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EDITORIAL REVIEW

A systematic review of strategies for partner notification for sexually transmitted diseases, including HIV/AIDS

Catherine Mathews MSc^{1,2}, Nicol Coetzee MBBCh MMed²,
Merrick Zwarenstein MBBCh MSc¹, Carl Lombard MSc PhD³,
Sally Guttmacher PhD⁴, Andrew Oxman MD⁵
and George Schmid MD MSc⁶

¹Health Systems Unit, South African Medical Research Council, Tygerberg, South Africa; ²Public Health Department, University of Cape Town, South Africa; ³Biostatistics Unit, South African Medical Research Council, South Africa; ⁴Health Sciences Faculty, New York University, USA; ⁵Health Services Research Unit, Norwegian National Institute of Public Health, Norway and ⁶Division of STD Prevention, National Center for HIV, STD, and TB Prevention, Centers for Disease Control and Prevention, Atlanta, USA

Summary: This review compares the effects of various sexually transmitted disease (STD) partner-notification strategies. Using review methods endorsed by the Cochrane Collaboration, it updates previous reviews, and addresses some of their methodological limitations. It includes 11 randomized 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.

Keywords: partner notification, sexually transmitted diseases, systematic review

INTRODUCTION

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. Three approaches to partner notification have been used:

- Provider referral uses third parties (usually health service personnel) to notify partners.

- Patient referral occurs 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 three months for primary syphilis and one month for most others¹) will usually identify those from whom infection

Correspondence to: Catherine Mathews, Medical Research Council, PO Box 19070, Tygerberg 7505, South Africa
E-mail: cmathews@mrc.ac.za

was acquired, while identifying partners after the onset of symptoms will identify those who may have been infected by the index case.

Partner notification has been practised for decades, with substantial resources directed towards it, and with little evidence as to 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 included only studies conducted in developed countries². 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), were 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 included only published studies conducted after 1980 in the USA³. It reviewed 13 comparative or cohort studies and found that partner notification detected 0.03–0.24 infections of syphilis, gonorrhoea, chlamydia or HIV in partners, per index patient, and 0.7–11% of notified partners were infected. It concluded, based on the results of randomized and non-randomized 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 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)². This does not fit the reality, where index patients have variable numbers of partners, and can thus only be considered a crude approximation. The second review did not include any statistical inference on intervention effects³.

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 up-dating 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.

METHODS

We included published or unpublished randomized controlled trials (RCTs) comparing two or more alternative partner notification strategies for people diagnosed with STDs, and which measured any of the following outcomes: partners elicited (named or counted by index patient), located, notified, medically evaluated (including partners presented for care at a health service, tested positive, and/or treated), harms to the index patient or partner (such as domestic violence, abuse or suicide), index patient reinfection rates, incidence of STDs, or changes in index patient's or partner's behaviour. We included costs (adjusted for inflation to 2001 values based on the consumer price index) of partner notification strategies when these were available.

We searched MEDLINE, EMBASE, Psychological Abstracts, Sociological Abstracts, and the Cochrane Controlled Trials register using an algorithm based on the Cochrane standard search for trials, and the keywords 'sexual partners', 'partner notification', and 'contact tracing'. We hand-searched the Proceedings of the International AIDS Conferences from 1994 to 2000, and the International Society for STD Research meetings (ISSTD) from 1991 to 1999. In addition, experts in the field were contacted to identify studies, and references in all studies were scanned for additional trials.

For each of the included RCTs, the following criteria of methodological quality were independently assessed by two reviewers: Whether randomization 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; and whether the groups were treated equally in all aspects other than the intervention.

ANALYSIS

For each study we tabulated the rate of partners elicited, notified, presenting for care, tested, treated or harmed, per index patient in the respective comparison groups (see Table 1). We assumed that the index patients from all 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

Table 1. Characteristics of included studies and relative effectiveness of the interventions compared.

Study and participants	Methodological quality	Comparisons of interventions, absolute effects (95% CI)* and NNTs
Gonorrhoea, chlamydia and non-gonococcal urethritis		
Cleveland (unpublished)		
• 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'	• Randomization 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	Contract referral (if partners did not present after 3 days, provider notified them), standard interview contact cards <i>vs</i> Patient referral with standard interview and contact cards • Partners elicited (i.e. cards taken)/index patient: 1833/632 (2.90)–2086/632 (3.30) = –0.40 (–0.59 to –0.21) NNT = –2.5 (–4.8 to –1.7) • Partners presented for care/index patients: 392/632 (0.62) – 235/632 (0.37) = 0.25 (0.17 to 0.33). NNT = 4 (3 to 5.9) • Partners tested positive/index patient 233/632 (0.37) – 154/632 (0.24) = 0.13 (0.07 to 0.19). NNT = 7.7 (5.3 to 14.3) Contract referral (if partners did not present after 3 days, provider notified them), standard interview and contact cards <i>vs</i> Patient referral, standard interview, contact cards, educational pamphlet and health education • Partners elicited (cards taken)/index patient: 1833/632 (2.90)–2092/634 (3.30) = –0.40 (–0.59 to –0.21). NNT = –2.5 (–4.8 to –1.7) • Partners presented for care/index patient: 392/632 (0.62)–234/634 (0.37) = 0.25 (0.17 to 0.33). NNT = 4 (3 to 5.9) • Partners tested positive (index patient: 233/632 (0.37)–161/634 (0.25) = 0.12 (0.06 to 0.18). NNT = 8.3 (5.6 to 16.7) Patient referral, standard interview, contact cards, educational pamphlet and health education <i>vs</i> Patient referral with standard interview and contact cards • Partners elicited (cards taken)/index patient: 2092/634 (3.30)–2086/632 (3.30) = 0.00 (–0.2 to 0.2). NNT = NS • Partners presented for care/index patient: 234/634 (0.37)–233/632 (0.37) = 0.00 (–0.07 to 0.07). NNT = NS • Partners tested positive/index patient: 161/634 (0.25)–154/632 (0.24) = 0.01 (–0.04 to 0.06). NNT = NS Contract referral, interview, names and addresses of partners elicited, provider notified partners if they did not present at the health service after 7–10 days <i>vs</i> Patient referral, shorter interview with contact cards. No names of partners elicited • Partners elicited/index patient: 192/94 (2.04)–198/93 (2.13) = –0.09 (–0.50 to 0.32). NNT = NS • Partners presented for care/index patient: 119/94 (1.27)–107/93 (1.15) = 0.12 (–0.20 to 0.44). NNT = NS • Partners tested positive and treated/index patient: 67/94 (0.71)–70/93 (0.75) = –0.04 (–0.29 to 0.21). NNT = NS
Potterat 1977		
• 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	• Randomization 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	

