrobial susceptibility and gonorrhea infections, it is important for staff to be aware of this issue so appropriate follow up can be completed for cases of gonorrhea infection that might be detected by DHCD staff. This presentation provided a brief overview of drug resistance, national gonorrhea surveillance, and current treatment modalities that are relevant in controlling and preventing gonorrhea.

Antimicrobial Resistant Gonorrhea

Lauren Cirrincione, PharmD
MPH Student, UNMC College of Public Health
11 September 2018

University of Nebraska Medical Center

Objectives

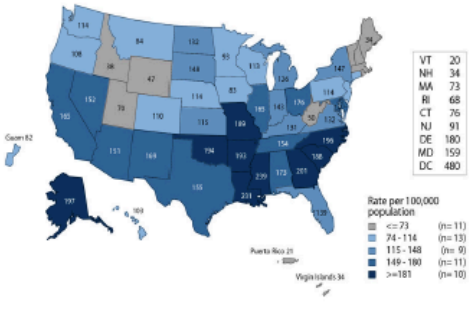
- Define antimicrobial resistance and bacterial mechanisms of resistance.
- Describe global patterns of antimicrobial resistant gonorrhea (ARG).
- Summarize current treatment regimens for gonorrhea.
- Describe current surveillance systems used in the United States to monitor antimicrobial susceptibility trends in gonorrhea.

Antimicrobial resistant gonorrhea (GC) is a public health threat

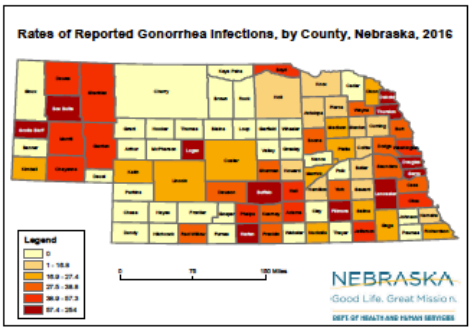
- GC is 2nd most commonly reported notifiable disease in U.S.
- Approximately 400,000 reported cases of gonorrhea per year.
  - CDC estimates 820,000 new infections may actually occur each year.
- **30% of new gonorrhea infections each year are resistant to at least one drug.**
- Gonorrhea (GC) has developed resistance to nearly every treatment option.

MMWR 2018; 67(16);473–476

Rates of gonorrhea are highest in South Eastern U.S. (2016)



Douglas County, Nebraska has highest rates of GC compared to other counties



General overview of mechanisms of antimicrobial resistance

Bacteria can **mutate** or **acquire genetic material from other bacteria** that allow them to resist an antibiotic. This enables bacteria to:

1) **Break down** the antibiotic molecule.
2) **Change targets** inside bacterium so antimicrobial cannot attach to appropriate spot in bacterium.
3) **Reduce** amount of drug that **enters** bacterial cell.
4) **Increase** the amount of drug that is **removed** from cell.

N Engl J Med. 2012;366(6):485-7

Antimicrobial resistance is ability of bacteria to resist effects of drugs to treat them

- This means bacteria are not killed and continue to reproduce.
- Ways antimicrobial resistant strains of bacteria occur:
  - Random mutation
  - Transmitted resistance

Specific examples of GC antimicrobial resistance mechanisms with penicillin

Plasmid-mediated resistance

- Plasmid=small circular piece of DNA that can be transmitted between cells; enables bacteria to produce an enzyme to destroy penicillin.
- 1976: Plasmids in GC allowed bacteria to resist penicillin.

Chromosomally-mediated resistance

- Genes alter the structure of small holes in bacterial cell membranes (pores).
- Prevents entry of penicillin into bacterial cell; penicillin cannot destroy the cell.

Unemo, M., et al (2014). *Antimicrob Agents Chemother, 58*(1), 624-625.

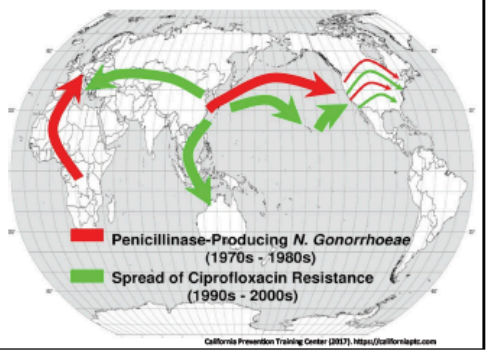
Timeline of antimicrobial use for GC

- **1970-80:** Penicillinase-producing *N. gonorrheae* develops
- **1990-2000:** Fluoroquinolone resistance patterns emerge
- **2007:** Cephalosporins recommended as first line therapy

2010 onward: CDC recommends dual therapy with **ûdose ceftriaxone (250 mg) + azithromycin 1 g**

Unemo, M., et al (2014). *Antimicrob Agents Chemother, 58*(1), 624-625.

