



Evidence Review

Partner Notification

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HIV Partner Notification: A review of the evidence with recommendations to move the field forward

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Introduction

HIV partner notification (PN) is mandated in Canada. According to Canadian STD guidelines, the treating physician is responsible for ensuring PN is initiated and public health authorities are available to assist [1]. Provincial and territorial health authorities for Ontario, British Columbia, Alberta and Northwest Territories have each issued guidelines addressing HIV PN [2-5]. Provincial and territorial health authorities for Ontario, British Columbia, Alberta and Northwest Territories have also issued guidelines that mandate the provision of PN [2-5]. However, guidelines are non-prescriptive and provincial PN practices are known to differ from policy and legislation [6], most adopting informal and often voluntary contact tracing procedures that respect rights to privacy and avoid coercion [7].

Despite being mandated in Canada, there is a dearth of published evidence on HIV PN in the Canadian context. There is one 1994 survey of the organization and practice patterns of Canadian HIV PN programs [8]. However, there appear to be no previous or subsequent Canadian HIV PN published peer-reviewed studies. It is unknown how Canadian HIV PN programs have developed and responded to the evolution of the Canadian HIV epidemic. There are gaps in knowledge concerning the current practice, coverage and effectiveness of HIV PN in Canada and how they vary by region or local context. The lack of published evidence on HIV PN in Canada hinders the development of the field. It also shows the need for national leadership and coordination.

Key Points

- HIV PN programs were designed to identify and notify those who may have undiagnosed HIV so that through testing, counselling and treatment further HIV transmission may be prevented. The most common goals of HIV PN were case-finding and long-term behaviour changes [1-7].
- Patient referral was the most effective referral type for notifying current primary partners [2, 8-10]. It also used less human resources [10-12]. Provider referral was most effective for notifying past and/or casual partners [2, 13, 14]. Contract referral appeared to be a promising option. It combined the economic benefits of patient referral with the assurance of provider referral as a contingency [10, 11, 15].
- It was challenging comparing results from different HIV PN studies. An outcome-classification standard would be beneficial to aid monitoring, evaluation and cross-country comparisons [16]. It is important that reports state the period of interest –the time period for which index patients report all their partners. Reports should state whether outcomes were provider-verified or patient-reported, whether both needle-sharing partners and sex partners were elicited and whether un-locatable partners were excluded from the denominators [1, 2, 15, 16].
- Case-finding effectiveness varied considerably by PN programming, HIV prevalence and the estimated proportion of undiagnosed HIV [6, 17]. However, case-finding effectiveness was maximized by

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Knowledge that's contagious!

Des savoirs qui se transmettent!

This review analyses peer-reviewed published evidence on HIV PN with special consideration for its application to the current Canadian context. The review focuses on the goals, methods and effectiveness of HIV PN. It will also discuss some of the challenges in conducting HIV PN, as well as some of the strategies to overcome these challenges. It will not discuss the ethical and legal implications of index patients who do not notify their partners.

Objective

The objective of this review is to analyze the peer-reviewed published evidence on HIV Partner Notification (PN) with special consideration for its application to the current Canadian context. Important findings and knowledge gaps are also identified to inform the development of Canadian HIV PN.

Methods

The Boolean logic used for the literature search was "(HIV OR AIDS OR HIV-1 OR HIV-2 OR "HIV infection" OR "sexually transmitted infection" OR "sexually transmitted disease") AND ("partner notification" OR "contact tracing")". It was applied to five databases: Cochrane Library (1 hit), Ovid Medline (780 hits), PsychINFO (105 hits), EMBASE (1,121 hits), Scopus (139 hits). This yielded a total of 2,014 unique English language hits. Of these, 91 relevant articles were identified based on titles and abstracts. A full review was conducted on these 91 articles. Additional sources reviewed included 37 articles from the reference lists of relevant articles, as well as 3 references from the presentations at the National Collaborating Centre for Infectious Diseases (NCCID) consultation: A Mixed-Methods

Key Findings *continued from p.1*

- focusing on index patients with incident HIV infections [2, 7, 17], not contacting partners known to be HIV-positive [2, 18] and using peer-driven cluster referral [6-9]. Improving case-finding also had the potential added advantage of augmenting the benefits of using treatment as a prevention strategy [17, 19, 20].
- HIV PN was found to have the potential to initiate short and long-term behaviour changes in both index patients and notified partners [3-5]. Notified partners, both those who tested HIV-positive and those who tested HIV-negative, were found to significantly decrease their mean number of sex partners and increase their condom use [3-5].
- HIV PN programs were cost-effective for HIV prevention and control both for infections found and infections prevented. HIV PN programs were considered cost-effective if they found a new HIV infection for less than \$30,000 [21]. Studies observed that HIV PN programs cost less than 25% of this threshold [7]. HIV PN programs were estimated to cost \$6,100 per infection prevented, while the average HIV infection cost \$385,200 in medical care. It was also found that HIV PN tended to reach fewer people than other HIV prevention programs, but when it did reach people, it had more impact [22, 23].
- Some challenges in conducting HIV PN were index patients forgetting their partners, partners not completing HIV testing, the low coverage of the programs and dealing with un-locatable partners and index patients' who are unwilling to notify their partners. One strategy was to use recall cues when eliciting partner information to help index patients remember their partners [21-24]. Another strategy was to use HIV field-testing and rapid-testing at the time of notification to help partners complete HIV testing, particularly for those facing barriers to seeking medical care [6, 17]. HIV PN programs were also able to market HIV PN programs to HIV-related providers and form partnerships with community-based organizations to improve coverage [17]. The strategy of using treatment as prevention showed little promise of improving HIV PN outcomes [2]. The patient-physician relationship between HIV medical providers and index patients was more predictive of an improvement of HIV PN outcomes than the treatment itself. Another strategy being developed is the use of internet and email applications to reach previously un-locatable partners [24-29].