(continued)

Table 1 (continued)

Study and participants	Methodological quality	Comparisons of interventions, absolute effects (95% CI)* and NNTs
Katz 1998		
- Type of STD: non-gonococcal urethritis (NGU) - Setting: USA, public health clinic - Inclusion criteria: heterosexual male index patients - Number of index patients who participated: 678 - Type of health worker: nurse, disease intervention specialist (DIS)	- Randomization 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	Provider referral with DIS who took names and identifying details of partners and attempted to refer them by phone calls, letters and visits vs Patient referral with nurse-given health education and referral letters, no names and identifying details of partners taken - Partners elicited/index patient: 177/221 (0.80)–252/217 (1.16) = –0.36 (–0.55 to –0.17). NNT = –2.8 (–5.9 to –1.8) - Partners treated/index patient: 159/221 (0.72)–48/217 (0.22) = 0.50 (0.37 to 0.63). NNT = 2.0 (1.6 to 2.7) Partners positive/index patient: 20/221 (0.09)–7/217 (0.03) = 0.06 (0.01 to 0.11). NNT = 16.7 (9.1 to 100) Provider referral with DIS who took names and identifying details of partners and attempted to refer them by phone calls, letters and visits vs Patient referral with DIS who took names of partners but no other identifying details - Partners elicited/index patient: 177/221 (0.80)–180/240 (0.75) = 0.05 (–0.07 to 0.17). NNT = NS - Partners treated/index patient: 159/221 (0.72)–43/240 (0.18) = 0.54 (0.42 to 0.66). NNT = 1.9 (1.5 to 2.4) - Partners positive/index patients: 20/221 (0.09)–7/240 (0.03) = 0.06 (0.01 to 0.11). NNT = 16.7 (9.1 to 100) Patient referral with nurse-given health education and referral letters, no names and identifying details of partners taken vs Patient referral with DIS who took names of partners but no other identifying details - Partners elicited/index patient: 252/217 (1.16)–180/240 (0.75) = 0.41 (0.23 to 0.59). NNT = 2.4 (1.7 to 4.4) - Partners treated/index patients: 48/217 (0.22)–43/240 (0.18) = 0.04 (–0.04 to 0.12). NNT = NS - Partners tested positive/index patient: 7/217 (0.03)–8/240 (0.03) = 0.00 (–0.03 to 0.03). NNT = NS
Solomon 1988		
- 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	- Randomization concealment: NOT CLEAR - Blinded assessment: NOT CLEAR - Baseline comparability: NOT CLEAR - Intention to treat analysis: NOT CLEAR - Proportion of those eligible who participated: 75%	Patient referral with videotaped story promoting partner notification, standard interview with DIS, and contact cards vs Patient referral with standard interview with DIS and contact cards - 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)
Montesinos 1990		
- 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	- Randomization concealment: NOT DONE - Blinded assessment: NOT CLEAR - Baseline comparability: NOT CLEAR - Intention to treat analysis: NOT CLEAR - Proportion of those eligible who participated: 95%	Patient referral with counselling, contact cards and reminder telephone call to index patient if the partner did not present in 5 days vs Patient referral counselling, contact cards and a financial incentive (if the partner presented at the service, the index patient's and the partner's fee of \$3 was waived) - Partners elicited/index case: 21/19 (1.11)–25/19 (1.32) = –0.21 (–0.91 to 0.49). NNT = NS - Partners presenting for care/index patient: 19/19 (1.00)–16/19 (0.84) = 0.16 (–0.44 to 0.76). NNT = NS

(continued)

Table 1 (continued)

