



Evidence Review

Partner Notification

JANUARY 2014

A Review of Evidence on Partner Notification Practices for Chlamydia

Harpa K. Isfeld-Kiely, MA

Introduction

Chlamydia is the most commonly reported sexually transmitted infection (STI) in Canada and is recognized as an important public health concern. Laboratory confirmed cases of *Chlamydia trachomatis* have been nationally notifiable to the Public Health Agency of Canada (PHAC) since 1990; PHAC surveillance data show steadily rising rates of Chlamydia since 1997 (1). Similar increases have been documented in other nations (2), and are at least partially attributable to improved screening and the development of more sensitive tests in the mid-1990s (i.e. nucleic acid amplification tests, or NAATs) (3). The trend may also reflect changes in sexual practices or, possibly, the unintentional effects of early treatment on levels of immunity in the population, as some theorists have proposed (e.g. Brunham and Rekart, 2008 cited in (1)). Regardless of the causal factors involved, the trend raises questions about how Canadian public health strategies should respond.

Although increased rates have been seen in other reported STIs, some distinct epidemiological features of Chlamydia are important to consider. In 2010, the number of laboratory confirmed cases of Chlamydia reached 94,690, which is equivalent to an annual incidence of 277.6 cases/100,000 population (1). Disparities among Canadians were evident, with females having nearly twice the rate of reported Chlamydia as males, young adults (aged 20-24) seeing the highest rates, and regional patterns showing excessive risks among

residents of the territories. Chlamydia represents a risk for serious, long-term complications, disproportionately affecting women (e.g. Pelvic Inflammatory Disease, or PID, scarring of fallopian tubes, and potentially fatal ectopic pregnancy, as well as conjunctivitis and Chlamydial pneumonia in newborns) (4). Repeat Chlamydia infections in females are common (20-30%) (Hosenfeld *et al.* 2009 cited in (3)) and heighten risks of complications (3).

Successful management of Chlamydia relies on timely identification, diagnosis and treatment of infections (5). Partner notification (PN)—also referred to as contact tracing, case investigation, or partner counseling and referral services, among other terms (6),—provides a process for querying individuals recently diagnosed with Chlamydia (or another STI or HIV) about their sexual partners to obtain their contact information and facilitate partner examination and treatment, where necessary. Despite widespread adoption of PN and a long history of use, many questions regarding the value and effectiveness of PN remain (6, 7); some reflecting concern over increasing rates of Chlamydia. As Rothenberg observed, “a substantial number of voices have raised the question of proven efficacy and point to the lack of demonstrable influence of PN on disease transmission” (6). In the Canadian context, added questions arise as to the state of knowledge relevant to national characteristics of the Chlamydia epidemic



National Collaborating Centre
for Infectious Diseases

Centre de collaboration nationale
des maladies infectieuses

Knowledge that's contagious!

Des savoirs qui se transmettent!

Objectives

The objectives of this review are to describe the structure of PN for Chlamydia and provide an analysis of key findings concerning effective practice, including the definition and measurement of outcome indicators, results of comparative studies and reviews of PN practice for Chlamydia, factors associated with improved outcomes, challenges in PN and strategies to address them, and key knowledge gaps. Representing one of a series of NCCID evidence reviews on partner notification for sexually transmitted and blood borne infections, this component will also distinguish issues particular to PN for Chlamydia, to the extent that the literature allows. This and other reviews in the series will contribute to advancing Canadian practice by providing information necessary to identifying commonalities in the practice of PN, challenges relating to specific diseases/infectious agents, and proposed strategies to address them.

Methods

This review focused on peer-reviewed, published research literature on partner notification for partners of patients diagnosed with *Chlamydia trachomatis*. It was restricted to articles published in English and to research on PN carried out in developed countries, and inclusive of all healthcare settings. The literature review was carried out in two phases: an initial, substantive search carried out in 2011, and a subsequent update in June 2013. In the initial phase, the search strategy was primarily based on a computerized search of MEDLINE, EMBASE, and CINAHL databases for articles published 1996 to July 2011. The search terms and Boolean logic applied were as follows:

MEDLINE: ["exp Chlamydia" or "exp Chlamydiaceae Infections/" or "Chlamydia.mp"] AND [(partner# adj3 notif*).mp or (contact# adj3 trac*).mp or (disease\$ adj3 notif*).mp or surveillance.mp or "exp Disease Outbreaks/" or "Sexual Partners/"]

EMBASE: ["exp Chlamydia," or "exp Chlamydi-

asis,"] AND ["contact examination" or "sexuality/ or exp sexual behaviour/ or sexual health," or (partner# adj3 notif*).mp or (disease# adj3 notif*).mp].

EMBASE: ["exp Chlamydia," or "exp Chlamydi-asis,"] AND ["contact examination" or "sexuality/ or exp sexual behaviour/ or sexual health," or (partner# adj3 notif*).mp or (disease# adj3 notif*).mp].

CINAHL: ["Chlamydia+" or "Chlamydia Infections+" or Chlamydia as a keyword] AND ["Contact Tracing" or (partner* adj3 notif*) or partner notification as a keyword].

As well, the initial search included suggestions from a content expert, a manual search of abstracts from the proceedings of two North American conferences on STIs (International Society for Sexually Transmitted Diseases Research 2011, and the 2010 National STD Prevention Conference in the United States), relevant policy documents and guidelines available online, and other articles selected from among the citations of the publications reviewed.

The update included an analysis of the literature gathered in the initial review, as well as the tabulated summaries of the main findings. Selected databases and websites were queried for publications released since 2011, including: MEDLINE (replicating the search strategy described above); The Cochrane Library (partner notif* AND Chlamyd* as title, abstract, or keyword); and PHAC surveillance data posted online. As well, the update included a search for more recent publications by authors (i.e. primary authors) of articles included in the initial review (MEDLINE and Google Scholar employed, in the course of gathering initial review documents), and a search of relevant articles that had cited key publications in the initial review.

¹ Where 'STD' (sexually transmitted disease) appears in this document, it reflects use of the term in the original reference. Preference is now given to the term 'STI' (sexually transmitted infection) because not all infected individuals develop symptomatic disease, although they carry the potential to develop symptoms and to transmit infection to others.

The Structure of Chlamydia PN

Goals of Chlamydia PN

The Public Health Agency of Canada defines partner notification as “a secondary prevention process through which sexual partners and other contacts exposed to an STI are identified, located, assessed, counselled, screened and treated” (8). Along with screening, partner notification is considered integral to public health strategies for the control and management of sexually transmitted infections in the population. It also functions to prevent or reduce illness in individuals. The commonly stated goals of PN for Chlamydia are to prevent or limit morbidity in the partners of index patients known to be infected and, by evaluating and treating infected partners, to prevent further transmission to other sexual partners or reinfection of the index patient (2, 9); PN holds distinct value for Chlamydia because the infection is often asymptomatic, in which case notification is necessary for individuals to become aware of a need to seek care. As well, PN can prevent serious long-term complications of Chlamydia, for which risks are heightened in recurrent cases.

In its basic form, PN has been described as a multi-step process that begins with eliciting information about the sexual contacts of index patients, proceeds with notifying these individuals that they are at risk for being infected, and informing them of available services for being assessed and tested. If infected, the partner is treated and may be interviewed to elicit additional contacts at risk (6). However, practices vary considerably in their intensity. Some may see only the provision of brief advice to index patients, whereas others encompass more intensive interview processes, education, follow-up activities, and strategies aimed at encouraging testing and treatment, or taken further toward analytical considerations of patterns in sexual contact networks that can inform prevention strategies (10). The intensity of PN activity varies by infection type (Chlamydia versus syphilis or HIV) and by jurisdiction (7). As well, programs vary in their

adoption of newer methods of communication and options for testing and treatment (10).

The following section clarifies several features that are commonly included in PN programs in developed nations, and that have been subject to studies concerning effective practice.

Referral Methods

The literature describes three main approaches to partner notification, distinguished according to who is responsible for notifying sexual partners of those with confirmed Chlamydia infection of their risk for infection. ‘Patient-based referral’, or simply patient referral, and often ‘self-referral’, is where a patient with a confirmed Chlamydia infection is asked to notify current and/or recent sexual partner/s of their risk for infection and need for medical assessment. ‘Provider referral’ involves a third party in notification; typically, a health care worker or trained public health officer will elicit information from a patient about their sexual partners within a period of interest, and then notify those identified, while maintaining the confidentiality of the client. A third method, ‘contract referral’ (also known as ‘conditional referral’), may involve providers in notification, but only when a patient fails to make contact with partners within a previously agreed upon time frame (usually 24-48 hours) (5, 8, 11). Contract referral requires verification that partners have been notified and confirmation of their seeking care, whether this is achieved through self-reports by index cases, or verified by health care staff when a partner comes for testing or makes an appointment (11). Patient referral potentially offers cost savings relative to other methods, because human resources are not required to spend time contacting sexual partners (11). It is typically used for primary, current partnerships but may also be preferred by patients in other circumstances where preserving their privacy is important and the involvement of a professional may be perceived as awkward (e.g. an affair, or anonymous sex).

Professional investments in referral practices vary from the simple provision of advice to refer partners to an STI clinic or physician, to

more supported models that may incorporate reminder phone calls to index patients, counseling on how best to notify partners (11), education about Chlamydia (signs, symptoms and potential complications) delivered verbally or in leaflets, or contact slips (referral slips/cards) that facilitate notification of a partner and verification that a partner has sought care (i.e. partners present the slip at their appointment). Outreach activities have also been described as helpful additions to some STI notification programs (6), although they appear to be associated with HIV/AIDS or syphilis PN, or to be used in high risk segments of the population (e.g. injection drug user [IDU]). Some programs offer their patients a choice of self-referral or provider referral, which may be selectively employed for different partners, when an index case has more than one current or recent sexual partner (8).

