Strategies for partner notification for sexually transmitted diseases (Review)

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ABSTRACT

Background
Partner notification has been practiced for decades, with substantial resources directed towards it, and with little evidence on whether it has made a public health impact on disease transmission. Most of the evaluations were not randomized controlled trials, and were conducted in the United States, prior to the HIV/AIDS epidemic. There are reasons to question whether partner notification for gonorrhoea and chlamydia is applicable to HIV. It is also questionable whether interventions for the developed world are applicable to the developing world.

Objectives
This review aims to compare the effects of various sexually transmitted disease (STD) partner notification strategies, including to compare provider referral with contract and patient referral, and to compare different patient referral strategies to each other. In addition to updating previous reviews, it addresses partner notification in developing countries as well as in developed countries, with particular consideration for HIV/AIDS. It attempts to address some of the methodological limitations of earlier reviews.

Search strategy
The search strategy included MEDLINE, EMBASE, Psychological Abstracts, Sociological Abstracts, the Cochrane Controlled Trials register, the proceedings of the International AIDS Conferences and the International Society for STD Research meetings.

Selection criteria
The review includes published or unpublished randomised controlled trials (RCTs) comparing two or more partner notification strategies for people diagnosed with STDs.

Data collection and analysis
For each comparison within each study, the difference in the rate of partners elicited, notified, medically evaluated, harmed, etc, the 95% confidence interval, and if significant, the numbers needed to treat (NNT) were calculated.

Main results
We found 11 RCTs, including 8014 participants. Only two trials were conducted in developing countries, and only two trials were conducted among HIV positive patients. There was some risk of bias in all the included trials. The review found moderately strong evidence that: 1. provider referral alone, or the choice between patient and provider referral, when compared with patient referral among patients with HIV or any STD, increases the rate of partners presenting for medical evaluation; 2. contract referral, when compared with patient referral among patients with gonorrhoea, results in more partners presenting for medical evaluation; 3. verbal, nurse-given health education together with patient-centred counselling by lay workers, when compared with standard care among patients with any STD, results in small increases in the rate of partners treated.

Authors' conclusions

There is a need for evaluations of interventions combining provider training and patient education, and for evaluations conducted in developing countries. All partner notification evaluations, but especially those among HIV positive patients, need to measure potential harmful effects, such as domestic violence, to ensure that partner notification does more good than harm.

PLAIN LANGUAGE SUMMARY

This review compares the effects of various sexually transmitted disease (STD) partner notification strategies. It updates previous reviews, and addresses some of their methodological limitations. It includes 11 randomised controlled trials (RCTs) comparing two or more strategies, including 8014 participants. Only two trials were conducted in developing countries, and only two trials were conducted among HIV positive patients. The review found moderately strong evidence that: 1. provider referral alone, or the choice between patient and provider referral, when compared with patient referral among patients with HIV or any STD, increases the rate of partners presenting for medical evaluation; 2. contract referral, when compared with patient referral among patients with gonorrhoea, results in more partners presenting for medical evaluation; 3. verbal, nurse-given health education together with patient-centred counselling by lay workers, when compared with standard care among patients with any STD, results in small increases in the rate of partners treated. The review concludes that there is a need for evaluations of interventions combining provider training and patient education, for evaluations conducted in developing countries, and for the measurement of potential harmful effects.

BACKGROUND

Partner notification is a process whereby the sex partners of patients diagnosed with an STD (index patients) are informed of their exposure to infection and thus the need to visit a health service. It aims to prevent reinfection of the index patient, a clinical goal, and reduce the spread of STDs, a public health goal. A large proportion of people infected with STDs will have neither symptoms nor signs of infection. For example, 22-68% of men with gonorrhoea, who were identified through partner notification, were asymptomatic Holmes et al, 1990. Partner notification is one of the two strategies to reach such individuals, the other strategy being screening. Managing infection in people with more than one current sexual partner will have the greatest impact on the spread of STDs. The likelihood of transmission from the partners who are referred for treatment is an important indication of success. Tracing a monogamous partner will have less impact on the STD epidemic than tracing a non-monogamous partner (who has several other partners) Fenton et al, 1997.

Three approaches to partner notification have been used. Provider referral uses third parties (usually health service personnel) to notify partners. Patient referral refers to when health service personnel encourage index patients to notify their partners. Contract referral (or conditional referral) refers to when health service personnel encourage index patients to notify their partners, with the understanding that health service personnel will notify those partners who do not visit the health service by an agreed date. To succeed, partner notification strategies need to first elicit from the index patient details of all sex partners from whom he/she may have acquired the infection, or whom he/she might have subsequently infected. Identifying partners in the latent period of infection, (usually, 3 months for primary syphilis and one month for most others Toomey et al, 1996), will identify those from whom infection was acquired, while identifying partners after the onset of symptoms will identify those whom were likely infected by the index case. Various health services may set up different criteria for identifying partners in the latent period of infection, and this definition may therefore vary from study to study.

Eliciting partner information from infected persons through various elicitation strategies is a prerequisite to notifying sex partners. For example, when health service personnel notify partners, they rely on the index patient to count, name and provide details to enable all his/her partners to be traced. (Even when patient referral is practiced, successful elicitation strategies, even if only involving a count of partners, may increase the notification of partners per index patient, by, for example, ensuring the provision of appropriate counseling or sufficient contact cards for each partner.) Once partners have been elicited, partner notification strategies need to provide either the index patient or the health service personnel with the necessary knowledge, skills or resources to enable them to locate, notify, medically evaluate and test or treat these partners.

Partner notification has been practiced for decades, with substantial resources directed towards it, and with little evidence on whether it has made a public health impact on disease transmission. Most of the evaluations were not randomized controlled trials, and were conducted in the United States, prior to the HIV/AIDS epidemic. There are reasons to question whether partner notification for gonorrhoea and chlamydia is applicable to HIV. It is also questionable whether interventions for the developed world are applicable to the developing world.

Two systematic reviews have been conducted prior to our review.

The first Oxman et al, 1994, included only studies conducted in developed countries. It included 12 controlled studies, and concluded that there was strong evidence that simple forms of patient assistance directed at improving patient referral (such as referral cards and reminder telephone calls) was effective in increasing the number of partners presenting for care, and there was moderately strong evidence that, for HIV, provider referral results in more partners being notified than patient referral. The effects of provider referral for other STDs were not clear. There was weak evidence that specially trained interviewers were more effective than routine health care providers at identifying partners, but there was no evidence that this resulted in improved notification or treatment. There was no evidence of the potential harms of provider referral.

The second, more recent review Macke et al, 1999 included only published studies conducted after 1980, in the United States of America. It identified five randomised controlled trials, four of which were included in the review published by Oxman et al. The fifth, more recently published trial, comparing provider and contract referral strategies among patients with syphilis, is reviewed by us below. It reviewed thirteen comparative or cohort studies and found that partner notification detected between 0.03 to 0.24 infections of syphilis, gonorrhea, chlamydia or HIV in partners, per index patient, and 0.7% to 11% of notified partners were infected. It concluded, based on the results of randomized and non-randomised studies, that provider referral, when compared with patient referral, results in more partners being notified and medically evaluated. It provided no evidence of the comparative effects of different methods of patient referral.

Both the previous reviews had limitations in their methods of analysis. The first Oxman et al, 1994 assumed that the number of partners notified (or treated) per index patient followed a binomial distribution (which assumes a fixed number of partners per patient). This does not fit the real setting where index patients have variable numbers of partners, and thus can only be considered a crude approximation. The second review did not include any statistical inference on intervention effects.

The objectives of this review are to compare provider referral with contract and patient referral, and to compare different patient referral strategies to each other. In addition to updating previous reviews, we have expanded the scope to address partner notification in developing countries as well as in developed countries, with particular consideration for partner notification for HIV/AIDS, and we have attempted to address some of the methodological limitations of earlier reviews.

