

Original  
article

## Patient referral outcome in gonorrhoea and chlamydial infections

Yvonne T H P van Duynhoven, Winfred A Schop, Willem I van der Meijden, Marita J W van de Laar

**Objective:** To describe the outcome of patient referral at the STD clinic of the University Hospital Rotterdam. To study characteristics of heterosexual index patients and partnerships related to referral outcome.

**Methods:** In 1994, patients with gonorrhoea and chlamydia were referred to public health nurses for interview and patient referral. Referral outcome was classified as "verified" if partners attended the STD clinic and as "believed" if partners were said to have attended elsewhere.

**Results:** Of 454 patients, 250 (55%) participated in the study. The outcome of patient referral for the 502 eligible partners was 103 (20.5%) verified referrals, 102 (20%) believed referrals, and 297 (59%) with unknown follow up. Of the 103 partners examined, 43 had an STD of which 63% reported no symptoms. The contact finding ratio was higher for chlamydia patients and heterosexual men. Also, referral was more effective for index patients with recent sexual contact, with follow up visits to the public health nurse, for men who were not commercial sex worker (CSW) clients, and, to a lesser degree, for Dutch patients and patients who sometimes used condoms. For steady partners, referral was improved if the last sexual contact was more recent. Casual partners visited the clinic more often if sexual contact occurred more than once, if the last contact was more recent, if they were older, and if they were Dutch.

**Conclusions:** Patient referral was more effective for certain groups, such as chlamydia patients and steady partners, but was inadequate for others, including CSW and their clients, other "one night stands", young partners, and ethnic minorities.

(*Sex Transm Inf* 1998;74:323-330)

Keywords: partner notification; gonorrhoea; chlamydial infections

## Introduction

Partner notification is an integral part of sexually transmitted disease (STD) control, alongside public health education, screening, and treatment of cases. The World Health Organisation defines partner notification as "the public health activities in which sexual partners of individuals with STD are notified, counselled on their exposure and offered services".<sup>1</sup> Partner notification endeavours to prevent late complications of infection, to interrupt the chain of transmission, and to encourage behaviour change.<sup>2-4</sup> Screening combined with partner notification is most effective for the control of treatable, bacterial STD with a high prevalence and high proportion of asymptomatic infection, such as gonorrhoea and chlamydial infection.<sup>4,5</sup> For viral STD, the rationale for partner notification is less clear.<sup>4</sup>

Partner notification may refer to patient referral, provider referral, or conditional referral, according to the amount of assistance by healthcare workers.<sup>4,6</sup> In the Netherlands contact tracing was first introduced in the early 1930s.<sup>7</sup> Nowadays, public health nurses working at STD clinics and health services provide support for partner notification. In general, infected patients are counselled on the STD and encouraged to notify partners themselves, without direct involvement of public health nurses. Usually, referral cards are handed out to the source patient to facilitate partner notification. However, the referral card also enables patients to inform partners anonymously, if

they consider this the only acceptable method. The public health nurse will never disclose the identity of the source patients without their permission. Field follow up to assure that the partners were located and informed is usually not performed.

Despite its potential importance in STD control, there has been little systematic evaluation of outcome measures (and cost) of partner referral.<sup>3</sup> In the Netherlands, only one study (in the STD clinic in Amsterdam in 1986-8) has addressed this subject so far.<sup>8</sup> In this paper we present the outcome of patient referral in gonorrhoea and chlamydia patients, at the STD clinic in Rotterdam, the Netherlands in 1994. The first objective was to describe the result of patient referral in terms of number of partners identified, number of partners referred at the STD clinic, and number of new STD cases discovered. The second objective was to identify subgroups of index patients and sexual relationships for whom patient referral was more effective in referring partners for STD consultation.

