

**PUBLIC HEALTH PARTNER NOTIFICATION (PN): REVIEW OF CURRENT PRACTICES,
OPTIONS, AND CONSIDERATIONS FOR EVALUATING PN APPROACHES**

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GLOSSARY

Accelerated Partner Therapy (APT): Facilitated access to antibiotic treatment for sexual partners to reduce the time between index case diagnosis and partner treatment. It involves a consultation with a health advisor by telephone, or with a pharmacist, to assess eligibility of the partner for treatment, but a face-to-face consultation with a physician is not required. APT is an adaptation of Expedited Partner Therapy (EPT) that complies with United Kingdom (UK) prescribing regulations.¹

Disease Intervention Specialist (DIS): Non-medical staff with specialized training in communicable disease follow-up activities, whose role was initially established to work in the field of sexual transmitted infection (STI) prevention and who are critical partner notification (PN) personnel in the United States (US).²

Expedited partner therapy (EPT): Treating the sex partners of patients diagnosed with a treatable STI without the healthcare provider first examining the partner. EPT usually involves **patient delivered partner therapy (PDPT)**, in which the patient delivers the medication, or a prescription for the medication, to his or her partner.

A **barrier**, in relation to EPT: A factor that prevents or hinders the process of treating sexual partners for STI(s) using EPT.³

A **facilitator**, in relation to EPT: a factor that may promote or accelerate the process of treating sexual partners for STI(s) using EPT.³

Index case: An individual who has been diagnosed with a STI.⁴

Partner or Contact: A person who has had sex, shared injecting drug equipment, or has had some other relevant exposure to the index case.⁴

Partner case finding: STI-positive partners being identified and brought to treatment.⁵

Partner elicitation: Index cases naming partner(s).⁵

Partner notification (PN), also referred to as contact tracing: A secondary prevention process through which sexual partners and other contacts exposed to a STI are identified, located, assessed, counselled, screened and treated.⁶

Patient referral: An index case notifies their current and/or recent partners of the risk of infection and the need for medical assessment.

Provider referral: A health care provider (diagnosing primary care clinician, public health practitioner, etc.) elicits information about sexual partner(s) from an index case, and notifies partner(s).

Contract referral or conditional referral: An index patient initially takes responsibility for notifying partners, but a health care provider becomes involved if patient referral is not completed within an agreed upon time frame.²

Patient group direction (PGD): In the UK, patient group directions allow healthcare professionals to supply and administer specified medicines to pre-defined groups of patients, without a prescription.⁷

Simple patient referral involves advice to the index case from a health professional that sexual partners need to be treated and that the patient should inform them and tell them to go to their own doctor or to a specialist clinic. **Enhanced patient referral** is patient referral with the addition of one or more of: written infection-specific information for index cases to give to their partners, additional verbal information given during the consultation, use of a website, or sampling kits for index cases to give to partners.⁸

Targeted partner notification: Limiting partner notification to groups where efforts are most likely to be successful or have the most public health impact.⁵

ABBREVIATIONS AND ACRONYMS

AIDS: Acquired Immunodeficiency Syndrome
AMR: Anti-microbial resistance
APT: Accelerated Partner Therapy
BC: British Columbia
BCCDC: BC Centre for Disease Control
CDC: United States (US) Centers for Disease Control and Prevention
CPS: Clinical Prevention Services
DIS: Disease intervention specialist
EPT: Expedited partner therapy
GBMSM: Gay, bisexual, and other men who have sex with men
GP: General practitioner
GUM: Genitourinary medicine clinic
HIV: Human Immunodeficiency Virus
HPV: Human Papillomavirus
HTA: Health Technology Assessment
LGBTQQ: Lesbian, gay, bisexual, transgender, queer or questioning their sexuality
LHD: Local health department
MHO: Medical Health Officer
MSW: Men who have sex with women
NAAT: Nucleic acid amplification test
NCCID: National Collaborating Centre for Infectious Diseases
NGO: Non-governmental organization
NGU: Nongonococcal urethritis
PCP: Primary care provider
PDPT: Patient-delivered partner therapy
PGD: Patient group direction
PHAC: Public Health Agency of Canada
PHCP: Public health care provider
PHN: Public health nurse
PHO: Provincial Health Officer
PHU: Public health unit
PID: Pelvic Inflammatory Disease
PLHIV: People living with HIV
PN: Partner notification
PNO: Partner notification officer
RCT: Randomized controlled trial
SHD: State health department
SMS: Short messaging service
STBBI: Sexually transmitted and bloodborne infection
STI: Sexually transmitted infection
WHO: World Health Organization
WSW: Women who have sex with women

EXECUTIVE SUMMARY

Partner notification (PN, also referred to as contact tracing) is a secondary prevention process through which sexual partners and other contacts exposed to a sexually transmitted infection (STI) are identified, located, assessed, counselled, screened and treated. PN may be delivered by index patients, diagnosing clinicians, or by public health practitioners, and the latter currently has an integral role in the delivery of partner services across jurisdictions. Yet public health PN is resource-intensive. Several sources suggest that public health agencies have insufficient resources to trace the sexual partners of index patients and refer them to medical evaluation, with a minority of patients receiving formal sex partner referral services. In British Columbia (BC), there is already a high demand for STI PN services, and with rising reported STI rates the demand for PN will continue and potentially increase in the future. It is important to explore PN options for public health.

This report aims to:

- 1) Explore public health PN practices across jurisdictions, particularly where PN has changed, and determine the rationale and impact (where available);
- 2) Outline options for public health PN and the available evidence associated with each option; and
- 3) Discuss public health PN evaluation, both general considerations for evaluating the impact of PN by the public health system; and estimating, predicting, and understanding the impact of changes in PN practices.

This report is intended to provide Clinical Prevention Services (CPS), BC Centre for Disease Control (BCCDC) with information about public health PN to inform a discussion about options, not to advise on a recommended course of action for PN service delivery in the province.

Methods

A rapid, non-systematic literature review was performed utilizing peer-reviewed published literature identified through Ovid Medline and a Google search, and grey literature identified through searching the resources of key organizations. Additional documents were identified using the reference lists of the aforementioned resources. Chlamydia, gonorrhoea, syphilis and Human Immunodeficiency Virus (HIV) were the focus of this report, as these are the sexually transmitted and bloodborne infections (STBBIs) that most health departments focus on for PN.

Diversity of PN practices

According to PN recommendations issued by the United States (US) Centers for Disease Control and Prevention (CDC), health departments should be actively involved in partner services for all newly diagnosed or reported cases of infectious syphilis (primary, secondary, and early latent) and HIV. With respect to gonorrhoea and chlamydia, while these cases are suitable for partner services, resource constraints and the high number of cases may mean that public health might need to limit involvement to high-priority cases and use other strategies for the remainder of cases (e.g., expedited partner therapy [EPT], which involves health care providers treating the sex partners of index cases without first examining the partners). Notably, the CDC recommendation does not suggest that groups not assessed as high priority would not receive any partner services; rather, that traditional public health PN would only occur for high priority cases, while other partners would still be reached in a different way.

Published literature, primarily from the US, revealed that public health departments varied in their PN practices by STI. For example, in a recent study in New England, each of the six states adapted their PN activities based on available resources. PN was routinely conducted for HIV and syphilis, but PN varied for gonorrhoea and particularly chlamydia. An older study among public health departments in 60

jurisdictions across the US found that public PN efforts largely focused on syphilis: PN interviews were conducted with 89% of the index cases of syphilis, 17% of index cases of gonorrhea, 12% of index cases of chlamydia, and (in the two-thirds of areas where HIV was reportable at the time of the study) 52% of index cases of HIV. Limited published Canadian data from the 1990s indicated that diversity in PN by STI type was observed nationally 25 years ago, where the proportion of cases with syphilis for which PN was conducted exceeded chlamydia and gonorrhea.

An additional example in the grey literature was found for the Winnipeg Regional Health Authority. In a clinical practice guideline for chlamydia, directed to public health nurses (PHNs) who followed up chlamydia cases, urgent, high, or low priority designations were given based on partner characteristics; and depending on the designation, specific procedures were recommended related to the number and method of contact attempts, and confirmation of partner testing and treatment.

However, none of these publications evaluated, or suggested plans or methods to evaluate, the impact of changing how PN services are delivered and in some cases eliminating notifying certain partners, on STI incidence/prevalence/recurrence/complications or other relevant outcomes. In fact, the Canadian study from the 1990s mentioned previously, highlighted this lack of evaluation data to monitor effectiveness for PN programs.

Options

In Canada, public health PN traditionally involves notifying all partners (within a specified time frame) that are identified. PN is often delivered by public health staff who have other roles outside of STI PN (e.g., PHNs or other nurses with expertise in Communicable Disease [CD] Prevention and Control). Other options for public health PN include the following, alone or in combination:

- ◆ Targeted PN: Prioritizing which partners to notify and how to notify them, based on index patient and/or partner characteristics.
- ◆ Involving new investigators with a dedicated PN mandate (e.g., Disease Intervention Specialists [DISs], who are non-medical staff with specialized training in CD follow-up activities whose role was initially established to work in STI prevention and who are critical PN personnel in the US, or equivalent).
- ◆ Promoting and supporting PN delivery in ways other than by public health practitioners, for example:
 - Traditional PN by diagnosing clinicians or other office staff
 - EPT by diagnosing clinicians with the involvement of pharmacists
 - PN by index cases
 - Online, automated clinical consultation and management system that encompasses index patient and partner services
- ◆ Continuing with traditional public health PN but seeking efficiencies in PN practices.

Each of these options were discussed in the literature, however no studies were identified that evaluated the impact of any of these options on public health PN demand. Therefore, the evidence that is presented for each option relates to the effectiveness of the option relevant to PN outcomes, not to public health PN workload.

1. Targeted PN

Targeted PN is defined as limiting PN to groups where efforts are most likely to be successful or have the most public health impact. This is an alternative to providing PN for all case-patients and is proposed as resource-saving. Targeted PN may prioritize one or more of the following broad partner groups:

1. Partners at higher risk of severe health outcomes

2. Partners at higher risk of STI transmission/more likely to be STI-positive
3. Partners that may be high-frequency transmitters and thus are particularly important in preventing onward community transmission
4. Partners who are less likely to present for STI testing and care

Alternately, targeted PN may be guided by characteristics of the index case.

Hoots et al. (2014) sought to determine if there were characteristics of index syphilis cases that were associated with highest/lowest yield for partner elicitation (i.e., naming partners) and subsequent case finding (i.e., identifying and bringing partners to treatment) to see if targeted syphilis PN was feasible and desirable. Their reasoning was that if certain group(s) were very low in naming partners and/or having partners brought to treatment, it might be appropriate to not focus PN efforts on these groups due to low yield. However, only two index patient characteristics were consistently associated with higher partner elicitation and case finding: younger age (<35 years) and diagnosis at a STI clinic. Other index patient characteristics such as sexual orientation, race/ethnicity, stage of infection, HIV status, and time-to-DIS assignment were not consistently associated with partner elicitation and case finding. Therefore, since the index patient characteristics associated with successful partner elicitation and case finding varied, it was unclear if targeting based on index patient characteristics would improve PN success.

Two studies created risk scores intended to guide targeted PN based on index patient and partner characteristics, and partner characteristics alone, respectively. Hoots et al. (2012) developed a predictive model to prioritize the follow-up of named partners of index cases newly diagnosed with HIV, using characteristics of both index cases and partners from DIS records in North Carolina (the set of possible predictors included demographic characteristics and risk behaviors of the index case, demographic characteristics of the named partner reported by the index case, and characteristics of the partnership reported by the index case). Brown et al. (2012) aimed to create a risk score to target PN by predicting which partners of patients newly diagnosed with HIV in Malawi were the least likely to respond to patient referral and report for counseling and testing on their own, and thus provider referral would be needed. Whether these models are assessed as useful in a given public health context in part depends on perceptions of the predictive power based on the sensitivity and specificity achieved at given numerical scores.

2. Disease Intervention Specialists (DISs) or equivalent

Several studies have shown that DISs have greater success in eliciting partners compared to other PN providers. This may be because, where DISs are exclusively in traditional STI prevention roles, they do not have to split their time and energy between PN and other clinical responsibilities as other health care providers do. Further, there is evidence from one study that although DISs did not notify as many partners as index patients (patient referral) or as occurred through PDPT, the partners that were notified by DISs were increasingly treated (the proportions of partners notified and treated were 56% and 34% for patient referral; 57% and 46% for PDPT; and 25% and 22% for DIS referral, respectively). DISs were not only placed in health departments, but were in different outreach sites such as STI clinics and other sites with higher STI rates. Several studies suggest an advantage to DIS community-based placements (sometimes called Community Embedded DIS [CEDIS]), where DISs can interact with index patients when they are newly diagnosed with STI(s).

If additional resources were available to hire new dedicated PN investigators, DISs or equivalent would likely assist in managing the PN workload of a jurisdiction and free up public health practitioners to focus on other public health issues. However, a key barrier to involving DISs in public health PN efforts in Canada is that no similar role currently exists, thus the training infrastructure would need to be established first. The likely greater PN yield for DISs, and freeing up public health practitioners to focus

on other public health activities (opportunity cost), would need to be weighed against the resource investment required.

3. PN outside of public health

There are several circumstances under which the need for public health PN might be reduced: namely, if traditional PN by index patients or diagnosing clinicians increased; if the presumptive treatment of partners by diagnosing clinicians increased (i.e., EPT); or if an automated system bypassed the need for both diagnosing clinician and public health involvement in index case and partner services. Partnerships with community pharmacists might also be important in EPT interventions particularly. These interventions may occur alone, or along with targeted PN (as was previously discussed in the CDC recommendations).

Reminders and links built into laboratory reports showed promise for traditional PN in a study among general practitioners (GPs) in Australia. A website address printed on chlamydia-positive laboratory results led to a significantly greater use of PN tools which were located in the site by practitioners who received the lab reports with the address compared to those who did not. The proportion of GPs who recommended PN to all index patients was high among those who received the results with website address (93%), but so was the proportion for those who didn't receive the website printed on lab results, and these proportions did not differ significantly.