Approach to Address Challenges Related to Sexually Transmitted and Blood-Borne Infection (STBBI) Partner Notification in Canada.

The sources were evaluated based on two priorities: high quality peer-reviewed research articles, and relevance to the current Canadian context. Quality was assessed by using the recommendations of Heller and colleagues from Critical appraisal for public health: a new checklist [9] as a guide. Relevance to the current Canadian context was assessed based on the location of the study, its relevance to Canadian high-risk populations and its relevance to the realities of the Canadian healthcare and public health system. The findings of studies conducted in the United States (US) were considered applicable to Canada. Although Canada has universal health care and the US does not, the majority of health services and programs conducted in connection to HIV PN were free public health services in both countries [11-13]. Furthermore, in both countries, HIV infection is reportable, with structures and guidelines for follow-up and PN [10, 12-14].

Evidence was extracted and analysed to best answer questions concerning the goals of HIV PN, the role of early treatment in HIV PN, the effectiveness of PN in HIV prevention and control and the role of PN in risk behaviour modification. Preference was also given to findings published from 2000 onwards. The results of these studies were thought to better reflect the current context of HIV/AIDS prevention where highly active antiretroviral therapy (HAART) is available and most jurisdictions have multi-sectored strategies for fighting the HIV/AIDS epidemic [1, 12, 13, 15, 16]. As a result, evidence published before 2000 was interpreted with added caution

The Structure of HIV PN Programs

Goals of HIV PN

The cited goals of HIV PN focused on preventing HIV transmission through case-finding and long-term behaviour changes [15, 17-19]. PN programs were designed to identify persons most likely to have undiagnosed HIV, particularly those who had sexual contacts with HIV positive individuals. The intent was to encourage these persons to undergo HIV counselling and testing so that they modify their behaviours to prevent future HIV transmission [14, 15, 17,

20-23]. Another goal of HIV PN was to increase early HIV diagnoses. This was desirable due to its implications for HIV transmission, the prognosis of HIV infections and the cost of HIV care [24-26].

As a result of these HIV PN goals, partners who were known to be HIV-positive were not notified. Partners of HIV-negative or unknown HIV status were prioritized, particularly when unprotected sex was known to have occurred [18, 27, 28]. This maximizes HIV PN's case-finding potential. However, it may be a missed opportunity for encouraging long-term behaviour change. Future research should explore whether notifying HIV-positive individuals that their partners have acquired HIV infection is a cost-effective strategy to motivate them to be more diligent about having protected sex with their current and future partners

Referral Types

Patient referral

Patient referral potentially uses less HIV PN program human resources than other referral types because the index patients¹ contact and notify their partners [15, 19, 29]. The programs typically involve health service personnel eliciting the partners the index patients had in the period of interest². The index patients are also counselled on how best to notify their partners [15, 19, 29]. They may also receive reminder phone calls and contact or referral cards from the HIV PN program to help facilitate the PN process [28, 29].

Patient referral works best under specific conditions. A study using logistic regression to identify factors associated with successful patient referral found that having no casual sex partners was correlated with successful patient referral (AOR³: 2.36, 95% CI: 1.37-4.09)[16]. Index patients who reported unprotected sex acts were also more likely to report completing patient referral (AOR: 2.08, 95% CI: 1.28-3.39). Another correlated factor was the number of locatable partners. The adjusted odds ratio for successful patient referral was 0.86 (95% CI: 0.76 – 0.94) in those with one additional locatable partner

¹ The HIV-positive individual having the partners notified

² The period of time for which the index patient should report all their sexual partners.

³ AOR = Adjusted Odds Ratio

relative to those with one less locatable partner [16]. This study did not record what types of partners were successfully contacted through patient referral (e.g. main versus casual). However, other studies have found that patient referral appears more effective for notifying index patients' current primary partners than past or casual partners [15, 32, 33].

One of the main criticisms of patient referral is that index patients require anonymity in the PN process and will not choose to self-notify [34, 35]. However, studies published in 1992 and 1998 found that 55-73% of survey respondents were willing to self-notify, depending on the respondents current relationship with their partner and whether the respondents were active drug users [36-39]. Furthermore, subsequent studies in the HAART era have also found patient referral to be acceptable to the majority of index patients [18, 36, 40]. A 2002 study observed willingness to self-notify among 97% of men who have sex with men (MSM), 96% of men who have sex with women, 94% of women who have sex with men and 97% of drug users in their study population [40]. A 2009 study also found that index patients chose to notify 84% of all locatable partners via patient referral [18]. Thus, patient referral appears to be an acceptable option for index patients in the US. Studies are needed to determine the acceptability of patient referral in the Canadian context.