Study and participants	Methodological quality	Comparisons of interventions, absolute effects (95% CI)* and NNTs
Andersen 1998		
- Type of STD: <i>Chlamydia trachomatis</i> - 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	- Randomization concealment: NOT DONE - Blinded assessment: NOT DONE - Baseline comparability: SIMILAR IN TERMS OF AGE, REPORTED SYMPTOMS, CONTRACEPTIVE USE - Intention to treat analysis: NOT CLEAR - Proportion of those eligible who participated: NOT CLEAR	Patient referral, urine sample test for partner taken by index patient, with instructions for partner to send sample to laboratory in an enclosed, prepaid envelope <i>vs</i> 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) - Partners elicited/index case: 65/45 (1.44)–68/51 (1.33)=0.11 (–0.36 to 0.58). NNT=NS - Partner specimens tested/index patient: 44/45 (0.98)–19/51 (0.37)=0.61 (0.28 to 0.94). NNT=1.6 (1.1 to 3.6) - Partner specimens positive/index patient: 12/45 (0.27)–7/51 (0.14)=0.13 (–0.05 to 0.31). NNT=NS
Syphilis		
Peterman 1997		
- 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	- Randomization concealment: NOT DONE - Blinded assessment: NOT DONE - Baseline comparability: YES - Intention to treat analysis: DONE - Proportion of those eligible who participated: 89%	Provider referral (immediate notification by DIS) <i>vs</i> Contact referral (if partners did not present within 2 days, the DIS would notify them on the 3rd day) - Partners elicited/index patient: 3116/742 (4.20)–3750/586 (6.40)= –2.20 (–2.45 to –1.95). NNT= –0.46 (–0.51 to –0.41) - Partners located/index patient: 816/742 (1.10)–703/586 (1.20)= –0.10 (–0.22 to 0.02). NNT=NS - Partners tested/index patient: 646/742 (0.87)–539/586 (0.92)= –0.05 (–0.15 to 0.05). NNT=NS - Partners positive/index patient: 134/742 (0.18)–117/586 (0.20)= –0.02 (–0.07 to 0.03). NNT=NS - Partners treated/index patients: 453/742 (0.73)–393/586 (0.67)=0.06 (–0.03 to 0.15). NNT=NS Provider referral and field testing (immediate notification by DIS who could draw blood for testing in the field, if it seemed unlikely the partner would come in for testing) <i>vs</i> Contract referral (if partners did not present within 2 days, the DIS would notify them on the 3rd day) - Partners elicited/index patient: 4402/638 (6.90)–3750/586 (6.40)=0.50 (0.21 to 0.79). NNT=2 (1.3 to 4.8) - Partners located/index patient: 702/638 (1.10)–703/586 (1.20)= –0.10 (–0.22 to 0.02). NNT=NS - Partners tested/index patient: 549/638 (0.86)–539/586 (0.92)= –0.06 (–0.17 to 0.05). NNT=NS - Partners positive/index patient: 115/638 (0.18)–117/586 (0.20)= –0.02 (–0.07 to 0.03). NNT=NS - Partners treated/index patients: 396/638 (0.62)–393/586 (0.67)= –0.05 (–0.14 to 0.04). NNT=NS
HIV		
Landis 1992		
- 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 counsellors	- Randomization concealment: NOT CLEAR - Blinded assessment: NOT CLEAR - Baseline comparability: NOT CLEAR - Intention to treat analysis: NOT CLEAR - Proportion of those eligible who participated: 46%	Choice between provider and patient referral (patients could notify all or some of their partners themselves, and the remaining partners, as well as those not presenting at the service after 2 weeks, were contacted by counsellors) <i>vs</i> Patient referral, interview with counsellor to discuss the process of notification - Partners elicited/index: 157/39–153/35 (4.03–4.37)= –0.34 (–1.26 to 0.58). NNT=NS - Partners notified/index: 78/39–10/35 (2.00–0.29)= 1.71 (1.35 to 2.07). NNT=0.6 (0.5 to 0.7) - Partners tested HIV positive/index: 9/39–1/35 (0.23–0.03)=0.20 (0.04 to 0.36). NNT=5 (2.7 to 25)

(continued)

Table 1 (continued)

Study and participants	Methodological quality	Comparisons of interventions, absolute effects (95% CI)* and NNTs
Levy 1998 (trial ongoing) • 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 counsellors	• Randomization concealment: ADEQUATE • Blinded assessment: NOT CLEAR • Baseline comparability: NOT CLEAR • In intention to treat analysis: NOT CLEAR • Proportion of those eligible who participated: currently 95%. STUDY NOT YET COMPLETE	Choice between provider and patient referral. Index patients received help in identifying and naming partners, were counselled about notification. Indigenous community workers working from the community notified those partners the index patients did not want to notify themselves, without revealing the identity of the index patient. Community-based testing for partners <i>vs</i> Patient referral. Index patients received help in identifying and naming partners, were counselled about notification. Community-based testing for partners DATA FOR COMPARISONS NOT YET AVAILABLE 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 that provider referral is preferred and facilitates notification
Any STD		
Faxelid 1996 • 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 officer	• Randomization concealment: ADEQUATE • Blinded assessment: NOT CLEAR • Baseline comparability: YES (data were stratified by gender and diagnosis) • In intention to treat analysis: NOT CLEAR • Proportion of those eligible who participated: 94% further 19 patients did not come for a second interview	Choice between patient and provider referral with counselling (10–20 minutes) and contact cards <i>vs</i> Patient referral (standard care, no contact cards) MEN: • Partners elicited/index patient: 310/150 (2.07)–318/152 (2.09)= −0.02 (−0.36 to 0.32). NNT=NS • Partners notified/index patient: 276/150 (1.84)–203/152 (1.34)=0.50 (0.21 to 0.79). NNT=2 (1.3 to 4.8) • Partners presenting for care/index patient: 262/150 (1.75)–176/152 (1.16)=0.59 (0.32 to 0.86). NNT=1.7 (1.2 to 3.1) • Domestic quarrels/index patient: 40/150 (0.27)–17/152 (0.11)=0.16 (0.06 to 0.26). NNT (harm)=6.3 (3.9 to 16.7) WOMEN: • Partners elicited/index patient: 48/46 (1.04)–54/48 (1.13)= −0.09 (−0.51 to 0.33). NNT=NS • Partners notified/index patient: 36/46 (0.78)–33/48 (0.69)=0.09 (−0.26 to 0.44). NNT=NS • Partners presenting for care/index patient: 31/46 (0.67)–30/48 (0.63)=0.04 (−0.29 to 0.37). NNT=NS Domestic quarrels/index patient: 0.11 across both groups (11/94). Data not presented by intervention group

(continued)

Table 1 (continued)