Cluster or Network Approaches

Cluster investigations or network approaches differ substantively from the referral methods described above, although they serve a similar purpose of notifying contacts of a potential risk of infection. While these approaches include notification of direct sexual partners, they also extend to other strategically selected types of individuals in the social or geographical context of an index case (e.g. friends, associates, ethnographically connected individuals). Rothenberg reviewed literature on traditional PN and social network approaches, finding a body of research that has not seen sufficient consideration in PN programming to date (6). The author notes that modeling studies and empirical studies that apply social network methods to PN have demonstrated that dense networks and geographic clustering underpin disease transmission. Moreover, specific infections (e.g. Chlamydia and gonorrhea) have been shown to exhibit distinct network patterns (12) or mixing matrices (the frequency with which groups with given characteristics have contact with each other) (13), which could provide important information to targeted approaches. Notably, concurrent sexual partnerships have been demonstrated to hold

importance for *C. trachomatis* transmission, more so than the actual number of partners (14). Based on a review of literature (1975+), Brewer found cluster investigation approaches for STIs and HIV to be less effective for case finding than other PN methods, except in populations with a high incidence of partners (15).

Other Features & Novel Strategies

Home sampling offers sexual partners options to the standard practice of performing tests for Chlamydia in clinical settings. Home sampling provides index cases with kits that may be brought to partners who provide a urine sample that is returned to a clinic, either in person or through the mail (i.e. referred to as postal testing kits or PTK). The kits provide a non-invasive, convenient option for partners who may not otherwise attend or have access to a clinic. The method was introduced in response to research that suggested male partners avoided invasive testing procedures, although non-invasive urine sample tests (nucleic acid amplification tests) have since become widely available (16).

Patient-delivered partner therapy (PDPT) is a strategy in which index cases deliver either medications or prescriptions directly to their partners. Where these programs are offered, partners may seek clinical services, yet a clinical evaluation is not a necessary precondition to their receiving treatment (3). Although providing treatment without prior diagnosis raises ethical concerns, the practice is seen as a beneficial trade-off to reduce the incidence of reinfection among index patients, considering that many partners identified in patient-based referral (especially male partners to females with a Chlamydia infection) do not seek testing or treatment (17). High rates of reinfection of index patients have been documented, where resumption of sexual intercourse with an untreated partner is understood to be an important contributor (18). PDPT has been shown to be most effective when used with index patients who have one regular partner, however, Cameron *et al.* point to trends of

increasing multi-partnered sexual relations in the UK (19).

PDPT dominates the literature on PN practices aimed at addressing low treatment rates, particularly among male partners. However, Yu *et al.* described a novel partner management strategy operating in California, which extended the services of publically funded family planning clinics to male partners of female index patients (3). Patients were asked to bring their partner with them when they returned for treatment, effectively limiting costs to both clinics and clients. Patient-partner concurrent treatment, like PDPT, is thought to be less beneficial for patients with more than one partner (about a quarter of the study participants).

Referral practices are also seeing inroads of internet assisted methods, for example those that allow anonymous notification of sexual partners on internet dating sites (5). Those practices fall outside of the scope of this paper, but have been described in a separate review. Further consideration of the merits of these referral methods are explored in a subsequent section that describes available evidence on the effectiveness of Chlamydia PN.

Canadian Guidelines for Chlamydia PN

The Canadian Guidelines on Sexually Transmitted Infections (8) outline recommended practice for the management of STIs, as well as Chlamydia infections specifically. The guidelines refer to reporting and partner notification, follow-up activities, and special considerations that relate to neonates and to suspected cases of sexual abuse of prepubescent children. Partner notification is not required as a public health measure in most provinces and territories for Chlamydia, which also applies to cases of genital herpes, gonorrhea, and human papilloma virus. Partner notification is, however, recommended as part of Chlamydia prevention and control activities, in tandem with screening of groups at risk (sexually active women and men under age 25, pregnant women at first prenatal visit), and promotion of safer sex.

The basic features of the guidelines are as follows:

- Sexual partners and newborns are to be notified/evaluated.
- Patients, health care providers, or public health care authorities perform PN.
- More than one strategy (patient referral, provider referral, contract referral) may be used to notify different partners.
- Empirical treatment of sexual partners, that is, where treatment follows from observation and where a confirmed diagnosis is not required prior to treatment.
- Prophylactic treatment may be provided to prepubescent children subjected to sexual abuse or to neonates born to infected mothers, where follow-up cannot be guaranteed.
- Trace-back period is typically 60 days prior to onset of symptoms or (if asymptomatic) prior to specimen collection.
- Recommend continued screening for STIs every three months for individuals who may experience ongoing risks for infection.

Additional guidelines for follow-up are offered, as follows:

- Follow-up is preferably conducted by the same health care provider.
- Where follow-up is not possible, patients are referred to community resources, counseled on when follow-up may be required, and indications of treatment failure.
- No test of cure is required, though it is recommended for pregnant women and in children, as well as individuals who are unlikely to comply with treatments.
- Where test for cure is carried out, this should occur at 3-4 weeks post-treatment.
- For infected individuals, repeat testing after 6 months to address high risks for reinfection.

The guidelines stipulate that health care providers/public health officials are responsible and legally and ethically obligated to ensure

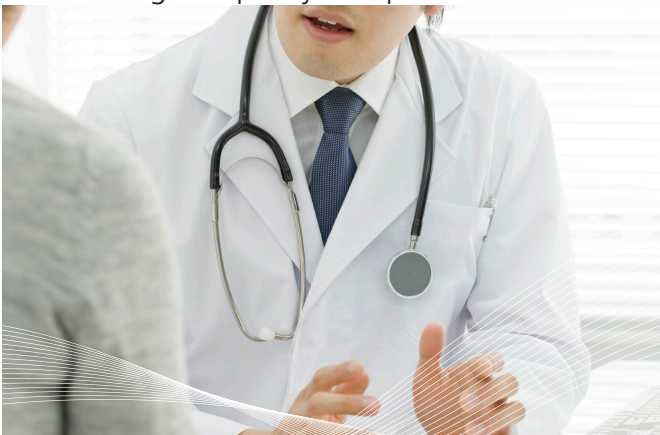
patient confidentiality. Specific methods of referral are suggested in certain circumstances: where anonymous partnering is a factor in infection, self- or patient referral is the primary recommendation; where index cases contracted an infection from a sexual assault, or fear physical or emotional abuse by a sexual partner, provider referral is the primary recommendation.

Notably, the safety of the index cases takes priority over PN. The policy also recognizes that the contexts for STIs often involve other health challenges (e.g. mental health or addictions) or social challenges, calling for integrated care.

The guidelines also refer to trends in STI rates and transmission that may warrant the use of alternative methods of PN, namely expedited patient-initiated treatment. Research into the feasibility of this and other novel PN methods is underway (8). The method has been considered beneficial in high risk and hard-to-reach populations (20,21). In these instances, safety information and a list of contraindications are to be provided to partners. The presumptive treatment this method entails is, however, described as controversial in Canada (8).

Comparisons of Guidelines Across Jurisdictions

Comparison across jurisdictions indicates areas of consensus, which may or may not reflect the evidence of effectiveness. Conversely, where variability in methods exists without evidence guiding choice of the more effective strategy, there may be need for further research to guide policy and practice.



Guidelines for Chlamydia PN in other developed nations are similar to the Canadian guidelines in many respects, although some particular differences may be noteworthy. One apparent difference is the length of trace-back periods. In Canada and the US, a 60 day period serves as the routine cut-off to identify partners at risk of infection, though the period is extended where the last sexual contact predates 60 days (8,22). In the UK, a cut-off of approximately 30 days (4 weeks) is used to identify sexual partners of symptomatic index patients, distinguished from asymptomatic cases, in which case a 6 month trace-back period is recommended (23). Referring to US guidelines, Rothenberg suggested that the usual case finding intervals recommended (e.g. by the CDC in the US) are likely to miss certain groups that are important in transmission patterns that contribute to endemic Chlamydia, particularly men with long-term asymptomatic Chlamydia (6).

Some variability is also found in guidelines concerning how much time should transpire before retesting after treatment of a confirmed case. In Canada, a six month period following initial treatment is suggested (8), three months are recommended in some jurisdictions (22, 24), and other regions have generally adopted some period within this range (25,26). Some guidelines, including those for Canada, appear silent on a recommended time period in which to complete partner notification.

Approaches to the treatment of partners vary in some respects. Some jurisdictions allow for presumptive, rather than empirical treatment of sexual partners (24). In Europe, there is acknowledgement of the value of PDPT (25,26), whereas in the UK, medication cannot be prescribed without prior evaluation (10). The US guidelines go farther than others, recommending the use of PDPT or expedited patient delivered partner therapy for partners who are unable or unlikely to seek evaluation and treatment, though only where legislation permits (22). In 2006, the CDC issued guidelines for providing PDPT to heterosexual patients diagnosed with gonorrhea or Chlamydial infection

(27); the procedure was not sanctioned for use with MSM because of concerns that it could decrease testing for syphilis and HIV among the sex partners of MSM with elevated risk for these infections (28). PDPT remains controversial in the US as prescribing medication to individuals without prior medical examination contravenes legislation in some jurisdictions (3). Based on a 2005 survey of state boards of pharmacy and medicine (37 of each), representing 47 states, Golden (29) found PDPT was largely viewed as either illegal or of uncertain legality and was clearly defined as legal in only 4 states covered by the survey.

The CDC has described variability in the type and comprehensiveness of PN services provided to Chlamydia patients by practitioner type, by public health agency, and by geographic area (22). European and UK guidelines emphasize the need for healthcare practitioners to be appropriately trained in PN and indicate preference for the use of specialist contact tracers for provider-based referral (25, 26); (23). As well, the UK and Europe make allowances for the use of telephone interviews in PN follow-up activities (23,25,26). The UK guidelines stand out for their suggestions to document both the methods of PN used in actual practice, and the outcomes of partner notification. As well, the UK has set minimal standards against which PN outcomes may be evaluated (0.43 contacts per index cases in cities, and 0.64 per case elsewhere) (23). The published literature on PN repeatedly points to a lack of documentation of outcomes of PN practice for evidence of effectiveness (30). Stokes referred to a Canadian publication dating back to 1994 (Millson *et al.*, 1994, cited in (30)), which recommended obtaining data on PN outcomes, including documentation on how many sexual partners receive a clinical assessment as a result of PN. However, it is unclear as to whether these recommendations were taken forward.