EPT usually involves patient delivered partner therapy (PDPT) in which patients deliver medication, or a prescription for medication, to their sexual partner(s). A public health intervention promoting PDPT among clinicians in the US involved supplying free PDPT packs for chlamydia and gonorrhea to clinicians and making packs available through pharmacies; providing information about and promoting PDPT among clinicians and other office staff, including by letters, outreach, and continuing medical education training; and modifying the chlamydia and gonorrhea reporting form that clinicians sent to public health. There was a significant increase in individuals receiving PDPT from practitioners (from 18% to 34%, $p < 0.001$), and an increase in the percentage receiving partner services (from 25% to 45%, $p < 0.001$). Note that that this multi-component intervention would require considerable public health investment.

Pharmacists are key partners in Prescription-EPT. One intervention in Scotland involved a partnership directly between diagnosing clinicians and pharmacists for Prescription-EPT, without the involvement of public health. Vouchers were distributed to chlamydia-positive index patients by physicians or nurses at various health care facilities. Medication was dispensed at pharmacies through a patient group direction (PGD). Partners could choose to redeem the voucher for free treatment (single dose azithromycin) at participating pharmacies ($n = 90$), or attend a clinic or their GP for treatment. The median number of vouchers issued was one per index case (range 1–4 vouchers), and 40% of vouchers were redeemed at pharmacies. Only 4% of partners chose to be treated at a clinic, thus, pharmacy voucher redemption was more popular.

Pharmacists may also have broader roles in partner services. In the study in Scotland, pharmacists (who had received information about chlamydia in advance) gave partners a prepared leaflet containing information about chlamydia as well as where to access STI testing. In a qualitative study in Australia, pharmacists indicated that they would be willing to provide education about STIs to patients who fill prescriptions, encourage health care seeking, and “follow up on partners.” Further, the provision of chlamydia self-test kits in pharmacies was supported and seen as a possible facilitator for EPT, as partners could choose to access testing for chlamydia when they come to the pharmacy for prescription EPT. In other studies that are not specific to partners, providing home STI testing kits to emergency contraception

(EC) users in pharmacies has been shown to be appealing to clients, as well as logistically feasible, but requires pharmacist commitment and proactive promotion to be successful.

Providing tools that index patients can use to perform PN is intended to support patient referral. However, there was mixed evidence about tool effectiveness. Paper notification cards had limited use in one study, although the way uptake was measured may have under-estimated utilization. For electronic tools, a systematic review found a discordance between high levels of acceptability and low levels of utilization. However, electronic tools were used for partners who would not have been notified otherwise. A pattern that emerged across studies was that anonymity was less acceptable than the electronic delivery method itself; thus, the use of open communication versus anonymity should be considered separately from the electronic delivery platforms when considering patient referral options.

4. Efficiencies in partner communication

Public health practitioners' utilization of a computer system that allowed multiple PN staff to access information on the same clients, thus avoiding waiting and telephone tag (e.g., if partners contacted the health unit when specific staff were unavailable) resulted in significantly lower PN times compared to a system where only the contact tracer assigned to each partner could communicate with that partner.

Evaluation

Studies have evaluated the impact of public health PN, usually measuring individual-level outcomes of partner elicitation (e.g., number of index patients interviewed, time to index patient interview, proportion of index patients who named at least one partner); sometimes including partner testing (e.g., proportion of named partners tested for STI/HIV, diagnosed as STI/HIV-positive through testing); and less frequently confirming partner treatment (e.g., proportion of STI/HIV-positive partners that are confirmed as receiving treatment, proportion of partners [irrespective of confirmed STI status] that are offered EPT). Another key measure has been the recurrence of curable STIs among index patients.

It is challenging to empirically study the population-level effects of PN services, i.e., the impact on STI incidence/prevalence in a jurisdiction by preventing onward transmission. Thus, mathematical models are potentially important in estimating the impact of PN programs. Modeling could also be used to estimate the impact of changing public health PN practices. However, there are many uncertainties in modeling, thus sensitivity analysis for parameter values is key, as is considering the optimal model structure.

Summary

The public health PN options and associated evidence are summarized in the table below. Highlights include that DISs were consistently found to be successful in PN, however no equivalent role currently exists in the Canadian context and new training would have to precede implementation. Limited evidence supports the addition of a website address linking to PN tools to the bottom of STI-positive laboratory reports in primary care; in the BC context, this option would require laboratory partnerships and potentially leverage an existing sexual health website already operating in the province. Promising results were seen with a comprehensive public health promotion of PDPT for diagnosing clinicians, which would require a resource investment up front in PDPT distribution and outreach; as well as with a diagnosing clinician/pharmacist Prescription-EPT intervention, without the involvement of public health. Efficiencies were achieved in public health PN by sharing partner files among contact tracers. No interventions were found that coupled targeted PN for certain partner groups with strategies (e.g., EPT) for the remainder.

No real-world evaluation of targeted PN was identified, despite several reports in the published and grey literature of jurisdictions that had discontinued PN for certain groups with chlamydia and in some cases

gonorrhoea, or had changed how PN occurs for groups based on assigning priority levels. This highlights the need for greater monitoring and evaluation of targeted PN interventions to enable the assessment of the various practices that are currently in place.

Intervention	Evidence (Comment)
Public health prioritizes certain groups for notification	
<ul style="list-style-type: none"> - Targeted PN based on partner characteristics (e.g., notifying certain partner groups and not others) - Targeted PN based on index patient characteristics (e.g., spending less time with certain index patients in the PN process, restricting time spent locating their partners, or on conducting re-interviews) 	<ul style="list-style-type: none"> - Examples of public health units in Canada and the US that deliver targeted PN, but no evaluation of impact. - No research found on targeted PN for high priority groups combined with EPT for others, which is highlighted in the 2008 CDC PN recommendations - Two studies have proposed scoring tools to guide PN based on partner characteristics alone, or index patient and partner characteristics. The utility of these tools depends on perceptions of the predictive power based on the sensitivity and specificity achieved at given numerical scores.
Public health involves new investigators with a dedicated PN mandate	
DIS or equivalent	<ul style="list-style-type: none"> - Evidence of DIS PN effectiveness compared to other PN providers in US studies. - DISs notified fewer partners than did index patients, or occurred through PDPT, but a higher proportion of those notified were treated under DIS referral. - Low current feasibility in the BC setting where DISs don't currently practice. - Cost considerations are uncertain, especially if compensation is lower than current public health PN staff, public health PN staff are freed to do other work (opportunity cost), and if DISs' PN yield is comparatively greater due to a dedicated and uninterrupted PN focus.
Greater PN by index patients, diagnosing clinicians, or through online automated tools, thus reducing the numbers of partners that come to public health for notification	
Traditional provider PN (simple or enhanced) by diagnosing clinicians or other office staff	<ul style="list-style-type: none"> - Embedding the address of a PN website on chlamydia-positive lab results was associated with the increased use of PN tools contained in the website by GPs. However, high levels of PN by providers who viewed these lab results did not differ significantly from those who didn't.
EPT by diagnosing clinicians	<ul style="list-style-type: none"> - The promotion of PDPT by public health in one large study was associated with improved patient PDPT access. - A direct partnership between pharmacists and clinicians, without involving public health, resulted in 40% of partners being treated with a voucher for prescription EPT at pharmacies. Among partners, the voucher option was much more popular than treatment at a clinic. - Broader roles for pharmacists warrant further investigation, as qualitative studies among pharmacists suggest an interest in providing STI education and encouraging health care seeking, as well as distributing (specifically chlamydia) testing kits to partners who present for prescription EPT.
Patient referral supported by PN tools	<ul style="list-style-type: none"> - PN paper cards for distribution by index patients had limited uptake. - Mixed evidence regarding electronic PN tools. The impact of anonymity should be separated from the utility of electronic platforms per se. - Electronic tools are useful for contacting partners who would not be reached in another way.
Online, automated clinical consultation and management system encompassing index patient and partner services	<ul style="list-style-type: none"> - Promising for index patients' diagnosis and treatment, but limited uptake of partner services.
Seek efficiencies in partner communication	
Sharing partner files	<ul style="list-style-type: none"> - Significantly reduced time per partner notified where groups of contact tracers share partner files rather than having one tracer per file.

OVERVIEW/CONTEXT

STI Epidemiology

The prevention and control of STIs continues to be a public health priority in Canada. Nationally, rates of reported chlamydia and gonorrhoea increased by 57.6% and 38.9%, respectively from 2003-2012.⁹ Whether this is due to increased occurrence and/or availability of STI testing, it remains the case that there is currently a high bacterial STI burden and this is likely to continue in the future. In 2012, the reported rate of genital chlamydia, the most commonly reported bacterial STI in Canada, was 298.7 per 100,000. In BC, the reported rate of genital chlamydia (the most common reportable infection in the province) was 286.4 per 100,000 in 2014 and 302.8 per 100,000 in 2015; and genital gonorrhoea was 38.6 per 100,000 in 2014 and 66.9 per 100,000 in 2015.^{10 11} Further, these rates are likely an underestimation as many cases are asymptomatic.

Consideration must extend beyond genital infection. The prevalence of extra-genital infections in numerous studies highlight the burden of pharyngeal and anorectal chlamydia and gonorrhoea. Dukers-Muijers et al. (2015) described the epidemiology of chlamydia and gonorrhoea at extra-genital sites among women (in mainly clinic-based populations) and gay, bisexual, and other men who have sex with men (GBMSM), and descriptive statistics suggest a similar or higher occurrence of anorectal chlamydia in women and gonorrhoea in GBMSM compared to genital sites (see table 1).¹² A review by Chan et al. (2016) reported a wide range of extra-genital chlamydia and gonorrhoea prevalence among women, GBMSM, and men who have sex with women (MSW). These differences are due to different clinical settings and methods of diagnosis (see Table 1).¹³

Table 1: Prevalence of extra-genital CT and NG in studies of women and GBMSM in two reviews

Author	Site	Women		GBMSM	
		Chlamydia	Gonorrhoea	Chlamydia	Gonorrhoea
Dukers-Muijers et al. (2015)	Pharyngeal	1 - 3%	1 - 2%	1 - 3%	4 - 12%
	Anorectal	7 - 17%	0 - 3%	1 - 18%	6 - 21%
	Genital	5 - 13%	1 - 2%	3 - 8%	3 - 11%
Chan et al. (2016)	Anorectal	median 8.7% (range 2.0–77.3%)	median 1.9% (range 0.6–35.8%)	median 8.9% (2.1–23%)	median 5.9% (range 0.2–24%)
	Pharyngeal	median 1.7% (range 0.2–3.2%)	median 2.1% (range 0–29.6%)	median 1.7% (range 0–3.6%)	median 4.6% (range 0.5–16.5%)

Nationally, rates of reported infectious syphilis increased by 101.0%, respectively from 2003-2012.⁹ In BC, a 40% increase in infectious syphilis cases occurred between 2014 (11.8 per 100,000) and 2015 (16.2 per 100,000). The national human immunodeficiency virus (HIV) diagnosis rate increased from 5.8 per 100,000 population in 2015 to 6.4 per 100,000 population in 2016; although the diagnostic rate was lower than in all years prior to 2012, it is the highest of the past five years and the reason for this is not known.¹⁴ In 2013, the rate of new HIV diagnoses in BC was 5.7 per 100,000 population.¹⁵

Health implications

Among women, complications of chlamydia include infertility, pelvic inflammatory disease (PID), ectopic pregnancy, urinary tract infections, and chronic pelvic pain.¹⁶ Untreated chlamydia in pregnant women poses a risk of transmission during childbirth, and may cause neonatal conjunctivitis and pneumonia.¹⁷ Complications of chlamydia in males may include epididymo-orchitis.¹⁸ The majority of

chlamydia-positive individuals are asymptomatic;¹⁹ yet even where there are no symptoms complications can still occur.²⁰

Among females, complications of untreated gonorrhea may include PID, infertility, ectopic pregnancy, and among males, complications of gonorrhea may include epididymitis.²¹ Further, although rare, gonorrhea can also affect the joints and blood.¹⁷

Untreated pharyngeal gonorrhea, although generally asymptomatic, can be passed to sexual partners through oral sex. It has also been shown that the pharynx may be the site of gonorrhea anti-microbial resistance (AMR) acquisition; and gonorrhea AMR is recognized as a significant public health concern. Rectal gonorrhea and chlamydia can present with discharge and proctitis, but are usually asymptomatic.²² Asymptomatic carriage of STI pathogens poses transmission risk and hinders control.^{13 23}

Syphilis, if left untreated, can progress through stages (i.e., primary, secondary, early latent, late latent, tertiary) and different signs and symptoms are associated with each stage. There can be damage to the nervous system, cardiovascular system, eyes, skin and other organ systems.¹⁷

Infection with HIV results in the progressive destruction of CD4+ T lymphocytes, which are white blood cells that are critical for immune system function.²⁴ Acquired immunodeficiency syndrome (AIDS) is a long-term sequelae of HIV infection. Individuals with HIV infection and subsequent immune suppression are at risk of developing a variety of AIDS-defining conditions, including opportunistic infections, primary neurologic disease, and malignancy. Early diagnosis and initiation of highly active antiretroviral therapy (HAART) can lead to reduced morbidity and mortality associated with HIV infection and disease progression to AIDS.

The existence of a current bacterial STI may increase the risk of contracting HIV (i.e., there is a relationship between STIs and HIV transmission, for example via a STI-related sore or inflammation).^{25 26} Some STIs are more closely associated with HIV than others.²⁷

The burden and impact of STIs/HIV highlight the importance of prevention, and opportunities to reduce transmission remain a key focus of public health authorities.²⁸

Partner notification (PN)

Partner notification (PN, also referred to as contact tracing) is a secondary prevention process through which sexual partners and other contacts* exposed to an STI are identified, located, informed, assessed, counselled, screened and treated.^{6 29} PN aims to interrupt the chain of STI transmission by targeting symptomatic and asymptomatic exposed individuals.^{† 30} Traditional methods of PN are patient referral (an index case notifies their current and/or recent partner[s] of the risk of infection and the need for medical assessment); provider referral (a health care provider [e.g., diagnosing primary care clinician, public health practitioner, etc.] elicits information about sexual partners from an index case, and notifies partner[s]); and contract or conditional referral (an index case initially takes responsibility for notifying their partner[s], but a health care provider becomes involved if patient referral is not completed within an agreed upon time frame).²

* With respect to HIV, partners are individuals with whom the index case has had unprotected sex, shared injecting equipment, or engaged in some other high-risk activity.