Study and participants	Methodological quality	Comparisons of interventions, absolute effects (95% CI)* and NNTs
Ellison (unpublished)		
• 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 counsellor	• Randomization 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%	Patient referral, contact card and standardized, nurse-given health education <i>vs</i> Patient referral (standard care) and contact card • Partners elicited (cards taken)/index patient: 553/431 (1.28)–448/433 (1.04)=0.24 (0.10 to 0.38). NNT=4.2 (2.6 to 10) • Partners treated/index patient: 87/431 (0.20)–77/433 (0.18)=0.02 (–0.04 to 0.08). NNT=NS Patient referral, contact card and patient-centred counselling (20–30 minutes) given by lay counsellor of same gender <i>vs</i> Patient referral (standard care) and contact card • Partners elicited (cards taken)/index patient 491/423 (1.16)–448/433 (1.04)=0.12 (–0.02 to 0.26). NNT=NS • Partners treated/index patient: 93/423 (0.22)–77/433 (0.18)=0.04 (–0.02 to 0.10). NNT=NS Patient referral, contact card and standardized, nurse-given health education combined with patient-centred counselling (20–30 minutes) given by lay counsellor of same gender <i>vs</i> Patient referral (standard care) and contact card • Partners elicited/index patient: 683/417 (1.64)–448/433 (1.04)=0.60 (0.44 to 0.76). NNT=1.7 (1.3 to 2.3) • Partners treated/index patient: 106/417 (0.25)–77/433 (0.18)=0.07 (0.01 to 0.13). NNT=14.3 (7.7 to 100)

*The absolute difference between the rate of partners elicited, notified, treated, harmed, etc., per index case; NNT=numbers to treat; DIS=disease intervention specialist; NS=not statistically significant.

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 summarized data from the included RCTs were available. 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 treat (NNT) were calculated. The NNT refers to the number of index patients that would need to receive the intervention for one additional partner to be elicited, to be notified, to present for medical evaluation, etc.

RESULTS

We found 11 RCTs, including 8014 participants. Most trials were conducted in the USA (USA 8, South Africa 1, Zambia 1, Denmark 1). Eight trials were based in public health services, one was conducted at a university, one in private practice and one completely outside formal health services, in a converted storefront.

Table 1 describes the trials, their participants, the interventions, and the outcome measures. Seven trials compared patient, provider or contract strategies. Seven trials compared various patient referral strategies, including financial incentives for the index patient, reminder telephone calls to the index patient, a video-based health education intervention, other health education and counselling strategies, alternative ways of testing partners for chlamydial infection, and the use of various health workers. Two trials measured harms; the rate of quarrels between the index patient and partners⁴ and suicide and domestic violence⁵. Patient preferences were only measured in one study⁵.

Table 1 also describes the methodological quality of the included studies, and shows that there is some risk of bias in all of the included trials. Randomization was adequately concealed in only two trials^{4,5}. One of these is still underway and only preliminary results are available⁵, and the other relied on a method of assessing outcomes that had a substantial risk of bias⁴: index patients' reports of whether they notified their partners and whether their partners presented for care. Outcomes were assessed blindly in only one trial⁶. Data on baseline comparability of the intervention and comparison groups were provided in only three studies^{4,6,7} and in one other study these data were obtained by writing to the author⁸. The participation rate (proportion of those eligible who participated in the research) was reported to be greater than 80% in five trials^{4,5-9}.

Gonorrhoea, chlamydia and non-gonococcal urethritis

Among patients with gonorrhoea, chlamydia or non-gonococcal urethritis (NGU), there was one comparison of provider versus patient referral, two comparisons of contract versus patient referral, and five comparisons of alternative patient referral strategies. There were no trials comparing provider and contract referral or testing alternative strategies to improve either provider or contract referral.

Table 1 describes the results of the studies comparing the relative effectiveness of provider, contract and patient referral strategies. In two studies of patients with NGU and gonorrhoea respectively^{10,11}, patients receiving the patient referral interventions elicited significantly more partners than those receiving provider or contract referral interventions. In the first study, 2.8 (95% CI=1.8 to 5.9) index patients would need to be offered patient referral, compared with provider referral, for one extra partner to be elicited¹⁰. In the second study, 2.5 (95% CI=1.7 to 4.8) index patients would need to be offered patient referral, compared with contract referral, for one extra partner to be elicited¹¹. In a third study, contract and patient referral were equally effective at eliciting partners¹².

In the three above-mentioned trials, patient referral strategies were consistently less effective at ensuring partners received medical evaluation than either provider or contract referral strategies. In the trial conducted among patients with NGU¹⁰, provider referral was compared to either of two patient referral strategies—in one, patients were counselled by nurses and, in the other, patients were counselled by disease interventions specialists (DISs), who are professionals trained in partner notification. Provider referral (using DISs not only to elicit names, but to contact the partners), compared to either of the patient referral strategies, resulted in more partners receiving treatment (0.7 compared with 0.2 per index patient). Two index patients would need to be offered provider referral for one extra partner to receive treatment¹⁰. This is despite the patient referral strategies resulting 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; NNT=16.7 [95% CI=9.1 to 100]). A limitation in this study was that the effectiveness of the patient referral strategies may have been considerably underestimated due to bias in outcome-assessment: partners choosing to be treated at other health services were not counted in the patient referral groups, while they were counted in the provider referral group. The cost of provider referral per partner treated was \$85 as compared to \$18 (nurse as provider) and \$158 (DIS as provider) for patient referral. The cost of provider referral per partner with a positive culture was \$675 as compared to \$120 (nurse provider) and \$845 (DIS provider) for

patient referral. The incremental cost of having one additional partner treated was \$113 for provider referral versus patient referral (nurse-given education), and \$60 for provider referral versus patient referral (DIS-given education).

The two trials conducted among patients with gonorrhoea comparing contract with patient referral found that contract referral was more effective at ensuring partners received medical evaluation^{11,12}. The first of these trials compared contract referral with two alternate patient referral strategies and found that contract referral resulted in more partners presenting for care (0.62 compared with 0.37 per index patient; NNT=4 [95% CI=3 to 5.9] in both comparisons) and more partners testing positive (0.37 compared with 0.24; NNT=7.7 [95% CI=5.3 to 14.3] in the first comparison; and 0.37 compared with 0.25; NNT=8.3 [95% CI=5.6 to 16.7] in the second)¹¹. This is despite the fact that patient referral was more effective at eliciting partners. Contract referral was more than three times as costly per infected partner treated than either of the patient referral strategies. Inflation-adjusted costs could not be calculated as the year in which the study was done was not reported.