Global transmission of ARG: 1970 to 2000s



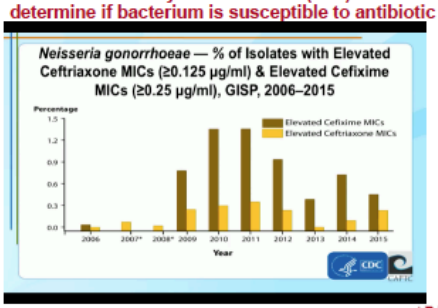
California Prevention Training Center (2017). https://californiaptc.com

Hawaii and California have strains of gonorrhea with increased resistance

- **2003:** Gonorrhea with increased resistance to current antimicrobials first documented in East Asia.
- **2006:** California and Hawaii reported gonorrhea strains with increased resistance to antimicrobials
- Antimicrobial resistant gonorrhea will continue to spread across the United States

MMWR 2018, 67(16);473-476

Minimum inhibitory concentration (MIC) used to determine if bacterium is susceptible to antibiotic



GISP, Gonococcal Isolate Susceptibility Project; MIC, minimum inhibitory concentration

California Prevention Training Center (2017). https://californiaptc.com

2015 Dual therapy CDC Treatment Recommendations for Gonorrhea

First-Line (preferred)

- Ceftriaxone 250 mg IM X1 + Azithromycin **1g** PO X 1 **or** Doxycycline 100mg PO BID X 7 days
- Azithromycin is preferred over doxycycline but both are acceptable
- Use dual therapy even if *C. trachomatis* is ruled out

Alternate

- Cefixime 400mg PO X1 + Azithromycin **1g** PO X1 **or** Doxycycline 100mg PO BID X 7 days
- Azithromycin **2g** PO X 1 (single therapy single dose)
  - Azithromycin 2g PO X1 is the only regimen currently available to treat a patient who has an allergy to cephalosporins

CDC STD Guidelines 2015.

Suspected Treatment Failure: Evaluating and Treating Sex Partners

- If treatment failure suspected, assure treatment for both patient and sex partner(s)
- Local health departments can help assure that sex partners of patients with suspected treatment failure get treated

CDC Cephalosporin-resistant case classification

CLINICAL CRITERIA

- Patient had laboratory-confirmed *N. gonorrhoeae* infection, and
- Patient received CDC-recommended cephalosporin-based antimicrobial regimen as treatment, and
- Patient subsequently had a positive *N. gonorrhoeae* test result (positive culture ≥72 hours after treatment or positive NAAT ≥7 days after treatment), and
- Patient did not engage in sexual activity after treatment

LABORATORY CRITERIA

Antimicrobial susceptibility testing of pre-treatment or post-treatment isolate of *N. gonorrhoeae* demonstrates:

- Cefixime MIC ≥0.25 µg/ml, or
- Ceftriaxone MIC ≥0.125 µg/ml

www.cdc.gov/std/treatment/Cept-R-ResponsePlanJuly30-2012.pdf

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Test-of-Cure vs. Re-screening

TEST OF CURE (TOC)

All persons who are treated with an alternate regimen for GC, or who have laboratory-evidence of cephalosporin resistance, or who are suspected of GC treatment failure should undergo a TOC

- If culture is used for TOC, it can be done ≥72h after initial therapy
- If NAATs are used for TOC, they can be performed ≥7d after initial therapy. The possibility of false-positivity with NAAT as early as 7 days after treatment is a concern, but is likely to be low

The goal of TOC is to rule out treatment failure

RESCREENING

- All persons treated for gonorrhea should be **rescreened** 3 months after treatment.
- For GC, rescreening can be done with either culture or NAATs (NAATs are more sensitive)
- The goal of rescreening is to rule out reinfection

J Clin Microbiol 2002;40(10):3596-601

Test of Cure

- If alternate regimen is used to treat GC, patient should return **1 week after treatment for test of cure** (culture is preferred but NAAT is also acceptable)
- If a NAAT is performed as the test of cure and the follow-up NAAT result is positive, a specimen for culture should be obtained so that susceptibility testing can be performed

NAAT, nucleic acid amplification test

CDC STD Treatment Guidelines 2015

Antimicrobial resistance is important because

- An ARG outbreak would be expensive
- Increased adverse outcomes
  - Pelvic inflammatory disease
- Increased HIV transmission
- Limited GC treatment options