Most published HIV PN research comparing referral types occurred before comprehensive national HIV prevention policies and HAART became widely available in the mid-1990s [13, 16, 18, 41]. Evidence from the pre-HAART era suggested that patient referral was less effective than provider referral [36]. However, these conclusions were heavily based on two small randomized control trials (RCT) from the 1990s [34, 35]. For these two RCTs, intention to treat analysis, blinding and the baseline comparability of the intervention versus the control group were not clear [29, 34, 35]. Furthermore, in the Landis study the concealment of randomisation was also not clear [29, 34]. In terms of generalizability, the Landis study population was sampled from a US public health department program and index patients were 69% male and 35% injection drug users (IDU)[29, 34]. The Levy study population were IDUs recruited from a community-based service in a poor,

high crime, urban area in the US [29, 35]. These were the only two RCTs on HIV PN referral types. RCTs on HIV referral types have not been conducted since widespread use of HAART [41]. Thus, given the advancements in HIV treatment and awareness since 2000, the acceptability of patient referral and its potential economic benefits, the effectiveness of patient referral should be re-examined.

Provider referral

Provider referral occurs when a third party, typically a health service provider, notifies the elicited partners [19, 29]. If a provider gives the index patient counsel or advice about notifying her or his partners but leaves it to the patient to notify the partners, this would be classified as a form of patient referral [27]. In provider referral, the provider must not simply initiate the PN process with the index patients; they must also be the one to notify the partners.

Studies published prior to 2000 found provider referral to be more effective than patient referral [35, 36, 42-46]. However, subsequent studies in the HAART era found that provider referral appeared more effective for notifying casual partners, while patient referral appeared more effective for notifying primary partners [18, 36]. One cited benefit of provider referral, particularly in the pre-HAART era, was that index patients preferred the anonymity of provider referral and would not complete PN unless a provider notified their partners [34, 35]. However, with respect to patient preferences, more recent evidence seems less conclusive. A 2001 study observed that 70% of cases chose patient referral and only 2% used provider referral [47]. One 2003 study found 42% of respondents preferring provider referral for its anonymity [48]. A 2009 study found that only 14% of participants chose provider referral over patient referral [18].

Provider referral is an essential component of HIV PN, especially because of its effectiveness in notifying casual partners. However, PN programs may benefit from supplementing it with other methods like patient referral. Index patients appear more open to completing HIV PN through patient referral, particularly for primary partners, and this could result in significant cost-savings for HIV PN programs.

As health service personnel take the responsibility for PN, questions arise as to which personnel should



do PN. Provider referral may be conducted by clinical health service personnel who help oversee and protect the health of index patients. This could be the index patient's doctor, nurse practitioner or nurse. However, provider referral is more commonly conducted by public health service personnel whose focus is to help oversee and protect the health of the public [27, 49]. This could include public health nurses or other public health staff assigned to PN.

According to Canadian guidelines, PN has typically been conducted by nurses and doctors and is perceived to be the treating doctors' responsibility [6, 8, 12]. However, based on evidence from the US, public health personnel specifically trained and paid to conduct PN, disease intervention specialists (DIS), did PN better than doctors [27, 49, 49]. A study comparing community clinicians to DIS in New York City found that DIS were more effective at both eliciting and notifying partners [27]. In this study, index patients who used DIS for PN were diagnosed in STD clinics and those who used community clinicians were diagnosed at non-STD facilities. Despite some differences in the clinic populations, DIS elicited more partners per index patient within all demographic and risk sub-groups⁴. Clinicians only facilitated the entire PN process for 47% of elicited partners; they referred the remaining partner information to DIS. For those elicited partners where clinicians facilitated the entire PN process, 71% of elicited partners were

⁴ Demographic and risk groups used were: age (13-29, 30-39, 40-49, 50+), sex, race (black, Hispanic, white, other/unknown), neighbourhood income category (<20% below poverty line, at least 20% above poverty line, unknown), transmission risk (MSM, IDU, Heterosexual, Other/unknown), concurrent HIV/AIDS (yes, no).

notified. But it must be noted that clinicians only notified 15% of these partners. The other 85% of these notifications happened through patient referral, where the clinician elicited the partners and the index patients notified their partners. When clinicians elicited partners and referred this information to DIS for notification, only 28% were notified because 53% of the partners the clinicians referred had inadequate locating information. As a result, only 48% of all partners with unknown HIV status that were elicited by community clinicians were notified; whereas this proportion was 71% for DIS.

It is hypothesized that DIS have better PN outcomes because they are specifically trained and paid to conduct PN [27]. For DIS, PN is not competing with other clinical or public health responsibilities. However, studies have not compared the outcomes of DIS in different states or organizations by training, work structure or interview styles. Similar research on PN outcomes by provider type (physician, nurse practitioner, public health nurse or other public health personnel), training, work structure or interview styles has also not been conducted in Canada.