† Expedited partner therapy (EPT) may omit testing and treatment may be presumptive.

PN benefits

PN has multiple objectives including (at the individual level) identifying and treating STI-positive partners and preventing reinfection of index cases; and (at the population level) reducing overall STI incidence and prevalence by preventing onward transmission to the population.^{31 32} In a systematic review, 20% of the partners of individuals newly diagnosed with HIV tested positive for HIV.³³ In a study in an Australian sexual health clinic where heterosexual partners who presented to the clinic at the same time were tested for chlamydia using NAAT, 76% of males and 77% of females tested positive for chlamydia when their partners tested positive.³⁴ Sixty-one percent of dyads were concordantly infected with chlamydia (95% CI 55%–67%). In an earlier study of patients presenting to the same clinic who reported sex with a partner with chlamydia, 39.9% of females and 36.1% of heterosexual males tested positive for chlamydia; however, in this earlier study chlamydia was reported by a sexual partner but not confirmed.³⁵ This data highlights the importance of partner services.

With respect to re-infection, approximately 14% of women with chlamydia and 12% of women with gonorrhea become re-infected within months of treatment, often due to untreated partners;³⁶ and women with repeat chlamydial infections are at a higher risk for ectopic pregnancy and PID compared to women with first time chlamydial infections.^{37 38} If partners are treated after being notified, reinfection and sequelae may be reduced.

PN challenges

PN is recommended as integral to public health strategies for the management, prevention, and control of STIs. However, the resource demands of PN can be extensive given the burden of STIs at a population level (discussed previously), and there will likely be an ongoing need for resources to meet PN requirements given STI trends. For example, in a study in Spain in primary care and STI clinics, among index cases diagnosed with STBBIs, the mean number of partners per index case were 3 (range: 1–30).³⁰ Heterosexual men reported a mean 1.7 partners; GBMSM 6.2 partners; and females (sexual orientation not specified) 1.7 partners. In another source, at the level of the general population, individuals who were screened through the United Kingdom (UK) National Chlamydia Screening Programme and tested chlamydia-positive, reported an average of 1.4 partners.³⁹

PN has traditionally been performed by public health professionals who interview index cases, contact their sex partners, and encourage them to seek evaluation and treatment. This notification method is labor intensive and it is recognized that the resources of public health will be stretched in order to follow up with all contacts.^{40 41} PN barriers and facilitators from a public health perspective have not been widely described, although there is a limited and emerging literature base.⁴⁹ In a survey of public health representatives from six states in New England, Magaziner et al. (2018) identified that barriers to PN include those at the level of the health unit such as insufficient staff, funding, and extremely high demand for PN due to STI epidemiology (particularly chlamydia). Other barriers included anonymous partners and index cases who did not feel comfortable sharing partners' names with disease intervention specialists (DISs, discussed below); inability of DISs to identify and contact partners; and index cases declining to speak with DISs.

PN in BC

The authority for PN of reportable STIs exists under the BC Public Health Act. The reportable STIs in BC include chlamydia, gonorrhea, syphilis, and HIV/AIDS. All reportable STIs are reported to the local Medical Health Officer (MHO) who then reports these diagnoses to the Provincial Health Officer (PHO);

through a memorandum of understanding, the BCCDC receives the reports on behalf of the PHO. Most commonly, the CD nursing team in each of the regional health authorities perform PN for chlamydia and gonorrhea. Currently, Vancouver Coastal, Fraser, and Northern Health Authorities refer follow up of chlamydia and gonorrhea in their regions to Public Health Care Providers at the BCCDC. For syphilis, the Public Health Care Providers at the BCCDC perform or coordinate PN for all cases of syphilis diagnosed in BC.

THE ISSUE

Several sources have suggested that public health agencies have insufficient resources to trace the sexual partners of index patients and refer them to medical evaluation, with a minority of patients receiving formal sex partner referral services.⁴² The public health system in BC is no exception, with rising STI rates and the subsequent demand for PN. Anecdotally in BC, the volume of PN required for chlamydia and gonorrhea in particular, exceeds capacity. Given the resource demands of PN, Hogben (2007) suggests that flexibility, openness to the use of multiple methods, and collaboration are important.⁴⁰

OBJECTIVES

This report aims to:

- 1) Explore public health PN practices across jurisdictions, particularly where PN has changed, and determine the rationale and impact (where available);
- 2) Outline options for public health PN and the available evidence associated with each option; and
- 3) Discuss public health PN evaluation, both general considerations for evaluating the impact of PN by the public health system; and estimating, predicting, and understanding the impact of changes in PN practices.

This report is intended to provide Clinical Prevention Services (CPS), BCCDC with information about public health PN to inform a discussion about options, not to advise on a recommended course of action for PN services delivery in the province.

METHODS

Literature search

A rapid, non-systematic literature review was performed. Peer-reviewed published literature was identified through Ovid Medline using the search terms in Box 1, and through a Google search using the terms “public health” and “partner notification”.

Box 1: Ovid Medline Search Terms

Public Health/
AND
partner notification.mp. or Contact Tracing/
AND
sexually transmitted infections.mp. or Sexually Transmitted Diseases/

Results: 38

Articles published since the year 2000 were prioritized, although an exception was made for articles that focused on the Canadian STBBI PN context. Grey literature was also identified through searching the resources of key organizations (e.g., National Collaborating Centre for Infectious Disease [NCCID], Public Health Ontario, CDC, etc.). Additional documents were identified using the reference lists of the aforementioned resources.

The STI PN programs of most health departments focus on syphilis, HIV, gonorrhea, and chlamydia,⁴³ and these were also the focus of this report.

Prior reports

This report will complement the PN report previously completed by Ahmad, Prescott & Wong (unpublished) with Clinical Prevention Services, BCCDC.⁴⁴

RECOMMENDATION REFLECTING DIVERSITY IN PUBLIC HEALTH PN

Recommendations issued in 2008 by the CDC acknowledge that different PN approaches may need to be taken for different STIs due to resource considerations. The CDC recommends providing PN for all newly diagnosed or reported cases of infectious syphilis (primary, secondary, and early latent) and HIV, as well as new cases of gonorrhea and chlamydia as resources permit[‡].⁴⁵ Specifically:

On the basis of evidence of effectiveness and cost-effectiveness of these services, CDC strongly recommends that all persons with newly diagnosed or reported HIV infection or early syphilis receive partner services with active health department involvement. Persons with a diagnosis of, or who are reported with, gonorrhea or chlamydial infection also are suitable candidates for partner services; however, resource limitations and the numerous cases of these infections might preclude direct health department involvement in certain instances. Health departments might need to limit direct involvement in partner services for gonorrhea and chlamydial infection to selected high-priority cases and use other strategies for the remainder (e.g., expedited partner therapy).

Notably, the CDC recommendation does not suggest that groups not assessed as high priority would not receive any partner services; rather, that traditional public health PN would only occur for high priority cases, while other partners would still be reached in a different way.

DIVERSITY IN PUBLIC HEALTH PN ACROSS JURISDICTIONS

Diversity in the STI partner services delivered by public health agencies in Canada appears to have a long history. In a 1994 publication, Rasooly et al. surveyed provincial and territorial epidemiologists/directors of STI control to ask about program organization; and 151 local health units plus three provincially run STI PN programs serving health unit areas, to ask about practice patterns of STI PN.⁴⁶ They found that the majority of public health agencies provided PN services for STIs, but that PN practices varied by STI. For syphilis, 67% of health units indicated that PN was done for most (>50%) cases; for gonorrhea, the comparable proportion was 60%, for chlamydia 52%, and for HIV 33% (only among the health units that reported any HIV cases).[§] Thirty-seven percent of health units used some type of targeting. Targeting was used for chlamydia in 28% of health units, and for gonorrhea in 24%. Pregnant women were the group most often targeted. Women in general were targeted in 9% of units for both chlamydia and gonorrhea. The authors also found that, at the time, the PN program was largely centralized in four provinces/territories, five had a high degree of local health unit autonomy in operating PN services, and three were between these two extremes.

Golden et al. (2003) surveyed public health department officials in 78 US jurisdictions with the highest rates of chlamydia, gonorrhea, syphilis and HIV (response rate of 77% for a sample size of 60 jurisdictions).⁴³ They sought to determine how health departments target PN services, what services they provide, and what proportion of individuals with reportable STI and HIV infections in their jurisdictions had PN interviews. Table 2 illustrates that PN efforts largely focused on syphilis: PN interviews were conducted with 89% of the index cases of syphilis, 17% of the cases of gonorrhea, 12% of the cases of

[‡] The recommendations in the 2008 CDC report focus on partner services for HIV infection and three other STIs: infectious (“early”) syphilis (i.e., primary, secondary, and early latent syphilis), gonorrhea, and chlamydial infection, and focus primarily on traditional, health department--based strategies for conducting partner services.

[§] As well, at that time, the authors report that HIV PN was frequently seen as the responsibility of the physician.

chlamydia, and (in the areas where HIV was reportable) 52% of the cases of HIV. With respect to gonorrhea and chlamydia, although by volume a large number of PN interviews were conducted for these two STIs (because there were so many cases as can be seen in table 2), only a minority of chlamydia- or gonorrhea-positive index patients received PN services. Thirty seven percent of health departments provided no routine PN services for gonorrhea, and 45% provided no routine PN services for chlamydia. Among those health departments that did provide services, a median 43% of patients with gonorrhea and 14% of patients with chlamydia were interviewed. Most health departments reported concentrating PN services for gonorrhea and chlamydial infection on patients seen in STI clinics.

Table 2: Proportion of index cases interviewed for PN

Variable	Syphilis	Gonorrhea	Chlamydia	HIV*
Total cases	8492	139,287	228,210	8328
Total number (%) of cases interviewed among all health Departments	7583 (89%)	23,097 (17%)	26,487 (12%)	4476 (52%)

*Only includes the jurisdictions in which HIV was a reportable disease at the time of the survey ($n = 41$ out of 60 responding jurisdictions)

With respect to targeting PN services, four health departments targeted pregnant women for PN services, two targeted untreated cases, one targeted adolescents, and one had a geographic focus as they targeted an area defined as a core. The authors also explored barriers to PN, and the most commonly reported barriers were insufficient funding or personnel, followed by the inability to retain staff.

The authors discussed the challenges of PN specifically for chlamydia and gonorrhea, stating that “providing traditional PN services to a majority of persons with gonorrhea and chlamydial infection would require substantially increased funding, substantially more efficient use of existing resources, or both” and that reaching all index cases with PN services “would involve hundreds of thousands of additional DIS investigations ** annually and is probably not feasible from a cost perspective.” They suggested that reform of the PN system was required, involving new and more efficient approaches to partner management, including PDPT.

In a more recent study, Cuffe et al. (2018) presented the results of a national survey entitled ‘Assessing STD Programs and Services in State and Local Health Departments survey’ conducted between 2013-2014.⁴⁷ A random sample of 311 local health departments (LHDs) and all state health departments (SHDs) that provided STI screening or treatment, including cities and counties with the top 50 highest number of reported STI cases or rates, were surveyed. Among the 61% of SHDs and 48% of LHDs that responded to the survey, 81% - 85% provided partner services. PHNs often provided services for LHDs (50.8%) and DISs or equivalent largely provided services for SHDs (90.9%). Close to three-quarters provided other forms of partner services (e.g. EPT, internet partner services). Among LHDs, 45.5% reported providing EPT for chlamydia and 32.0% for gonorrhea; the lower provision of EPT by SHDs was not significant. Thirty seven percent of LHDs and 30% of SHDs had STI staff temporarily reassigned for non-STI related activities (e.g., public health emergencies). Of LHDs who had staff reassigned for non-STI related activities, most reported that staff reassignment had a minor (56.7%) or major impact (22.4%) on programmatic activities. Finally, 28.8% of LHDs and 25.9% of SHDs reported that budget cuts led to reductions in partner services activities. Among programs who reported negative impacts from budget cuts, the most common impact was fewer partner services for chlamydia, gonorrhea, or other STI cases in both LHDs (21.3%) and SHDs (40.0%) ($p = 0.0391$).

** See a discussion of DISs below

Further, Leichter et al. (2017) surveyed 331 of 1225 LHDs in 2013-2014, who provided STI testing/treatment and/or were in the 50 areas with the highest STI cases or rates.⁴⁸ Among 148 LHDs (response rate 48%), over 60% reported recent cuts to the government funded portion of their STI program budget in the 2011-2012 fiscal year. Among LHDs whose budgets decreased one of the most common impacts was reductions in partner services (for 42.1% of LHDs who experience budget cuts; 95% CI 23.6–60.7).

The published article that provided the most detail regarding the range of public health PN services is a recent examination of the experience of health departments in New England (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont) by Magaziner et al. (2018).^{49 ††} In a survey of representatives from the public health departments in each state, it was found that all six states delivered PNS for HIV and syphilis (i.e., every state surveyed reported prioritizing PN for newly diagnosed HIV cases and for individuals with infectious syphilis). However, PN services for gonorrhea, and particularly chlamydia, varied (see Table 3). Maine, New Hampshire and Vermont performed services for all gonorrhea cases; but Rhode Island, Connecticut, and Massachusetts performed limited PN for gonorrhea due to lack of resources. New Hampshire offered targeted PN for gonorrhea, as PN was prioritized among individuals with a diagnosis of HIV and those who had multiple gonorrhea infections in the previous 12 months. None of the six states routinely provided full PN services for chlamydia, though Maine and Vermont did so for high-priority populations such as HIV co-infected individuals or pregnant women.