Differences in PN programs by jurisdiction may reflect varying incidence rates and distinct epidemiological features in populations served. However, some comparisons of PN policies

across jurisdictions have been offered in the research literature with the aim of identifying strengths and weaknesses in various systems, and to promote good practice (7). As part of a review of STI surveillance, care and prevention practices in the European Union, Arthur (7) noted considerable heterogeneity in approaches to PN among 15 nations, among which only 8 had national guidelines. Based on surveys conducted with STI surveillance leaders, the author found Chlamydia PN was largely delivered as a voluntary program, although in Norway and Sweden, physicians and patients are legally obligated to notify partners of a Chlamydia infection. Patient referral methods (primarily simple patient referral) were by far the most commonly employed, although 5 countries also offered provider referral, and contract referral was selectively employed in 3. These findings were consistent with those reported by Stokes (30) for the UK, based on mail-in questionnaires, and by Golden (31) for the US, based on interviews with representatives of 60 departmental programs in regions representing 35% of US Chlamydia cases. PN provision most often involved personnel with specialization in bacterial STIs (7). Arthur also found that most (10 of 14) of the European nations included in the study provided etiological treatment (treatment according to test results). Expedited, presumptive treatment (i.e. PDPT) was uncommon, and where offered, was given to only a small proportion of patients and only for Chlamydia (7). Again, the uncommon use of PDPT echoed similar observations made in studies from the UK and US (30,31), though US practice saw PDPT more likely reserved for HIV and new cases of syphilis. Arthur's review indicated the need for minimum standards for PN practice, mechanisms to share best practices between jurisdictions (the ESSTI Network [www.essti.org] being one existing forum), and monitoring systems for PN



Usage / Application of PN

The outcomes of PN depend not only on adequate guidelines, but on the application of PN in actual practice. The research literature indicates significant deviations from intended practice, as well as limited documentation of PN practice overall.

Arthur *et al.* (7) found that a considerable proportion of Chlamydia cases were seen in primary care settings in over half the countries surveyed and that the private sector was important in STI service provision in many countries. In the UK, surveys of health professionals have indicated a trend toward increasing treatment of Chlamydia in general practice, outside of genitourinary clinics (Cameron 2007 cited in (19)). This runs counter to the stated policy in the UK that PN should be carried out by health advisors in GUM clinics specializing in STIs. However, a 66% increase in Chlamydia in recent years (1999-2004) suggests increasing workloads may account for a substantial shift in the site of PN service provision (Health Protection Agency cited in (32)).

Based on a cross-sectional survey conducted with STI services leaders in 15 European nations, Arthur *et al.* found that most countries' specialist STI clinics may succeed at reaching less than 10% of partners for treatment of STIs, although this proportion exceeds 75% in Ireland and Norway, and may reach 90% in Sweden, for partners of individuals who test positive for *Chlamydia trachomatis*. The study showed that while simple patient PN was generally thought to be universal by the STI program leaders surveyed, there was uncertainty about any more intensive support for PN being offered by service providers in primary care and family planning clinics (except Sweden and Norway). The survey identified weakness in PN provision in non-specialist centers compared with specialized care sites, noted as a particular concern for countries where most STIs are not treated in specialist settings, and for Chlamydia (7).

Given the increasing participation of pri-

vate practice physicians in US STI services, there is a need to better understand PN services in this health care setting. Although recent research appears lacking, a few US studies indicate unmet needs for PN supports among Chlamydia patients diagnosed in private clinics. Based on a survey of state health departments (n=60) in states with high STD morbidity, Golden *et al.* (31) found that PN services provided by public health staff almost exclusively focused on STD clinic patients and where services extended outside of those settings (i.e. to cases seen at private clinics, in jails, or in other public health clinics) these were less labour intensive activities. The least investment of public health support was afforded to Chlamydia cases and to clients seen in private clinics. Most health departments (46, or 77%) reported that only basic patient referral was provided to Chlamydia cases diagnosed in private clinics, whereas 23% reported more intensive services to this clientele (3 departments supplied provider referral; 2 conditional referral, 9 other assistance), compared to patients in other clinical settings, more of whom received intensive public health supports (ranging from 29% to 55%). Poor cooperation by private physicians was regarded as a barrier to (31). An earlier, small-scale study by Golden and colleagues (33) found that although a large majority of private clinic clients interviewed (72/76, or 95%) received basic patient referral from their physician, 65% (11/17) of those who failed to notify their partners reported that they would have accepted a clinician's support for PN, suggesting unmet needs in the population.

Based on a large-scale survey of US physicians, 87% of whom worked in private practice settings, St. Lawrence *et al.* (34) found patient counseling (e.g. suggesting clients inform partners about exposure and recommend partners seek testing and treatment, recommending condom use and abstinence from sex until completion of treatment) was commonly undertaken (78-81% for Chlamydia),

but follow-up to confirm that partners were notified was uncommon (20%), and direct involvement in partner notification was rare (4%). Furthermore, private physicians showed limited awareness of reporting requirements to public health officials, indicative of the need for greater collaboration between private and public sectors for improved Chlamydia control.

Similarly, a study from 1998 of general practice physicians in Denmark (16) described low levels of engagement in Chlamydia PN. Although a large proportion of cases were seen in general practice, many GPs offered only simple patient referral and were not seen to be supporting the public health mandate for controlling Chlamydia. The authors recommended continuous medical education and auditing procedures to promote improved GP engagement in PN.

Andersen (35) also compared knowledge of PN, or 'usual practice' with actual practice in general practice physicians' management of Chlamydia and found significant discrepancies. Moreover, the study revealed greater shortcomings in PN practice applied to former partners as compared with current partners, as well as significant differences by the sex of index patients. Only 60% of GPs reported their usual practice to include recommending that previous partners be assessed for Chlamydia, whereas reports of actual practice showed that only 42% of male index patients and 26% of female index patients were given this recommendation (35).

A survey of UK practice also found considerable variability in the time period over which PN was undertaken. For Chlamydia, this ranged from 1 to 24 months, with a median of 3 months. As well, the author observed a lack of published literature to support a specific recommended time period (30). Similarly, Macke *et al.* found a lack of consistency and systematization on time allocation for components of PN in the US public health system (36).

²The example of 'other assistance' provided was the practice of interviewing cases and offering to contact partners for them if they stated they could or would not do so themselves.

Although these studies are over 10 years old, this review did not find more recent publications on the timing of PN.

The frequent absence, in practice, of follow-up and verification of successful outcomes of PN was highlighted in a national UK audit of 169 genitourinary clinics with service to 4616 individuals. The study revealed that the number of partners per index case tested for Chlamydia—whether verified by HC staff or reported by index patients—were not recorded for 41% of patients managed for Chlamydia in the genitourinary clinics. Where outcomes were reported, the mean number of partners tested for Chlamydia ranged from 0 to 1.5 per index case per clinic (37).

Evidence of Effectiveness

Indicators of Effectiveness

Randomized controlled trials examining the effectiveness of PN for Chlamydia are lacking in Canada and, although international data may be informative, American, UK and European findings may not be generalizable due to cultural differences in sexual behaviour, as well as differences in the structure of health care in various jurisdictions.

Measures of effectiveness employed in the literature have been described as lacking consistency (38). The most common measures of effectiveness include rates of notification, testing, treatment and reinfection. The number or rate of contacts notified per infected case are commonly cited in the literature, although Wright *et al.* (2) suggests that the number of infected contacts may be a more informative measure of PN effectiveness. Partner notification rates in the literature have been found to range from 0.11 to 0.89 notified partner per infected patient (cited in (18)). Hogben and Kissinger's review of research on female partners of *C. trachomatis* infected men found that, overall, 48% to 79% of partners receive notification, and a somewhat smaller proportion (30-61%) are subsequently treated (39). Estimates have placed treatment rates for partners of index cases with *N. gonorrhoea* or *C. trachomatis* infection between 29% to 59%

of partners (cited in (5)). Studies of *Chlamydia trachomatis* among women demonstrate that only 25%-40% of named male partners actually sought care and were treated (40, 41). Reinfection rates are also important to track in light of the risk of complications (e.g. PID) associated with recurrent infections. Reinfection rates in the UK have been estimated at 29.9 per 100/person years (42).

Although all these measures may be informative, the public health objectives of PN need also be clear and balance the value of various PN benefits. Althaus *et al.* (43) brought into question the goals and priorities of PN, that is, whether it is more extensive contact tracing to find more individuals at potential risk, or improved treatment of current partners. Model simulation found that while extending PN periods beyond one year helps to find new index cases, most of the additional effect that PN has on reducing transmission in a general heterosexual population of young adults is achieved by notifying the current or most recent partner (43).

Standards of evidence of PN effectiveness are not equal. US guidelines on STD treatment from the Centers for Disease Control and Prevention's (CDC's) note that there is uncertainty regarding the extent to which sexual partner notification effectively decreases the prevalence and incidence of infections in the population (22). While such definitive evidence of effect is lacking, more general effects have been interpreted from systematic reviews that have found evidence that PN can identify significant numbers of new asymptomatic and untreated infection (7).

Comparisons of Referral Methods

Reviews have found fair to moderate evidence that provider referral is more effective than self-referral, both for the number of partners presenting for care and infections identified/diagnosed (11,44,45). Generally, more intensive approaches to PN have shown greater effectiveness. A systematic review by Mathews *et al.* found moderately strong evidence that for index cases with Chlamydia (or any STI)

provider referral, alone or as a choice offered with patient referral, increased the rate of partners presenting for assessment compared with patient referral. Provider referral also showed a higher mean number of sexual contacts treated per index case (0.58 [27/47] compared 0.38 [23/61]) in an observational study of a high risk urban adolescent population (91% African American) with Chlamydia and gonococcal cervicitis, where subjects chose the referral type (40). Other reviewers have noted that while evidence of effectiveness favour provider-based practices, these methods are not commonly employed in practice for Chlamydia infections (and gonorrhoea) increasingly seen outside of specialist genitourinary clinics/ STI clinics (46). Few studies have compared contract referral methods with provider or patient referral (11). An early systematic review found conflicting evidence regarding the relative effectiveness of provider referral and conditional/contract referral compared with patient-based referral for Chlamydia and gonorrhoea (45).