Currently, the Public Health Agency of Canada (PHAC) states that it is the responsibility of the treating physician to initiate PN [1]. However, given the success of US HIV PN programs using DIS, Canadian programs should explore training PN-dedicated public health personnel to conduct PN.

Contract referral

In contract referral the index case agrees to notify partners within a certain timeframe but if they do not, the provider completes the process [15, 19, 51]. Contract referral programs verify whether or not the index patient notified their partners by either the index patient's self-report or the elicited partner coming to the clinic for testing or an appointment within the allotted timeframe [15, 19, 34]. Contract referral programs must be careful to give index patients sufficient time to process their own diagnosis and notify their partners. Future research on contract referral should report and compare the success of different timeframes.

Contract referral has great potential for increasing the economic efficiency of HIV PN. It combines the economic benefits of patient referral with the assurance of provider referral as a contingency. However,

few studies have evaluated contract referral in comparison to provider and/or patient referral [15, 19]. This is an area for further research. The partner notification guidelines for Northwest Territories and Alberta outline a contract referral structure for index cases choosing to self-notify [4, 5]. Evaluations of these two systems would be informative.

Other Mixed Methods

Some programs give their index patients the choice of whether they will notify their partners through patient referral or provider referral [18, 28]. In this approach index patients can designate some partners for patient referral and others for provider referral. As with contract referral, this could be economical because patients can choose to notify some of their partners themselves. The main difference from contract referral is the lack of contingency. The HIV PN service providers do not take responsibility for notifying the partners designated for patient referral that the index patients did not notify. This system may cost less than contract referral to implement. Human resources aren't spent verifying patient referral notifications and reassigning un-notified partners to provider referral. However, these cost-savings are at the expense of quality control.

HIV Testing

Some HIV PN studies have reported the proportion of notified partners getting tested. A systematic review of nine US HIV PN studies found that on average 63% of notified partners were tested for HIV [15]. However, having a notified partner tested will not accomplish all the HIV PN goals unless the partner receives the test result. Studies on general HIV testing and counselling programs found that among people testing for HIV at STD clinics, over 50% did not return for their results, and of those who tested positive, 60% did not return [52, 53]. In outreach settings it was estimated that 18-43% of those tested for HIV did not return [54]. Another study estimated that 10-27% of its study population that consisted of MSM, IDUs and heterosexuals at STI clinics did not return for their HIV test results [55]. Although these studies were for general HIV testing and counselling programs, and therefore were not specific to the HIV PN context, their results still warrant concern that partners may not return to receive their test results.



To improve HIV testing outcomes, some HIV PN programs have successfully implemented field-testing, where tests are done at the time of notification. This improved outcomes for those who accepted testing less frequently and may have barriers to seeking medical care [56]. Other HIV PN programs also offered rapid testing and found that 94% of clients received their results. Although positive rapid tests would require confirmatory testing, this approach is thought to be cost-effective because less time is spent following up on negative test results and earlier results may cause an earlier change in risk behaviours [28]. Field and rapid-testing are two promising approaches that may be particularly useful for HIV PN in remote communities in Canada.

Outcomes

As case-finding, behaviour change and prevention are HIV PN priorities; the outcomes most commonly assessed reflect this. These are:

- “number needed to be interviewed to find a new HIV case” (NNTI_{new});
- “number needed to be interviewed to find any HIV case” (NNTI_{any});
- “number of new infections diagnosed per case”, also known as the “brought-to-treatment index” which is the inverse of NNTI_{new};
- “overall number of HIV-infected partners counselled”; and
- “number of partners elicited for PN” [56, 57].

Another factor that can affect the comparability of outcomes is the definition of the period of interest.

One study defined this as the previous year or three months before the index patients' last negative HIV test result [21]. Another study defined the period of interest as the six months prior to HIV diagnosis [14]. Other studies do not report the period of interest used in their PN program [56]. Future research on HIV PN outcomes should report period of interest. It would also be beneficial for Canadian authorities to standardise the principles advising the period of interest to improve the comparability of HIV PN outcomes.

It would be worthwhile for Canadian researchers and public health professionals to develop and agree on a standard for classifying and calculating outcomes. In the US, DIS use an outcome classification standard that differentiates between partners that are:

- previous positive;
- previous negative, new positive;
- previous negative, still negative;
- not previously tested, new positive;
- not previously tested, new negative;
- not previously tested, not tested now;
- insufficient information to begin investigation;
- unable to locate;
- located, refuse counselling and testing;
- out of jurisdiction; and
- other [49].

This level of detailed information would be very useful for the evaluation of Canadian programs. Among other things it can help identify the prevalence of previous testing among high-risk groups, the acceptability of testing and counselling among notified partners and the extent to which insufficient locating information is an issue.