The other trial among patients with gonorrhoea found a non-significant trend for more partners to present to health services with contract referral: 1.27 compared with 1.15 per index patient¹². No cost information was reported.

Table 1 also describes the results of the studies comparing the effects of various patient referral strategies. One study of patients with NGU¹⁰ 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 (1.2 compared with 0.8 per index patient). Approximately two index patients would need to be offered the nurse-given intervention for one extra partner to be elicited (NNT=2.4; 95% CI=1.7 to 4.4). There was, however, no significant difference between the two strategies in the numbers of partners who tested positive or were treated. The strategy with nurse-given health education cost only \$4 per patient counselled, versus \$28 per patient counselled for the DIS strategy. The nurse-given strategy yielded a few more partners treated, and, importantly, when compared with the DIS strategy, resulted in a savings of \$608 per extra partner treated.

Three studies compared various patient referral strategies among patients with gonorrhoea. They compared health education using an educational pamphlet with standard care¹¹, an educational video with standard care¹³, and counselling and reminder telephone calls with counselling and modest financial incentives (\$3 in 1990) for the index patient and partner⁹. 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^{9,13}, 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 counted returned contact cards as the main outcome¹³, 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 evaluation¹². 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)⁶. The study comparing reminder telephone calls with incentives included only 38 participants⁹, 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^{6,7}). Furthermore, university students with sex partners outside of the university campus were excluded from the study, this perhaps limiting the generalizability of the results.

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 care¹¹, and that incentives were more than three times the cost per partner contacted than reminder telephone calls (\$17 versus \$5 when physicians were used to do the counselling; \$14 versus \$3 when nurses were used to do the counselling)⁹.

A small study, conducted among women with chlamydia attending private practices in Denmark, compared two strategies for testing male partners for chlamydia⁸. 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 two index patients would need to receive the intervention (urine test) for one extra partner to send a specimen for testing (NNT=1.6; 95% CI=1.1 to 3.6). There was, however, no difference in the number of specimens that tested positive. Neither was there a difference between strategies in the number of

partners elicited. 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.

Syphilis

In people with syphilis, one large trial including 1966 participants compared two forms of provider referral with each other, and with contract referral⁷. The relative effectiveness of the strategies is presented in Table 1. 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; 95% CI=1.3 to 4.8). Contract referral was more effective at eliciting partners than provider referral without field testing (NNT= -0.46; 95% CI= -0.51 to -0.41). However, despite these differences in the rate of partner elicitation, no significant differences between the three strategies were found in the rate of partners located, tested, testing positive and treated. There was little difference in the costs of the interventions, which ranged from \$290-\$315 per partner tested, and \$396-\$452 per partner treated. 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 that there had been subversion of the randomization schedule. These problems may explain the absence of an effect. However, aside from these problems, the three strategies being tested were not very different (for example, with the contract referral, index patients were only given two days before the disease intervention specialists sought their partners).

Among people with syphilis, we found no trials comparing strategies to improve patient or contract referral. Nor did we find trials comparing provider or contract referral with patient referral.

HIV

Among people with HIV, only two comparisons were reviewed. The relative effectiveness of the alternate strategies is presented in Table 1. In the first trial it was found that offering index patients a choice between provider or patient referral, compared with patient referral alone, resulted in more partners being notified (2.0 per index patient compared with 0.3 per index patient; NNT=0.6; 95% CI=0.5 to 0.7)¹⁴. In the group with the choice, most partners (70, 89.7%) were notified by the provider, and only eight by the index patient. More partners in the group with the choice tested HIV-positive: 0.23 compared with 0.03 per index patient; NNT=5; 95% CI=2.7 to 25. There was no difference

between strategies in the number of partners elicited. The participation rate in this study was 46%, and the participants reflected 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 or bisexual.

The second study among HIV-positive index patients compared a choice between provider and patient referral, with patient referral alone⁵. This trial was underway at the time of the review and did not have results on the relative effectiveness of the alternate strategies. The investigators had, however, reported patient preferences with regard to provider and patient referral. The provider referral strategy involved the use of indigenous community workers to notify those partners the index patient did not want to notify themselves. The identity of the index patient was not revealed to the partners. Both patient and provider referral strategies included community-based testing for partners. Among the group of index patients randomly allocated to receive a choice between provider and patient referral, 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 the indigenous community workers as a result of the index patients' preferences.

We found no trials comparing alternate strategies to improve patient referral, contract referral or provider referral among people with HIV. Nor did we find studies comparing provider referral with contract referral, or contract referral with patient referral.

Any STD

Among people with any STD, two trials were reviewed, both conducted in developing countries. In the first, conducted in Zambia, offering index patients a choice between provider and patient referral, counselling (10-20 minutes) and contact cards, was compared with patient referral without counselling or contact cards⁴. The second trial was conducted in South Africa and evaluated three strategies to improve patient referral⁶. Health education, counselling, and a combination of health education and counselling were compared with standard care. The results of these comparisons are included in Table 1.

The Zambian trial found that offering male index patients a choice between provider and patient referral as well as counselling 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 counselling and cards, compared with 1.3 in the patient referral group without counselling and cards)⁴. The choice between provider and patient

referral, counselling and contact cards would need to be offered to two index patients (95% CI=1.3 to 4.8) for one 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; 95% CI=1.2 to 3.1). However, the index patients' reports were not validated in any way, so these differences may reflect a reporting bias. It is not possible to know which part of the intervention (providing a choice between provider and patient referral, counselling, or contact cards) was responsible for the increase in reported partners presenting for care. Among female index patients, there were no differences between the comparison groups. When comparing the harms resulting from the respective strategies, a higher rate of domestic quarrels was reported among men in the group with a choice between patient or provider referral, counselling and cards, compared with those in the patient referral group. No differences with regard to quarrels were detected among women index patients.