OBJECTIVES

The objective is to assess the effects of alternative partner notification strategies. The following comparisons were performed, according to either of two broad objectives sought by the studies:
1.Provider, contract and patient referral strategies were compared;
2.Different patient referral strategies (the various ways health service personnel encourage index patients to inform partners directly of their possible exposure to STDs), were compared.

We planned to compare different service provider oriented strategies (strategies which encourage those providing care to the index patient to adhere to guidelines aimed at improving partner notification either by provider, contract or patient referral strategies), however, no trials assessing such strategies were identified.

Because of the substantial heterogeneity across studies, the main aim of the analysis was to identify interventions that had been shown to be effective (or ineffective), the circumstances under which they had been shown to be effective, and the specific effects that had been measured. We also aimed to identify important gaps in what is known.

CRITERIA FOR CONSIDERING STUDIES FOR THIS REVIEW

Types of studies

Randomised controlled trials that compared at least two alternative partner notification strategies were included.

Types of participants

People diagnosed (clinically or by a laboratory) in health services with any of the following STDs: gonorrhoea, chlamydia, trichomoniasis, syphilis, chancroid, genital herpes, human papillomavirus, hepatitis B, and HIV. Diagnoses of the following STD syndromes were also included: urethral discharge syndrome in men, epdidymitis, lower genital tract syndrome, pelvic inflammatory disease, and genital ulcer syndrome. Studies conducted in any type of health service were included.

Types of intervention

Interventions directed at patients or health workers were included. The following types of interventions were included:

-Strategies that aimed to enhance the effectivness of patient referral through, for example, health education and counselling, health education materials (such as pamphlets, posters, video and audio productions), patient assistance strategies directed at facilitating patient referral (such as referral cards, incentives, reminders, video and audio productions)

-Strategies that evaluated provider referral through the use of different types of health workers.

-Strategies that aimed to enhance the effectiveness of provider referral through, for example, academic detailing, continuing medical education, patient-mediated strategies, audit and feedback, and printed materials up to the level of prompted guidelines.

-Combinations of the above.

Types of outcome measures

Trials that included any of the following outcomes were reviewed:
-partners elicited;
-partners located;
-partners notified;
-partners presented for care;
-delay in partners presenting for care;
-partners tested positive;
-partners treated;
-index patient re-infection rates;
-incidence of STDs;
-changes in index patient's or partner's behaviour with regard to condom use, abstinence in the presence of symptomatic infections, the number of partners, the number of concurrent partners;
-emotional impact on the index patient or partner or their relationship;
-harms to patient or partner, such as domestic violence, abuse or suicide;
-ethical outcomes (patient autonomy vs beneficence).

SEARCH METHODS FOR IDENTIFICATION OF STUDIES

See: methods used in reviews.

A MEDLINE search, from 1966 was conducted.

EMBASE, Psychological Abstracts and Sociological Abstracts were searched from 1974, 1967 and 1963 respectively.

The Cochrane Controlled Trials register was searched with the text words 'sexual partners', 'partner notification', 'contact-tracing', and 'contact tracing'.

The EPOC register of studies was searched, as was the register of the HIV and AIDS Cochrane review group.

Hand searching of the Proceedings of the International AIDS Conferences, from 1996 to present (2001) was conducted.

Hand searching of the International Society for STD Research meetings (ISSTDR) was undertaken from 1991 to present was conducted.

Bibliographies of studies and previous reviews were examined for references to other trials.

Experts in the field were contacted.

METHODS OF THE REVIEW

Titles and abstracts of the electronic search results were screened independently by two reviewers (CM and Riabatu Abdullah). All the accepted abstracts (those of comparative studies) were obtained in full article format, and independently reviewed by 2 reviewers (CM and Riabatu Abdullah), for inclusion. All studies in which the design was a RCT were included.

Two reviewers (CM and NC or MZ) independently abstracted study characteristics and outcomes including information on:
-social context (developing or developed country)
-access to health services
-legislative context (permissive or proscriptive public health legislation)
-type of health facility
-type of provider (for example, nurse, physician, etc)
-participants
-type of interventions
-outcome measures
-results
-study quality

Where there were missing data, attempts were made to obtain the data by contacting authors.

The following criteria of methodological quality were independently assessed by two reviewers (CM and NC or MZ):
-whether randomisation was designed and completed in an appropriate manner;
-whether the participation rate was greater than 80%;
-whether participants were analysed in the groups to which they were assigned;
-whether outcome assessors were blinded to the assignment status of the participants;
-whether the groups were similar at the start of the trial;
-whether the groups were treated equally in all aspects other than the intervention.

Disagreements on inclusion or quality were resolved by discussion.

Tables were prepared summarising the results of each study for each comparison. Whenever possible, for each study, the rate of partners elicited, notified, presenting for care, tested, treated or harmed, per index patient in the respective comparison groups was compared. We assumed that the index patients from the groups within a study had similar distributions for exposure time to partners, for time to notify their partners, and that the same assumption held for partners with respect to the time taken to present to the health service. Thus, we assumed that the number of units counted (partners elicited, notified, presenting for care, tested, treated or harmed) per index patient was a random variable following a Poisson distribution. To calculate a confidence interval for the difference in the rate of partners elicited, notified, etc, we used the normal approximation to the Poisson distribution since only summarised data from the included RCTs were available. The approximate 95% confidence interval for the rate difference is given by (Lamda1 - lamda2) +/- 1.96 square-root (lamda1/n1 + lamda2/n2), where lamda1 and lamda2 are the rates of partners per index patient in two groups, and n1 and n2 the number of index patients. In studies where the rate of partners elicited

per index patient was not reported, the number of contact cards given to the index patient was used as a proxy indicator. Where the rate reduction was significant, the numbers needed to be treated (NNT) were calculated. The NNT refers to the number of index patients that would need to receive the intervention for one additional partner be elicited, notified, to present for medical evaluation etc. (For non-significant rate differences, the NNTs are not presented as their interpretation is not immediately meaningful.)

DESCRIPTION OF STUDIES

The search strategy produced 11 RCTs, including 8014 participants. All 11 RCTs were included in the review. Most of the trials (8) were conducted in the United States. One trial was conducted in Denmark. Only two trials were conducted in developing countries (South Africa and Zambia).

Most trials (8) were based in public health services. One was conducted in a university campus Montesinos, 1990, one in private practices Andersen et al, 1998 and one completely outside formal health services, in a neighborhood-based service in a converted storefront (Levy et al, 1998).

Participants:
Three trials included only patients with gonorrhoea, and one included patients with gonorrhoea or non-gonoccoccal urethritis. One trial included patients with NGU only. One trial included only patients with chlamydia, and one trial only patients with syphilis. Two trials included patients with HIV, and two trials (those in developing countries where syndromic diagnoses are made) included patients with any STD.

Four trials included male patients only, or reported over 90% male index patients (Cleveland, Potterat et al 1977, Katz et al 1988 and Solomon et al 1988). One trial included female index patients only (Andersen et al, 1998). The remaining trials included male and female index patients.

Types of interventions:
Trials fell into those that addressed Objective One or Two:
Objective One: 7 trials compared patient, provider or contract strategies. One of these compared patient referral with provider referral (Katz et al 1988), three compared patient referral with offering the index patient a choice between patient or provider referral (Levy et al 1998, Faxelid et al 1996, Landis et al 1992), two compared patient referral with contract referral (Cleveland, Potterat et al 1977) and one compared contract with two provider referral strategies (Peterman et al 1997).

Objective Two: Seven trials compared various strategies to enhance patient referral. One trial compared the use of financial incentives for the index patient, with reminder telephone calls to the index patient (Montesinos et al 1990) and another assessed the effect of a video-based health education intervention (Solomon et al 1988). Another assessed the effects of a counselling intervention , a health education standard message, and a sequential combination of these two (Ellison). Yet another compared providing counseling and contact cards to index patients with standard care (Faxelid et al 1996). One compared two ways of testing partners for chlamydia infection (Andersen et al 1998). One compared the use of educational pamphlets and health education with a standard interview (Cleveland) and the last compared patient referral using a nurse who did not elicit names of partners, with patient referral using a disease intervention specialist who elicited the names of partners (Katz et al 1988).