HIV PN Effectiveness

Case-finding effectiveness

HIV PN is useful for case-finding because it can reach those who may not otherwise be tested for HIV because they were unaware that they had sexual contact with an HIV-infected individual. A study found that 22% of tested partners had never been tested for HIV and 41% had no plans to be tested in the next six months [28]. However, the effectiveness of HIV PN as a case-finding strategy also depends on the population's HIV prevalence and the proportion

of undiagnosed HIV. The higher the HIV prevalence, the greater the chances of finding cases but as the proportion of undiagnosed HIV decreases the NNTInew is likely to increase [28, 56]. Thus, the NNTInew of HIV PN programs can vary considerably even when the programs have similar structures. A survey of 28 US jurisdictions with over 500,000 population and over 200 AIDS cases in 2001 found the average NNTInew to be 14 but the range was 1 to 196 [58]. Given this level of variability, it is difficult to define a target NNTInew for Canadian HIV PN programs.

Although the programs and context may differ, one good predictor of effective case-finding was duration of HIV infection. In Quebec, persons within their first six months of HIV infection transmitted half of the new HIV infections from 2001 to 2005 [59]. Therefore, it is not surprising that HIV PN on newly infected index patients tends to yield lower NNTInew than PN for those with long standing infections [21, 28, 57, 60]. A San Francisco study where 89% of participants were MSM found that the case-finding effectiveness of HIV PN was greatest among incident acute infections [21]. In acute infections, 25% of partners identified were newly infected while this figure was 13% and 7% for incident non-acute infections and prevalent long-standing infections, respectively. Although their case-finding yield is high, index patients with acute infections are more difficult to identify. But even to simply focus on incident infections (acute and non-acute) should improve effectiveness, particularly for populations with lower proportions of undiagnosed HIV. A HIV PN program in Los Angeles found that their NNTInew dropped from 179 to 26 when they limited their analysis to index patients diagnosed within 3 months [28]. However, it is noteworthy that this Los Angeles program was based on provider referral. A patient referral study found that the proportion of patients who notified all their locatable partners increased with the time of diagnosis up to 6 months for both those with only one locatable partner and those with multiple locatable partners [18].

Effectiveness in Behaviour Change

HIV PN can contribute to risk behaviour change for index patients and notified partners [61-63]. A meta-analysis on the impact of the awareness of

HIV positivity on sex behaviour change found that the prevalence of unprotected anal or vaginal sex (UAV) with any partner was an average of 53% lower in HIV-positive individuals aware of their status, relative to those unaware of their status [17]. With respect to HIV PN, other studies found that following HIV PN, notified partners decreased their mean number of sex partners and increased condom use. A 1988 study on MSM in which 24% were IDU found that at a six month follow-up interview, notified partners who tested HIV-positive decreased their mean number of partners by 82% [62]. Notified partners who tested HIV-negative decreased their mean number of partners by 54% [62]. A 1991 study in which 75% were MSM and 5% were IDU found that after a 30 month follow-up period, notified partners who tested HIV-positive decreased their mean number of partners by 80% [63]. In this study, notified partners who tested HIV-negative decreased their mean number of partners by 50% [63]. A 2003 study in which 60% were MSM observed that condom use among both index patients and notified partners was higher than the control group [61]. At a six month Follow-up, condom use was reported at 80% by index patients describing partnerships with notified partners, 100% by notified partners describing partnerships with index patients, 50% by index patients describing partnerships with non-notified partners, 38% by notified partners describing partnerships with others and 30% by controls [61]. The evidence of short-term and long-term behaviour change following HIV PN is almost ten years old. It may also be prone to social desirability bias. More recent studies are needed, particularly in the Canadian context. However, the existing evidence shows that HIV PN has the potential to promote short-term and long-term risk behaviour change in index patients, notified partners who test HIV-positive and notified partners who test HIV-negative.

Cost-effectiveness

The cost-effectiveness of HIV PN is dependent on the HIV positivity rate and the cost of HIV PN per person reached [64]. It can be analysed from two perspectives: the cost to prevent an infection and the cost to find a new infection. The average, lifetime direct cost of HIV medical care has been modelled and estimated to be \$385,200 US dollars (USD) [65]. Interventions that prevent an infection for less than this amount are arguably cost-effective. According to decision analytic

modelling by Coco, the cost-effectiveness threshold for finding a new infection is \$30,000 USD [66]. HIV PN programs can meet both of these criteria.

From the perspective of preventing infections, it is estimated that HIV PN costs \$250 per person reached and \$6,100 USD per HIV infection prevented [64, 67]. One study used modelling to analyse the cost-effectiveness of various components of HIV prevention programs in order to optimize HIV prevention spending. It found that HIV PN was the second most cost-effective prevention strategy after single session videos in STD clinics. However, HIV PN reached the least number of people. According to this model, the number of infections PN prevented was equal to 4% of the number of people PN reached. For HIV counselling and testing that number is 0.07% [64, 67]. Thus, although PN reached fewer people, when it reached them it potentially had more impact.