The South African trial evaluated the effects of three strategies to improve standard patient referral: nurse-given health education, patient-centred counselling by lay workers, and a combination of these two strategies⁶. Patients in the group given health education, and those in the group given both health education and the 20–30 minute counselling session, elicited more partners than those in the control (standard care) group (1.3 and 1.6 versus 1.0). When comparing health education alone to the control, approximately four index patients would need to be offered the intervention to elicit one extra partner (NNT=4.2; 95% CI=2.6 to 10). When comparing health education combined with counselling to the control, approximately two index patients would need to be given the intervention for one extra partner to be elicited (NNT=1.7; 95% CI=1.3 to 2.3). The combination of health education and patient-centred counselling significantly increased the number of partners treated from 0.18 to 0.25 per index patient (NNT=14.3; 95% CI=7.7 to 100). Neither health education nor counselling in isolation increased the number of partners receiving treatment.

General comments

Partner elicitation rates per index patient ranged from 0.7 to 6.9 across all the trials comparing provider, contract and patient referral strategies (Table 1). Across studies comparing various strategies to improve patient referral, the rate of partner elicitation per index patient ranged from 0.8 to 3.3. The rates of partners who tested positive per index patient ranged from 0.03 to 0.75 across the trials comparing provider contract and patient referral strategies, and from 0.03 to 0.27 across the trial comparing various patient referral strategies

(Table 1). It is not possible to determine whether the differences in rates across studies is a reflection of the different populations studied (differing rates of sex partner change, differing cultures with regard to admitting multiple sex partners, differing transmission rates for different diseases), a reflection of differing definitions of 'current partners' used by health services for the various STDs, or an indicator of differential success of the notification strategies themselves.

Few studies included costs. The differences in costs of partner notification strategies across studies can be attributed in part to variations in costing methodology. All costing studies included direct costs of personnel time and communication, but only one study included overhead costs (rental, and programme management), therefore accounting for higher overall costs⁷. No study included indirect costs.

Figures 1, 2 and 3 illustrate graphically the results of the five 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.

Figures 4 and 5 each illustrate the result of one study. Figure 4 shows the results of the comparison of contract referral with two 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. Figure 5 shows the effects of nurse-given health education and/or 20–30 minutes' counselling by a lay worker, when compared with standard care among patients with any STD. It illustrates that the interventions had small effects, which were statistically significant in the case of health education and health education combined with counselling.

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. Secondly, the methodological weaknesses of studies that met even our quality criteria do not allow rigorous conclusions to be made. In every

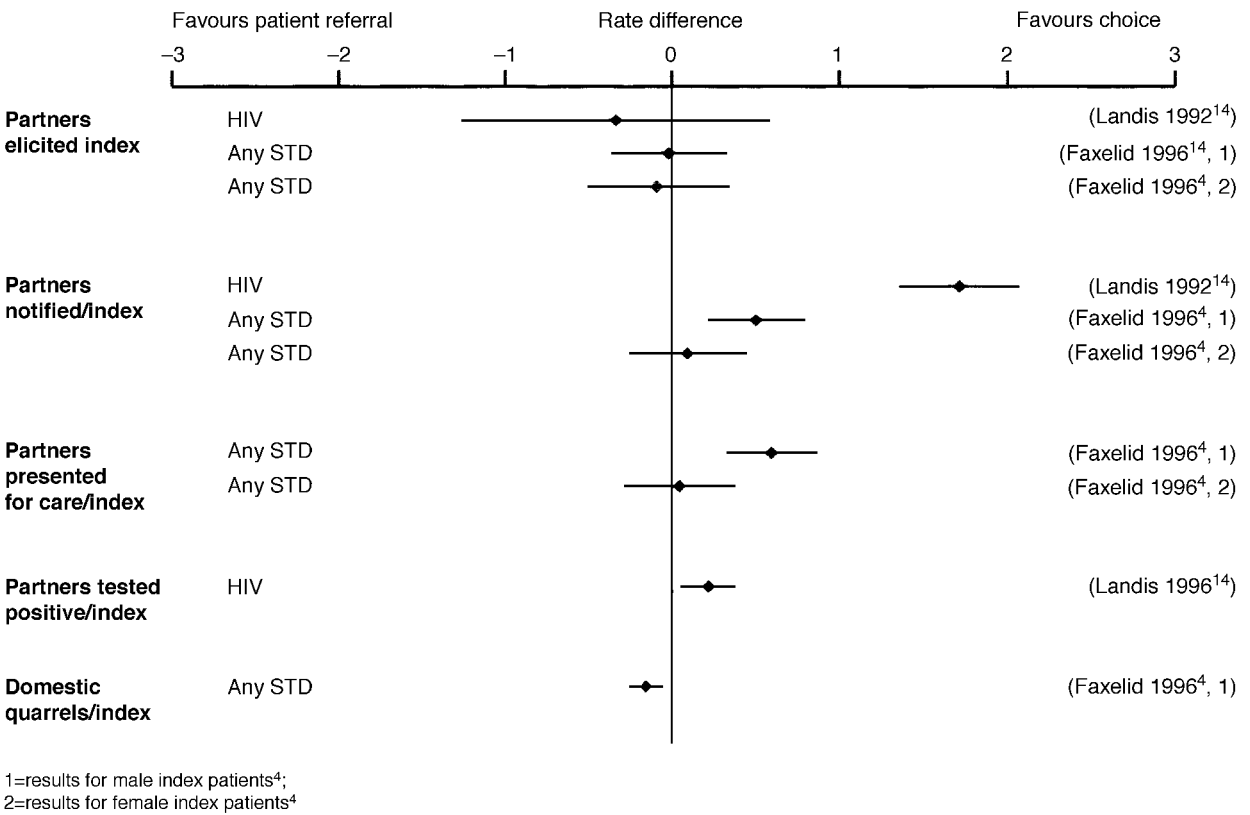


Figure 1. Patient referral versus choice between provider and patient referral (two studies)