## Patients and methods

## STUDY POPULATION

Between 1 January and 16 December 1994, a cross sectional study was carried out among consecutive visitors to the STD clinic at the Department of Dermatology and Venereology, University Hospital Rotterdam, Netherlands, as described previously.<sup>9</sup> Briefly, at the initial visit information was collected on reason for

Department for  
Infectious Diseases  
Epidemiology,  
National Institute of  
Public Health and the  
Environment,  
Bilthoven, Netherlands  
Y T H P van Duynhoven  
W A Schop  
M J W van de Laar

Department for  
Dermatology and  
Venereology,  
University Hospital  
Rotterdam  
W I van der Meijden

Correspondence to:  
Y T H P van Duynhoven,  
Department for Infectious  
Diseases Epidemiology,  
National Institute of Public  
Health and the Environment,  
PO Box 1, 3720 BA  
Bilthoven, Netherlands.

Accepted for publication  
8 July 1998

consultation, urogenital symptoms, nationality, native country, injecting drug use, history of STD, commercial sex, the use of antibiotics, the age at first sexual intercourse, type and sex of sexual contacts, the number of sexual partners, orogenital contact, anal contact, and condom use with casual partners. During the medical examination specimens were collected for culture for *Neisseria gonorrhoeae* and for culture and Gen-Probe PACE 2 assay for *Chlamydia trachomatis*.

#### INTERVIEW WITH PUBLIC HEALTH NURSE

Patients with verified gonococcal or chlamydial infection who returned for their test results and treatment were referred to the public health nurse. Patients were counselled about the nature of the infection and were asked to participate in an interview on sexual activities by signing an informed consent. Detailed information was collected on sexual partners (with a maximum of nine) in the year preceding the interview: sex, age, native country, highest education, current occupation, type of contact (steady, in advance (arbitrarily) defined as sexual relationship for at least 3 months; casual, sexual relationship for less than 3 months), when and where they had met (municipality and location such as bar, brothel, at friend's home, etc), when they had their first sexual intercourse, when and where they had their last sexual intercourse, frequency of intercourse in the last month, sexual activities involved during last sexual contact (kissing, caress, mutual masturbation, orogenital contact, vaginal intercourse, anal intercourse, digit insertion in the anus, oroanal contact), use of contraceptives during the last sexual contact, use of alcohol or drugs during the last contact, and whether they paid or were paid for the last contact. In addition, information on the index patient was collected; next to items previously asked by the physician, the questions included highest education, current occupation, main daily activity, native country of both parents, housing conditions (alone, with steady partner, etc) and number of sexual partners in the past 3 and 12 months.

#### PATIENT REFERRAL

After completing the interview the need for partner notification, examination, and treatment was discussed. For gonorrhoea patients it was attempted to notify the sexual partners in the 3 months before diagnosis; for chlamydia patients, a 6 month period was used. Partners for whom the index patient ascertained that all sexual contacts were protected by a condom were not included. In addition, we excluded partners attending the STD clinic before patient referral started. Patients were encouraged to notify and refer their own partner(s), but were offered assistance, if desired. Patients were given one referral card for each sexual partner. On the card it was stated that the receiver had been exposed to infection and that medical examination at the STD clinic was warranted. The referral card also contained the index identification number for cross referencing, the diagnosis of the index patient, the issu-

ing date, and the address, phone number, and office hours of the STD clinic. The identity of the index patient was never revealed to the partner. The index patient was defined as the patient first diagnosed at the STD clinic and for whom patient referral was initiated. Partners who presented for STD examination were managed similarly as to the index patients, but were always referred to the public health nurse for interview, independent of their test results. If partners were found to have an STD, they served as new index patients for notification of the remaining sexual partners (second generation). A female partner was considered asymptomatic if no abnormal vaginal discharge, malodorous discharge, bleeding during/after intercourse, interim bleeding, itching/burning sensation, or lower abdominal pain were reported. A male patient was asymptomatic if no symptoms of urethral discharge, dysuria, or itching/burning sensation were reported. The outcome of patient referral included the number of partners identified for referral, the number (still) eligible for patient referral, the number attending the STD clinic (per index patient = contact finding ratio), the number infected (per index patient = case finding ratio), the number attending elsewhere, and the number with unknown follow up. A verified referral was defined as the sexual partner attending the STD clinic. Believed referrals were defined as partners who, according to the index patient, consulted other healthcare providers, and partners who informed the STD clinic (as requested on the referral card) that they intended to visit or visited another physician. The remainder of partners were classified as "unknown follow up".