When analysing the cost to find a new infection, HIV PN can also be cost-effective. A San Francisco study found that their HIV PN program cost \$7,081 USD per new case identified from incident HIV index cases [21]. This study estimated that DIS spent an average of 8 hours on PN for each incident HIV index case. For index cases with long-standing HIV infections, it was cost-effective to add HIV PN to an existing syphilis program. For cases with long-standing HIV infections that were already enrolled in syphilis programs, it cost an added \$2,603 to identify a new HIV case. The average additional time DIS spent doing HIV PN, as part of their syphilis program duties, was only 1 hour. In both these programs, the one for incident cases and the one for long-standing infections, the cost for HIV PN to identify one new case was less than 25% of the cost-effectiveness standard. Although one must take into consideration the characteristics of the San Francisco population in generalizing these figures as expenditure targets, these estimates demonstrate that HIV PN can be a cost-effective case-finding strategy.

Added Benefits of HIV PN

Treatment as Prevention

HIV PN can augment the benefits of using treatment as prevention. It can improve case-finding and thereby reduce the proportion of undiagnosed HIV-positive persons who are not receiving the



appropriate treatment. This is important because HAART significantly decreases HIV infectiousness [68]. Sero-discordant heterosexual couples were found to have an 80% reduction in HIV transmission when on treatment [69]. Therefore, HIV PN may increase the potential for treatment to prevent further acquisition of HIV infection by HIV-negative persons.

HIV PN Challenges

Low Coverage

Given the potential effectiveness of HIV PN for prevention and case-finding, there may be many missed opportunities. In 2001 only about one third of persons diagnosed with HIV in the US received HIV PN [58]. Furthermore, a study with participants recruited from Chicago and Los Angeles observed that only 51% of study participants reported that their HIV test provider discussed the need to notify partners [58]. In implementing HIV PN programs in Canada, care should be taken to reach more newly diagnosed HIV patients and the HIV test providers to avoid replicating this issue.

Un-locatable partners

The number of un-locatable partners limits the effectiveness of HIV PN, particularly for MSM [58, 67]. One study with a 75% MSM study population from Chicago and Los Angeles found that 86% of partners were not notified. Of these partners who were not notified, only 11% of them were locatable [16]. Another study with a 50% MSM population

from Chicago, Colorado, Los Angeles, Louisiana, San Francisco and Wisconsin found that only 29% of index clients provided partner-locating information [28]. Of those who gave reasons for not providing information, 12% stated they did not know their partners names [28]. Canadian HIV PN program evaluations may benefit from collecting information on the reasons for not notifying or giving locating information. It may enhance data analysis and provide insight for the development and implementation of strategies to overcome this challenge. For example, understanding whether the majority of partners are un-locatable because they are casual partners found through a particular internet site or social media application may help inform future HIV PN strategy.

Index patients who are unwilling to notify their partners

Although acceptability of PN has increased dramatically since the early stages of the HIV epidemic, there is still room for improvement. Some index patients do not believe they have a responsibility to notify past or casual partners and are less likely to notify a casual partner than a primary partner [70, 71]. Some do not notify because their partners looked healthy [18]. For others, fear of the consequences of participating in PN can still be a barrier. A 2000 study observed that 24% of respondents were fearful about notifying their partner [72]. Furthermore, a 2009 study observed that 8% of respondents did not participate in PN due to fear of loss of anonymity or reprisal from the health department or partners [18]. A study in which 91% of HIV index patients were African-American and 78% were heterosexual found that primary partnerships were less likely to dissolve after PN compared to those where PN was not completed [20]. This study also observed that after PN primary partnerships were less likely to dissolve compared to occasional partnerships (OR: 0.34, CI: 0.19-0.59). However, emotional abuse was experienced at least once in the six months post PN by 24% of partnerships [20]. Physical abuse was experienced at least once in the six months post PN by 9% of partnerships. Therefore, steps should be taken to help index cases understand the importance of HIV PN and the evidence concerning its consequences. Concerns expressed by the index case, about possible abuse, should be taken seriously.

Strategies to Improve HIV PN

Innovations for the HIV PN Interview Process

The quality of the information collected in the interview with the index patients will determine the number of locatable partners. Research has shown that some index patients genuinely forget who their partners were [73, 74]. One effective aid in overcoming this challenge was recall cues [73-75]. It elicited 11-21% more partner names for follow-up. Recall cues involve triggering the index patients' memory by mentioning words like individual characteristics (e.g. brown hair or blue eyes), common first names and meeting locations that may be associated with their past partners. They are inexpensive to implement. Recall cues only require the public health authorities to compile a list of cues that are likely to be relevant to the population being serviced [73, 74]. The health service personnel that elicits partners can then incorporate the cues into the interview, particularly when index patients are having difficulty remembering their partners[76].

Integrating HIV PN into Community-based Organizations

In Los Angeles, the health department built capacity in community-based organizations (CBOs) to conduct HIV PN and improve referrals to the local health departments [28]. HIV medical outpatient clinics at three CBOs hired HIV PN liaisons. CBO counselors and staff were also trained to facilitate the PN process. New index patients were recruited through the CBO's HIV programs (e.g. counselling and testing programs, care and treatment services, support groups and pharmacy visits). After being interviewed, the index patients were asked to bring their partners to the CBO where they could be notified in the presence of the HIV PN liaison. Alternately, index patients could provide their partner information directly to the health department for provider referral [28].