Enhancements to Standard Patient-Based Referral

Enhancements to standard, patient-based partner referral have generally shown improved PN outcomes. A systematic review focused on studies of female partners of men infected with *C. trachomatis* found supportive evidence for the use of contact slips (39). Refinements in the use of contact slips were explored by Wright *et al.* (2). This comparative UK study found significantly increased attendance for treatment at STI clinics among partners of index cases given augmented contact slips (160 of 190 slips issued or 84% attendance) compared to standard slips (48 of 144 slips issued or 33% attendance). Augmented contact slips identified Chlamydia as the source of potential infection and provided information on symptoms, sequelae and clinic locations. The authors posited that limited information on coded contact slips, while preserving the confidential diagnosis of the index patient, fails to motivate partners to seek screening and treatment. Conversely, a small Australian study found that use of a wallet-sized contact slip

and website resources provided to index patients produced no appreciable improvements in the number of partners notified or treated compared to standard practice of verbal advice to refer sexual partners (47). The study design may have been vulnerable to bias, but presents interesting ideas for enhanced PN, including community-level social marketing strategies to improve the social acceptability of notifying partners and to reach the general public.

Compared to standard interviewing techniques, enhanced techniques that employ specific types of memory cues have been shown to significantly improve the number of traceable contacts elicited from index patients with known STIs (83% Chlamydia only). Brewer demonstrated that these methods yield a 12% increase in the number of cases found and a 3-5% increase in the number of partners brought to treatment in a high risk population (n=123 patients; 70 female, 53 male). Among three sets of cues tested, location of meeting and first name cues were most effective. Interestingly, the partners elicited through the special technique tended to have less frequent and less recent sexual interactions with study cases than partners elicited through standard methods, but were equally likely to be infected, indicating a valuable expansion in traceable networks of index cases (48).

Employing a randomized controlled trial, Wilson *et al.* (5) compared the effectiveness of standard patient-based notification for STIs (Chlamydia or gonorrhoea) with that of patient referral augmented by counseling, educational materials and follow-up components. The intervention, developed for an urban population (n=600; 96% heterosexual; 40% African American; 52% African Caribbean) with high rates of STIs, was designed to build positive attitudes about notification among patients and to develop skills among them for contacting partners and influencing their seeking care, as well as skills for reducing sexual risk behaviours. The intervention group saw significantly improved outcomes, including more index cases self-reporting successful notification of sexual partners (outcome defined as at

least one partner notified), decreases in sexual risk behavior, and a reduction in recurrent or persistent infections among index cases. Additionally, a gender interaction was evident, as a greater reduction in the number of infections was seen primarily among men.

Personnel Used to Deliver PN

The research literature has also explored the relative effectiveness of particular types of health care personnel in the delivery of PN. The skills of specialists relative to those of general health practitioners are most often considered. Given the high rate of Chlamydia in many populations, and trends toward more cases being managed in general practice, where specialists in STI management are lacking, questions regarding the effectiveness of providers carry particular importance.

The bulk of research evidence supports the use of specially trained STI personnel, yet exceptions have been noted. An older study by Oxman *et al.* (45) found only weak evidence that trained interviewers were more effective in eliciting partners from index cases than routine health care providers. However, in the US, disease intervention specialists (DIS specifically trained to conduct PN) have been shown to be more effective than doctors in the delivery of PN (49). A Swedish study, based on prospective design, compared the effectiveness of PN services delivered by trained social workers based in STD clinics and PN delivered by physicians. Social workers elicited significantly more partners from their clients than did health care workers ($p < 0.001$). The social workers were more familiar with contact tracing procedure, spent more time with index patients, obtained a longer sexual history, and were more insistent in their techniques than were health care workers (50).

Other research has explored a combined approach with supported use of health care workers in general practice. According to a multi-centre randomized controlled trial in the UK (32), practical nurses in primary care (n=36 nurses in 27 practice sites) were found to be at least as effective as specialized health

advisors at eliciting sexual partners and securing partner treatment when supported by a research health advisor who provided training and follow up by telephone. The proportion of index cases with at least one treated sexual partner was the primary outcome measured; secondary outcomes were number of sexual contacts elicited, positive tests six weeks after treatment, and cost of each strategy. Notably, the supported social work strategy did not differ significantly in cost.

The involvement of community-based, non-specialist staff in PN is advocated for use in some populations by Bell and Potterat (10) who note the benefits their local knowledge and rapport bring to supporting PN among certain distinct populations, which may include First Nations, youth, sex workers, and drug users.

Telephone-based Interviews or Follow-up

An observational pilot study explored the potential effectiveness of telephone interviews



with index patients for the purpose of eliciting sexual contacts. In the context of a high risk population in New Orleans, the authors reported a 46.3% success rate in contacting and interviewing index patients, and estimated that for every 100 index cases interviewed, 54 new contacts (partners) were made and 21 additional cases were treated. Another observational study in Sweden demonstrated excellent outcomes of PN (1.9 partners treated per index case) in a large, sparsely populated area where centralized contact tracing using telephone interviews were performed by a small team of experienced staff (51). The use of telephone interviewing may deserve study as a method appropriate to the Canadian population, particularly in sub-populations with high morbidity.

Telephone interviews have also been shown to be effective when used in follow-up to PN activities, demonstrated in a UK setting. A retrospective review compared outcomes for cases of Chlamydia managed with a traditional clinic follow-up (n=400) compared with cases provided with telephone follow-up (n=400)—a change in practice introduced to address wait lists. Calls were used to verify satisfactory treatment of patients, exclude the possibility of re-infection, enquire about whether contacts were informed and treated, and encourage contact tracing. The new procedure failed to achieve standards set by UK policy, but resulted in an increase in the number of patients treated and partners of patients treated compared to traditional clinic follow-up (respectively: 204 [51%] vs 121 [30%]; $P < 0.0001$, and 0.57 vs 0.45 contacts per case; $P < 0.0006$) (52).

Sampling / Testing AIDS

The effectiveness of alternative sampling or testing strategies has been compared in the research literature, primarily in studies based in Denmark and Scotland. Various aids to sampling which allow partners of individuals infected with *C. trachomatis* the convenience of completing a urine test in their home are the main subject of study. Home sampling strategies for partners show a body of sup-

portive research evidence as indicated by two systematic reviews (38, 46). A Danish randomized control trial that compared Chlamydia home sampling (mail-in sample) to standard office sampling (bring kit to health care providers) found higher rates of partner testing as well as partner treatment in the experimental group. The authors estimated that a two- to four-fold increase in testing could be achieved with home sampling compared to office sampling. Although home testing resulted in more women and men being tested and diagnosed, a greater relative effectiveness was evident for female partners of male index cases (18).

A randomized controlled trial conducted in Denmark (16) also found evidence of improved outcomes with home sampling of partners of women infected with *C. trachomatis* (n=96 women). Index cases were randomly assigned to one of two groups, where the intervention group was given a questionnaire on sexual partners in the past 6 months, a urine sample kit to provide to their partners, and a prepaid envelope for partners to return a sample for testing. The control group was given a request for their partner/s to visit his doctor, a contact slip, and a prepaid envelope for his doctor to return a urethral swab sample. A significantly larger proportion of partners given the home sampling option were examined for Chlamydia (68% versus 28%) than those who visited clinics for testing, leading the authors to conclude that urine samples obtained at home can improve partner care (16).

Contrary to these favourable results, Apoola *et al.* (9) found that the addition of urine sampling kits provided to partners of women with Chlamydia (n=200) had no significant effect on partner notification or treatment rates compared to those achieved through standard patient referral practices (patient referral, provision of contact slips and swab tests). Similarly, Cameron *et al.* (19) found no appreciable difference in the proportion of partners tested and treated for Chlamydia in comparisons between women who received patient referral and those who received postal treatment kits. Moreover, comparisons of PTK with PDPT and patient referral interventions showed no sig-

nificant differences in the rate of reinfections among female index cases. PTK was recommended as an adjunct to PDPT, if confirmation of an infection was desired by partners. However, the practice was not recommended as a replacement for patient referral, because of the risk for increased reinfection. Concerns remain that home sampling may actually delay treatment of partners, as otherwise treatment would occur in the same clinic visit as testing.

Expedited Partner Treatment / Patient-delivered Partner Treatment

Outcome measures for PDPT are either equivalent to other PN strategies, or show improvements, particularly when compared with simple patient referral methods. A review of evidence on PN for female partners of males infected with *C. trachomatis* found that higher rates of notification and treatment were associated with enhancements to basic referral advice, especially where a partner treatment strategy was employed (39). Similar conclusions were drawn by Trelle *et al.* (38, 46), who found that where index patients shared responsibility for the management of sexual partners, including PDPT strategies, outcomes of PN were improved.

Several randomized controlled trials have compared expedited partner treatment to standard patient-based referral practices, or other PN methods. Four trials (17, 20, 53, 54) demonstrated lower reinfection rates in index patients with the use of EPT compared standard patient referral practices, although one (54) found a 20% lower reinfection rate which did not achieve statistical significance. Evidence in support of lower reinfection rates with use of EPT have also come from retrospective studies of individuals with Chlamydia (53); and (Ramstedt *et al.* 1991, cited in (54)). As well, RCTs have provided evidence of significantly improved rates of treatment of partners of both infected heterosexual (17) and of MSM (28) in studies that evaluated EPT for Chlamydia and/or gonorrhoea. The effect of the intervention was large in both studies; Kerani *et al.* (28) found a 54% increase in the mean number of partners treated per index patient,

and Kissinger *et al.* (17) found that patients in the EPT arm of the study were 2.88 times more likely to report that partners had told them they'd taken the medication.