Outcomes:
Most trials (9) measured the number of partners elicited by index patients, however 2 studies only reported the number of contact cards taken (Cleveland, Ellison) and this was accepted in this review as a proxy measure for the number of partners elicited. The other outcomes measured in the trials were:
-Partners sought: 1 trial (Peterman)
-Partners located: 1 trial (Peterman)
-Partners notified: 2 trials (Faxelid, Landis)
-Partners presented for care: 6 trials (Cleveland, Potterat, Montesinos, Faxelid,)
-Partner contact cards retrieved by the health service (proxy measure for partners presented for care: 2 trials (Solomon, Ellison)
-Partners treated: 3 trials (Potterat, Katz, Peterman)
-Partners tested: 5 trials (Potterat, Landis, Peterman, Andersen, Levy)
-Partners tested positive: 7 trials (Cleveland, Potterat, Katz, Landis, Levy, Andersen, Peterman)
-Time to present for treatment: 2 trials (Solomon, Ellison)
Only 2 trials measured harmful outcomes. In one, the rate of quarrels between the index patient and partners was measured (Faxelid) and in the other, incomplete trial, suicide and domestic violence was measured (Levy).

METHODOLOGICAL QUALITY

There is some risk of bias in all of the included trials (see included studies table). Randomisation was clearly concealed in only 2 trials (Faxelid, Levy). One of these is an incomplete study (Levy). The other (Faxelid) was the only study that relied on a method of assessing outcomes that had a substantial risk of bias: index patients' reports of whether they notified their partners and whether their partners presented for care. In 5 trials, randomisation was clearly not concealed (Potterat, Montesinos, Peterman, Andersen, Ellison). In the remaining 4 trials, randomisation concealment was scored as not clear.

It was clear that outcomes were assessed blindly in only 1 trial (Ellison). In most trials (7) it was not clear whether the outcome

assessors were blinded. In two studies (Peterman, Anderson), there was clearly no blinded outcome assessment.

Data on baseline comparability of the intervention and comparison groups was provided in only 3 studies (Faxelid, Peterman, Ellison,) and in one other study this data was obtained by writing to the author (Andersen).

The participation rate (proportion of those eligible who participated in the research) was reported to be greater than 80% in 5 trials (Montesinos, Faxelid, Peterman, Ellison, Levy). It was lower than 80% in 2 trials (Solomon, Landis), and it was not reported in the remaining trials.

RESULTS

Comparison 1. Comparing patient, contract and provider referral strategies:
Seven trials compared patient, provider or contract strategies. First we compared the relative effectiveness of provider, contract and patient referral strategies on the rate of partner elicitation by index patients. (As we have said, eliciting partner information from infected persons through various elicitation strategies is a prerequisite to notifying sex partners. Here we use the term 'partner elicitation' to refer to the partners index patients report to the health workers.) In two studies of patients with NGU and gonorrhoea respectively (Katz 1988, Cleveland), patients receiving the patient referral interventions elicited significantly more partners than those receiving provider or contract referral interventions. In the first study (Katz 1988), 2.8 (95% confidence interval: 1.8, 5.9) index patients would need to be offered patient referral, compared with provider referral, for one extra partner to be elicited, and in the second, 2.5 (1.7, 4.8) index patients would need to be offered patient referral, compared with contract referral, for one extra partner to be elicited.

In people with syphilis, one large trial including 1966 participants (Peterman 1997) compared 2 forms of provider referral with each other, and with contract referral. Patients receiving provider referral with field testing (the health worker who notifies the partner has the option of drawing blood in the field if the partner seems unlikely to come to the clinic for a syphilis test), elicited more partners than those receiving the contract referral intervention (NNT = 2 (1.3, 4.8)). Contract referral was more effective at eliciting partners than provider referral without field testing (NNT = -0.46 (-0.51, -0.41).

In the other 4 studies comparing patient, contract and provider referral strategies, there was no evidence that any one of the strategies was more effective in eliciting partners from index patients. This may be because the interventions tended to focus on methods to achieve success in notifying and medically evaluating partners, rather than on methods to encourage index patients to elicit partners.

When comparing partner elicitation across studies, the rates per index patient ranged from 0.75 to 6.9. We are not able to determine whether the differences in rates across studies is a reflection of the different populations studied (differing rates of sex partner change or differing cultures with regard to admitting multiple sex partners), or a reflection of differing "interview periods" used by health services for the various STDs, or an indicator of differential success of the respective partner notification strategies in eliciting partners.

Next, we compared the relative effectiveness of patient, contract and provider referral on notification, medical evaluation and treatment of partners:

-One trial among patients with HIV (Landis) found that offering index patients a choice between provider or patient referral, compared with patient referral, resulted in more partners being notified (2 per index patient compared with 0.29 per index patient). More partners in the group with the choice tested HIV positive (0.23 compared with 0.03 per index patient). The participation rate in this study was 46%, and the participants reflect a select group of HIV positive patients who, when compared with those declining to participate, and those ineligible or unavailable, were more likely to be female, black and to have been tested confidentially rather than anonymously. The male participants were more likely to be homosexual bisexual.

-One trial among patients with NGU (Katz) found that provider referral, when compared to either one of two patient referral strategies, resulted in more partners receiving treatment (0.72 compared with 0.18 per index patient). This is despite that the patient referral strategies resulted in the elicitation of more partners. Provider referral also resulted in a greater chlamydial isolation rate among elicited partners (0.09 compared with 0.03 per index patient).

-The two trials conducted among patients with gonorrhoea (Cleveland, Potterat), compared contract with patient referral. One, (Cleveland) found that contract referral resulted in more partners presenting for care (0.62 compared with 0.31 per index patient) and more partners testing positive (0.37 compared with 0.25). This is despite that patient referral was more effective at eliciting partners. The other, (Potterat) found no significant differences in the number of partners presenting for care and testing positive/receiving treatment. There was, however, a trend for more partners to present with contract referral: 1.27 compared with 1.15.

-In people with syphilis, one large trial including 1966 participants (Peterman), which compared two provider referral strategies with contract referral, found no significant differences in the strategies in terms of the rate of partners located, tested, testing positive and treated. This is despite differences in the rate of partner elicitation between the 3 strategies. The investigators reported some evidence of 'contamination', in that some of those assigned to the contract referral group received one of the provider referral interventions. Furthermore, they speculated subversion of the

randomisation schedule. These problems may explain the absence of an effect. However, aside from these problems, the 3 strategies being tested were not very different (for example, with the contract referral, index patients were only given 2 days before the disease intervention specialists sought their partners).

-In people with any STD, Faxelid (1996) found that offering Zambian male index patients a choice between provider and patient referral as well as counseling and contact cards, resulted in index patients reporting that more partners had been notified. (1.8 partners per index patient were notified in the group with the counseling and cards, compared with 1.3 in the patient referral group with out counseling and cards.) The choice between provider and patient referral, counseling and contact cards would need to be offered to 2 index patients (95% CI 1.3, 4.8) for 1 extra partner to be notified. It also resulted in index patients reporting that more partners presented at a health service for care (1.8 compared with 1.2 per index patient; NNT=1.7 (1.2, 3.1)). However, the index patients' reports were not validated in any way, so these differences may reflect a reporting bias. It was not possible to separate out the effects of the various parts of the intervention (providing a choice between provider and patient referral, counseling, or contact cards), and it is not known which part was responsible for the increase in reports of partners presenting for care. Among female index patients, there were no differences between the comparison groups, although the authors speculate that their study did not have adequate power to show a difference. (No sample size determination was included.) A higher rate of domestic quarrels was reported among men in the group with a choice between patient or provider referral, counseling and contact cards, compared with those in the patient referral group without counseling or cards. 27% of men, given a choice between patient and provider referral, counseling and contact cards, reported domestic quarrels vs. 11% of men receiving patient referral only; no differences occurred among women given the same choice (11% in both groups).