Table 3: Selected program elements relevant to gonorrhea and chlamydia partner notification

Jurisdiction	Selected details of PNS for chlamydia and gonorrhea
Rhode Island	<ul style="list-style-type: none"> - Focused partner notification efforts for gonorrhea on urban centers and on regions that collectively accounted for 75% of gonorrhea cases due to limited staff resources. - Cited insufficient staff, prohibitively high prevalence of chlamydia, and insufficient funding as barriers to adequately perform PN for chlamydia.
Vermont	<ul style="list-style-type: none"> - PN for gonorrhea was offered, and gay, bisexual, and other men who have sex with men (GBMSM) with gonorrhea were considered a priority for receiving PNS. - PN for chlamydia was only offered among pregnant women who either had untreated partners or who were untreated themselves, or who had not had a test of cure performed
New Hampshire	<ul style="list-style-type: none"> - PN for gonorrhea was prioritized among individuals with a diagnosis of HIV and those who had multiple gonorrhea infections in the previous 12 months. - Cited insufficient staff, prohibitively high prevalence of chlamydia, and insufficient funding as barriers to adequately perform PN for chlamydia.
Massachusetts	<ul style="list-style-type: none"> - Due to limited resources and a high number of syphilis cases, unable to offer PN to all gonorrhea cases, though the state was working toward offering interviews to newly gonorrhea-positive patients who had HIV co-infection. - Did have PN for chlamydia, but services were limited and available upon provider request.
Maine	<ul style="list-style-type: none"> - PN for chlamydia was prioritized for individuals with HIV or gonorrhea co-infection, high-risk pregnant women (such as those lacking prenatal care or with an untreated partner), women younger than 20 years old, men younger than 25 years old, persons who were positive for another STI in the prior six months, and STI clinic clients.

^{††} DIS were commonly used across health departments; therefore, these findings should be interpreted in this human resource context.

Connecticut - Cited insufficient staff and prohibitively high prevalence of chlamydia as reasons for being unable to adequately perform PN for chlamydia.

An additional example in the grey literature was found for the Winnipeg Regional Health Authority (2013).⁵⁰ A clinical practice guideline for chlamydia was directed to PHNs who followed up chlamydia cases. The reasons for adopting targeted PN for chlamydia are described below:

There is evidence that public health case and contact management efforts have not been effective in reducing the incidence of chlamydia infection, although theoretically these efforts may reduce the incidence of pelvic inflammatory disease, or other negative sequelae of chlamydia. Due to the high prevalence of chlamydia infection, universal case and contact follow up requires resources beyond what is available in the Winnipeg Health Region and compromises the ability to carry out other evidence informed programs for the reduction of sexually transmitted and blood borne infections. For these reasons, a targeted program has been developed to focus efforts on cases and contacts who are most likely to experience the negative sequelae of chlamydia, who are likely to have barriers to health service access, and those who are more likely to benefit from public health interaction... Gonorrhoea, syphilis, hepatitis C, and HIV infections are prioritized for follow-up before chlamydia infections. (p. 2)

When a PHN received the file of an index patient for PN, the level of priority for partners (urgent, high, low, self-managed, unknown) needed to be determined based on the partner’s characteristics. Depending on the priority designation, specific procedures were recommended related to the number and method of contact attempts, and confirmation of partner testing and treatment. Table 4 presents a summary of priority designations and associated public health interventions. The guideline does not specify how priority designations were determined other than what is mentioned above: “to focus efforts on cases and contacts who are most likely to experience the negative sequelae of chlamydia, who are likely to have barriers to health service access, and those who are more likely to benefit from public health interaction.” The guideline also notes that chlamydia contacts should receive their first contact attempt from the PHN within five working days of receipt of the file.

Table 4: Criteria for level of priority of chlamydia contacts/partners in the Winnipeg PHN chlamydia PN clinical practice guidelines, and associated interventions

Priority	Urgent	High	Low	Self-Managed	Unknown
Criteria for priority designation	Includes contacts under 12 years of age (e.g. newborns of mothers who were infected with chlamydia at the time of vaginal delivery).	Includes contacts: - Between 12-16 years old (or ongoing partner between these ages) - Pregnant (or ongoing partner is pregnant) - Named a contact 3 times in the past 12 months	Includes contacts: - Between 16 - 24 years old - No high priority conditions (pregnant/partner pregnant, contact to under 16 year old, named 3x contact in 12 months)	Includes contacts: - Over age 25 years - Don’t meet any of the conditions for an urgent, high-priority, or low-priority designation	- Not enough information about contacts to determine a priority designation.
Interventions	- Pursue urgent contacts without delay. - In many cases the PHN will contact the legal guardian and may be negotiating	- Pursued with up to 2 phone calls and 2 letters - Attempt to confirm testing and/or treatment - If the contact is	- Receive two contact attempts starting with a phone call if possible and following up with a letter.	- Cases encouraged to notify their own partners. - Public health will not assist with partner notification unless partners meet	- Pursue as ‘low priority’.

<p>follow up with the primary care provider or pediatrician.</p> <ul style="list-style-type: none"> - If the contact or legal guardian is unresponsive, use PHN judgment re: home visit. - PHN should confirm testing and/or treatment of urgent contacts. 	<p>under the age of 15 and is not attending for care or responding, the PHN may discuss involving the parent or guardian with the case.</p> <ul style="list-style-type: none"> - Home visits only in exceptional cases 	<ul style="list-style-type: none"> - No expectation to confirm testing or treatment. 	<p>the criteria under one of the other priority designations.</p>	
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Lack of evaluation data

Although some jurisdictions have changed, and in some cases reduced, public health PN services, no studies were found that evaluated the impact of these changes. Therefore, it is uncertain what impact such changes have had on individual- and population-level STI outcomes.

PUBLIC HEALTH PN OPTIONS

In Canada, public health PN traditionally involves notifying all partners (within a specified time frame) that are identified. PN is often delivered by public health staff who have other roles outside of STI PN (e.g., PHNs or other nurses with expertise in Communicable Disease [CD] Prevention and Control). Other options for public health PN include the following (see Box 2), alone or in combination:

Box 2: Options for public health PN

- ◆ Targeted PN: Prioritizing which partners to notify based on index patient and/or partner characteristics; thus, fewer partners receive full traditional PN although the CDC recommends coupling this with other PN strategies for the remainder.
- ◆ Involving new investigators with a dedicated PN mandate (Disease Intervention Specialists [DISs] or equivalent).
- ◆ Promoting and supporting PN delivery in ways other than by public health practitioners, for example:
 - PN by index cases
 - Traditional PN by diagnosing clinicians or other office staff
 - EPT by diagnosing clinicians with the possible involvement of pharmacists
 - Online, automated clinical consultation and management system that encompasses index patient and partner services, culminating in partner e-prescription EPT
- ◆ Continuing with traditional public health PN but seeking efficiencies in PN practices.

Each of these options were discussed in the literature, however no studies were identified that evaluated the impact of any of these options on public health PN demand. Therefore, the evidence that is presented for each option relates to the effectiveness of the option relevant to PN outcomes, not to public health PN workload.

In addition, a section entitled “other interventions” includes an account of a public health unit in the US which dealt with a large budget cut and attempted to maintain STI partner services in the midst of these budgetary constraints, using efforts across multiple areas.

1. Targeted PN

Targeted PN is defined as limiting PN to groups where efforts are most likely to be successful or have the most public health impact. This is an alternative to providing PN for all case-patients and proposed as resource-saving. Targeted PN may prioritize one or more of the following broad partner groups:

1. Partners at higher risk of severe health outcomes
2. Partners at higher risk of STI transmission/more likely to be STI-positive
3. Partners that may be high-frequency transmitters and thus are particularly important in preventing onward community transmission
4. Partners who are less likely to present for STI testing and care

Alternately, targeted PN may be guided by characteristics of the index case, and spend less time with certain index patients in the PN process, restricting time spent locating partners, or on conducting re-interviews.

The published article by Magaziner et al. (2018) presented examples of New England states that had targeted PN for gonorrhea and chlamydia, and the Winnipeg Regional Health Authority for chlamydia based on priority rating. Program evaluations of these targeted approaches were not identified; nor were evaluations of targeted PN for other jurisdictions.

Targeted PN relies on having reliable data to determine the index case and/or partner characteristics that warrant prioritization. Several studies have attempted to identify what the characteristics are, with mixed results.

Targeted PN based on index case characteristics

Hoots et al. (2014) sought to determine the characteristics of *index cases* with syphilis that were associated with the elicitation of partners (i.e., an index case names sex partner[s] during an interview with the public health DIS), and case finding (i.e., an index case's partner[s] are successfully traced, tested positive, and treated after the interview), in order to determine whether targeted PN for syphilis is desirable.⁵ Their reasoning appeared to be that if certain group(s) were very low in naming partner(s) and/or having partner(s) brought to treatment, these group(s) might be appropriate to not focus PN efforts on due to low yield. Data was derived from the de-identified syphilis PN case management systems in New York City, Philadelphia, Texas, and Virginia. Data was provided on all index cases that included demographics and diagnosis, and all contacts of index cases that included demographics and the PN outcome.

Female sex, younger age (<35 years), and diagnosis at a public STI clinic were consistently associated with effective partner elicitation (i.e., naming partners) across sites. However, some of these varied by other index case characteristics in certain sites (e.g., the association between age and naming a partner varied by race in certain cities). Race and sexual orientation were associated with naming a partner, but the direction of the association differed by site. For example, GBMSM index patients were less likely than women and men who have sex with women only (MSW) to name a partner in New York City, Texas, and Virginia; while in Philadelphia, GBMSM were more likely than MSW and as likely as women to name a partner. Black index patients were more likely than other races/ethnicities to name one or more partners in NYC, Texas, and Virginia, whereas the opposite was true in Philadelphia. A shorter time-to-assign date was associated with naming a partner in certain sites, but in some cases this was only true if the index case was assigned to a DIS within seven days. The same inconsistent associations were seen for index patient HIV status, and stage of syphilis.

With respect to having a partner brought to treatment, index patients who were younger, and had been diagnosed in a STI clinic rather than a private clinic, were most likely to have a partner brought to treatment. The association between sexual orientation and having a partner brought to treatment was not consistent across sites. Again, index patient HIV status, and stage of syphilis, were not consistently associated with having a partner brought to treatment.

Few groups had a proportion of case-patients with a named partner or with a partner brought to treatment that was so far below average that sites should consider curtailing PN among that demographic. The lowest proportion of index patients that named a partner among all categories was 23%, indicating that almost a quarter in each group named a partner. The proportion of case-patients with a partner brought to treatment was as low as 2% among older age groups in one site, but only 4% overall had a partner brought to treatment. Index patients with late latent syphilis or syphilis of unknown duration were consistently unlikely to have a partner brought to treatment, so it may be useful to limit PN to earlier stages. However, syphilis stage is often uncertain until a partner investigation is completed, so it is unclear if decisions on pursuing case-patients should be made from initial staging. In addition, several sites already limit the number of case-patients with late syphilis for which they conduct PN because transmission is unlikely.

Therefore, since the index patient characteristics associated with successful partner elicitation and case finding varied by site, it is unclear if targeting would improve PN success. If targeting is considered, it would need to be implemented using site-specific data to determine what groups would yield the most success.

Targeted PN based on index case and partner characteristics

Hoots et al. (2012) developed a model to predict undiagnosed HIV infection in sexual partners in order to inform prioritizing interviews of public health DISs; thus, if DIS were unable to trace all named partners in the future, identifying those partners most likely to be HIV-positive would be a potentially effective strategy.⁵¹ The driver for this work in North Carolina was that DIS conduct PN for both HIV and syphilis and 48 DIS are available to locate ~2,000 newly identified HIV cases and ~600 early syphilis cases in the state per year as well as their named sexual and drug sharing partners. Further, DIS PN caseloads are increasing due to increased HIV testing. As well, DIS were being increasingly engaged for work outside of their standard scope (e.g., community awareness campaigns and public health research), which left less time for traditional PN duties. Finally, public health budget cuts and hiring freezes made it unlikely that more DIS would be hired. The authors used demographic, behavioral, and partnership data from DIS records of index cases newly diagnosed with HIV in North Carolina; thus, both index patient and partnership characteristics were considered. The set of possible predictors included demographic characteristics and risk behaviors of the index case, demographic characteristics of the named partner reported by the index case, and characteristics of the partnership reported by the index case.

Reporting only one partner total in the past year to DIS compared to reporting four or more partners was the predictor most strongly associated with a newly diagnosed HIV-positive partner (odds ratio [OR] 2.7, 95% confidence interval [CI]: 1.6, 4.4). Other potentially important predictors of a newly diagnosed HIV-infected partner ($p < .05$ in bivariate analyses) were a history of ever having exchanged sex for drugs or money, fewer than four weeks between time of HIV diagnosis and DIS interview, and having a younger partner; as well, no history of crack use, and no anonymous sex ever were also identified as possible predictors.

The authors identified five factors that predicted a partnership with an undiagnosed partner: four weeks or fewer between HIV diagnosis and DIS interview; no history of crack use; no report of anonymous sex; fewer sexual partners reported to DIS (reporting only one partner total in the past year to DIS compared to

reporting four or more partners was the predictor most strongly associated with a newly diagnosed HIV-positive partner in bivariate analysis); and sexual partnerships between an older index case and younger partner. Theoretically, it could be used by PN providers in an Excel spreadsheet (that would also include instructions on risk score interpretation), where providers would enter 1's and 0's corresponding to the characteristics of the partnership to calculate the risk score. An appropriate cutoff could be chosen by determining the weight of false negatives relative to false positives. However, the overall predictive power of the model was low, and the model had low specificity. Interviewing all partners at a score ≥ 2 has a sensitivity of 90.2% and reduces the number of partners DIS would need to locate and interview by 26%.

Targeted PN based on likelihood of partners accessing services

Brown et al. (2012) aimed to create a risk score to target partner notification by predicting which partners of patients newly diagnosed with HIV in Malawi were the least likely to respond to patient referral and report for counseling and testing on their own, and thus provider referral would be needed.⁵² The final model predicting failure to report to the clinic included male partner gender, relationship duration < 6 months, relationship duration 6–24 months, and greater than primary education in the index. Male gender, index education greater than primary, and relationship duration 6–24 months were assigned a score of 1 and relationship duration less than 6 months was assigned a score of 2 in the risk score algorithm.

A risk score cut-off of ≥ 3 had a sensitivity of 29% and a specificity of 94% for identifying partners unlikely to report to the clinic on their own; thus, with this cut-off score, only 24% of all partners would be traced by a community counselor and 32% of all partners would be tested. When the cut-off score is ≥ 2 (and note that all new partners in the last 6 months would meet this cut-off and thus be targeted for provider referral), the sensitivity increases to 68% (95% CI 60%–75%) and specificity is 77% (95% CI 70%–84%); thus, 58% of all partners would be traced with provider-assisted notification and 46% of all partners are expected to be tested using a risk score cut-off of ≥ 2 .