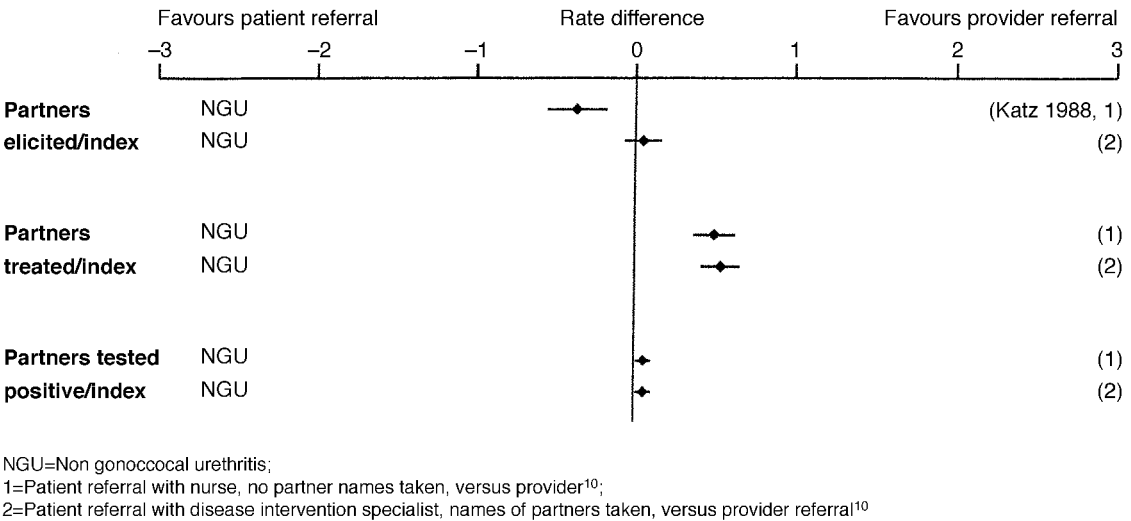


Figure 2. Patient referral (two strategies) versus provider referral (one study)

study, there were threats to the validity of the findings. Thirdly, 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. Lastly, although most studies were conducted in the USA, 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. Even if one determines the effectiveness of varying means of partner notification, a policy maker cannot decide which means to choose without knowing the relative cost of each option. It does little good, for instance, to know the most effective means if it is unaffordable. Unfortunately, the studies provided few cost data. The study by

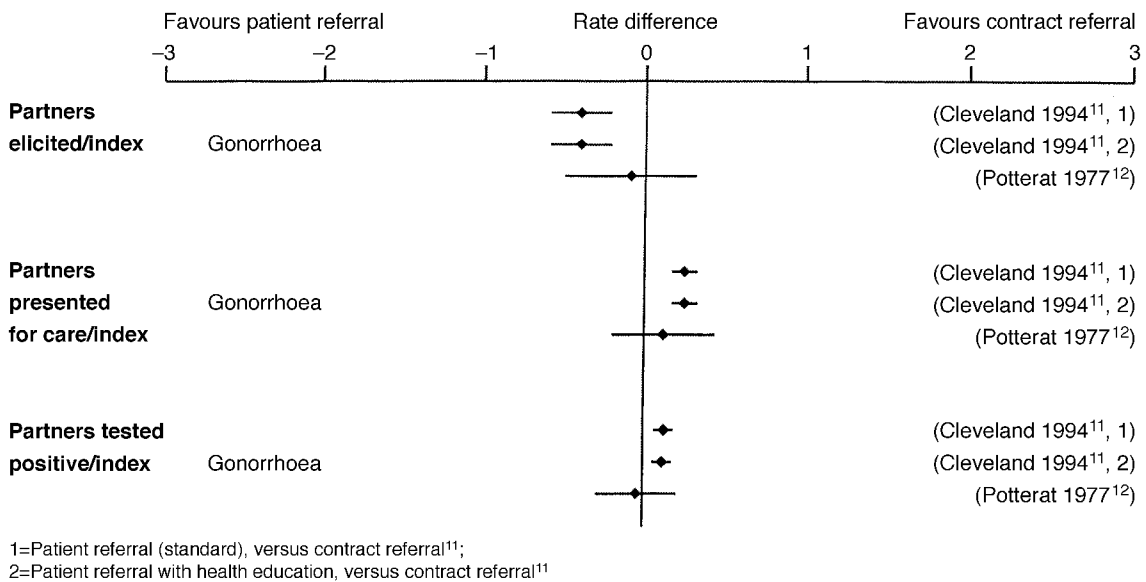


Figure 3. Patient referral versus contract referral (two studies)