#### STATISTICAL ANALYSIS

Participation in the study (both interview and patient referral) was evaluated per STD, by comparing characteristics of participants and non-participants as collected at the initial visit. For statistical testing we used the  $\chi^2$  test or the two tailed Fisher exact test for categorical data and the Wilcoxon rank sum test for continuous distributions. Factors were further analysed by multiple logistic regression analysis to identify independent predictors of study participation. A full logistic model including the main effects of the univariate analysis was compared with models excluding one of these factors (manual backward). A factor remained in the model if either the likelihood ratio test was significant ( $p < 0.05$ ) or the estimates of the beta coefficients for other variables in the model changed by at least 10%. Subsequently, the outcome of patient referral was evaluated, overall and stratified by diagnosis, sex, or sexual orientation (for men). Also, characteristics of index patients with at least one verified self referred partner were compared to those for whom follow up of partner(s) was unknown. Index patients for whom only "believed referrals" were registered were excluded from these analyses to avoid misclassification. Additionally, homosexual index patients were excluded from the analysis of index characteristics because of low numbers. The index analyses

Table 1 Outcome of patient referral in 250 patients with chlamydial infection or gonorrhoea, University Hospital Rotterdam, 1994

Diagnosis, sex of the index (n=all index cases/index cases with eligible partners for referral)	Identified per index*	Eligible for referral per index†	STD clinic per index‡	Elsewhere per index§	Unknown follow up per index¶	Infected per index‡¶
Chlamydia total (n=182/149)**	2.21	2.21	0.56	0.48	1.17	0.23
Men (n=97/80)**	2.47	2.64	0.53	0.60	1.51	0.23
Women (n=85/69)**	1.91	1.72	0.59	0.35	0.78	0.25
Gonorrhoea total (n=55/52)**	2.93	2.79	0.31	0.50	1.98	0.15
Men (n=41/41)**	3.20	3.05	0.32	0.54	2.20	0.17
Women (n=14/11)**	2.14	1.82	0.27	0.36	1.18	0.09
Men total (n=143/125)	2.71	2.82	0.44	0.57	1.81	0.20
Heterosexual (n=120/102)	2.49	2.64	0.49	0.62	1.53	0.23
Homo/bisexual (n=23/23)	3.87	3.61	0.22	0.35	3.04	0.09
Women total (n=107/88)	1.91	1.70	0.55	0.35	0.81	0.20
Total index cases (n=250/213)	2.37	2.36	0.48	0.48	1.39	0.20
Total of partners	592	502	103	102	297	43

\*Within the specified interval for partner referral; 3 months for gonorrhoea, 6 months for chlamydial infection.

†Only index patients with eligible partners for referral included in the calculations.

‡Contact finding ratio; visit at STD clinic is verified.

§Visit elsewhere is believed.

¶Case finding ratio; based on partners attending the STD clinic, for partners elsewhere the diagnosis is unknown.

\*\*5 men and 8 women with both chlamydial infection and gonorrhoea excluded.

included univariate analysis only using the  $\chi^2$  test, Fisher exact test, or Wilcoxon rank sum test, because the identified factors were not interrelated. Characteristics of the sexual partner and of the sexual partnership, as provided by the index patient, were also studied in association with the outcome of patient referral. Factors were studied for steady and casual partnerships separately. Again, partners classi-

fied as "believed referrals" and homosexual partners were excluded from the analysis of partnership characteristics. Both univariate analysis and multiple logistic regression analysis (for factors univariately associated with the outcome with a p value <0.10) were performed. The logistic model including the most relevant effect of the univariate analysis was compared with models including a second factor (manual forward). The factor entered the model if either the likelihood ratio test was significant (p<0.05) or the estimates of the  $\beta$  coefficients for other variables in the model changed by at least 10% (manual forward). Odds ratios (OR) are presented with 95% confidence intervals (95% CI).