The results from 2 studies suggest that patient referral may improve the elicitation of partners (Katz and Cleveland). However, this did not translate into practically important benefits as the rate of partners presenting for medical evaluation did not increase with improved partner elicitation. Even in the study where provider referral resulted in an increase in partner elicitation (Peterman), this did not lead to an increase in partners being medically evaluated.

Apart from the Zambian study (Faxelid), no studies reported data on harmful effects. Only one study reported patient preferences with regard to provider and patient referral among HIV positive patients (Levy). In the group of index patients randomly allocated to receive a choice between provider and patient referral, it found that provider referral was preferred, with 82% of patients choosing provider referral for at least one partner. Of all the partners elicited by index patients in this group, 71% were notified by providers as a result of the index patients' preferences.

Figures 1- 3 (published, for technical reasons, at http://www.sahealthinfo.org/Modules/Evidence-based/review/review.htm) illustrate graphically the results of the 5 trials comparing patient referral strategies with either provider referral, a choice between provider referral and patient referral, or contract referral. They show that patient referral strategies were almost consistently (across study and STD) more effective at eliciting partners from index patients. However, this did not translate into practically important benefits. Patient referral strategies were consistently less effective at ensuring partners were notified and presented to health services to receive the appropriate medical evaluation and treatment. In addition, patient referral strategies were generally less effective at identifying partners who tested positive for the STD in question.

Figure 4 shows the results of the comparison of contract referral with 2 provider referral strategies among patients with syphilis. It shows that there were very small differences in the effectiveness of the respective strategies (which, in themselves, did not differ very much), except, inexplicably, when measuring the number of partners elicited.

Comparison 2. Comparing various patient referral strategies:
Seven studies compared various strategies to improve patient referral.

When comparing the relative effectiveness of the various patient referral strategies on the rate of partner elicitation by index patients:
-One study of patients with NGU (Katz) found that patient referral with nurse-given health education, and with no identifying details of partners taken, when compared with patient referral with a disease intervention specialist who took names of partners, resulted in more partners being elicited. (1.16 compared with 0.75 per index patient).

-Another study among patients with any STD (Ellison) found that patients in the group given health education alone, and those in the group given both health education and counseling, elicited more partners than those in the control group (1.28 compared with 1.04; and 1.64 compared with 1.04 respectively).

There were no other differences in elicitation rates between the strategies compared within trials. Across trials, the rate of partner elicitation per index patient ranged from 0.75 to 3.3.

When comparing the relative effectiveness of the various patient referral strategies on notification, medical evaluation and treatment of partners we found:

-Three studies compared various patient referral strategies among patients with gonorrhoea. They compared health education using an educational pamphlet with standard care (Cleveland), an educational video with standard care (Solomon 1988), and reminder telephone calls with modest financial incentives ($3 in 1990) for the index patient and partner (Montesinos 1990). None

of these studies found significant differences in the number of partners elicited or receiving medical evaluation or treatment. Due to methodological weaknesses in two of the studies (Solomon 1988, Montesinos 1990), there is insufficient evidence to draw firm conclusions regarding the effects of educational videos, and reminder telephone calls compared with incentives. The study evaluating the educational video (Solomon 1988), counted returned contact cards as the main outcome, which may not be a sensitive surrogate indicator for partners presenting for care. In another trial included in this review, Potterat et al showed that contact card returns constituted a poor proxy indicator for partners receiving medical evaluation. Of 198 named partners, 54% sought medical evaluation, yet if the investigators had relied on card returns, they would have concluded that only 7% had sought medical evaluation. (Only one of the other trials included in this review relied on returned contact cards as an indicator of partner treatment [Ellison et al]). The study comparing reminder telephone calls with incentives (Montesinos 1990) included only 38 participants, and there was no indication that they had conducted a sample size determination prior to performing the study. (Indeed, of all the studies included in this review, only two provided details of sample size determinations [Ellison et al, and Peterman et al, 1997]). Furthermore, the results of this study may be applicable only to university students with sex partners at the same university. Comparisons of the costs included in two of these studies, found that the cost per partner identified with a positive culture was the same for health education using an educational pamphlet and standard care (Cleveland), and that incentives were more than three times the cost per partner contacted than reminder telephone calls (Montesinos 1990).

-One study (Katz) of patients with NGU found no difference in patient referral with a nurse providing health education and referral letters, where no names or identifying details of partners were taken, when compared with patient referral with a disease intervention specialist, where names of partners were gathered, but no other identifying details.

-In a South African study conducted among patients with any STD (Ellison), where health education was complemented with a 20-30 minute counseling session, the rate of partners treated increased significantly from 0.18 to 0.25 per index patient. In this study, neither health education nor counseling in isolation increased the proportion of partners receiving treatment. Figure 5 shows the effects of nurse-given health education and/or 20-30 minutes counseling by a lay worker, when compared with standard care among patients with any STD.

-As mentioned under "Comparison One" above, Faxelid (1996) found that offering Zambian male index patients a choice between provider and patient referral as well as counseling and contact cards, resulted in index patients reporting that more partners had been notified and that they presented at a health service for care. However, it was not possible to determine whether the counseling and contact cards, or the choice between patient and provider referral, (or both) was responsible for the effect observed.

-A small study, conducted among women with chlamydia attending private practices in Denmark (Andersen), compared two strategies for testing male partners for chlamydia. In the first strategy, female index patients gave their partners an envelope containing a sterile container, and information about collecting a urine sample at home and sending it in a prepaid envelope to the laboratory for testing. In the second strategy, female index patients gave their partners an envelope containing a request for them to visit a doctor, a contact slip and a prepaid envelope to give to the doctor for returning the urethral swab sample to the laboratory. The urine test strategy increased the number of partners who had a specimen tested for chlamydia by the laboratory (0.98 compared with 0.37 per index patient in the urethral swab test strategy). Approximately 2 index patients would need to receive the intervention (urine test) for one extra partner to send a specimen for testing (NNT= 1.6, (1.1, 3.6)). There was, however, no difference in the number of specimens that tested positive, although it is possible that the study did not have the statistical power required to show a difference (no sample size determination was included). The authors of this study were not able to determine whether more partners in the intervention group were eventually treated, thus the practical benefits of such an intervention are as yet unknown.

None of the studies apart from the Zambian one, measured harms, and none measured patient preferences.

DISCUSSION

Determining the most effective means of partner notification from a systematic review of the literature is challenging. First, despite an extensive literature on partner notification for STDs, few randomized controlled trials have been conducted. Second, the methodologic weaknesses of studies that met even our quality criteria do not allow rigorous conclusions to be made. In every study, there were threats to the validity of the findings. Third, the variability of study designs even within categories, e.g., provider referral, and the differences in diseases assessed, complicate greatly the identification of strategies that are, or are not, effective. Last, although most studies were conducted in the United States, that some studies were performed in other countries, including two in the developing world, raises cultural issues that might well influence results and make comparison among studies hazardous.

Partner notification affects either of two outcomes, i.e., prevention of morbidity in those notified, or prevention of transmission to others-both are benefits. Whether it is better to identify and treat partners who have detectable infection, as opposed to those who have no detectable infection, is arguable. However, it would seem more likely that infected partners are more valuable to identify, since these individuals have either acquired infection from the

index case (and are at high risk of further morbidity or transmitting infection to others), or infected the index case (proving that they are high risk sex partners, responsible for transmission). Few of the studies assessed the proportion of partners who were infected. Instead, most studies relied on surrogate outcomes such as partners presenting for medical evaluation, or reports by index patients of partners presenting. As a result, we cannot know more fully the benefits of partner notification.