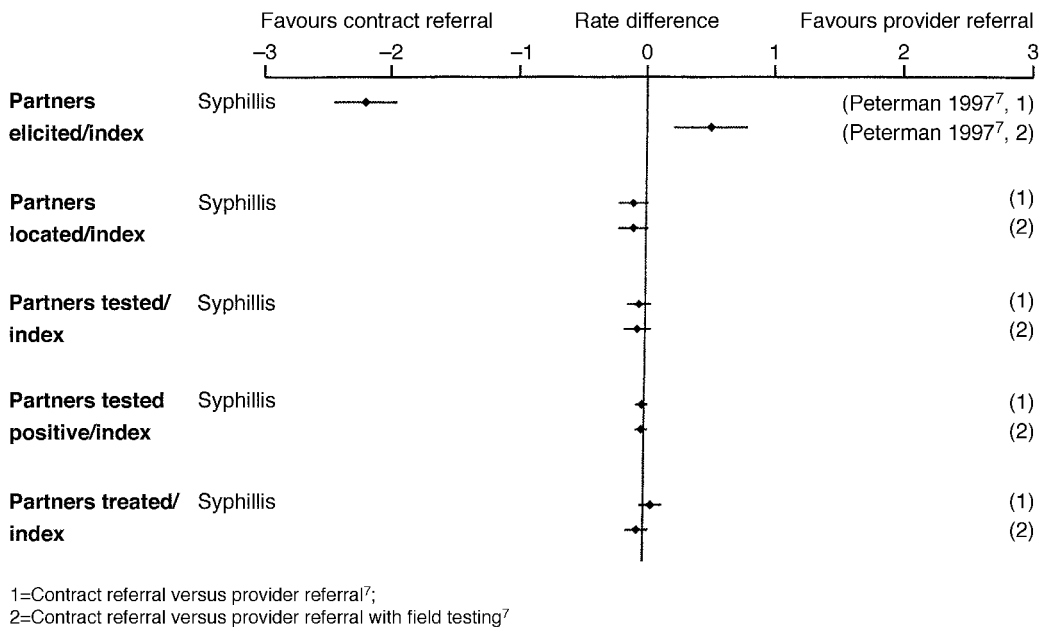


Figure 4. Contract referral versus provider referral with or without field testing (one study)

Katz *et al.*¹⁰ provides the most complete data, and shows that provider referral is the most effective means of referral, but also the most expensive. Among the two patient referral strategies, knowing costs makes choosing the 'best' strategy easy—the nurse-educator strategy brought more partners to treatment and at a cheaper price than did the DIS-educator strategy. But the lack of standardized costing methodology, variation in costs per setting, and cultural variation in acceptability of varying notification strategies make simple adoption of a strategy that worked efficiently in one locale hazardous without considering local conditions.

Costs must be determined, however, to guide the local selection of a notification method.

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

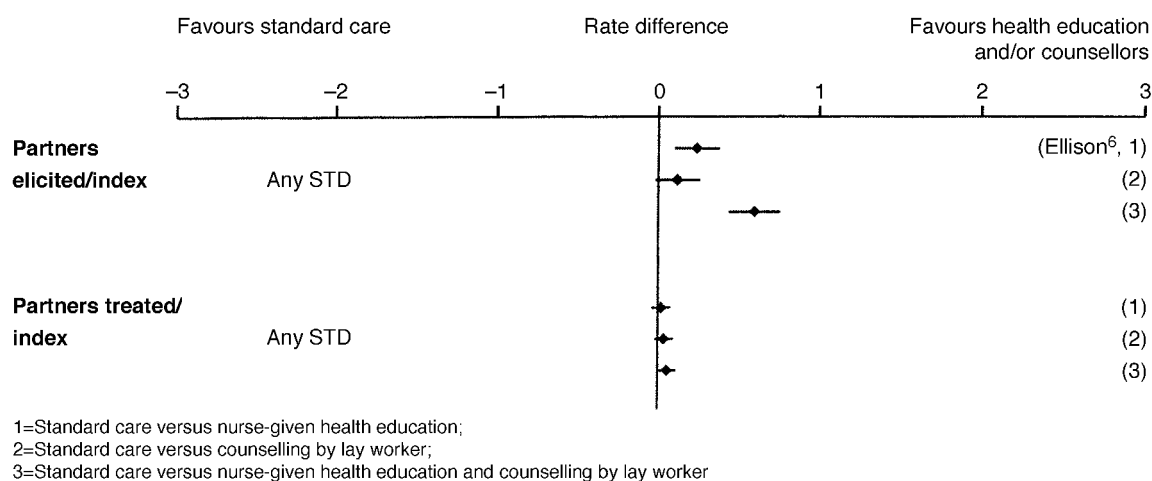


Figure 5. Patient referral: standard care versus nurse-given health education and/or counselling by lay workers (one study)

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 the studies included in our review or in other studies. Only two of the studies reviewed here investigated the harms resulting from the various partner notification strategies and one has not reported results⁵. Faxelid *et al.*⁴ reported that 27% of STD-positive men in Lusaka, given a choice between patient and provider referral, counselling and contact cards, reported domestic quarrels versus 11% of men performing patient referral only; no differences occurred among STD-positive women given the same choice (11% in both groups). In a pilot project for the Ellison study, provider referral was not an acceptable strategy in their South African site. Although prior to the notification process, 25% of women preferred provider referral compared to patient referral, as did only 2% of men, provider referral was labour intensive and successful in reaching only 11 of 83 (13%) partners sought¹⁵. One concern was that some patients feared partner notification might lead to violence. However, in the subsequent study, which included only patient referral, no violence was reported⁶. Descriptive studies conducted among index patients with HIV infection in industrialized countries have found very low rates of disclosure of HIV status to sex partners¹⁶ even after repeated counselling of index patients about disclosure and a six-month opportunity to disclose¹⁷. 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 notification⁵. 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, it may be most effective^{4,14}. However, it may not be without risks⁴.

Patient education and counselling and provider training

Patient education and counselling, 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 counselling, 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 weaknesses¹³. Another evaluating an educational pamphlet failed to demonstrate any effect. A third⁶ found that verbal health education together with intense, patient-centred counselling resulted in a small but significant increase in the rate of partners treated. A fourth⁴, which evaluated the effect of counselling 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^{5,14}. 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 STDs⁴. 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^{4,6}. 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^{5,6}.

CONCLUSIONS

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^{4,10,14}.

2. Contract referral, when compared with patient referral among patients with gonorrhoea, results in more partners presenting for medical evaluation^{11,12}.
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 treated⁶.

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 reinfection 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.

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