2. New public health investigators with a dedicated PN mandate

Disease Intervention Specialists (DISs) or equivalent

DISs are non-medical staff with specialized training in communicable disease follow-up activities, whose role was initially established to work in the field of STI prevention and who are critical PN personnel in the US.² DISs have skills in communication, interviewing, counseling, case analysis, and provider and community engagement. DIS skills are identified as valuable as patient navigators and in linking patients to care.⁵³ Table 5 summarizes studies examining DIS yield in PN; in these studies, DISs are compared to other PN providers, to patient referral, to PDPT, and to usual clinic PN practices. There are examples in the literature of DISs using a variety of communication methods, including phone, letter, text messages, visits, etc. (see “DIS models” Box 5 below).

DISs have success in tracing partners compared to other providers. This may be because, where DISs are exclusively in traditional STI prevention roles, they do not have to split their time and energy between PN and other clinical responsibilities as other health care providers do.² For example, in the New York City Department of Health and Mental Hygiene (DOHMH), for the notification of partners of HIV-positive index cases, DISs at DOHMH STI clinics elicited four times more partners and were more successful than non-DOHMH providers in notifying and testing partners.⁵⁴

With respect to comparing DIS to other methods of PN, Fleming & Hogben (2017) conducted a literature review to compare the proportions of partners of gonorrhea index cases that were notified and treated when PN was from public health professionals (DIS referral), patients (patient referral), and via PDPT.⁵⁵ The authors used data from published studies: patient referral data from 7 studies (3853 patients, 7490 partners); 5 estimates of PDPT data from 5 studies (1781 patients, 3125 partners); and DIS referral data from 14 program settings (4581 patients interviewed, 8301 partners). The proportions of partners notified and treated were, for patient referral, 56% and 34%; for PDPT, 57% and 46%; for DIS referral, 25% and 22%. Notification and treatment estimates for patient referral and PDPT were significantly higher than for DIS referral, but DIS referral was more efficacious than the other methods in assuring treatment among those notified (all $p < .001$).

In several studies, the placement of DISs within clinics and other community sites, were important for improving partner services. Rudy et al. (2012) studied the impact of Community-Embedded Disease Intervention Specialists (CEDIS) on PN for syphilis and other outcomes, in a community-based clinic serving GBMSM (i.e., the DIS was employed by and stationed at the clinic and thus could interact with index patients diagnosed with syphilis at the time of diagnosis).⁵⁶ After CEDIS placement, 100% of index cases assigned to DIS were interviewed (vs. 67% before CEDIS placement) and there was a large increase in the proportion interviewed within seven days (64% post-DIS vs. 2% pre-DIS). After DIS placement, 15% of the partners elicited were identified with early syphilis and brought to treatment compared with 0% of the partners elicited before. Similar benefits were observed and reported by Taylor et al. (2010) when DIS were placed in a HIV clinic and PN occurred in relation to syphilis.⁵⁷ Interestingly, the DIS in this study was only placed in the clinic ½ day per week in two clinics, and on an on-call basis in a third clinic. Significant improvements were seen in several areas. A higher proportion of patients completed a partner elicitation interview during the period of DIS placement (94% after vs. 81% before, $p = 0.001$); there were increases in the average number of locatable partners (1.1 after vs. 0.6 before, $p = 0.004$); increases in the average number of partners exposed and brought to treatment, or infected and brought to treatment (0.6 after vs. 0.3 before, $p = 0.02$); and the time to interview decreased (18 days before vs. 9 days after, $p = 0.02$).

Other DIS outreach sites were also studied. In New York City, the DOHMH formed the HIV Field Services Unit in 2006 in order to increase partner services for patients diagnosed by non-DOHMH health care providers.⁵⁸ This Unit was intended to help expand the partner services delivered in neighbourhoods that were hardest hit by the HIV epidemic. Some DISs were assigned on full-time or on-call bases at voluntarily participating hospitals to provide on-site partner services assistance to providers and HIV-positive patients, while others delivered partner services at patients' homes and at prearranged field sites in the community. Sites that participated in the DIS intervention had significant improvements ($p \leq 0.0001$) in the partner-index ratio (partners elicited/patients interviewed) (0.3 in 2005 [pre-intervention] vs. 0.9 in 2008 [post-intervention]); proportions of patients naming partners (33% in 2005 vs. 61% in 2008); proportion of named partners notified (51% in 2005 vs. 67% in 2008). In 2008, 61% of notified partners at participating sites were tested, and 13% of those tested were newly diagnosed with HIV infection. A significantly higher proportion of newly diagnosed patients had a provider report form (PRF) submitted (indicating submission of partner elicitation information from the clinical provider) compared with non-participating sites (75% vs. 44%). Significantly more partners at participating sites were elicited (474 vs. 13) and notified (194 vs. 1). The number of partners tested could not be compared due to incomplete HIV testing information on partners notified by non-DOHMH providers.

Table 5: PN by DIS or equivalent referral compared to either patient referral or diagnosing clinician referral

Study	Setting	STI(s)	DIS or equivalent	Comparison	Results	
					Partners notified and/or tested	Partners treated

Malave et al. (2008)	New York City Department of Health and Mental Hygiene (DOHMH)	HIV	DISs in DOHMH STI clinics	non-DOHMH providers	DISs elicited four times more partners and were more successful than non-DOHMH providers in notifying and testing partners	Not assessed
Fleming & Hogben (2017)	Review of published studies in 14 program settings	Gonorrhea	DIS	1) Index patient referral and 2) PDPT	The proportions of partners notified and treated were: 56% and 34% for patient referral, respectively; 57% and 46% for PDPT, respectively; and 25% and 22% for DIS referral, respectively. Thus, DISs notified fewer partners than occurred with patient referral or PDPT, but DISs had the highest proportion of partners notified who were treated (88%).	
Rudy et al. (2012)	Community-based clinic serving GBMSM	Syphilis	CEDIS*	Usual PN practice before CEDIS were placed in clinics	100% of index cases assigned to CEDIS were interviewed vs. 67% before CEDIS placement, and a higher proportion were interviewed within seven days (64% vs. 2%, respectively). 15% of the partners elicited were identified with early syphilis and brought to treatment vs. 0% of the partners elicited before	
Taylor et al. (2010)	HIV clinic	Syphilis	DIS in clinic	Usual PN practice	A higher proportion of patients completed a partner elicitation interview during the period of DIS placement (94% after vs. 81% before, $p = 0.001$); there were increases in the average number of locatable partners (1.1 after vs. 0.6 before, $p = 0.004$); increases in the average number of partners exposed and brought to treatment, or HIV-positive and brought to treatment (0.6 after vs. 0.3 before, $p = 0.02$); and the time to interview decreased (18 days before vs. 9 days after, $p = 0.02$).	
Udeagu et al. (2012)	HIV Field Services Unit founded by New York City DOHMH	HIV	DIS in hospitals, index patient homes, other community sites	Usual PN practice	Participating sites had significant improvements ($p \leq 0.0001$) in the ratio of partners elicited/patients interviewed** (0.3 in 2005 [pre-intervention] vs. 0.9 in 2008 [post-intervention]); proportions of patients naming partners (33% vs. 61%); proportion of named partners notified (51% vs. 67%).	Post-intervention, 61% of notified partners at participating sites were tested, and 13% of those tested were newly diagnosed with HIV. The number of partners tested could not be compared due to incomplete HIV testing information on partners notified by non-DOHMH providers.

* Community-Embedded Disease Intervention Specialists (CEDIS) - located in clinics, thus able to interact with index cases at the time of diagnosis.

** Partner-index ratio

DIS models

In New England, the DIS models utilized are described in Box 3 and the process of contacting partners in Box 4.⁴⁹

Box 3: DIS models in New England states

- In both Maine and Rhode Island, the PN programs were staffed by three individuals, two of whom were responsible for STI cases with a third person designated solely for HIV. In this arrangement, individuals co-infected with HIV and another STI were referred to the STI DIS in the case of a pre-existing HIV infection, and to HIV DIS if the HIV diagnosis was new.
- In other states, DIS shared responsibility for cases of HIV and other STDs.
- The number of DIS employed to conduct PN ranged from one in New Hampshire and Vermont to 11 in Massachusetts, with considerable variation in how responsibilities were delegated.
- Most DIS were based in centrally located state-run offices, but split their time by traveling to clinics for interviews. In all the New England states, the DIS worked directly with the surveillance staff to obtain names of newly diagnosed patients to contact.

Box 4: PN methods and process

- In most states, DIS used phone calls as the preferred way to reach partners. Connecticut, Massachusetts and Vermont first placed several phone calls to identified partners, and followed up with a home visit if there was no response. For HIV, syphilis, and gonorrhea, Maine DIS started with phone calls and followed up with a letter, after which a visit was made if there was no response. For chlamydia, Maine DIS relied solely on phone calls. New Hampshire DIS used phone calls to contact partners for all infections. For HIV, Rhode Island DIS first attempted a phone call, followed by a text message, a visit, a letter and an online form of contact. For syphilis, Rhode Island attempted a phone call and a text message, and for gonorrhea, DIS employed a phone call, a text, a visit, and a letter.
- Internet PN was rarely used. Massachusetts, Maine, and New Hampshire reported the use of smartphone applications used for meeting sexual partners (“hook-up apps”) and websites to contact partners for at least HIV and syphilis; no states reporting using Facebook to contact partners.
- All states reported making at least two attempts to get in touch with each partner, with the number of typical attempts varying by STI.
- Upon contact, DIS referred partners to a range of facilities for testing and treatment. These included Planned Parenthood, hospital-based clinics, STI clinics, and other local providers.

Another term that is used in the US literature to refer to a specialized PN role within a health department is a Partner Notification Officer (PNO). Rane et al. (2016) conducted a study in Australia among GBMSM attending a STI clinic in which individuals newly diagnosed with HIV were offered referral to the Victorian Department of Health PNOs by clinic nurses and physicians.⁵⁹ The study investigated differences in the partners notified between “opt-in referral” which was used in the first time period versus an “opt-out referral” which was used in the second time period (i.e., all patients newly diagnosed with HIV were referred to the PNO unless they declined the referral). The activities of the PNO are outlined in Box 5.

Men diagnosed with HIV were significantly more likely to accept assistance from the PNO during the opt-out period (85%) compared with the opt-in period (24%); a significantly higher proportion of reported partners were notified with opt-out referral (46.0%; 95% CI, 38.6–53.4) compared with opt-in referral (12.3%; 95% CI, 8.5–17.0); and the median number of partners notified of their risk was 1 (IQR, 1–2) in the opt-out period and 0 (IQR, 0–1) in the opt-in period. Although opt-out referral to partner notification services increased the proportion of contacts who were informed of their risk, 55% of partners were ultimately unable to be contacted. This likely reflects a high number of anonymous or casual sex partners.

Notably, the involvement of the PNO was important whether an opt-in or opt-out policy was used. PN was more effective when the PNO were involved in both time periods. During the opt-in period: for those who used the PNO, 21.4% (95% CI, 13.3–29.5) of partners were contacted vs 6.5% (95% CI, 2.6–10.4) where the PNO wasn't involved. During the opt-out period: 24.0% (95% CI, 7.3–40.7) partners were contacted by the index patient without the assistance of the PNO vs. 48.8% (95% CI, 41.2–56.7) with PNO involvement.

Box 5: PNO activities as described by Rane et al. (2016)

- Arranged to meet with the newly diagnosed patient face to face, where possible at the clinic, immediately after the consultation where the diagnosis of HIV was given.
- Interviewed the index patient to identify the number of partners, names and contact details.
- Usually contacted partners via telephone, but also used any other methods of contact provided by the index patient, such as via internet chat room sites, phone applications used to meet partners, email, letters, and occasionally face-face meetings.
- If necessary, multiple attempts were made to contact partners.
- Advised partners that they had come into contact with HIV and recommended HIV testing.
- Did not conduct HIV testing themselves or ascertain the outcome of any HIV tests.

DIS logistics

The US is not the only country that have DIS-type roles, however DISs are not employed in Canada. In order to explore this as an option for PN in Canada, it is useful to understand DISs' education/qualification. Specialized training would be required for anyone that holds a DIS-equivalent role and DIS training programs in Canada must necessarily precede incorporation of this or a similar specialty. The Centers for Disease Control and Prevention (CDC) is in the process of developing a national certification program for DIS and as part of this national competencies for DIS will be established.⁶⁰

Magaziner et al. (2008) describe the training offered to the DISs in New England. Connecticut, Massachusetts, Maine and New Hampshire provided DIS with specialized training in addition to the national CDC-sponsored training. In Connecticut, this training covered state-specific issues, phlebotomy, rapid HIV testing, confidentiality guidelines, and other topics as they arose. At the time of the survey, Massachusetts was in the process of piloting a new training program for staff, which includes in the modules "HIV Fundamentals," "Field Safety" and "Sex in Context," as well as those addressing other pertinent issues, along with a shadowing requirement for all new staff. New Hampshire also required that new DIS shadow trained DIS in clinics, at home visits and testing events, and during phone interviews and data entry.

Expanded DIS roles

In some settings, the DIS role has expanded to also be involved with TB outbreak response, other infectious disease control efforts, and public health emergency management. Utilizing DISs' in an expanded role has, in some contexts, been important for maintaining STI PN efforts in the face of STI program budget constraints, as will be discussed further below.

DIS feasibility

If additional resources were available to hire new staff, the involvement of dedicated PN investigators would clearly assist in managing the PN workload of a jurisdiction and free up public health practitioners to focus on other public health issues. There is a comparatively high yield of DISs for partners notified in

most studies, and particularly for the proportion of notified partners that are treated. The main barrier is that DISs aren't currently a recognized occupational group in Canada, thus training and monitoring programs would need to first be established.

If additional resources aren't readily available for new hires, then the feasibility of DISs or equivalent is uncertain. The likely greater PN yield for DISs, and freeing up public health practitioners to focus on other public health issues (opportunity cost) would need to be weighed against the resource investment required.