There are also potential harms to partner notification. These have, however, been poorly investigated in either studies included in our review or in other studies. Only two of our studies investigated the harms resulting from the various partner notification strategies and one has not reported results (Levy 1998). Faxelid et al reported that 27% of STD-positive men in Lusaka, given a choice between patient and provider referral, counseling and contact cards, reported domestic quarrels vs. 11% of men receiving patient referral only; no differences occurred among STD-positive women given the same choice (11% in both groups). Moniez et al found, in a pilot study, (Moniez 1997) that provider referral was not an acceptable strategy in their South African site, because patients feared it might lead to violence. Similarly, descriptive studies conducted among index patients with HIV infection in industrialized countries have found very low rates of disclosure of HIV status to sex partners (Stein et al 1998), even after repeated counselling of index patients about disclosure and a six month opportunity to disclose (Perry et al, 1994). The reluctance to notify partners suggests expectation of harms from doing so. These harms need further investigation.

Provider versus contract versus patient referral versus choice:
There is no strong or consistent evidence for the relative effects of provider, contract, or patient referral, or patient choice among strategies. Provider referral, where the identity of the index patient is not revealed to the partner, is preferred by many index patients, particularly for HIV partner notification (Levy 1998). Patient referral incurs less service costs, and in some circumstances may be more effective. In the light of the absence of compelling evidence, perhaps offering patients a choice is most appropriate and, based on some evidence (Landis 1992, Faxelid 1996), it may be most effective. However, it may not be without risks (Faxelid et al, 1996).

Patient education and counseling and provider training:
Patient education and counseling, and provider training are likely to be important strategies to improve partner notification and prevent domestic violence. However there is no clear evidence to guide decisions about the provision of effective patient education and counseling, and provider training. We found no studies evaluating provider training. Of the four studies investigating various health education and counselling strategies, one, evaluating an audiovisual presentation, was unable to provide sufficient evidence due to methodological weaknesses (Solomon 1988). Another, evaluating an educational pamphlet failed to demonstrate any effect. A third (Ellison) found that verbal health education together with intense, patient-centred counselling resulted in a small but significant increase in the rate of partners treated. And a forth (Faxelid 1996) which evaluated the effect of counseling and contact cards together with a choice between provider and patient referral, only demonstrated an effect on index patients reports that their partners visited a health facility. Innovative strategies combining provider training and patient education that are based on an evaluation of the barriers to achieving the desired behavioural changes, need to be evaluated. Such interventions may have only moderate effects and evaluation designs need to be rigorous to protect against biases that can be as large or larger than the expected effects.

HIV/AIDS:
Only two studies evaluated partner notification strategies for HIV/AIDS (Landis 1992, Levy 1998). Based on these two studies, there is evidence that giving index patients a choice between provider and patient referral may be more effective than patient referral and this is supported from one other study from a developing country, which included all STDs (Faxelid 1996). However, HIV partner notification interventions require special consideration. One of the aims of such interventions needs to be long-term behavioural change, and thus interventions may need to include appropriate, long-term support for such change. Other aims are the availability of effective treatments, such as those preventing vertical transmission. Evaluations of HIV partner notification strategies need to address these issues, as well potential harmful effects, such as domestic violence, and costs to ensure that partner notification does more good than harm and that scarce resources are used efficiently.

Developing countries:
Only two studies were conducted in developing countries (Faxelid 1996, Ellison). Rigorous evaluations here are even more important than in wealthier countries, to ensure that scarce resources are used effectively and efficiently. This requires collaboration between stakeholders and researchers. On the one hand, policy makers, health service providers and consumer groups need to be involved in the evaluations to ensure they are policy relevant and likely to be implemented. On the other hand, researchers need to help to ensure that evaluations that are undertaken are likely to yield results that are valid as well as relevant. Given the severe limitations of resources and trained health care professionals in developing countries, a particularly important question to investigate is the use of lay health workers (Levy 1998, Ellison).

AUTHORS' CONCLUSIONS

Implications for practice

The main findings of this review are that there is moderately strong evidence that: 1. provider referral alone, or the choice between patient and provider referral, when compared with patient referral among patients with HIV or any STD, increases the rate of partners presenting for medical evaluation (Landis 1992, Faxelid 1996,

Katz 1988); 2. contract referral, when compared with patient referral among patients with gonorrhoea, results in more partners presenting for medical evaluation (Potterat 1977, Cleveland); 3. verbal, nurse-given health education together with patient-centred counselling by lay workers, when compared with standard care, among patients with any STD, results in small increases in the rate of partners treated (Ellison).

Implications for research

There is a need for evaluations of interventions combining provider training and patient education, and for evaluations conducted in developing countries. Trials conducted in the future need to assess whether the partner notification strategies they evaluate have an impact on index patient re-infection rates, changes in the behaviour of index patients or partners, particularly for HIV patients, and incidence of STDs. Furthermore, they need to consider measuring to what extent strategies are successful at reaching partners who are 'high transmitters' as opposed to monogamous partners. The acceptability of various partner notification strategies to index patients and partners needs to be assessed, and the costs and potential harms of partner notification need to be measured and compared.

POTENTIAL CONFLICT OF INTEREST

There are no known conflicts of interest.

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TABLES

Characteristics of included studies

Study	Andersen et al, 1998
Methods	· RCT · Randomisation concealment: NOT DONE · Blinded assessment: NOT DONE · Baseline comparability:

Characteristics of included studies (*Continued*)

	SIMILAR IN TERMS OF AGE, REPORTED SYMPTOMS, CONTRACEPTION USE. · Intention to treat analysis: NOT CLEAR · Proportion of those eligible who participated: NOT CLEAR
Participants	· Type of STD: Chlamydia trachomatis · Setting: Denmark, private practices. · Inclusion criteria: Infected women · Number of index patients who participated: 96 · Other characteristics of index patients: Heterosexual · Type of health worker: Physician
Interventions	1. Patient referral, urethral swab test for partner: index patient takes a contact card, letter requesting partner to visit doctor for testing, prepaid envelope for doctor to send urethral swab to the laboratory. 2. Patient referral, urine sample test for partner: index patient takes a urine sample specimen with instructions to partner. Sample to be sent by partner to laboratory in prepaid envelope.
Outcomes	· Partners elicited · Partners tested · Partners tested positive for chlamydia · Time until testing
Notes	It is not known how many of the partners who tested positive were treated.
Allocation concealment	D – Not used

Characteristics of included studies (*Continued*)

Study	**Cleveland, undated**
Methods	· RCT · Randomisation concealment: NOT CLEAR · Blinded assessment: NOT CLEAR · Baseline comparability: NOT CLEAR · Intention to treat analysis: NOT CLEAR · Proportion of those eligible who participated: NOT CLEAR
Participants	· Type of STD: Gonorrhoea · Setting: USA, public health clinic. · Inclusion criteria: index patients with a new episode, confirmed by smear or culture, volunteering to the clinic · Number of index patients who participated: 1898 · Other characteristics of index patients: 94% male · Type of health worker: “Health worker”.
Interventions	1. Patient referral using contact cards and standard interview 2. Patient referral with contact cards and standard interview PLUS educational pamphlet and health education 3. Contract referral: Patient referral with cards and standard interview. If partners did not present after 3 days, then provider referral.
Outcomes	· Contact cards taken · Partners presented to health service · Partners tested positive
Notes	

Characteristics of included studies (*Continued*)

Allocation concealment	D – Not used

Study	**Ellison, undated**
Methods	· RCT · Randomisation concealment: NOT DONE · Blinded assessment: ADEQUATE · Baseline comparability: ASSESSED AND DIFFERENCES CONTROLLED FOR IN ANALYSIS · Intention to treat analysis: ADEQUATE · Proportion of those eligible who participated: 99%
Participants	· Type of STD: Any STD diagnosed syndromically · Setting: South Africa, community health clinic in poor, urban setting. · Inclusion criteria: Any outpatient between 19 and 60 years, who did not come with a partner. · Number of index patients who participated: 1719 · Type of health worker: Nurse and lay counselor.
Interventions	1. Patient referral: standard clinical consultation, contact card. 2. Patient referral and health education: standard care, contact card, and standardised verbal health education message given by nurse. 3. Patient referral and counselling: standard care, contact card and patient-centred counselling in a private place, conducted by trained lay-counsellors of

	same gender. 4. Patient referral with health education and counselling: Standard care, contact card and both interventions 2 and 3 (health education and counselling).
Outcomes	· Contact cards issued · Partners presenting at health service (contact cards returned). · Time until partner presented.
Notes	
Allocation concealment	D – Not used