Table 2 Univariate analysis of characteristics of the heterosexual index patient and outcome of patient referral, University Hospital Rotterdam, 1994†

Index patient characteristics‡ Total n/overall % successful	Number 139§	At least one self referred partner 61%
Native country:		**
Netherlands	77	64
Turkey/Morocco	9	22
Surinam	30	53
Dutch Antilles	9	78
Other foreign	13	77
Place of residence:		*
Rotterdam	106	65
Within 35 km of Rotterdam	28	54
(Other/unknown)	5	20
Education:		*
Low 0-12 years	72	60
Middle 13-16 years	42	62
High ≥17 years	19	68
Time since last sexual contact:		***
0-7 days	84	70
≥8 days	55	47
Partners eligible for referral:		*
1	51	63
2	47	64
≥3	41	56
Condom use in casual partners:		**
Sometimes	58	53
Never	25	80
No casual partners past half year	50	62
Commercial sex status¶:		*
Ever	37	51
Never	97	65
History of STD:		*
Yes	57	65
No	80	58
Report of symptoms:		*
Yes	93	62
No	46	59
Number of visits to public health nurse:		***
1 visit	53	43
≥2 visits	86	72

\*\*\*p<0.05, \*\*p≤0.10, \*p>0.10 of  $\chi^2$ /Fisher exact test; category in parentheses not included in testing.

†Excluded from analysis: the 37 index patients without eligible sexual partners for patient referral, 23 homosexual or bisexual index patients, and 51 index patients with believed referrals only (referrals elsewhere, not verified).

‡Non-significant associations not in table: age, coitarche, partners past 3 months, 6 months, life, main daily activity.

§Numbers do not always add up to the total because of missing values.

¶Commercial sex work for women, visit of commercial sex workers for men.

## Results

During the study period, 454 patients with gonorrhoea or chlamydia attended the STD clinic. Of these, 250 (55%) participated in this study (182/317 (57%) chlamydia patients; 55/111 (50%) gonorrhoea patients, 13/26 (50%) patients with both STD). The remainder either did not visit the public health nurse (n=64; 14%) or did not participate in the study because of language barrier, refusal to cooperate, or constraints of time of the patient or public health nurse (n=140; 31%).

### PARTICIPATION OF STD PATIENTS

The 148 chlamydial patients who were not interviewed (47 did not contact the public health nurse; 101 refused to participate) were significantly more often male (64% versus 52% of participants); of foreign origin, not including Surinam and the Dutch Antilles (29% versus 13%); were older (median 28 years versus 26 years); their visits were less often prompted by an at risk, symptomatic, or infected sexual partner (7% versus 14%); and, for men, were clients of commercial sex workers (CSW) more often (56% versus 37%). Because these factors were interrelated, logistic regression analysis was performed: being born in the Netherlands, Surinam, and the Dutch Antilles ( $OR_{\text{interview=yes}}=2.2$ , 95% CI 1.1-4.0) and not being a (former) CSW client ( $OR_{\text{interview=yes}}=2.0$ , 95% CI 1.2-3.3) were independently associ-

Table 3 Univariate analysis of heterosexual relationship/partner characteristics and the outcome of patient referral, by type of partnership, University Hospital Rotterdam, 1994