This strategy may be particularly useful in Canadian settings with CBOs that are effective and influential in communities with relatively high HIV incidence rates. It could help to overcome some of the cultural and language barriers to HIV PN. Having the CBO involved may also help reach potential index patients that are distrustful of the local health authorities.

Another potential benefit of this strategy is that it could strengthen communication, collaboration and coordination between public health departments and CBOs. This strategy should be piloted and tested in Canada to assess its potential to improve HIV PN in a Canadian context.

Partner Disclosure Assistance Program

In San Francisco, the public health department implemented a novel approach called the Partner Disclosure Assistance Program (PDAP)[28]. They used counselling and testing providers, medical providers, CBOs working with HIV-infected clients and the local media to market the availability of their PDAP staff to assist in the PN process. HIV-infected persons were encouraged to contact the PDAP staff by phone or email for help with PN. Field-based rapid HIV testing was also made available [28].

This strategy could help increase the coverage of HIV PN and build the capacity of various HIV-related providers to encourage their clients to engage in HIV PN. This strategy may also be particularly effective in Canadian regions or communities with relatively high incidence rates. For example, the PDAP could focus their local media marketing campaign in media outlets that reach demographics that have relatively high incidence rates. This strategy should be piloted and tested in Canada to assess its potential to improve HIV PN in a Canadian context.

Peer-Driven Cluster Referral

To identify more high-risk individuals for testing and counselling, some PN programs also elicit contact information for their index patients' socio-sexual networks instead of just their sexual partners [76, 77]. This approach is based on insights from the social network analysis of STD transmission [77-80]. It takes PN beyond the mandate of notifying those the index patient potentially infected prior to diagnosis, to contacting persons the index patient suspects are at high-risk of infection. This strategy has been called peer-driven cluster referral.

Peer-driven cluster referral has potential for success in Canada. It has already been successfully implemented in Saskatchewan to improve case-finding [81]. HIV PN studies have offered gift cards to newly infected HIV patients and high risk HIV-negative persons to recruit their socio-sexual networks, including drug users, for HIV testing and counselling[82]. This



network approach has been shown to be cost-effective particularly when those recruited get tested for other STBBIs in addition to HIV. A study found HIV PN using this strategy to cost \$4,929 per new HIV case detected, while the community HIV counselling and testing program cost \$11,481 per new case detected [83]. Another benefit to this approach is that it can help elucidate HIV transmission patterns. A study that recruited their cases' acquaintances, friends and sexual partners was able to trace the social networks via the numbers on the referral cards that were given out to index patients [77]. Peer-driven cluster referral shows promise and should be considered for broader implementation.

HIV Medical Providers and Treatment as Prevention

It has been questioned whether HIV treatment enhances HIV PN outcomes. However, the evidence suggested that the patient-physician relationship may be more important in motivating index patients to complete HIV PN than whether they are on the treatment or not. A 2009 study observed that patients

with HIV medical care providers were more likely than those without HIV medical care providers to notify all their locatable partners [18]. In this study, those with HIV medical providers who discussed the need to notify partners were more likely to notify than those without HIV medical providers (OR: 3.03; 95% CI: 1.95-4.69). Furthermore, those with HIV medical providers who never discussed the need to notify partners were also more likely to notify than those without HIV medical providers (OR: 2.56; 95% CI: 1.50-4.39). In this study, the association between notifying partners and taking HAART was inconclusive. The odds ratio for notifying partners for those taking HAART versus not taking HAART was 2.41 (95% CI: 1.34-4.35). However, the adjusted odds ratio was insignificant at 1.07 (95% CI: 0.53-2.18). Therefore, although the strategy of treatment as prevention may be enhanced by PN, PN may not be directly improved by the treatment as prevention strategy. The patient-physician relationship may be more important for improving PN outcomes than the treatment itself.

Internet PN

Internet PN is being developed and implemented to supplement existing PN programming [76, 84-88]. It involves the use of email, websites and internet applications to notify partners of possible exposure to HIV. For example, HIV infected persons can go online and access resources on how to notify their partners. Some internet PN services also allow for index patients to send anonymous emails or e-cards to notify their partners. These services are aimed at notifying partners that are unlocatable using existing programs [76, 84-88]. There is an evidence review in

this NCCID series devoted to internet PN. Please refer to it for more details.

Conclusions and Recommendations

This analysis of peer-reviewed evidence has found HIV PN to be an effective strategy for case-finding, behaviour change and HIV prevention that ought to be further researched, developed and implemented in Canada. The main limitations of these findings are that most of the studies were not conducted in Canada and some are older studies that may not

Key Research Recommendations

This review identified many gaps in HIV PN research in Canada. National leadership and co-ordination is necessary if Canadian HIV PN is to improve. Based on the HIV PN evidence that was reviewed, some of the recommendations for developing HIV PN in Canada are:

- Documentation of the existing policies and practices of HIV PN in the Canadian provinces, territories and health regions.
- Monitoring the coverage of Canadian HIV PN programs.
- Monitoring how index patients are being referred to HIV PN programs.
- Forming a working group to develop and facilitate the implementation of a centralized strategy to improve Canadian HIV PN.
 - ~ Development of a training program or manual for health service personnel conducting HIV PN.
 - ~ Development and use of a standardized outcome-classification system.
 - ~ Development and use of a HIV PN reporting checklist.