Contrary to these findings, a randomized controlled trial conducted in Scotland with female index cases infected with *C. trachomatis* found no significant differences between patient referral, PDPT, or PTK for either reinfection rates among women or the proportion of male partners tested or treated (19). The authors qualified the results by noting that in research contexts, patient referral is delivered at a gold standard unlikely to be achieved in practice. The authors suggested that given negligible difference in effectiveness between PDPT and properly executed patient referral, the simplicity of implementing PDPT may favour its use for women with uncomplicated Chlamydia infections, particularly in light of the growing burden of Chlamydia in general practice settings.

Cost-effectiveness

The relative costs of PN strategies and factors influencing cost-effectiveness have received some attention in the research literature. The larger investments associated with more labour intensive, provider-based referral strategies have long been established. A systematic review performed by Oxman *et al.* in 1994 found that provider referral was 4 to 8 times as expensive as patient referral in the US (45).

Howell *et al.* (4) used a model to compare the cost-effectiveness of two PN strategies for preventing Chlamydia and PID in women. The study found that early diagnosis and treatment of the female sex partners of infected men prevented more cases (in the hypothetical cohort) and saved more money than the strategy of preventing reinfection of women through diagnosis and treatment of male partners of infected females. However, the latter strategy was subject to changes in the probability of reinfection, for which evidence is lacking.

A UK modeling study demonstrated that intensifying PN efforts to achieve a certain level of improved treatment rates (0.4 to 0.8 partners

treated per case) may be more cost-effective than increasing screening among men, based upon high Chlamydia positivity rates found in notified male partners (65%) compared with men diagnosed through screening programmes (6%) (55).

The value of EPT has been given critical consideration by Gift *et al.* (56). Balanced against the costs of treating repeat infections and serious complications, EPT is less costly compared to standard practice. However, the authors also point to disparate perspectives on cost, as despite the benefits from overall health care and societal perspectives, some individual payers (organizations) may find it more costly than standard practice where the burden of service provision falls heavily upon certain payers. Thus decisions to provide EPT often run counter to evidence and broader public interests.

Individual & Social Factors Influencing Effectiveness

Little attention has been brought to the PN success from a client perspective, or through knowledge of the experiences, needs and values of key populations with distinct or high service needs. Clients' preferences for PN methods are not well researched, and little knowledge has accrued on which approaches are more acceptable than others (44). Brewer *et al.* (15) noted shortcomings in standard interviewing procedures that do not address the circumstances of individuals who engage in casual sex with multiple sexual partners, who are more likely to forget partners. Forgetting is a significant impediment to PN effectiveness, as has been indicated by research showing inconsistent reporting of partners in repeat interviews, self-reported forgetting, and omissions among the partners named in interviews who are named in diaries (Brewer *et al.*, 1999; Brewer *et al.*, 2001, cited in (48)). Supplementary interview techniques, described earlier in this document, were proposed by the author to address this challenge.

Interactions between social and cultural variables and PN effectiveness are also rarely considered in this literature. Apoola *et al.* (52)

suggested that the ethnic makeup of an urban UK population may have influenced the degree to which their implementation of a new protocol for follow-up achieved the UK standards for successful management of Chlamydia. The authors posit that population diversity has not been adequately addressed and suggested that intrinsic variability be both acknowledged and acted upon in the application of standards. They suggest a process whereby clinics with results above or below control limits be investigated to either replicate successes or receive greater support to improve practice. An extensive literature review, examining factors influencing case-finding effectiveness, found indications that PN success is higher where index cases are of the majority culture group (15). Another older study, representing exploratory work on the use of factorial analysis to explore patient preferences, found no preference for a PN practitioner's sex and ethnicity to match that of the index patient (44).

Cluster or network investigations have broached the subject of social variables as factors in STI transmission with implications for PN effectiveness. Lauman and Youm (57) suggested that the high prevalence of some STDs could be explained by distinct patterns in sexual networks in a black population (where 'black' may serve as a proxy variable for cultural group or socioeconomic status) among whom partnering tended to follow lines of the same ethnic group while crossing sexual risk groups (high risk with low risk individuals).

Based on a retrospective review of records (n=415 from 19 sites), Morgan (58) addressed questions of equitable service provision in New Zealand for the management of Chlamydia. The study found no significant differences in access to PN by ethnicity or sex (Maori compared to non-Maori), although ineffective PN management was found across all demographic variables. The study did find evidence of inequitable access to treatment for Chlamydia, men receiving faster treatment (median of 3 days compared to 6 days, $p < 0.001$). Cases without documented treatment were more likely to be women (8.2% versus 2.1,

$p < 0.037$) and more likely to be Maori than non-Maori (13.6 versus 4.8% $p < 0.036$).

Although several researchers have suggested that gender relations and power dynamics among male and female sexual partners influence communication about safer sex practices and sexual decision making (59), the literature captured within this review shows limited attention to the influence of gender or gender dynamics on PN. It is commonly observed that men are less likely than women to be screened or to seek care (53). Studies exploring reasons for sexual partners delaying care suggest that men perceive practical obstacles in obtaining treatment (60). Men may be reluctant to attend clinics due to a stigma being associated with STIs, and where Chlamydia is asymptomatic (Darroch *et al.*, 2003 cited in (53)). Schlinger reports on studies comparing strategies for partner treatment that have suggested that women have preferences for how partners are contacted, which is influenced by their age and other factors (40), and by the nature of the relationship with their partner, preferring not to notify someone not considered to be a 'steady partner' (van de Laar *et al.*, 1997, cited in (54)).

Qualitative research by Gorbach *et al.* (61) showed that the nature of relationships was important to patients' compliance and follow-through with PN. Based on content-analysis of in-depth interviews with heterosexual women and men with Chlamydia, gonorrhea, or urethritis (n=60) and MSM (19) with gonorrhea, the authors found that PN compliance was high in those relationships where there is no expectation of exclusivity, although in these cases patient referral was preferred. Poor compliance was found in one time and anonymous partnerships. As well, partnerships assumed to be monogamous also presented challenges to PN. According to the authors, one surprising finding was that a patient's perception of partners as transmitters of infection was important for compliance and differed by sex. Women tended to confront perceived transmitters where these were main or former partners, whereas men, regardless of sexual orienta-

tion, tended not to contact them. Contacts who preceded symptom onset were often not recognized as potential transmitters and not contacted.

The influence of violence or the fear of violence has also received little attention in the PN literature. However, Gorbach *et al.* (61) found that partners who have threatened violence or who are feared tend not to be notified. The authors found that up to one third of index patients failed to tell all partners because of embarrassment or fears for personal safety or reputation, and that casual and ex-partners are the least likely to be informed.

Sexual orientation is understood to influence index patient preferences and PN outcomes. According to an audit of UK GUM clinics, Herzog (37) found that factors associated with variation in completed partner testing outcomes (ranging from 0 to 1.5 partners tested per index case per clinic) included sexual orientation and symptomology. Men who had sex with men (MSM) were less likely than heterosexual patients to report one or more partner having been tested, as were patients with symptoms compared to asymptomatic patients (37). Mimiaga (62) used multivariate logistic regression analysis to explore psychosocial and behavioural factors influencing PN compliance among MSM and found that social anxiety and alcohol dependence were significant predictors of PN use in this population, affected individuals being less willing to notify past sexual partners.



Chlamydia PN Challenges

Challenges and barriers to Chlamydia PN most commonly raised in the published literature tend to focus on basic operational needs of health systems, such as resources, personnel, skills, and procedural standards. According to US public health department representatives (n=60) interviewed by Golden (31), the most commonly reported barrier to PN is a lack of sufficient funding or personnel (24/60 respondents, or 40%), with related issues raised concerning the inability to retain staff, and insufficient allocations for disease intervention specialists (DIS). Other key barriers noted were the lack of ongoing training opportunities for PN staff, particularly for interviewing techniques (23/60). Several public health representatives described a general erosion in PN practices, quality assurance by the CDC, and epidemiologic and data management support (31).

A disconnect between policy guidelines and reported or observed practice for Chlamydia PN has already been described. As well, the low level priority afforded to Chlamydia, relative to other public health concerns, as has been described for the US and UK, may serve to further contextualize challenges in public health systems. In the US, approaches to STI PN are seen to vary according to the type of infection. Despite high rates of Chlamydia in several states, most public programs in these jurisdictions do not use PN for Chlamydia (or for gonorrhea) because scarce resources are reserved for HIV and syphilis partner management. Where services are offered, they tend not to include provider referral, which has greater human resource needs. Rather, patient referral has been described as the preferred method for Chlamydia PN for the vast majority of cases (31, 34). According to one US study, fewer than 20% of those with Chlamydia received more than simple patient referral (31). Golden (31) found that most jurisdictions in the US provided assistance to only a limited proportion of reported Chlamydia cases. Based on a survey of STD program staff

conducted in 1998, in regions of the US with the highest reported rates of STDs, only 12% (26,487) of Chlamydia cases were interviewed compared to 17% of gonorrhea cases, 52% of HIV cases, and 89% of syphilis cases. As well, 45% of health departments didn't provide any services to individuals with Chlamydia. Thus, despite Chlamydia accounting for the majority of all PN interviews performed, only a small proportion of cases received attention from public health services.

Regardless of the service centre type and sector recommended by policies for Chlamydia control, high and increasing rates of infection have resulted in increasing number of cases seen in general practice, primary care and private practice, where capacity is lacking and individual care rather than population health priorities drive practice. Golden (31) found that in the US, in high Chlamydia morbidity states, PN services for both Chlamydia and gonorrhea reached very small minorities of infected individuals, and were largely focused on clientele at STD clinics (31). Despite most federal funding going to state and local health departments and STI clinics in the US, most STIs are actually treated in private practice. Based on a US national survey of physicians, which assessed STI and HIV services in private practice settings, St. Lawrence *et al.* (34) reported that almost three quarters (71%) of individuals diagnosed with an STD in the previous year had received their care from a private practice, community health center clinic, emergency room, or family planning clinic rather than from a publicly funded STD clinic. Conversely, only 5% reported that they were treated in an STD clinic.