Partner(ship) characteristics Total n/% verified referrals	Steady partners†		Casual partners‡	
	n=109‡	61%	n=216‡	15%
Type of sexual partner:				***
casual partner, more than once sexual contact	not applicable	not applicable	83	29
casual partner, "one night stand"			133	6
Age of sexual partner:		*		***
≤25	49	57	97	12
26-30	18	72	33	21
>30	38	63	38	32
(Unknown)	4	25	48	2
Native country of sexual partner:		*		***
Netherlands	49	65	77	27
Surinam/Dutch Antilles	35	60	37	11
Other foreign	23	57	68	11
(Unknown)	2	0	34	0
Where did they meet:		*		***
At home, work, school, family or friends	40	63	45	24
Place of entertainment	39	54	57	18
Sex club, brothel, sex sauna, street CSW	n=3 in else	—	67	4
Elsewhere	30	67	47	17
Time since last sexual contact:		***		**
less than 8 days	32	88	28	21
8-30 days	34	71	38	26
31-90 days	22	32	82	12
more than 90 days	20	35	65	9
Municipality of last sexual contact:		*		***
Rotterdam	83	66	123	19
Within 35 km of Rotterdam	16	44	43	21
Other in the Netherlands	4	50	15	0
Abroad	5	40	31	0
Location of last sexual contact:		*		***
At home of index case or partner	103	61	102	26
Sex club, brothel, sex sauna, street CSW	n=1 in else	—	50	2
Hotel/motel	0	—	42	5
Elsewhere	6	50	22	9
Last sexual contact paid?:		no testing		***
Yes	3	0	72	6
No	105	63	139	20
Contraceptives during last contact::		*		***
None	17	59	27	22
Condom	19	63	85	8
Other	70	60	51	29
Unknown	3	67	53	8
Alcohol or drug use during last contact:		*		*
Yes	25	68	80	14
No	83	59	132	16

\*\*\*p<0.05, \*\*p≤0.10, \*p>0.10 of the  $\chi^2$ /Fisher exact test; subcategories in parentheses not included in testing

†Homosexual/bisexual partners excluded: 11 steady, 72 casual, "believed referrals" excluded: 50 steady, 44 casual.

‡Numbers do not always add up to the totals because of missing values.

ated with participation in the study. Participation was independent of the number of sexual partners, the age at first sexual intercourse, sexual orientation, condom use, history of STD, and report of symptoms.

For gonorrhoea, 69 patients were not interviewed (19 did not contact the public health nurse; 50 refused to participate). These non-participants differed significantly with respect to history of (former) injecting drug use (reported by 14% versus 4% of participants); native country (for women, 41% foreign born versus 73% of participants; for men, 71% and 46%, respectively); CSW or being a client (49% versus 26%); the number of lifetime partners (19% reported 1 to 5 sexual partners versus 46% among the participants); and, for women, a history of STD (59% versus 32% among female participants). In logistic regression analysis, not being a CSW or a CSW client ( $OR_{\text{interview=yes}}=2.4$  95% CI 1.1-5.1), for men, a Dutch native country ( $OR_{\text{interview=yes}}=2.0$  95% CI 0.9-4.9) and for women, a foreign native country ( $OR_{\text{interview=yes}}=5.1$  95% CI 1.2-21.6) were independently associated with participation in the study. Participation was independent of age, sex, the number of recent sexual partners, age at first sexual intercourse,

condom use, sexual orientation, reason for STD consultation, and report of symptoms.

#### OUTCOME OF PATIENT REFERRAL

The outcome of patient referral in 250 patients is summarised in table 1. Patient referral included two generations of partners in 17% (n=43) of the cases. All patients identified at least one sexual partner in the specified interval for patient referral: in total, 592 sexual partners were identified (2.37 per index patient). For 90 partners (0.36 per index), patient referral was not initiated: for 17 partners consistent condom use was reported, 32 partners consulted the clinic before partner notification started (22 had an STD), and 41 partners were initial index patients identified by STD positive partners participating in the interview. These partners, and the 37 index patients (15%) for whom this was the sole partner in the specified period, were excluded. Eventually, 502 partners (170 steady, 332 casual; 2.36 per index with eligible partners) were eligible for partner referral; the number of eligible partners was significantly higher for men than for women (p=0.0001). A borderline significant difference was observed for homosexual versus heterosexual men (p=0.056) and for male gonor-