If HIV PN in Canada is to improve it must go beyond the publication of guidelines to the publication of descriptive and analytical research. PHAC has issued guidelines for HIV PN [1, 10]. Ontario, British Columbia, Alberta and Northwest Territories have

also published HIV PN guidelines [2-5]. These guidelines are helpful but much more must be done if Canadian HIV PN is to move forward. There is only one peer-review published study on Canadian HIV PN and it was published in 1994. It is difficult to improve a system that has yet to be documented or researched. Descriptive and analytic studies and reports of HIV PN in Canada are essential. Some of the key areas for research in HIV PN in Canada are:

- Comparisons of patient, provider and contract referral, their outcomes, cost-effectiveness and factors associated with success.
- Evaluation of short and long-term behaviour changes following HIV PN in the Canadian context
- Evaluations of peer-driven cluster referral that compares its cost-effectiveness with that of PN that focuses on the index patients' known sexual contacts.
- Investigations into which provider or mix of providers is most suitable for conducting PN in Canada, including the impact of specific training strategies, specialised personnel for certain STB-BIs, work and pay structures, as well as interview style and location of interviews.
- Research into whether emotional abuse and physical violence is associated with HIV PN in the Canadian context.

reflect the current Canadian context. In addition, many studies are based on self-reported information without verified outcomes and given the sensitive subject matter, many studies are also prone to social desirability bias, particularly those collecting information via interviews.

National Leadership & Coordination

This review has identified many gaps in HIV PN research in Canada. National leadership and coordination is necessary if Canadian HIV PN is to improve. Based on the HIV PN evidence that was reviewed, some of the recommendations for developing HIV PN in Canada are:

- **Documentation of the existing policies and practices of HIV PN in the Canadian provinces, territories and health regions.** The realities of HIV PN in Canada are largely undocumented. A better understanding of the current system is needed in order to make informed decisions about how best to improve HIV PN in Canada.
- **Monitoring the coverage of Canadian HIV PN programs.** Investigations into the coverage of HIV PN programs in the US yielded useful insights into whether the programs were most successful in areas with the greatest burden of disease and into which subpopulations needed to be targeted to increase coverage[56]. Research on the proportions of newly diagnosed HIV patients who enroll in Canadian HIV PN programs would be helpful for public health planning.
- **Monitoring how index patients are being referred to HIV PN programs.** If low HIV PN coverage is found in key demographics, it may be helpful to explore partnerships with relevant CBOs, as CBO partnerships were beneficial in California[28].
- **Forming a working group to develop and facilitate the implementation of a centralized strategy to improve Canadian HIV PN.** This strategy should include developing a training program or manual for health service personnel conducting HIV PN. It should also include strengthening the monitoring and evaluation of HIV PN programs through the development and use of a standardized outcome-classification system. HIV PN training programs, as well as standardized outcome-classification, continue to build capacity in the US, and Canada could benefit

from similar programming and national coordination [27, 49, 50, 89].

- **Developing a HIV PN reporting checklist.** Based on the challenges in evaluating HIV PN evidence for this review, a checklist for the reporting of HIV PN methods is also recommended. It would improve monitoring, evaluation and the ability to compare HIV PN programs across Canada. For a list of suggested checklist items see Appendix 1.

Key Areas for Future Research on HIV PN in Canada

The combination of standardizing outcome classification and the widespread use of a reporting checklist for HIV PN reports and articles would set the foundation for vast improvements to HIV PN in Canada. It would help facilitate future analytic studies on the HIV PN process in Canada. The results of this research, along with the outcome-classification and reporting standards, could inform the development of HIV PN training programs, manuals and work structures. Some of the key areas for research in HIV PN in Canada are:

- **Comparisons of patient, provider and contract referral, their outcomes, cost-effectiveness and factors associated with success.**
- **Evaluation of short and long-term behaviour changes following HIV PN in the Canadian context.**
- **Replication of the Saskatchewan PN peer-driven cluster referral that compares its cost-effectiveness with that of PN that focuses on the index patients' known sexual contacts.**
- **Investigations into which provider or mix of providers is most suitable for conducting PN in Canada.** This research should include the impact of specific training strategies, specialised personnel for certain STBBIs, work and pay structures, as well as interview style and location of interviews.
- **Research into whether emotional abuse and physical violence is associated with HIV PN in the Canadian context.** The evidence from this research will help to ensure that the benefits of HIV PN for public health outweigh the costs to the individual index patients.

If HIV PN in Canada is to improve it must go beyond the publication of guidelines to the publication of descriptive and analytical research. PHAC has issued guidelines for HIV PN [1, 12]. Ontario, British Columbia, Alberta and Northwest Territories have also published HIV PN guidelines [2-5]. These guidelines are helpful but much more must be done if Canadian HIV PN is to move forward. There is only one peer-review published study on Canadian HIV PN and it was published in 1994. It is difficult to improve a system that has yet to be documented or researched. Descriptive and analytic studies and reports of HIV PN in Canada are essential.

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