Study	**Faxelid et al, 1996**
Methods	· RCT · Randomisation concealment: ADEQUATE · Blinded assessment: NOT CLEAR · Baseline comparability: YES (data was stratified by gender and diagnosis) · Intention to treat analysis: NOT CLEAR · Proportion of those eligible who participated: 94% A further 19 patients did not come for a second interview.
Participants	· Type of STD: Any STD · Setting: Lusaka, urban public health clinic. · Inclusion criteria: Patients diagnosed with a clinical or laboratory diagnosed STD. Patients with only one STD. · Number of index patients who participated: 94 women and 302 men · Type of health worker: nurse and male clinical

Characteristics of included studies (*Continued*)

	officer
Interventions	1. Patient referral: standard care, no contact card 2. Patient referral or provider referral (choice): individual counselling (10-20 mins) and contact cards. Names and address of partners taken. Provider referral offered if patient did not want to talk to partner.
Outcomes	· Partners elicited · Partners notified · Partners presenting at health service · Harms: domestic quarrels
Notes	The policy at this health service was not to treat an index patient unless they bring a partner. This may affect the generalisability of the study to other settings. Great potential for bias in the method of outcome assessment: index patient reports that partner attended health service. No more objective outcome measures were used. This study compares a potential harm.
Allocation concealment	D – Not used

Study	**Katz et al, 1988**
Methods	· RCT · Randomisation concealment: NOT CLEAR · Blinded assessment: NOT CLEAR · Baseline comparability: NOT CLEAR · Intention to treat analysis: NOT CLEAR · Proportion of those eligible who participated: NOT CLEAR
Participants	· Type of STD: Non-gonoccocal urethritis (NGU) · Setting: USA, public health clinic. · Inclusion criteria: Heterosexual male index patients · Number of index patients who participated: 678

Characteristics of included studies (*Continued*)

	· Type of health worker: Nurse, Disease intervention specialist (DIS)
Interventions	1. Patient referral with nurse providing health education and referral letters. No names or identifying details of partners taken. 2. Patient referral with DIS, names of partners gathered, but no other identifying details. 3. Provider referral by DIS who took names and identifying details of all partners and attempted to refer them by phone calls, letters and visits
Outcomes	· Partners elicited · Partners treated · Partners tested positive for chlamydial infection · Cost-effectiveness
Notes	The effectiveness of interventions 1 and 2 underestimated due to bias in outcome assessment: partners choosing to be treated at other health services where not counted for these groups.
Allocation concealment	D – Not used

Study	**Landis et al, 1992**
Methods	· RCT · Randomisation concealment: NOT CLEAR · Blinded assessment: NOT CLEAR · Baseline comparability: NOT CLEAR · Intention to treat analysis: NOT CLEAR · Proportion of those eligible who participated: 46%
Participants	· Type of STD: HIV · Setting: USA, public health department. · Inclusion criteria: Patients returning for their test results who had sex or needle-sharing partners whose names

	they knew. · Number of index patients who participated: 74 · Other characteristics of index patients: 69% male. 35% IDU. 50% homo- or heterosexual · Type of health worker: Public health counselors
Interventions	1. Patient referral: with interview with counselor, discussing the process of notification. 2. Choice between provider and patient referral: patients could choose to notify some or all of their partners themselves, and the remaining partners, as well as those not presenting at the health service after 2 weeks, were contacted by the counselors.
Outcomes	· Partners elicited · Partners notified · Partners tested · Partners tested HIV positive
Notes	Of 534 people testing positive for HIV, 255/534 were not eligible as they did not return for test results. Of the 162 eligible, 88 declined to participate. Those consenting were randomised to the interventions. This limits the generalisability of the findings.
Allocation concealment	D – Not used

Study	**Levy 1998**
Methods	· RCT · Randomisation concealment: ADEQUATE · Blinded assessment: NOT CLEAR · Baseline comparability: NOT CLEAR · Intention to treat analysis: NOT CLEAR · Proportion of those eligible who participated: Currently 95%. STUDY NOT YET COMPLETE

Characteristics of included studies (*Continued*)

Participants	· Type of STD: HIV · Setting: USA, poor, high crime urban area, neighbourhood-based service in converted store-front. · Inclusion criteria: Injecting drug users (IDUs) testing HIV positive and receiving test results · Number of index patients who participated: Currently 60. NOT YET COMPLETE · Type of health worker: Indigenous community members (previous IDUs) and HIV counselors
Interventions	1. Patient referral: index patients receive help in identifying and naming partners, are counseled about notification. Community based testing for partners 2. Provider or patient referral: index patients receive help in identifying and naming partners, are counseled about notification. Indigenous community workers working from the community notify those partners the patient does not want to notify themselves, without revealing the identity of the index patient. Community-based testing for partners.
Outcomes	· Partners elicited · Partners tested · Partners testing positive · Domestic violence · Suicide
Notes	This study is still ongoing, and apart from limited data on patient preferences, there is not yet data on other outcomes. The only study conducted outside of the formal health services. Harms are being compared.
Allocation concealment	D – Not used

Characteristics of included studies (*Continued*)

Study	**Montesinos, 1990**
Methods	· RCT · Randomisation concealment: NOT DONE · Blinded assessment: NOT CLEAR · Baseline comparability: NOT CLEAR · Intention to treat analysis: NOT CLEAR · Proportion of those eligible who participated: 95%
Participants	· Type of STD: Gonorrhoea or NGU · Setting: USA, a university health service. · Inclusion criteria: University students whose partners were also students at the same university · Number of index patients participating: 38 · Type of health worker: Physicians and nurses
Interventions	1. Patient referral with counseling, contact cards and incentives. If partner presented at service, the index patient's fee of $3 was waived. 2. Patient referral with counseling, contact cards and follow-up telephone call. If the partner did not present in 5 days, the index patient was telephoned to remind about notifying partner.
Outcomes	· Partners elicited · Partners presenting at health service · Mean cost per partner traced
Notes	The results of this study may be applicable only to university students with sex partners at the same university.
Allocation concealment	D – Not used

Study	**Peterman et al, 1997**
Methods	· RCT

Characteristics of included studies (*Continued*)

	· Randomisation concealment: NOT DONE · Blinded assessment: NOT DONE · Baseline comparability: YES · Intention to treat analysis: DONE · Proportion of those eligible who participated: 89%
Participants	· Type of STD: Syphilis: primary, secondary or latent · Setting: USA, public health services. · Number of index patients who participated: 1966 · Other characteristics of index patients: 50% male · Type of health worker: DIS
Interventions	1. Contract referral: Notification of partners by index patient within 2 days, or a DIS would notify them on the 3rd day 2. Provider referral: immediate notification by DIS 3. Provider referral and field test: immediate notfication by DIS who could draw blood for testing in the field, if it seemed unlikely the partner would come in for testing.
Outcomes	· Partners elicited · Partners sought · Partners located · Partners tested · Partners positive (for syphilis) · Partners treated · Cost per partner tested
Notes	Some contamination is evidenced and further is speculated and this would have reduced the difference between the 3 groups, making them more similar to intervention 3.
Allocation concealment	D – Not used

Study	**Potterat et al, 1977**
Methods	· RCT

Characteristics of included studies (*Continued*)