3. PN outside of public health

There are several circumstances under which the need for public health PN might be reduced; namely, if traditional PN by index patients or diagnosing clinicians increased, if the presumptive treatment of partners by diagnosing clinicians increased (i.e., EPT), or if an automated system bypassed the need for both diagnosing clinician and public health involvement in index case and partner services. Partnerships with community pharmacists might also be important in EPT interventions particularly. These interventions may occur alone, or along with targeted PN (as was previously discussed in the CDC recommendations).

Traditional PN by diagnosing clinicians

There is room for greater PN by diagnosing clinicians. For example, among 7300 physicians in five specialties (obstetrics/gynaecology, internal medicine, general/family practice, emergency medicine, and pediatrics) in the US, only 4.1–4.4% of physicians always practised provider referral, while 71.6 - 71.8% never did.⁶¹ However, general practitioners (GPs) have reported that it is difficult to fit contact tracing into a standard consultation as there are multiple issues to cover when a patient is newly diagnosed with a STI, including those relating to the patient's own physical and emotional health.⁶²

Bilardi et al. (2009) examined the PN practices for chlamydia of 550 GPs in Australia, and identified the supports they would find most useful in assisting them in carrying out PN (response rate 45%).⁶³ Almost all participants felt it was their role to discuss PN with their patients, but less than half reported being sure of how to best assist their patients with PN and 84% indicated that they would find resources that support PN useful. Resources considered useful included a PN website for GPs (including advise on how to undertake PN and chlamydia treatment guidelines), a PN website for patients (i.e., that helps patients inform their partners), printed information for patients, and, importantly, reminders directing GPs to these resources when chlamydia is diagnosed either in laboratory reports (text that appears at the bottom of positive chlamydia laboratory reports that lists the address for the aforementioned GP and patient websites) or practice software (patient information leaflets built into practice software that can be selected/pop up when a patient is diagnosed with chlamydia).

Tomnay et al. (2007) tested the effectiveness of printing PN resource information on positive chlamydia laboratory results that were sent to GPs in Australia (48% response rate among 499 GPs); specifically, the address of a website.⁶⁴ An example of how a laboratory report appeared is presented in Figure 1. The website contained treatment guidelines, a printable patient brochure, and a printable partner letter for index cases to pass on to their partners. This was not a randomized study but it used a paired design that analyzed GPs that were exposed and unexposed to the website; "exposed" GPs diagnosed at least one patient with chlamydia during the period when the web address appeared on positive results from two participating laboratories, and "unexposed" GPs had not diagnosed a chlamydia case during the study period or had used a laboratory other than the two participating labs. Surveys were sent out before and after the website information was added to the lab results and completed by exposed and unexposed GPs.

There was a significant increase in the use of printable partner letters from 13% to 36% ($p = 0.0009$) and brochures from 33% to 54% ($p = 0.003$) among those exposed to the website; while there was no significant change in the use of either resource among those not exposed to the website. The proportion of GPs who recommended PN to all index patients was high among those who received the results with website address (93%), but so was the proportion for those who didn't receive the website printed on lab results, and these proportions did not differ significantly. Up to 25% of GPs utilized the site.

Figure 1: Copy of a positive chlamydia result sent to a GP from a laboratory

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CHLAMYDIA TRACHOMATIS by POLYMERASE CHAIN REACTION (PCR)
Site :      Vaginal swab
C. trachomatis:  Positive      (Roche COBAS AMPLICOR)      *
For treatment guidelines, partner letter and client brochure please
visit www.mshc.org.au/secure
If you have any difficulties please call 1800 082 820
Comment: This result has been notified to Health and Community
Services, Victoria. Notification by the referring medical
practitioner is also required by the Health (Infectious
Diseases) Regulations 1990.
Notifications and enquiries should be directed to
Confidential
Chief Health Officer
Communicable Diseases Section
Reply Paid 65937
Melbourne VIC 8060
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This intervention would either require the creation of a new website that contains practitioner PN information and tools, or (ideally) leverage an existing site. In BC, online sexual health resources already exist, such as the SmartSex website (smartsexresource.com). This website was previously linked with a movie theatre-based promotion for the public.⁶⁵

EPT by diagnosing clinicians

Introduction to EPT and EPT effectiveness

EPT involves treating the sex partners of STI-positive individuals without their medical evaluation. EPT usually involves patient delivered partner therapy (PDPT) in which patients deliver medication, or a medication prescription, to their sexual partner(s). Medication- (i.e., giving partners actual antibiotics) and Prescription-EPT (i.e., giving partners a prescription for antibiotics) were found to be similarly effective in a recent study among young women in New York newly diagnosed with chlamydia. Oliver et al. (2016) found that both types of EPT resulted in comparable rates of partner treatment as reported by index patients (77.1% for Prescription-EPT and 79.5% for Medication-EPT [$p > 0.05$]).⁶⁶ However, a study by Okah et al. (2017) suggested that the form of EPT-prescriptions may make a difference.⁸⁸ This study is described in detail later in this report in the Evaluation section as it also highlights complexities with evaluating PN. In short, a higher proportion of “double-dose” electronic prescriptions that allowed treatment for both patient and partner on the same prescription were found at pharmacies, than were paper prescriptions that were given to partners by index cases and were separate from electronic index patient prescriptions.

There are numerous potential benefits of EPT. Treatment reaches partners who would otherwise not present to health services and receive care (whether due to stigma, shame, decreased access, etc.). Thus, EPT has the potential to reduce structural barriers to STI testing and treatment. In studies, including RCTs, in the US and UK, PDPT was as least as effective as patient referral both in terms of reinfection rates in index patients and in the proportion of sexual contacts treated.^{67 68 69 70 71}

Potential challenges of EPT include missed opportunities to offer testing for other STIs/HIV and prevention information, as well as concerns about presumptive antibiotic treatment. With respect to the latter, this includes the possibly unnecessary use of antibiotics among partners who are not STI-positive. There are also specific concerns that antibiotic therapy for uncomplicated chlamydia will not be adequate treatment if a female partner has PID; and with treating gonorrhea using oral cefixime due to antimicrobial resistance (AMR). The use of EPT among GBMSM has been debated, in part due to concerns about missed opportunities to diagnose unidentified cases of HIV and syphilis infection in partners.

In a recent study by van Aar et al. (2018) in the Netherlands, the authors explored some of these challenges. Unfortunately, this was only published as a “short report” and the full text of this article was not available at the time of writing this report.⁷² The authors describe the study populations as “a potential EPT target population of chlamydia-notified heterosexual men and women attending STI clinics for testing.” It is unclear whether “chlamydia-notified” is referring to individuals that have been told that their partner has chlamydia, or individuals that are diagnosed with chlamydia at a STI clinic and thus notified that they are chlamydia-positive; although the way the results are presented suggest the former. This study used cross-sectional national STI/HIV surveillance data, which contained information on all consultations at STI clinics. Among over 14,000 “chlamydia-notified” patients, 34.2% were chlamydia positive and 65.8% were chlamydia negative; thus, assuming these are partners of chlamydia-positive index cases, if they had been given EPT, two-thirds would have unnecessarily used azithromycin. Further, 10% of gonorrhea infections were among “chlamydia-notified clients”, and 11% of all infectious syphilis, HIV and/or infectious hepatitis B infections were among “chlamydia-notified clients”; therefore, if this study is in fact referring to patients with a chlamydia-positive partner, these findings do raise concerns about the implications of EPT implementation without additional STI testing for partners of chlamydia-positive index patients. It would be important to access the full text article when it becomes available in order to understand how to interpret these findings.

Increasing EPT by diagnosing clinicians

Golden et al. (2015) conducted a stepped wedge RCT^{‡‡} at the community level, where the majority of local health jurisdictions (LHJs^{§§}) across Washington State were randomly assigned to a public health intervention promoting the use of free PDPT.⁷³ Specifically, the intervention had two broad components: promotion of PDPT use, and targeted provision of public health partner services, but this intervention also had many sub-components as well as partnerships (e.g., with pharmacies) (see Box 6). The study aimed to both see whether this public health initiative could increase PDPT use by practitioners, and whether this would in turn decrease CT test positivity among young women age 14 - 25 years tested at selected

^{‡‡} Stepped-wedge trials are a type of cluster randomized trial in which clusters of clinics or communities receive an intervention in a randomly assigned order; analyses then compare variance both between communities and within a community before and after the intervention. In this study, the stepped wedge design allowed all areas of the state to eventually adopt the intervention promoting PDPT. The trial initiated the study intervention in groups of LHJs (i.e., waves) at four time points (i.e., steps) separated by intervals of 6–8 months.

^{§§} Local health jurisdictions (LHJs) are administrative units that usually correspond to a single county.

sentinel clinics, and NG incidence among heterosexual women. The study achieved high participation, from 23/25 LHJs in the state (data was available for 22).

There was a significant increase in individuals receiving PDPT from practitioners (from 18% to 34%, $p < 0.001$), and an increase in the percentage receiving partner services (from 25% to 45%, $p < 0.001$). However, there was not a significant change in CT/NG incidence, after adjusting for temporal trends (i.e., changes in trends that were occurring at the same time in the study area). Study design features may have played a role, thus interpretation and generalization to the general population is difficult. For example, although the intervention was delivered population-wide, CT was only measured in certain sentinel clinics; trends in that population may not have been representative of trends among all women in the state as women in the clinics were younger than the population of sexually active women ages 14–25 the state overall, and may be at higher risk for STIs than the total population. Ideally, the trial would have measured CT prevalence in a random sample of women in each LHJ but this was not feasible. No major adverse drug reactions were reported.

Box 6: Multi-component public health intervention promoting PDPT

- Supplied free PDPT packs to clinicians (packs contained condoms, STI information, medication allergy warning in English and Spanish as well as contact information in case of an adverse drug reaction; 1 g of azithromycin; and packs for NG also included a 400-mg dose of cefixime^{***} [both medications were to be taken as a single dose])
- Made free packs available through selected commercial pharmacies ($n = 157$) for clinicians to prescribe for their patients' partners.
- Sent a letter to every clinician who had reported ≥ 1 cases of bacterial STI in the prior year, informing them that state guidelines recommend that medical providers offer PDPT to all heterosexual individuals with NG or CT infection when the clinician cannot "otherwise assure" that all of a patient's potentially exposed partners will be treated; information about how to obtain free PDPT to stock in their office/clinic; and how to prescribe free PDPT through local pharmacies.
- Discussed the program with clinic or office staff during telephone calls about incomplete STI case reports.
- Included information about PDPT in continuing medical education training.
- Worked with the largest health maintenance organization in the state and with large family planning organizations to promote PDPT use.
- Modified CT and NG case reporting form that clinicians send to public health to ask whether they wanted the public health department to provide their patient with partner services. Staff providing partner services offered patients free PDPT to treat up to three partners, and offered to directly contact partners whom patients did not want to notify. When contacting partners, staff advised them to seek medical evaluation, but also offered them treatment without an evaluation. Both patients and partners could obtain free PDPT through commercial pharmacies or via the mail.

Pharmacists

In the case of prescription EPT, pharmacists fill prescriptions and provide information related to the medication, thus are key partners. An increasing number of pharmacies have private rooms and pharmacists are well placed to interview a patient about their medical history and any contraindications to antibiotic therapy, as well as to identify possible drug interactions with other medications partners may be taking. Pharmacies also have the advantage of less stigma compared to traditional healthcare facilities (e.g., STI clinics, family planning clinics, GP offices).

^{***} Appropriateness of cefixime in the context of AMR needs to be considered.

Partnership between diagnosing clinicians and pharmacists

Cameron et al. (2010) explored EPT for uncomplicated chlamydia at community pharmacies in Scotland.⁷⁴ Index patients (men and women who had been diagnosed and treated for uncomplicated chlamydia and received written and verbal information about partner treatment) at five selected health service sites in the area (GUM, family planning, University health, and pregnancy termination health facilities), were given a 'pharmacy treatment voucher' to pass on to their sexual partner(s). These partners could redeem the voucher for free treatment (single 1-g dose of azithromycin) at participating pharmacies ($n = 90$), if they wished to do so, unless they preferred to attend a clinic or their GP for treatment. Vouchers could be issued by all medical and nursing staff responsible for managing chlamydia-positive patients. The information in Box 8 was contained on the voucher. All five sites gave vouchers to female index cases; males were given vouchers at GUM clinics, but vouchers were not given to GBMSM as it was felt that GBMSM were a higher-risk group for comorbidities and that management should occur at a specialist GUM clinic. Index cases were also given a leaflet for sexual partners that contained information for partners (see box 7).

After receiving the voucher, pharmacists would first check that the individual had no contraindications to azithromycin before dispensing the medication through a patient group direction (PGD). This project did have a cost as pharmacies received a £5 fee for treating each sexual partner, plus the corresponding British National Formulary cost for azithromycin.

Box 7: Contents of pharmacy partner voucher and information leaflet

Voucher:

- Stated that the bearer was a partner of an individual with chlamydia infection
- Stated that the bearer should be treated immediately with 1 g of azithromycin orally
- A unique number that matched with the index case identifying number in order to provide data on partner notification rates
- The reverse of the voucher listed the names, addresses and phone numbers of all the pharmacies that had agreed to participate.

Partner leaflet from index patients:

- Provided contact details for clinics that offered testing and treatment should they prefer to be treated at a clinic
- Advised that anyone with pelvic pain, vaginal or penile discharge or dysuria, or who was currently pregnant should attend a doctor instead of a pharmacy.

Partner leaflet from pharmacists:

- Information about chlamydia
- Details of GUM and FPC clinics where STI testing could be performed if desired.

During the 18 months of the study, a total of 577 vouchers were issued to chlamydia-positive index patients (63% of all eligible patients at the non-GUM sites vs. 20% at the GUM sites; $p < 0.001$). Two-thirds were given to female index patients. The median number of vouchers issued was one per index case (range 1–4 vouchers). Forty percent of vouchers were redeemed at pharmacies. Not all index patients passed on vouchers to their partners; while this may mean that 40% represents an under-estimation of the partners that would choose to be treated in this way had they received the voucher, it is also important to consider why index patients did not pass on the voucher to their partners (i.e., barriers). The time to redemption of the voucher was a median two days after issue (range 0–224 days). Only 4% of partners chose to be treated at a clinic, thus, pharmacy voucher redemption proved much more popular.