Screening and PN are both major components of Chlamydia control, and yet observational studies indicate poor coordination between service areas, resulting in delayed treatment and lost opportunities for referral (63, 64). According to Blackwell (63), interdepartmental protocols are needed for managing the referral of women who screen positive for *C. trachomatis* during biopsy of the cervix (colposcopy clinics) or in advance of termination of preg-

nancy procedures. Delays in treatment observed by the study showed a need for coordinated action to fast-track women seen in these contexts to ensure timely treatment and notification by STI health advisors. Similarly, a study by Ayuk 2004 (64) showed incomplete follow-up and poor contact tracing of screen-positive women attending health for termination of pregnancy, increasing their risk of reinfection by untreated sexual partners. Added concerns for adequate counseling and PN for this population were raised because women who have recently undergone termination of pregnancy and have a Chlamydial infection have heightened risks for PID.

The main challenges to PDPT described in the literature stem from legal and ethical concerns. As already described, PDPT is not legal in some jurisdictions or not explicitly legal, thus lacking a basis for inclusion in public health programs. The legal status of PDPT carries broader implications. For example, in California, PDPT medication is not covered by the state's public family planning program because of federal restrictions, creating financial barriers for clients, which may explain the underutilization of PDPT (3). Yu *et al.* (3) posited that barriers to PDPT may include providers' concerns that PDPT results in incomplete care for partners, may be dangerous without knowing the partner's medical or allergy history, may create medicolegal issues, and may not be delivered by the patient. In the UK, Accelerated Partner Therapy, whereby partners receive telephone or pharmacy consultation with a prescriber before collecting medication and a sampling kit, is being explored as one strategy that may be permissible and feasible within legal and policy frameworks (65).

Studies of the perspectives of physician and other PN delivery personnel reveal systemic and attitudinal barriers that may help account for the observed levels of practice and measures of proficiency. A US study of physicians and nurse practitioners in California found that the majority of respondents reported that a lack of time, concerns regarding confidentiality of clients, and limited training in partner notifica-

tion pose barriers to PN practice (66). Greater challenges have been observed in the American private sector. Golden *et al.* observed that both clinicians and patients in the private sector were often unaware of standard PN procedure (33).

Research on strategies to improve GP engagement and motivation of PN practitioners may be called for, though some research has touched on the subject. Andersen *et al.* (35) found that compared to GPs in solo practice, GPs who shared a practice with other GPs carried out more contact tracing for previous partners, where the greatest shortfalls in PN practice relative to knowledge appeared. Research by Brook *et al.* (67) observed that the use of electronic record keeping in Chlamydia and gonorrhea management led to substantial improvements in the efficiency of public health staff and improved partner treatment rates (i.e. proportion of index cases with at least one partner treated). Electronic record keeping was seen to improve outcomes by providing more feedback to staff from regular measurement of PN program outcomes, by enabling staff to identify clients with suboptimal management, and by effecting a perception among staff of added scrutiny as to whether they were upholding standards for care.

Summary and Discussion

Chlamydia is the most common reported STI in Canada, which has been on the rise since the late 1990's, with somewhat greater increases seen among men. Whether this trend reflects true change in infection rates or improved case finding, it requires renewed consideration of Public Health practices. Researchers have and continue to raise questions about the efficacy of the long time standard practice of PN as it is applied to *Chlamydia trachomatis*, among other sexually transmitted infections. This review considers the evidence for PN effectiveness in published research literature, for various measures of outcome, methods and factors understood to influence success, and for some populations and sub-populations identifiable in data.

Canadian epidemiological evidence indicates that the priority target populations for Chlamydia control and management include young adults (under age 25), residents of the territories and to a lesser degree Prairie provinces, and females, who have twice the rate of infection overall and greater vulnerability to serious and long-term complications compared to males. Accordingly, public health strategies include screening, safe sex promo-

Research Gaps

Overall, there is a lack of published evidence from Canada on Chlamydia PN to account for current Canadian Chlamydia management practices, and to demonstrate public health responsiveness to changes in the epidemic. Several gaps in knowledge and evidence are noted in the research literature—some of which are also implied by their omission in this review. Gaps are not limited to, but include the following:

- Consensus on outcome measures
- Routine data gathering on PN outcomes in STI surveillance systems, including the proportion of sexual contacts who complete testing and treatment (7)
- Studies designed to demonstrate the effect of PN on disease transmission and incidence in communities (7)
- More research on PN case finding yields for MSM, differentiating the proportion referred by different referral approaches
- Clarity on factors associated with successful PN
- Factors that influence men's decisions to accept treatment, which patients are best suited to PDPT, and cost-effectiveness studies (54)
- Information on the acceptability of PN, particularly in special populations: prison inmates, migrants, immigrants and refugees, domestic and International travelers, remote and isolated populations, culturally distinct populations in Canada e.g. Aboriginal populations
- Evaluation data measuring potential harmful effects, including domestic violence, to ensure that partner notification does more good than harm (21).

tion, and partner notification, and reflect a focus on the pre-reproductive ages, pregnant women and their infants, early repeat infections that increase risks for complications, as well as the protection of children victimized by sexual abuse. Surveillance reports acknowledged that unaddressed, asymptomatic infection in men and women presents an ongoing challenge to efforts at control and management of Chlamydia.

Chlamydia PN is a multi-stage process for secondary prevention, which in Canada, is supported by flexible guidelines that recommend a range of strategies of varying intensity (e.g. self-referral, contract referral, or provider referral) which may be selectively employed for different partners of an index case. No minimal standards of practice are defined and, as is common across many jurisdictions, Chlamydia PN is not required but voluntary. The guidelines feature such recommendations as a 60 day trace back period, empirical treatment of partners, re-testing of infected individuals at 6 months, added cautions and information to those for whom follow-up is unlikely, prioritization of the safety of index cases, preference for continuity of care in follow-up, and periodic (three month) screening of individuals with ongoing risks for infection, specific methods recommended for anonymous partnering (provider referral) and sexual assault or fear of abuse (patient referral) circumstances, and integrated care for those with mental health and addictions challenges, among other advice to practitioners.

Comparing guidelines from several developed nations shows many common features, with a few notable differences. Canada generally does not sanction prophylactic treatment of partners without diagnosis (i.e. PDPT); the length of trace back period differs somewhat across jurisdictions, and in Canada does not extend longer for asymptomatic index cases; time until retesting of infected individuals is longer in Canada than in other jurisdictions (3 months in the US and Australia); overall, there are no recommendations on the time frame for Chlamydia PN.

Research evidence on PN often does not distinguish findings concerning Chlamydia from other sexually transmitted infections (e.g. gonorrhoea). Consensus on standards of evidence and measures in this area of research are unresolved. As well, there is a lack of published research on PN in Canadian populations, including randomized controlled trials. Documentation on practice and outcomes for Chlamydia PN is limited overall, but absent for Canadian populations. This may be concerning given that research has also shown that guidelines and intended practice are not borne out in actual practice. The intensity of PN inputs varies by jurisdiction, by practitioner type, with general practitioners often less engaged in PN than specialists, and by infection type, with greater priority afforded to syphilis and HIV than to Chlamydia. Outcome measures (notification and treatment rates) range widely, although ranges for female partners tend to be somewhat higher than for males. A UK study suggested that no information on PN outcomes are given for a substantial proportion of reported cases of Chlamydia.

Few of the areas of difference in guidelines described above have been specifically addressed in the research on Chlamydia PN in the past 15 years, although there is considerable attention to PDPT, as part of several reviews and comparisons of PN methods, some comparisons of enhancements to standard patient-based referral, consideration of which personnel are most effective in PN and whether selective and efficient use of PN specialists may be achieved, the state of knowledge and coordinated action among health care practitioners and public health personnel, and some separate attention to high risk populations including, youth, women, MSM, and in the US to high risk populations commonly described only as 'black' (low socio-economic status being implied).

International research comparing PN methods shows that higher intensity PN activities and enhancements to standard practice (i.e. patient referral) are associated with better outcomes than less intensive practices. That is, provider referral generally yields more

sexual contacts identified and results in more partners treated than patient-based referral. Contract referral has received limited attention and yielded conflicting evidence. Enhancements like patient education, counseling, cued interview methods, and special training of PN practitioners are also associated with improved outcomes. These results are concerning when taken together with research, albeit from other nations, that describes limited use of intensive methods for Chlamydia PN, a predominance of simple patient referral practice or no PN applied to Chlamydia, increasing reliance on general practitioners not trained in PN, and common challenges of limited funding and training opportunities. Although intensive methods show better outcomes, some research points to patient preference for patient-referral and flexible application of various methods is also supported in the research literature.

Research on PDPT has generally shown it to be equal to or more effective than other PN strategies, especially compared with simple patient referral, and associated with lower reinfection rates and higher rates of notification and treatment. The method is still controversial in some jurisdictions, and cautions for its use apply (e.g. not recommended for use with MSM), but it holds promise for reducing reinfection rates, with the greatest potential benefits to young women with uncomplicated Chlamydia and newborns. However, PDPT is best applied in circumstances where index patients identify one main sexual partner, rather than multi-partner contexts, which has been raised as a growing concern though does not appear to be a substantiated trend. The legal status of PDPT across Canada requires added consideration, as it was not included in this review.

Research on home sampling has yielded some contradictory evidence of its effectiveness. Some studies indicating increased partner treatment rates, while others show no differences. It appears that while home sampling may not significantly improve outcomes, it may be a useful option for clients, and has been recommended for use in conjunction with PDPT.

The use of telephones, either for interviews to elicit partners for notification or for follow-up purposes, has not been systematically researched, though some observational studies indicate benefits of use in some sparsely populated regions. They may also be advantageous in reducing workloads of public health practitioners or improving access to PN specialists' services in high incidence populations. Thus, they may have utility in parts of Canada (e.g. territories). However, communication forms are sensitive to socio-cultural differences in preference and the acceptability of telephones for PN purposes would need to be examined among Canadian populations.