Table 4 Multiple logistic regression analysis of relationship/partner characteristics of heterosexual casual partners and the outcome of patient referral, University Hospital Rotterdam, 1994

Partner(ship) characteristics	Crude OR (95% CI) (n=216)	Adjusted OR (95% CI) (n=182†)
Type of sexual partner: more than once sexual contact "one night stand"	1 0.2 (0.07–0.4)	1 0.1 (0.04–0.4)
Age of sexual partner: ≤25 >25 Unknown	1 2.6 (1.2–5.8) 0.2 (0.02–1.2)	1 6.4 (2.2–18.6) 2.7 (0.3–28.2)
Time since last sexual contact*: less than 8 days 8–30 days 31–90 days more than 90 days	1 1.3 (0.4–4.2) 0.5 (0.2–1.6) 0.4 (0.1–1.3)	1 0.6 (0.1–3.1) 0.3 (0.1–1.1) 0.1 (0.01–0.4)
Native country sexual partner‡: Netherlands Surinam/Dutch Antilles Other foreign	1 0.3 (0.1–1.0) 0.3 (0.1–0.8)	1 0.2 (0.05–0.7) 0.3 (0.1–1.1)

\*n=3 cases excluded because of missing value for time since last sexual contact.

†n=31 additional cases excluded for native country "unknown": none of these cases attended the STD clinic, therefore this subgroup could not be included in the multiple logistic regression analysis.

rhoea patients versus male chlamydia patients ( $p=0.075$ ) (table 1). Of these, 103 partners (20.5%) consulted the STD clinic, 102 (20%) were believed to have consulted elsewhere and for 297 (59%) follow up was unknown, including 164 partners for whom name and address were unknown to the index patient. In contrast with the number of eligible partners, the contact finding ratio was significantly higher for chlamydia patients than for gonorrhoea patients ( $p=0.022$ ) and borderline significant for heterosexual men compared with homosexual men ( $p=0.058$ ), but no difference was observed by sex (table 1). The proportion of self referred partners of those eligible was lower for men (16%; 19% for heterosexual men only) than for women (32%). Steady partners ( $n=69$ ; 41%) consulted the STD clinic more often than casual partners ( $n=34$ ; 10%) (not in table 1). The number of partners with unknown follow up was significantly higher for gonorrhoea patients ( $p=0.0009$ ), men in general ( $p=0.0001$ ), and homosexual men ( $p=0.024$ ) (table 1).

#### CLINICAL EVALUATION

In total, 103 partners (52 female partners, 48 heterosexual male partners, three homosexual male partners) presented at the STD clinic. The median delay between examination of index patient and partner was 16 days; 25% were examined within 8 days, 75% within 29 days, and 90% within 56 days. Overall, 42% (43/103) of them had an STD (case finding ratio=0.20), with no statistically significant differences by sex, diagnosis, or sexual orientation of the index patient (table 1). Of the female partners, 46% (24/52) had an STD: gonorrhoea ( $n=5$ ), chlamydial infection ( $n=18$ ), both STD ( $n=1$ ). Fourteen (58%) of the infected female partners reported no symptoms at presentation. Of the heterosexual male partners, 38% (18/48) had an STD: chlamydial infection ( $n=15$ ), both gonorrhoea and chlamydia ( $n=1$ ), and non-gonococcal urethritis ( $n=2$ ). No symptoms were reported by 13 (72%) of the infected men. Of the three homosexual

male partners, one was diagnosed with (symptomatic) gonorrhoea.