	· Randomisation concealment: NOT DONE · Blinded assessment: NOT CLEAR · Baseline comparability: NOT CLEAR · Intention to treat analysis: NOT CLEAR · Proportion of those eligible who participated: NOT CLEAR
Participants	· Type of STD: Gonorrhoea · Setting: USA, public health department. · Inclusion Heterosexual male index patients · Number of index patients who participated: 187 · Type of health worker: UNCLEAR
Interventions	1. Patient referral: Short interview with contact cards. No names of partners elicited. 2. Contract referral: Longer interview, names and addresses of partners elicited, programme to contact partners if they did not present at the health service after 7-10 days.
Outcomes	· Partners elicited · Partners presenting at health service · Partners tested positive and treated
Notes	
Allocation concealment	D – Not used

Study	**Solomon et al, 1988**
Methods	· RCT · Randomisation concealment: NOT CLEAR · Blinded assessment: NOT CLEAR · Baseline comparability: NOT CLEAR · Intention to treat analysis: NOT CLEAR

	· Proportion of those eligible who participated: 75%
Participants	· Type of STD: Gonorrhoea · Setting: USA, public health clinic. · Inclusion criteria: Male patients · Number of index patients who participated: 902 · Other characteristics of index patients: Inner city, 96% single · Type of health worker: DIS
Interventions	1. Patient referral and videotape: Contact tracing interview with DIS, contact cards and viewing of a video-taped story promoting partner notification. 2. Patient referral alone: Contact tracing interview with DIS and contact cards.
Outcomes	· Partners elicited · Partners presented at health service · Time for partners to present at health service.
Notes	The main outcome, partners presented at the service, was measured by returned contact cards. Perhaps card returns is not a sensitive enough indicator. Other studies have shown that of partners presenting, most do not come with the cards.
Allocation concealment	D – Not used

ADDITIONAL TABLES

Table 01. Results - Comparing provider, conditional and patient referral

Study	STD	Effects (95% CI)*	NNT (95% CI)	Notes
Landis 1992	HIV	Provider or patient referral (choice) versus patient referral · Partners elicited/index: 157/39 - 153/35 (4.03 - 4.37) = -0.34 (-1.26, 0.58) · Partners notified/index: 78/39 - 10/35 (2.00 - 0.29) = 1.71 (1.35, 2.07) · Partners tested HIV positive/index: 9/39 - 1/35 (0.23 - 0.03) = 0.20 (0.04, 0.36)	· NNT = NS · NNT = 0.6 (0.5, 0.7) · NNT = 5 (2.7, 25)	There was no difference in elicitation of partners. A choice between provider and patient referral needs to be offered to fewer that 1 index patient for one additional partner to be notified, and to 5 index patients for one HIV positive partner to be identified.
Levy 1998	HIV	FORTHCOMING		In the group with the choice between provider and patient referral, 82% of index patients chose provider referral for at least one partner, (covering 71% of partners), suggesting provider referral is preferred and facilitates notification.
Katz 1988	NGU	Provider versus patient referral strategy 1 (with nurse) · Partners elicited/index patient: 177/221 (0.80) - 252/217 (1.16) = -0.36 (-0.55, -0.17) · Partners treated/index patient: 159/221 (0.72)- 48/217 (0.22)= 0.50 (0.37,0.63) · Partners positive/index patient: 20/221 (0.09) - 7/217 (0.03) = 0.06 (0.01, 0.11) Provider versus patient referral strategy 2 (with DIS) · Partners elicited/index patient: 177/221 (0.80) - 180/240 (0.75) = 0.05 (-0.07, 0.17)	· NNT = -2.8 (-5.9, -1.8) · NNT = 2.0 (1.6, 2.7) · NNT = 16.7 (9.1, 100) · NNT = NS · NNT = 1.9 (1.5, 2.4) · NNT = 16.7 (9.1, 100)	When compared with provider referral, patient referral with a nurse needs to be offered to approximately 3 index patients for 1 extra partner to be elicited. Patient referral with a DIS was equally effective at eliciting partners compared with provider referral. Provider referral, when compared with either of the patient referral strategies, would have to be offered to approximately 2 index patients for 1 additional partner to be assessed, and to 17 index patients to identify one additional partner with a positive chlamydial culture.

Table 01. Results - Comparing provider, conditional and patient referral (*Continued*)

Study	STD	Effects (95% CI)*	NNT (95% CI)	Notes
		· Partners treated/index patient: 159/221 (0.72) - 43/240 (0.18) = 0.54 (0.42, 0.66) · Partners positive/index patients: 20/221 (0.09) - 7/240 (0.03)= 0.06 (0.01, 0.11)		
Cleveland, unpublished	Gonorrhoea	Contract versus patient referral strategy 1 (standard interview) · Partners elicited (i.e. cards taken)/index patient: 1833/632 (2.90) - 2086/632 (3.30) = -0.40 (-0.59, -0.21) · Partners presented for care/index patients: 392/632 (0.62) - 235/632 (0.37) = 0.25 (0.17, 0.33) · Partners tested positive/index patient: 233/632 (0.37) - 154/632 (0.24) = 0.13 (0.07, 0.19) Contract versus patient referral strategy 2 (health education) · Partners elicited (cards taken)/index patient: 1833/632 (2.90) - 2092/634 (3.30) = -0.40 (-0.59, -0.21) · Partners presented for care/index patient: 392/632 (0.62) - 234/634 (0.37) = 0.25 (0.17, 0.33) · Partners tested positive	· NNT= -2.5 (-4.8, -1.7) · NNT = 4 (3, 5.9) · NNT = 7.7 (5.3, 14.3) · NNT= -2.5 (-4.8, -1.7) · NNT = 4 (3, 5.9) · NNT = 8.3 (5.6, 16.7)	When compared with contract referral, patient referral (either strategy) needs to be offered to approximately 3 index patients for one extra partner to be elicited. When comparing contract referral with either of the patient referral strategies, contract referral needs to be offered to 4 index patients for one additional partner to present for care, and to 8 index patients for one additional positive partner to be identified.

Table 01. Results - Comparing provider, conditional and patient referral (*Continued*)

Study	STD	Effects (95% CI)*	NNT (95% CI)	Notes
		/index patient: 233/632 (0.37) - 161/634 (0.25) = 0.12 (0.06, 0.18)		
Potterat 1977	Gonorrhoea	Contract versus patient referral · Partners elicited/index patient: 192/94 (2.04) - 198/93 (2.13) = -0.09 (-0.5, 0.32) · Partners presented for care/index patient: 119/94 (1.27) - 107/93 (1.15) =0.12 (-0.2, 0.44) · Partners tested positive and treated/index patient: 67/94 (0.71) - 70/93 (0.75) = -0.04 (-0.29, 0.21)	· NNT = NS · NNT= NS · NNT= NS	There was no difference in the elicitation of partners when comparing contract with patient referral. Contract referral did not increase the number of partners presenting for care, or partners infected with gonorrhoea being identified and treated.
Peterman 1997	Syphilis	Provider versus contract referral · Partners elicited/index patient: 3116/742 (4.20) - 3750/586 (6.40) = -2.20 (-2.45, -1.95) · Partners located/index patient: 816/742 (1.10) - 703/586 (1.20) = -0.10 (-0.22, 0.02) · Partners tested/index patient: 646/742 (0.87) - 539/586 (0.92) = -0.05 (-0.15, 0.05) · Partners positive/index patient: 134/742 (0.18) - 117/586 (0.20) = -0.02 (-0.07, 0.03) · Partners treated/index	· NNT = -0.5 (-0.5, -0.4) · NNT =NS · NNT = NS · NNT =NS · NNT = NS · NNT = 2 (1.3, 4.8) · NNT= NS · NNT= NS · NNT= NS · NNT=NS	Contract referral, when compared with provider referral, was more effective at eliciting partners: it needs to be offered to 1 index patient for 2 additional partners to be elicited. However, provider referral and field testing, when compared with contract referral, was more effective at eliciting partners: it needs to be offered to 2 index patients for one additional partner to be elicitied. The 3 strategies were equally effective at locating, testing and treating partners, and at identifying positive partners.