Research supports the use of trained staff specializing in PN, although perhaps sufficiently involved as support to primary health care workers, and with concessions for the benefits of community knowledge and rapport gained from use of community-based primary health care staff. The latter is likely to benefit culturally distinct Canadian populations (e.g. Aboriginal communities, residents of northern territories). As well, DIS programming from the US may warrant further study and comparison with Canadian PN resources.

The influence of social factors and client perceptions of Chlamydia PN have been given insufficient attention in the research literature. According to some research, factors that influence the acceptability of PN activities include sex and age, as well as nature of relationship (e.g. main, former, or casual partner), and perceptions about *C. trachomatis* transmission. It's also known that men are less likely to be screened for Chlamydia and male gender norms are associated with less active health seeking. Thus, males with asymptomatic Chlamydia infections are thought to be important factors in transmission and endemic levels of Chlamydia. Psychosocial factors influencing male perceptions and acceptance of PN services may require further study.

Other questions remain. For example, it is unclear whether flexible PN strategies allow for greater responsiveness to varying needs within the population and reduce disparities,

or give allowance to deliver minimal or different Chlamydia PN services where there are resource constraints or biases in service delivery. Equitable access to PN services, as well as acceptable services, among regional, gender, ethnic, racialized, and sexual identity populations require attention to achieve effective, targeted PN services. The study of sub-populations specific to Canada is warranted. We may also need to know more about sexuality in Canadian culture and whether and how sexual behaviour is changing, which may include the influence internet-based communications have had on anonymous sexual partnering.

Conclusions

Together with screening and the promotion of safe sex, partner notification remains important to Chlamydia control and management in Canada. However, knowledge of Chlamydia PN effectiveness is limited by the availability of Canadian research, lack of specificity concerning Chlamydia PN results, lack of consensus on standards of evidence and on outcome measures to track. Canadian guidelines are generally in line with those in other developed nations and priorities reflect patterns in surveillance data, although they may indicate the need for improved strategies specific to the territories. They may also do more to signal attention to the needs of MSM and other minorities at elevated risk in contemporary Canadian social contexts, while maintaining recognition for women, youth, and children among priority populations. The importance of gender norms and power dynamics to the sexual transmission of illness may also be considered and include strategies to better address the acceptability of PN services for males. Strategies to address multi-partner sexual relations and anonymous pairings appear lacking, although concurrent partnership has been shown to be distinct factor in the transmission of *C. trachomatis*. The range and flexibility of PN services recommended by Canadian guidelines are not inconsistent with evidence, although without minimal standards for practice, enhancements to patient-delivered referral services and more

intensive activities with proven effectiveness, may be lost in practice in favor of less expensive simple patient referral. Regular surveillance of Chlamydia PN services and outcomes would provide a necessary basis for further directions in practice. Awareness building and education on Chlamydia PN among general physicians and the public would be important to pursue, given not only the increasing rates of reported cases and the seriousness of long-term complications, but the common reliance on primary care and self-referral reported in the literature.

Acknowledgements

This review was funded by the National Collaborating Centre for Infectious Diseases (NCCID) as part of a series of evidence reviews on partner notification for sexually transmitted and blood borne infections. It draws on some preliminary work performed by Dr. Pamela Leece who—with supervision from Dr. Herveen Sachdeva and expert advice from Dr. Rita Shahin—devised a methodology for the review, gathered peer-reviewed literature (1996-2011), and tabulated summaries of key research findings and partner notification policies and practice in several jurisdictions. Dr. Leece is gratefully acknowledged for these contributions, which are described in the methods section and in tables included in the appendices to this document. As well, thanks go to staff of the NCCID, specifically to Margaret Haworth-Brockman, Program Manager, and Dr. Eve Cheuk, Project Manager, for their assistance in framing the work and editing the document. Interpretations of the evidence were made by the contracted author. Any errors and omissions are the responsibility of the contractor and do not necessarily express the views of NCCID or its funder.

References

- Public Health Agency of Canada. Report on sexually transmitted infections in Canada: 2010. 2012:66 p.
- Wright A, Chippindale S, Mercey D. Investigation into the acceptability and effectiveness of a new contact slip in the management of Chlamydia trachomatis at a London genitourinary medicine clinic. *Sex Transm Infect* 2002 DEC 2002;78(6):422-424.
- Yu Y, Frasure-Williams JA, Dunne EF, Bolan G, Markowitz L, Bauer HM. Chlamydia partner services for females in California family planning clinics. *Sex Transm Dis* 2011 OCT 2011;38(10):913-918.
- Howell MR, Kassler WJ, Haddix A. Partner notification to prevent pelvic inflammatory disease in women; cost-effectiveness of two strategies. *Sex Transm Dis* 1997;24(5):287-292.
- Wilson TE, Hogben M, Malka ES, Liddon N, McCormack WM, Rubin SR, et al. A randomized controlled trial for reducing risks for sexually transmitted infections through enhanced patient-based partner notification. *Am J Public Health* 2009 2009;99:S104-S110.
- Rothenberg R. The transformation of partner notification. *Clin Infect Dis* 2002;35(Suppl 2):S138-S145.
- Arthur G, Lowndes CM, Blackham J, Fenton, K.A. & The European Surveillance of Sexually Transmitted Infections Network. Divergent approaches to partner notification for sexually transmitted infections across the European Union. *Sex Transm Dis* 2005;32(12):734-741.
- Public Health Agency of Canada. Canadian guidelines on sexually transmitted infections - Updated January 2010. 2010; Available at: <http://www.phac-aspc.gc.ca/std-mts/sti-its/cgsti-ldcits/index-eng.php>. Accessed August 20, 2013.
- Apoola A, Beardsley J. Does the addition of a urine testing kit to use of contact slips increase the partner notification rates for genital Chlamydial infection? *Int J STD AIDS* 2009 NOV 2009;20(11):775-777.
- Bell G, Potterat J. Partner notification for sexually transmitted infections in the modern world: a practitioner perspective on challenges and opportunities. *BMJ* 2011;87(Suppl 2):ii34-ii36.
- Mathews C, Coetzee N, Zwarenstein M, Lombard C, Gutmacher S, Oxman A, et al. A systematic review of strategies for partner notification for sexually transmitted diseases, including HIV/AIDS. *Int J STD AIDS* 2002 MAY 2002;13(5):285-300.
- Stoner BP, Whittington WL, Hughes JP, Aral SO, Holmes KK. Comparative epidemiology of heterosexual gonococcal and Chlamydia networks: Implications for transmission patterns. *Sex Transm Dis* 2000;27(4):215-223.
- Aral SO, Hughes JP, Stoner B, et al. Sexual mixing patterns in the spread of gonococcal and Chlamydial infections. *Am J Public Health* 1999;89:825-833.
- Potterat J, Zimmerman-Rogers HP, Muth SQ, et al. Chlamydial transmission: Concurrency, reproduction number, and the epidemic trajectory. *Am J Epidemiol* 1999;150(2):1331-1339.
- Brewer DD. Case-finding effectiveness of partner notification and cluster investigation for sexually transmitted diseases/HIV. *Sex Transm Dis* 2005 FEB 2005;32(2):78-83.
- Andersen B, Ostergaard L, Moller JK, Olesen F. Home sampling versus conventional contact tracing for detecting Chlamydia trachomatis infection in male partners of infected women: randomised study. *BMJ* 1998 1998 Jan 31;316(7128):350-351.
- Kissinger P, Mohammed H, Richardson-Alston G, Leichter JS, Taylor SN, Martin DH, et al. Patient-delivered partner treatment for male urethritis: A randomized, controlled trial. *Clinical Infectious Diseases* 2005 SEP 1 2005;41(5):623-629.
- Ostergaard L, Andersen B, Moller JK, Olesen F, Worm AM. Managing partners of people diagnosed with Chlamydia trachomatis: a comparison of two partner testing methods. *Sex Transm Infect* 2003 OCT 2003;79(5):358-362.
- Cameron ST, Glasier A, Scott G, Young H, Melvin L, Johnstone A, et al. Novel interventions to reduce re-infection in women with Chlamydia: a randomized controlled trial. *Human Reproduction* 2009 APR 2009;24(4):888-895.
- Golden MR, Whittington WLH, Handsfield HH, Hughes JP, Stamm WE, Hogben M, et al. Effect of expedited treatment of sex partners on recurrent or persistent gonorrhoea or Chlamydial infection. *N Engl J Med* 2005 FEB 17 2005;352(7):676-685.
- Mathews C, Coetzee N, Zwarenstein M, Lombard C, Gutmacher S, Oxman A, et al. Strategies for partner notification for sexually transmitted diseases. *Cochrane database of systematic reviews (Online)* 2001 2001(4):CD002843-CD002843.
- Workowski KA, Berman S. Sexually transmitted diseases treatment guidelines, 2010. *Morbidity and Mortality Weekly Reports, Centres for Disease Control and Prevention* December 17, 2010;59(RR-12):August 20, 2013-1-110.
- Horner PJ, Boag F. UK national guideline for the management of genital tract infection with Chlamydia trachomatis. London, UK.: British Association of Sexual Health and HIV (BASHH).; 2006.
- Australasian Society for HIV Medicine Inc. Australasian contact tracing manual, edition 3. 2006.
- European Centre for Disease Prevention and Control. ECDC guidance: Chlamydia control in Europe. 2009.
- European Centre for Disease Prevention and Control. Technical report: Review of Chlamydia control activities in EU countries. 2008.
- Mickiewicz T, Al-Tayyib A, Mettenbrink C, Rietmeijer C. Use and effectiveness of expedited partner therapy in an inner-city STD clinic. *Sex Transm Infect* 2011 JUL 2011;87:A93-A94.
- Kerani RP, Fleming M, DeYoung B, Golden MR. A randomized, controlled trial of inSPOT and patient-delivered partner therapy for gonorrhoea and Chlamydial Infection among men who have sex with men. *Sex Transm Dis* 2011 OCT 2011;38(10):941-946.
- Golden MR, Anukam U, Williams DH, Handsfield HH. The legal status of patient-delivered partner therapy for sexually transmitted infections in the United States - A national survey of state medical and pharmacy boards. *Sex Transm Dis* 2005 FEB 2005;32(2):112-114.
- Stokes T, Schober P. A survey of contact tracing practice for sexually transmitted diseases in GUM clinics in England and Wales. *Int J STD AIDS* 1999;10:17-21.
- Golden MR, Hogben M, Handsfield HH, St Lawrence JS, Potterat JJ, Holmes KK. Partner notification for HIV and STD in the United States: Low coverage for gonorrhoea, Chlamydial infection, and HIV. *Sex Transm Dis* 2003 JUN 2003;30(6):490-496.
- Low N, McCarthy A, Roberts TE, Huengsberg M, Sanford E, Sterne JAC, et al. Partner notification of Chlamydia infection in primary care: randomised controlled trial and analysis of resource use. *Br Med J* 2006 JAN 7 2006;332(7532):14-18.
- Golden MR, Whittington WL, Gorbach PM, Coronado N, Boyd MA, Holmes KK. Partner notification for Chlamydial infections among private sector clinicians in Seattle-King County: a clinician and patient survey. *Sex Transm Dis* 1999 Oct;26(9):543-547.
- St. Lawrence JS, Montano DE, Kasprzyk D, Phillips WR, Armstrong K, Leichter JS. STD screening, testing, case reporting, and clinical and partner notification practices: A national survey of US physicians. *Am J Public Health* 2002;92(11):1784-1788.
- Andersen B, Ostergaard L, Nygard B, Olesen F. Urogenital Chlamydia trachomatis infections in general practice: diagnosis, treatment, follow-up and contact tracing. *Fam Pract* 1998;15(3):223-228.
- Macke BA, Hennessy M, McFarlane MM, Bliss MJ. Partner notification in the real world: A four site time-allocation study. *Sex Transm Dis* 1998 Nov 1998;25(10):561-568.
- Herzog SA, McClean H, Carne CA, Low N. Variation in partner notification outcomes for Chlamydia in UK genitourinary medicine clinics: multilevel study. *Sex Transm Infect* 2011 Aug 2011;87(5):420-425.
- Trelle S, Shang A, Nartey L, Cassell JA, Low N. Improved effectiveness of partner notification for patients with sexually transmitted infections: systematic review. *Brit Med J* 2007;334(7589):354-357.
- Hogben M, Kissinger P. A review of partner notification for sex partners of men infected with Chlamydia. *Sex Transm Dis* 2008 NOV 2008;35(11 Suppl):S34-S39.