MMWR 2018, 67(16);473–476

GISP, eGISP are national gonorrhea surveillance systems

Expedited partner therapy (EPT) in the context of gonorrhea

- Expedited partner therapy should be considered, using oral combination antimicrobial therapy for gonorrhea (cefixime 400 mg and azithromycin 1 g)
- Emergence of resistance is threatening the viability of EPT for gonorrhea

MMWR 2018 ;61(31):590-4

Emerging antimicrobial options

REPEAT TREATMENT:

Gemifloxacin 320mg+AZ 2g **OR** Gentamicin 240mg IM+AZ 2g
If reinfection suspected, repeat tx with CTX 250 + AZ 1g

AZ, azithromycin; CTX, ceftriaxone

CDC STD Treatment Guidelines 2015

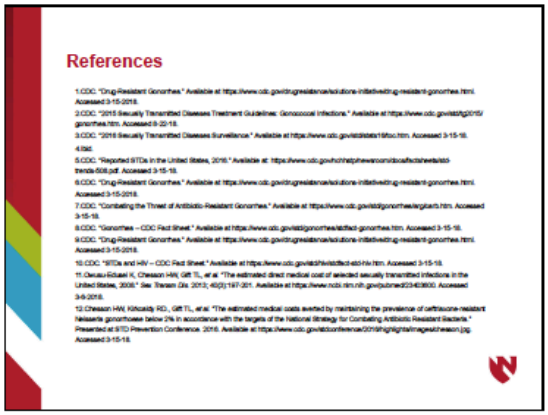
Resources for State and Local Health Departments

1. CDC (2015) STD Treatment Guidelines

2. CDC (2012) Cephalosporin-Resistant *Neisseria Gonorrhoeae* Public Health Response Plan
https://www.cdc.gov/std/treatment/ceph-r-responseplanjuly30-2012.pdf

3. National Network of STD Clinical Prevention Training Centers
http://nnptc.org/about-us/

Questions?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2.CDC. "2015 Sexually Transmitted Diseases Treatment Guidelines: Gonococcal Infections." Available at https://www.cdc.gov/std/tg2015/gonorrhea.htm. Accessed 9-22-18.
3.CDC. "2016 Sexually Transmitted Diseases Surveillance." Available at https://www.cdc.gov/std/stats16/toc.htm. Accessed 3-15-18.
4.Ibid.
5.CDC. "Reported STDs in the United States, 2016." Available at: https://www.cdc.gov/nchhstp/newsroom/docs/factsheets/std-trends-508.pdf. Accessed 3-15-18.
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Appendix C: Disease Investigation Protocol example – Hepatitis A

Disease/Condition: Hepatitis A
Effective Date: 3/--/11
Last Updated/Reviewed Date: 8/28/18

Assignment of Responsibility	Disease Investigators, Epidemiologist, Clerk Typist
Reporting to Health Department Requirements	Immediate report (within 24 hours)
Investigation Timeline	Start investigation within 24 hours Initiate control measures within 2 days
Notification to Supervisor	XX

The Disease and Its Epidemiology

Short Summary

Hepatitis A virus (HAV) is a picornavirus. It replicates in the liver and is shed in feces 2-3 weeks before, and up to 1 week following, onset of symptoms. It is a self-limited infection that produces acute illness with fever, malaise, anorexia, nausea, abdominal discomfort, dark urine and jaundice. Symptomatic HAV infection is related to age, and children younger than 6 years of age are usually asymptomatic. HAV infection usually resolves within 2 months, although prolonged or relapsing signs and symptoms can occur up to 6 months. Humans are the primary reservoir. Transmission occurs mainly via the fecal-oral route, either by person-to-person contact or consumption of contaminated food or water. The average incubation period is 28 days (range: 15 to 50 days). Maximum infectivity occurs during the latter half of incubation and continues for a few days after onset of jaundice. Treatment is limited to supportive care. Hepatitis A vaccination is recommended routinely for children, persons at increased risk for infection, and for any person wishing to obtain immunity. In 2010, 7.3% of cases were associated with personal contact (sexual or household) with an infected person; 3.1% of cases were related to employment or attendance at a nursery, day-care center, or preschool; 4% involved contact with a child or employee in child care; 14.1% occurred among persons reporting recent international travel; and 10.4% occurred in the context of a recognized foodborne or waterborne outbreak. Injection-drug use was a risk factor in 2% of cases; men who have sex with men represented 4.9% of cases.

For more information, please refer to the Control of Communicable Diseases Manual, 20th Edition or the Red Book, 30th Edition.