Table 01. Results - Comparing provider, conditional and patient referral (*Continued*)

Study	STD	Effects (95% CI)*	NNT (95% CI)	Notes
		patients: 453/742 (0.73) - 393/586 (0.67) = 0.06 (-0.03, 0.15) Provider referral and field testing versus contract referral · Partners elicited/index patient: 4402/638 (6.90) 3750/586 (6.40) = 0.50 (0.21, 0.79) · Partners located/index patient: 702/638 (1.10) - 703/586 (1.20) = -0.10 (-0.22, 0.02) · Partners tested/index patient: 549/638 (0.86) - 539/586 (0.92) = -0.06 (-0.17, 0.05) · Partners positive/index patient: 115/638 (0.18) - 117/586 (0.20) = -0.02 (-0.07, 0.03) · Partners treated/index patients: 396/638 (0.62) - 393/586 (0.67) = -0.05 (-0.14, 0.04)		
Faxelid 1996	Any STD	Choice of patient referral or provider referral with counselling and cards versus patient referral MEN: · Partners elicited/index patient: 310/150 (2.07) - 318/152 (2.09) = -0.02 (-0.36, 0.32) · Partners notified/index patient: 276/150 (1.84) - 203/152 (1.34) = 0.50	· NNT = NS · NNT= 2 (1.3, 4.8) · NNT= 1.7 (1.2, 3.1) · NNT (harm) = 6.3 (3.9, 16.7) · NNT = NS · NNT = NS · NNT = NS · NNT not able to be calculated	Among men, there was no difference between the strategies in the elicitation of partners. Among men, the choice of patient or provider referral would need to be offered to 2 index patients for one additional partner to be notified, and to approximately 2 index patients for one additional partner to present for care. Among men offered the choice of patient or provider referral, for every 1 index patient receiving the intervention, approximately 6

Table 01. Results - Comparing provider, conditional and patient referral (*Continued*)

Study	STD	Effects (95% CI)*	NNT (95% CI)	Notes
		(0.21, 0.79) · Partners presenting for care/index patient: 262/150 (1.75) - 176/152 (1.16) = 0.59 (0.32, 0.86) · Domestic quarrels/index patient: 40/150 (0.27) - 17/152 (0.11) = 0.16 (0.06, 0.26) WOMEN: · Partners elicited/index patient: 48/46 (1.04) - 54/48 (1.13) = -0.09 (-0.51, 0.33) · Partners notified/index patient: 36/46 (0.78) - 33/48 (0.69) = 0.09 (-0.26, 0.44) · Partners presenting for care/index patient: 31/46 (0.67) - 30/48 (0.63) = 0.04 (-0.29, 0.37) · Domestic quarrels/index patient: 0.11 in both groups (11/94) Data not presented by intervention group. *The absolute difference between the rate of partners elicited, notified, treated, harmed, etc., per index case.		quarrels with partners will result. Among women, there was no difference between the strategies.

Table 02. Results - Comparing various patient referral strategies

Study	STD	Effects (95% CI)*	NNT (95% CI)	Notes
Cleveland, unpublished	Gonorrhoea	Patient referral, contact cards, educational pamphlet and health education versus patient referral and contact cards Partners elicited (cards taken)/index patient: 2092/634 (3.30) - 2086/632 (3.30) = 0.00 (-0.20, 0.20) Partners presented for care/index patient: 234/634 (0.37) - 233/632 (0.37) = 0.00 (-0.07, 0.07) Partners tested positive/index patient: 161/634 (0.25) - 154/632 (0.24)= 0.01 (-0.04, 0.06)	· NNT = NS · NNT = NS · NNT = NS	There was no difference between the strategies in terms of partners elicited, presenting for care or testing positive.
Katz	NGU	Patient referral, nurse-given health education, referral letters, and no identifying details of partners taken; versus patient referral with DIS, names of partners gathered, but no other identifying details Partners elicited/index patient: 252/217 (1.16) - 180/240 (0.75) = 0.41 (0.23, 0.59) Partners treated/index patients: 48/217 (0.22) - 43/240 (0.18) = 0.04 (-0.04, 0.12) Partners tested positive/index patient: 7/217 (0.03) - 8/240 (0.03) = 0.00 (-0.03, 0.03)	· NNT = 2.4 (1.7, 4.4) · NNT = NS · NNT = NS	Patient referral with nurse-given health education, and with no identifying details of partners taken, needs to be offered to approximately 2 index patients for one additional partner to be identified. There were no differences in the rate of partners treated or testing positive.
Solomon 1998	Gonorrhoea	Videotape and standard interview versus standard interview Partners elicited/index patient: NO DATA GIVEN Partners presenting for care/index patient: NO DATA GIVEN	The differences were reported to be not significant, and the results of the statistical tests were reported. It appeared that the chi squared test was used for the difference between the rates of partners elicited per index patient.	The authors reported that the outcome measure, contact cards returned, may not have been sensitive enough to detect changes. Use of inappropriate statistical tests is apparent.
Montesinos 1990	Gonorrhoea or NGU	Counselling, cards and reminder		There were no differences in the rate

Table 02. Results - Comparing various patient referral strategies (*Continued*)

Study	STD	Effects (95% CI)*	NNT (95% CI)	Notes
		telephone call versus counselling, cards and incentives Partners elicited/index case: 21/19 (1.11) - 25/19 (1.32) = -0.21 (-0.91, 0.49) Partners presenting for care/index patient: 19/19 (1.00) - 16/19 (0.84) = 0.16 (-0.44, 0.76)	· NNT = NS · NNT = NS	of eliciting partners or in partners presenting for care. The sample size may be too small to detect differences.
Andersen 1998	Chlamydia	Urine versus urethral swab test for partner Partners elicited/index case: 65/45 (1.44) -68/51 (1.33) = 0.11 (-0.36, 0.58) Partner specimens tested/index patient: 44/45 (0.98) - 19/51 (0.37) = 0.61 (0.28, 0.94) Partner specimens positive/index patient: 12/45 (0.27) - 7/51 (0.14) = 0.13 (-0.05, 0.31)	· NNT = NS · NNT = 1.6 (1.1, 3.6) · NNT = NS	There was no difference in the rate of eliciting partners. The urine test strategy needs to be offered to approximately 2 index patients for one additional partner to be tested. There was no difference in the rate of specimens testing positive.
Ellison, unpublished	Any STD	Patient referral, contact card, and verbal health education message given by nurse versus patient referral and contact card Partners elicited (cards taken)/index patient: 553/431 (1.28) - 448/433 (1.04) = 0.24 (0.1, 0.38) Partners treated/index patient: 87/431 (0.20) - 77/433 (0.18) = 0.02 (-0.04, 0.08) Patient referral, contact card and patient-centred counselling versus patient referral and contact card Partners elicited (cards taken)/index patient: 491/423 (1.16) - 448/433 (1.04) = 0.12 (-0.02, 0.26) Partners treated/index patient: 93/423	· NNT = 4.2 (2.6, 10) · NNT = NS · NNT = NS · NNT = NS · NNT = 1.7 (1.3, 2.3) · NNT = 14.3 (7.7, 100)	Approximately 4 index patients need to be given health education, compared with the control, to elicit one additional partner. Approximately 2 index patients need to be given health education and counseling, compared with the control, to elicit one additional partner. Health education or counseling alone, was as effective as the control strategy. Health education together with counseling would need to be provided to approximately 14 index patients for one additional partner to be treated.

Table 02. Results - Comparing various patient referral strategies (*Continued*)

Study	STD	Effects (95% CI)*	NNT (95% CI)	Notes
		(0.22) - 77/433 (0.18) = 0.04 (-0.02, 0.10) Patient referral, contact card, verbal health education message and patient-centred counselling versus patient referral and contact card Partners elicited/index patient: 683/417 (1.64) - 448/433 (1.04) = 0.60 (0.44, 0.76) Partners treated/index patient: 106/417 (0.25) - 77/433 (0.18) = 0.07 (0.01, 0.13) *The absolute difference between the rate of partners elicited, notified, treated, harmed, etc., per index case.		

GRAPHS AND OTHER TABLES

This review has no analyses.

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