40. Oh MK, Boker JR, Genuardi FJ, Cloud GA, Reynolds J, Hodgens JB. Sexual contact tracing outcome in adolescent Chlamydial and gonococcal cervicitis cases. *Journal of Adolescent Health* 1996 JAN 1996;18(1):4-9.
41. McCree DH, Liddon NC, Hogben M, St Lawrence JS. National survey of doctors' actions following the diagnosis of a bacterial STD. *Sex Transm Dis* 2003;79(3):254-256.
42. Scott Lamontagne D, Baster K, Emmett L, Nichols T, Randall SM, L., Meredith P, et al. Incidence and re-infection rates of genital Chlamydial infection among women aged 16-24 years attending general practice family planning and genitourinary medicine clinics in England: a prospective cohort study. *Sex Transm Infect* 2007;83(4):292-303.
43. Althaus CL, Heijne JCM, Herzog SA, Roellin A, Low N. Individual and population level effects of partner notification for Chlamydia trachomatis. *PloS one* 2012 2012 (Epub 2012 Dec 12);7(12):e51438.
44. Macke BA, Maher JE. Partner notification in the United States - An evidence-based review. *Am J Prev Med* 1999 OCT 1999;17(3):230-242.
45. Oxman AD, Scott EAF, Sellors JW, Clarke JH, Millson ME, Rasooly I, et al. Partner notification for sexually transmitted diseases - an overview of the evidence. *Canadian Journal of Public Health-Revue Canadienne De Sante Publique* 1994 JUL-AUG 1994;85:S41-S47.
46. Trelle S, Shang A, Nartey L, Cassell JA, Low N. Revised rapid review of evidence for the effectiveness of partner notification for sexually transmitted infections including HIV. 2006:167 NICE.
47. Edmiston N, Merritt T, Ooi C. Make contact: a comparative study of contact tracing strategies. *Int J STD AIDS* 2010 JUN 2010;21(6):431-434.
48. Brewer DD, Potterat JJ, Muth SQ, Malone PZ, Montoya P, Green DL, et al. Randomized trial of supplementary interviewing techniques to enhance recall of sexual partners in contact interviews. *Sex Transm Dis* 2005 MAR 2005;32(3):189-193.
49. Hennessy M, Williams SP, Mercier MM, Malotte CK. Designing partner-notification programs to maximize client participation - A factorial survey approach. *Sex Transm Dis* 2002 FEB 2002;29(2):92-99.
50. Eitrem R, Erenius M, Meeuwisse A. Contact tracing for genital Chlamydia trachomatis in a Swedish county. *Sex Transm Dis* 1998 SEP 1998;25(8):433-436.
51. Carre H, Boman J, Osterlund A, et al. Improved contact tracing for Chlamydia trachomatis with experienced tracers, interviewing for one year back in time and by phone in remote areas. *Sex Transm Infect* 2008;84(3):239-242.
52. Apoola A, Boothby M, Radcliffe K. Is telephone follow-up as good as traditional clinic follow-up in achieving the proposed national outcome standards for Chlamydia management? *Int J STD AIDS* 2004 JUN 2004;15(6):376-379.
53. Kissinger P, Brown R, Reed K, Salifou J, Drake A, Farley TA, et al. Effectiveness of patient delivered partner medication for preventing recurrent Chlamydia trachomatis. *Sex Transm Infect* 1998 OCT 1998;74(5):331-333.
54. Schillinger JA, Kissinger P, Calvet H, Whittington WLH, Ransom RL, Sternberg MR, et al. Patient-delivered partner treatment with azithromycin to prevent repeated Chlamydia trachomatis infection among women - A randomized, controlled trial. *Sex Transm Dis* 2003 JAN 2003;30(1):49-56.
55. Turner K, Adams E, Grant A, Macleod J, Bell G, Clarke J, et al. Chlamydia screening and partner notification: a novel tool to calculate costs and cost-effectiveness. *BMJ* 2011;342:c7250.
56. Gift T, Kissinger P, Mohammed H, Leichter J, Hogben M, Golden M. The cost of expedited partner therapy compared to the cost of standard partner referral for the treatment of Chlamydia or gonorrhoea. *Sex Transm Infect* 2011 JUL 2011;87:A62-A62.
57. Laumann EO, Youm Y. Racial/ethnic group differences in the prevalence of sexually transmitted diseases in the United States: A network explanation. *Sex Transm Dis* 1999;26:250-261.
58. Morgan J, Donnell A, Bell A. Is everyone treated equally? Management of genital Chlamydia trachomatis infection in New Zealand. *Int J STD AIDS* 2010;21:595-600.
59. Pulerwitz J, Gortmaker SL, DeJong W. Measuring sexual relationship power in HIV/STD research. *Sex Roles* 2000;42(7/8):637-660.
60. Fortenberry JD. Health care seeking behaviors related to sexually transmitted diseases among adolescents. *Am J Public Health* 1997;87:417-420.
61. Gorbach PM, Sevgi OA, Celum C, Stoner BP, Whittington WLH, Galea J, et al. To notify or not to notify; STD Patients' perspectives of partner notification in Seattle. *Sex Transm Dis* 2000;27(4):193-200.
62. Mimiaga MJ, Reisner SL, Tetu AM, Cranston K, Bertrand T, Novak DS, et al. Psychosocial and behavioral predictors of partner notification after HIV and STI exposure and infection among MSM. *Aids and Behavior* 2009 AUG 2009;13(4):738-745.
63. Blackwell A, Linton D, Emery S, Calvert J. Chlamydia trachomatis infection in a colposcopy unit: an audit of a fast track referral system for infected patients to a genitourinary medicine department and a survey of patients' demography, clinical findings and partner details. *Int J STD AIDS* 2003 OCT 2003;14(10):661-664.
64. Ayuk PT, Dudley S, McShane H, Rees M, Mackenzie IZ. Efficacy of follow-up and contact tracing of women who test positive for genital tract Chlamydia trachomatis prior to pregnancy termination. *Journal of obstetrics and gynaecology*: 2004 2004-Sep;24(6):687-9.
65. Estcourt C, Sutcliffe L, Cassell J, et al. Can we improve partner notification rates through expedited partner therapy in the UK? Findings from an exploratory trial of accelerated partner therapy (APT). *Sex Transm Infect* 2012;88(1):21-26.
66. Packel LI, Guerry S, Bauer HM, Rhew M, Chow J, Samuel M, et al. Patient-delivered partner therapy for Chlamydial infections: Attitudes and practices of California physicians and nurse practitioners. *Sex Transm Dis* 2006;33:458-463.
67. Brook MG, Rusere L, Coppin-Browne L, McDonagh S, McSorley J. A prospective study of the effectiveness of electronic patient records in rapid-cycle assessment of treatment and partner notification outcomes for patients with genital Chlamydia and gonorrhoea infection. *Sex Transm Infect* 2011;87:152-155.



National Collaborating Centre
for Infectious Diseases

Centre de collaboration nationale
des maladies infectieuses

515 PORTAGE AVENUE, WINNIPEG, MB R3B 2E9
204.943.0051
NCCID@ICID.COM
WWW.NCCID.CA

Production of this document has been made possible through a financial contribution from the Public Health Agency of Canada.

The views expressed herein do not necessarily represent the views of the Public Health Agency of Canada.