Broader role for pharmacists

It has also been suggested that pharmacists may have broader roles in partner services. In the Cameron et al. (2010) study, pharmacists gave partners a prepared leaflet containing information about chlamydia as well as about STI testing sites (see Box 7).⁷⁴ Pharmacists had received information in advance about chlamydia.

Wood et al. (2018) explored the perspectives of community pharmacists specifically regarding what their role would be if chlamydia EPT was to be implemented in Australia, through a qualitative study.^{3 †††} When pharmacists were asked to describe their current work related to STIs, they described a much broader role than simply dispensing medications, with one suggesting the provision of public health and prevention activities. For example:

“Giving information about the disease state or how it is spread . . . encourage people to have check-ups with their doctor . . . We can also talk to them [about] how to take medication . . . following up on partners.”

“To help provide medications, to counsel patients . . . I think preventive health as well, so like public health and public awareness.”

The provision of chlamydia self-test kits in pharmacies was supported and seen as a possible facilitator for EPT, as partners could opt to be access testing for chlamydia when they come to the pharmacy for prescription EPT. In other studies that are not specific to partners, providing home STI testing kits to emergency contraception (EC) users^{†††} in pharmacies has been shown to be appealing to clients, as well as logistically feasible, but requires pharmacist commitment and proactive promotion to be successful.^{75 76} In a study by Taylor et al. (2007), among 25 pharmacists surveyed, 84% supported a pharmacy-based chlamydia screening program.⁷⁷ Pharmacists indicated that they would be comfortable providing chlamydia testing kits (92%), counselling results (88%) and providing antibiotics (80%). Among 50 women age 18 - 29 years who presented for EC, 76% would accept and return a sample while 53% indicated a preference for testing by doctors; privacy and confidentiality were concerns identified by the women.

Pharmacists and APT in the UK

A similar approach to EPT in the UK is called accelerated partner therapy (APT). The main difference between EPT and APT is that with APT a consultation occurs by telephone with a health advisor or with a pharmacist to assess eligibility of the partner for treatment although face-to-face physician consultant is not required, while with EPT partners don't require consultation with a health professional. This adaptation of EPT complies with UK prescribing regulations which don't support EPT due to the absence of a clinical assessment of sex partners. Studies of “APTPharmacy” demonstrated that partner treatment was similar in the APTHOTline, APTPharmacy (see Box 8), and standard PN arms; in each case fewer than half were treated, and the addition of APT interventions to standard PN did not appear to improve

^{†††} In this article, the authors use the term “Accelerated Partner Therapy (APT)” as a blanket term to describe Patient-Delivered Partner Therapy (PDPT) and Expedited Partner Therapy (EPT). The authors distinguish PDPT as where a patient provides a medication to their partner, and EPT as where a patient gives their partner a medication prescription then the partner fills the prescription at a pharmacy.

^{†††} EC users have been selected for study because they are assumed to be at higher risk for STIs (i.e., may not have used birth control or are worried that their birth control method has not worked).

outcomes.⁷⁸ An older study suggests that even when index patients choose an APT option for their partners, testing and treatment may be obtained in another way.⁷⁹

Box 8: Description of the APTPharmacy and other APT intervention in Estcourt et al. (2015) study

APTPharmacy (intended intervention)

- PIN sent by SMS (text message) to sexual partner
- Sexual partner undergoes consultation with community pharmacist who has had sexual health training
- Pharmacist gives sex partner APT pack at the time of consultation, based on a patient group direction, which is a legal framework that allows some healthcare professionals to supply a specified medicine to a predefined group of patients without a physician's assessment
- Sexual partner mails back CT NAAT test contained in APT pack
- Sexual partner is invited by pharmacist to attend clinic for HIV and syphilis tests at a later date
- Index case received follow up call and is sent urine CT retest at 6 weeks by postal mail
- Specialist clinic receives all results and manages future clinical care

APTHotline (intended intervention)

- PIN sent by SMS (text message) to sexual partner
- Sexual partner calls APT hotline for a telephone consultation with a health advisor (a standard consultation guide was used)
- Sexual partner collects an APT pack (prepackaged azithromycin 1 g, condoms, CT written information, urine sample collection kit for CT NAAT with instructions to collect the sample before taking antibiotics, prepaid postal envelope and packaging for returning the sample to the clinic) from a designated GUM clinic reception or pharmacy
- Sexual partner mails back CT NAAT test contained in APT pack
- Sexual partner attends clinic for HIV and syphilis tests at a later date
- Index case receives follow up call and is sent urine CT retest at 6 weeks by postal mail
- Specialist clinic receives all results and manages future clinical care

PN by index cases

Tools

Providing patients with more options for PN in the form of notification tools may enable the choice of method that is best suited to their relationships and circumstances. Electronic and paper-based tools have been studied in the literature.

Paper notification cards

Tuneu et al. (2013) conducted a study of notification cards for patient referral in Spain³⁰. Participants had been diagnosed with a STI and were attending primary care centres (seen by primary health physicians, gynaecologists and midwives) or a STI specialist unit. Notification cards contained: the date of diagnosis of infection, type of infection, syndromic or laboratory-confirmed, and treatment given to the index case. Syndromic diagnoses were specifically written in a blank space in the notification card: (e.g. urethral syndrome). A number of cards equal to the number of partners eligible for being contacted by notification card were distributed to each index case. Notification cards received from notified partners at health centres were counted and the date of the partner presenting at the health centre was recorded.

Among 219 index cases that included heterosexual men and women and GBMSM, who identified 687 partners (mean 3 partners per index patient, range 1 - 30 - 1.7 for heterosexual men, 6.2 for GBMSM, and 1.7 for women [sexual orientation not specified]), less than half were identified as appropriate to receive

notification cards (300). The remaining 387 partners were not appropriate for receiving PN via paper card, including those that may be impossible to trace by the index case (the main reason for not using a card was because sex was anonymous, 38%). The ratio of cards distributed/contacts reported (i.e., index cases able to give the paper cards to their partners) was highest among women with a ratio of 0.75 (95% CI: 0.62–0.79); among heterosexual men the ratio was 0.59 (95% CI: 0.48–0.68); and among GBMSM the ratio was lowest at 0.30 (95% CI: 0.26–0.35). Overall, only thirty-one cards were returned to participating health centres (10%), representing a low yield of PN cards distributed and recovered. This percentage was higher in the STI Unit (20%). The authors feel these numbers are an underestimation because the study could not include all of the health care facilities in the region where partners might choose to present for STI follow-up. Nevertheless, this study questions the effectiveness of this paper-based strategy.

Electronic PN

Electronic PN tools include anonymous e-cards that can be sent after entering an Internet portal; and non-anonymous text messages and e-mails.

A 2016 systematic review explored the acceptability of and interest of index patients in using electronic communication technologies to notify sex partners following an STI diagnosis (in nine studies), and actual utilization of these technologies (in 14 studies).⁸⁰ There was interest in using e-notification technologies, but actual use was mixed. The study found that electronic notification tools were likely to be used with partners who may not be notified otherwise. A pattern that emerged across studies was that anonymity was less acceptable than the electronic delivery method itself. Thus, the use of open communication versus anonymity should be considered separately from the various electronic delivery platforms when considering PN options.

Office staff support

Support for patient PN may be provided by other staff in diagnosing clinicians' offices. Low et al. (2005) conducted a randomized controlled trial (RCT) in 27 general practices in the Bristol and Birmingham areas, UK.⁸¹ In the UK, PN is usually done by specialist sexual health advisers in departments of genitourinary medicine (GUM). The study involved different methods for PN by provider referral among 140 men and women diagnosed with chlamydia (index cases), having received their positive result at their general practice. In the first arm, one or two nurses in general practices delivered the intervention. The nurses in this study received one day's training about sexual history taking, management of chlamydia, and partner notification, including role play with actors who simulated clinical scenarios. They did not actually provide PN (i.e., practice nurses did not follow-up index cases thus did not engage in provider referral), but rather supported patients in patient referral. The nurses conducted a partner notification interview, which included a sexual history of all sexual contacts in the six months before the chlamydia diagnosis; supported patient referral (index cases informed contacts themselves) using contact slips for each partner; provided advice on avoiding sexual intercourse until the partner had completed treatment; and provided information about being screened for other sexually transmitted infections. Contact slips included details of the study genitourinary medicine clinics, and requested the treatment centre to return the slip to the study centre. A research health advisor followed up by telephone. In the second arm, index cases were referred to a specialist health adviser in a genitourinary medicine (GUM) clinic. Specialist advisers carried out PN by telephone using standardised protocols for patient referral, provider referral (immediately informing partners on behalf of the patient), or conditional referral (contacting partners if the patient had not done so after an agreed period) and issued contact slips. They also offered patients a consultation for screening for STIs.

Practice based PN by nurses who had only received one day's PN training, with telephone follow up by research health advisers, was at least as effective as referral to a GUM clinic specialist health adviser, and costs were the same. In the practice nurse PN arm, two-thirds (65.3%) of index cases had at least one partner treated compared with 52.9% in the specialist health advisor arm (risk difference 12.4%, 95% CI – 1.8% to 26.5%). One-third of participants who were referred to the GUM clinic did not attend, suggesting that immediate notification was advantageous as the potential of index patients being lost to follow-up prior to commencing PN services was eliminated. The costs per index case were £32.55 for the practice nurse led strategy and £32.62 for the specialist referral strategy.

Online, automated clinical consultant and management system with partner services

A fully automated online clinical consultation and treatment tool, targeting both index cases and partners, would off-load the requirements for many services, including PN, from diverse practitioners, including public health. In a study of such a tool, promising results were seen for index patients but partner management was sub-optimal, suggesting that this system may have to be augmented in order to provide partner services.

An online intervention called the eSexual Health Clinic (eSHC) includes the assessment and medical management of uncomplicated CT. It had several portals, including a patient portal, and an online CT pathway is within the patient's interface along with a results service and access to health promotion materials. Patients with uncomplicated genital CT^{§§§} are managed via an automated online clinical consultation and care pathway; this includes an automated online consultation (assessment of symptoms, past medical history, medication and allergy history, sexual history, and a risk assessment) and if appropriate, the collection of antibiotics from a pharmacy (selected by patients from among 30 participating community pharmacies). Antibiotic collection is authorized by an automated email sent via a secure UK National Health Service (NHS) account. If the online clinical algorithm predicts that patients aren't appropriate for online care (e.g., those with symptoms, allergies, or drug interactions), they are directed to call a clinical helpline that is staffed by health advisers that can facilitate a face-to-face appointment. With respect to PN, index patients can request a unique access code for their sexual partners to access care via the online chlamydia pathway.

Estcourt et al. (2017) evaluated this intervention in England among individuals age 16 years and older with untreated CT from GUM clinics; and individuals age 16 - 24 years who had tested positive and negative^{****} for CT through the *Checkyourself National Chlamydia Screening Programme's* (NCSP) online service (individuals can request a self-sampling kit and post a urine [men] or vulvo-vaginal swab sample [women] to a laboratory for testing, then receive results by text message, letter, or telephone call).⁸² The primary outcome was the proportion of patients with CT who consented to the online chlamydia pathway who then received appropriate clinical management either exclusively via online management or a combination of online management and face-to-face care. Secondary outcomes included the proportion of index patients who received antibiotic treatment solely online, time from diagnosis to appropriate treatment in index patients, proportion of sex partners treated online, and adverse treatment outcomes.

§§§ Selected for automated management because a single oral dose of azithromycin is one of the first-line treatments.

**** CT-negative participants ($n = 1997$) received an automated text message containing a link to the online results service, health promotion advice, and a survey regarding acceptability. Of these, 89% accessed their test results within seven days via the online results service. One-quarter of those who accessed their results online also accessed health promotion resources, and one-third of these followed links to access further information.

Across both participant groups, approximately three-quarters of those eligible chose to access the online chlamydia pathway and two-thirds managed their care completely remotely. Almost a quarter of patients contacted the clinical helpline at some point, which highlights the importance of also having telephone support. Those who were directed off the online pathway for clinical reasons were for the most part successfully managed in traditional settings. In both groups, median time to collection of treatment was within one day of receiving their diagnosis. The analysis showed non-inferiority^{††††} of the proportion treated by the eSHC relative to current care for NCSP patients but not for GUM patients. No patients in either group who reported contraindications (due to health conditions, interacting medications, or allergies) were prescribed azithromycin via the online pathway. No serious adverse reactions to azithromycin were reported.

However, few partners were managed using the online service. Among index patients that identified sexual partners within the past six months, a very small proportion accessed the eSHC (15/253 among partners of GUM patients, and 13/199 among partners of NCSP *Checkurself* patients), and an even smaller number collected treatment from the pharmacy they selected.

4. Efficiencies in partner communication

Macke et al. (2000) explored the determinants of time spent on PN clients in four US STI programs.⁸³ While the focus of this study was DISs' time, theoretically this can apply to other public health PN practitioners. Only one site spent significantly less time than the reference site on PN activities (42 minutes per client). One explanation relates to how partner communication is organized. This site used a computer system that allowed more than one PN worker to access information about PN clients. Thus, when a partner called the health department in response to communication s/he had received (e.g., a letter), any worker who received the call could look up the case and give the contact information about the exposure and counsel the contact. In contrast, in the other three sites only the DIS actually assigned to the case could provide this information. If that DIS was busy or out of the office then telephone tag would ensue, which would sometimes take days. This would delay the evaluation and treatment of the partner. Thus, an efficiency of this type could reduce time wasted listening and leaving messages.

Other considerations

Response to STI program budget shortfalls

One published article was identified that described in detail the response of a public health department to budget cuts that resulted in a suspension of public health STI services. Their response is described below, encompassing various departmental mergers and rebranding and expansion of DISs' roles. This is provided for general information only.

In Massachusetts in 2008, the line item supporting a network of publicly funded STI clinics (described below) was cut due to budget shortfalls connected to the economic recession.⁸⁴ As a result, there was a sudden termination of the state's contracts with these clinics and the direct provision of STI clinical services through these sites, supported by the Massachusetts Department of Public Health (MDPH), was suspended. Carter et al. (2016) discuss the MDPH internal response and impact, based on interviews of MDPH staff (including STI program Disease Intervention Specialists [DISs], managers, supervisors, and other program staff), and staff from partner agencies (including program directors, clinicians, counselors, and health educators) in 2010 and 2013.

^{††††} Non-inferiority of the eSHC (i.e., that treatment outcomes for index patients are better or only slightly worse than current routine care).

Originally the STI clinic system was an eight-site system located in health centers, hospitals, and family planning clinics in major urban centres. These provided walk-in clinical services for index cases, and partner services (DISs had space to interview cases and initiate partner services). Most STIs were diagnosed and treated elsewhere, but some care was provided through these MDPH clinics (e.g., about 17% of early syphilis cases statewide in 2007 were treated in these clinics). Once the announcement of the budget cut was made, six of these eight sites closed within two months. The two remaining sites, which were located in hospital settings, experienced disruptions but managed to continue providing services - there were however reduced hours of operation and new fee structures or requirements for health insurance to help relieve cost pressures caused by the loss of state funding.

DIS were clinic frontline staff; they lost access to a stable location to conduct interviews and partner service activities, and it was difficult to know where to refer patients and partners for screening and treatment (e.g., they began seeking Urgent Care clinics that might see their patients and their partners), especially for uninsured and undocumented patients who had previously received services through the publicly funded clinics. There was a shift to conducting interviews in different locations, such as at a health care providers office, at patient's homes, or in agreed upon locations such as parking lots. Morale was low during the 2010 assessment period.

However, morale had improved among DIS by 2013, and they also had adapted to a new way of operating. First, management had rebranded the role of DIS as "health navigators" to highlight a variety of skills beyond contact tracing and to better market their skills to a wide range of health care providers and new partners. This new terminology reportedly had more positive associations with some providers than the term "DIS." The DIS staff also indicated that this term was perceived by patients as less intimidating. In addition, MDPH hired staff with advanced degrees and broader skill sets to fill vacant positions; and they provided opportunities for other staff (e.g., epidemiologists) to also train as DIS.

There was also a merger of the MDPH HIV/AIDS Bureau and the Bureau of Communicable Disease Control (where the Division of STD Prevention had been located) into the new Bureau of Infectious Disease, that was accelerated by the budget cuts. Within this Bureau was the Office of HIV/AIDS (OHA), that had been given an expanded mandate of STI and viral hepatitis testing in the past and some were also delivering treatment. Initially, MDPH managers did not report strong collaboration with this Office. However, over time there was greater cooperation and integration. For example, STD program DIS' were incorporated into OHA's written protocol for the use and follow-up of acute HIV testing of patients. By 2013, MDPH had worked to expand the language directing state funding for HIV services to include STI screening and treatment, and more OHA service contracts with HIV providers incorporated these STI services. Essentially, the public STI services newly allowable and expanded through these HIV contracts created a network that—to some degree— helped fill the gap left when most of the STI service sites were eliminated in 2008.

DIS were also stationed within facilities that were in the OHA-state funded network (outside of the health department), and these "out-postings" were also supported with better technology. The contribution of DISs to the clinical activities in these sites were noted.

EVALUATION

A 1994 survey of public health agencies across Canada found that there was limited available data at a local level monitoring the effectiveness of STI PN programs⁴⁶. Among over 150 public health agencies, representing all of the provinces/territories at that time, only 14% of units (located in five provinces/territories) previously had some form of PN program evaluation done. Only a minority were

able to provide even process measures (e.g., number of index patients and partners participating in any stage of the PN process for any STI).

More recently, there are examples of the evaluation of public health direct PN efforts (see the section of DISs previously). There was also one example of a public health department’s efforts to increase PDPT by clinical providers (see previous discussion of this study). What remains lacking is the evaluation of *changing* public health PN practices, including where services are reduced to certain partners under a targeted PN model.

Therefore, this report explores what might be included in an evaluation of changing public health PN services; this considers both measures as well as an overall evaluation approach.

Measures

Process and outcome measures to consider in evaluating PN services generally include those in Table 6; these have been used in PN evaluation studies and suggested as measures to include in understanding the impact of PN services.^{85 86} At the individual-level, these relate to partner elicitation (i.e., index cases naming partner[s]); partner case finding (STI/HIV-positive partner receiving treatment); and recurrence of infection in index cases that were previously successfully treated.

However, individual-level effects are only one objective of PN. The impact of STIs/HIV at the population-level is also a measure of PN program success. However, it can be challenging to definitively attribute STI/HIV rates in a jurisdiction to PN services, as these occur in an environment of multiple other STI/HIV prevention and control initiatives that operate simultaneously. The approach seen most often in the literature is to establish baseline STI/HIV rates before an intervention (including whether there are trends in a particular direction at the time the intervention is implemented), then measure STI/HIV rates after the intervention, and qualitatively describe other programs/activities/factors that were operating at the same time as the intervention that might be responsible for, or have contributed to, the observed effects. Applying this to changing public health PN services, the “intervention” would be implementing a new model of public health PN.

Table 6: Process and outcome measures relevant in an evaluation of PN

Measure	Comment
Number of index patients interviewed for partner elicitation	
Time to index patient interview	This includes the average time to interviewing index patients, and the proportion of index patients that receive a partner elicitation interview within a certain timeframe.
Number and proportion of index patients who named at least one partner	
Proportion of named partners who tested for STI/HIV	
Proportion of named partners who were diagnosed STI/HIV positive through testing	This should not include partners who are longstanding STI/HIV-positive (i.e., they are not newly diagnosed related to the PN program services under evaluation)
Proportion of STI/HIV-positive partners that are confirmed as receiving treatment	Where partners are only treated once confirmed STI/HIV-positive.
Proportion of partners, irrespective of confirmed STI status, that are offered EPT	Where EPT is used (for chlamydia) and medication- or prescription-EPT is distributed to partners.

Proportion of partners confirmed accessing treatment	Where EPT-prescription is used (for chlamydia) and partners are recorded filling prescriptions for prophylactic antibiotics
Proportion of partners observed taking treatment	Where EPT-medication is used (for chlamydia) and partners are observed taking prophylactic antibiotics
Average number of partners treated per index case	See aforementioned nuances in classifying partners “treated”
Recurrence of curable STIs among index patients	

Feasibility

It is difficult to study the effects of PN empirically.⁸⁷ There are challenges defining and collecting data on PN outcome measures, and related to denominator data. This is difficult enough to do with a sample of specific site(s) (e.g., PN outcomes in a single clinic or group of clinics, or for a single contact tracer or group of tracers); this becomes even more complex when empirically measuring PN outcomes across a jurisdiction.

Data on the number of index patients interviewed, time to interview, and partners named during interview, are comparatively easier to capture within a defined sample. The proportion of partners tested, and particularly the proportion of partners treated, can be difficult to determine. Just one example of this complexity can be seen in relation to prescription-EPT, which may comprise part of a PN program.

The effectiveness of prescription EPT hinges on whether EPT prescriptions are filled, and a study by Okah et al. (2017) highlights the complexities in measuring just this one aspect of partner services.⁸⁸ This study was prompted by previous data in which providers documented much higher use of EPT than pharmacists reported receipt of EPT prescriptions. Possible reasons included that patients or partners were not filling EPT prescriptions given to them; and/or that providers were not writing “EPT” in the body of the prescription (as required by state law) and therefore pharmacists weren’t aware that some of the azithromycin prescriptions they were filling were in fact EPT prescriptions. They identified the two New York City health care facilities reporting the most frequent use of EPT prescriptions (both facilities were Federally Qualified Health Centers in resource-poor neighbourhoods with high chlamydia rates), and selected pharmacies in the two neighborhoods where these facilities were located. Twenty-six pharmacies were within walking distance of the facilities, and 12 of these participated in the study. The number of EPT prescriptions found at pharmacies were compared to provider case reports where EPT was documented. Only one quarter of the number of EPT prescriptions reported in the provider case reports were found within the participating pharmacies. About 20% of the azithromycin prescriptions at these pharmacies either had “EPT” written in the prescription or specified that the prescription was intended for partner therapy (and did not write “EPT” in the prescription).

Further, this study also highlights that prescription EPT practices are not all the same; thus, comparing the effectiveness of different programs must consider context. There were more EPT prescriptions found for one neighbourhood than the other. In the higher area, the health care facility would electronically prescribe treatment for index patients, and, if they accepted EPT, to include partner treatment on the same prescription. Thus, the index patient could fill their own and their partner(s) treatment at the same time. At the other facility, index patients were electronically prescribed treatment, and separate paper prescriptions were given for partner EPT. The EPT prescriptions found were mostly the double-dose

prescriptions that allowed treatment for both patient and partner on the same prescription. Thus, the same intervention (EPT) was implemented in different ways, and this likely contributed to the success of the intervention; although it is unclear whether EPT was also better classified in the double-dose prescription approach rather than the partner paper prescription approach.

Modeling

Given the challenges evaluating PN empirically, mathematical models are potentially important to estimate the impact of PN programs. Modelling may also be used to predict the impact of changing public health PN practices, although no examples of this have been found in the literature.

A detailed discussion of how to conduct modeling, and explanation of specific mathematical models, are beyond the scope of this report. A brief overview of modeling is presented in Box 9 and general considerations are discussed below. If there is an interest in using modeling related to public health PN in a jurisdiction, modeling experts should be consulted.

Box 9: General information about mathematical modeling⁸⁹

- A mathematical model is a representation of a system, process, or relationship in mathematical form.
- In mathematical models, equations are used to simulate the behaviour of the system or process of interest.
- A mathematical model is *deterministic* if the dependent variables take on values not allowing for chance; or *stochastic* or random if there is the incorporation of chance (random variation).

Generally, mathematical models have been used to inform public health policies and programs. They may be used as tools for understanding the transmission and spread of infections in populations; simulating the implications of alternative disease control strategies; estimating population-wide health impacts and costs of public health initiatives, etc.^{90 91} Models can be useful for planning interventions that cannot be tested through randomized controlled trials (RCTs), or observational studies, ethically or practically.⁹⁰

For example, Althaus et al. (2012) performed modeling using a program called Rstism (from R STI Simulator) to investigate the outcomes of different PN strategies for chlamydia.³² They specifically looked at the numbers of partners, and which partners notified, had the greatest impact on chlamydia occurrence at the individual and population-levels. In another modeling study Kretzschmar et al. (2012) estimated the impact on chlamydia positivity of a variety of potential changes to the chlamydia prevention program in the US, including hypothetical changes in PN.⁹²

Outside of PN, Schmid et al. (2013) conducted a modeling study to predict the effects of different chlamydia screening strategies;⁹³ and Armbruster & Brandeau (2007) used modeling to explore the appropriate level of investment in contact tracing for endemic infectious disease generally, among individuals in a network.⁹⁴

Assumptions

A list of explicit assumptions will go into a given model, and these should be in line with available data.⁹⁰ This can be daunting as the accuracy of assumptions is not always certain. However, modelling can compare how outcomes of interest can change if assumptions are altered. In sensitivity analyses, the value of each parameter is varied across its range of possible values. This explores how raising or lowering a parameter's value may raise or lower the value of the outcome variable in a model. Basu et al. (2013) also refer to "uncertainty analysis", which involves generating error bars around the model's results by sampling from the probability distributions describing the parameter values.

Choosing a Model

There are many models that might be used to model a given public health intervention (i.e., alternative model structures may appear appropriate for the same public health issue). Rarely is one model obviously superior to others in a particular situation. There have been cases where different models have been constructed to simulate the same situation, and the same information was entered into each model, but the results have been different. For example, this occurred for models that simulated the effect of antiviral treatment on reducing HIV transmission, and the cholera epidemic in Haiti to inform control efforts.⁹⁰

There are also questions about model complexity, specifically whether complex models that accommodate more variables where the parameters' values or behaviours are not well understood, is advantageous because they more easily fit real-world data than simpler models that are grounded in more well- characterized data on the behavior of disease processes. Complex models are not necessarily more accurate or reliable in this context; however, complexity can be important to include when uncertain factors are central to a disease process or research question. (i.e., the complexity is critical to the question being asked). This may occur in the case of a STI as it may be critical to ask questions about how diverse contact patterns (i.e., sexual network structure) may influence transmission.

A decision about the structure of models being used for simulation, including about model complexity, will need to be made by the planning team along with decisions about the assumptions that will be used in a model.

Sensitivity and uncertainty analyses involve varying a model's parameter values (i.e., capturing "parameter uncertainty"), not varying the underlying model structure. A strategy for model selection suggested by Basu et al. (2013) involves generating several alternative model structures and using objective criteria to evaluate which models can best balance complexity and uncertainty. Comparing alternative models takes more time than generating one model structure, but the argument is that performing explicit model comparisons and selection helps assess the "robustness" of modeling results.

SUMMARY

A number of public health PN options were reviewed for this report. DISs were consistently found to be successful in PN, however no equivalent role currently exists in the Canadian context and new training would have to precede implementation. Limited evidence supports the addition of a website address containing PN tools to the bottom of laboratory reports with chlamydia-positive results as a way to increase the use of website-containing PN tools by GPs; this option would require laboratory partnerships and potentially leverage existing online STI prevention and control tools already operating in BC. Promising results were seen with the comprehensive public health promotion of PDPT for diagnosing clinicians; this would require a resource investment up front in PDPT distribution and outreach. As well, a direct pharmacist-diagnosing clinician voucher Prescription-EPT intervention, without the involvement of public health, was preferable to clinic treatment for partners, and 40% of partners received treatment using the voucher method.

Online PN tools are rated acceptable by index patients for use in patient referral, but the evidence on utilization reviewed for this report was mixed. However, electronic tools were used for partners who would not have been notified otherwise. It is important to consider the impact of anonymity separately from the electronic delivery platforms when considering patient referral options.

An automated online tool providing index patient and partner services did not have the same success for partners as it did for index patients.

Efficiencies were achieved in public health PN practices that resulted in some time saving for PH personnel, including in sharing partner files among contact tracers.

No real-world evaluation of targeted PN was identified, despite several reports in the published and grey literature of jurisdictions that had discontinued PN for certain groups with chlamydia and in some cases gonorrhea, or had changed how PN occurs for groups based on assigning priority levels. No interventions were identified that coupled targeted PN for certain partner groups with strategies, such as EPT, for the remainder, as is discussed in the CDC (2008) PN recommendations. This highlights the need for greater monitoring and evaluation of PN interventions to allow for the better assessment of the wide array of STI PN practices that are currently in place and proposed.

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