#### OUTCOME OF PATIENT REFERRAL AND CHARACTERISTICS OF THE INDEX PATIENT

Characteristics of the index patient were studied with respect to the outcome of patient referral (table 2). Index patients with believed referrals ( $n=51$ ) were excluded to avoid misclassification, as well as homosexual patients ( $n=23$ ). Patient referral was less successful for index patients born in Turkey, Morocco, and, to a lesser degree, Surinam, although statistical significance was not reached ( $p=0.06$ ). The outcome of patient referral was significantly improved when subsequent visits to the public health nurse were made to discuss the progress of referral, when the last sexual contact was within 7 days before consultation and, less strong, when the index patient never used condoms ( $p=0.07$ ). For men (not in table 2), fewer partners were referred if they were CSW clients (42% at least one self referral versus 71% for men without commercial sex contacts).

#### OUTCOME OF PATIENT REFERRAL AND CHARACTERISTICS OF THE SEXUAL PARTNERSHIP

In table 3, characteristics of the steady and casual heterosexual partnerships are evaluated for the outcome of patient referral. For steady partners, the outcome was only affected by the time since last sexual contact: the proportion of self referred steady partners decreased sharply if the last contact was more than 30 days before the public health nurse visit. For casual partners, patient referral improved if sexual contact occurred more than once, if partners were born in the Netherlands, were older than 25 years, had more frequent sexual intercourse per month, had their last sexual contact within 30 days before consultation ( $p=0.08$ ), in or nearby Rotterdam, without any payment, and at the index's or partner's home. It was also noticed that patient referral failed in the majority of casual partners for whom age or native country was unknown to the index patient, suggesting a more anonymous contact. No associations were found with specific sexual techniques (not in table 3). Whereas the univariate factors for casual partners were mutually strongly dependent, logistic regression analysis was performed to identify independent correlates (table 4). Self referral of sexual partners was associated with sexual contact more than once, older age, the last sexual contact in the recent past, and a Dutch origin.

#### Discussion

In our study of 250 patients with chlamydia or gonorrhoea, we found that as a result of patient referral about one in five partners consulted the STD clinic and another one in five was believed to have consulted elsewhere. Follow up was unknown for 60%. Of the partners consulting the STD clinic, 42% had an STD. Importantly, 58% and 68% of the infected female and male partners, respectively, reported no symptoms at presentation at the clinic and might have remained undetected without partner notification.

There are some limitations of importance for the interpretation of our results. Foremost, the participation rate was only 55%. Fortunately, demographic and sexual data were available for all patients and revealed that cases involved in commercial sex contacts and ethnic minorities (except for the female gonorrhoea patients) participated less often. For the ethnic minorities, failure to participate in the extensive interview was a more important reason for non-participation in this study over not visiting the public health nurse. Therefore, we believe that their non-participation was largely caused by a language barrier, maybe in addition to a cultural barrier. For CSW and their clients the opposite was true: not contacting the public health nurse was the main reason for non-participation over rejecting the interview. Probably, as a result of previous experiences with STD, they did not want to be bothered again with "safe sex" messages. Whereas similar cases included in the study were less effective in patient referral, the contact finding ratio was overestimated as a result of non-participation. On the other hand, this effect might be counteracted by an underestimation, as some of the partners with unknown follow up in our study may have presented elsewhere without informing the STD clinic, presented at the STD clinic without being recognised as a partner, or were already treated because of symptoms. Our results cannot be generalised to other clinic populations, as the effectiveness of partner notification is dependent on the prevalence of infection in the study population, the method of partner notification, and the acceptability of partner notification to index patient, partner, and clinic staff.<sup>4</sup>

In our STD clinic population, on average 2.4 partners per index patient were identified. This mean number is in agreement with some studies concerning similar STD,<sup>10-16</sup> but more often lower numbers were identified.<sup>8 17-29</sup> However, comparison of studies is difficult because of differences in study period, study population, intervals for partner referral, and the method of data collection on sexual partners. The study in Amsterdam identified partners in retrospect up to the believed source of infection, resulting in lower numbers of partners (1.6 per index patient).<sup>8</sup> In our study higher numbers of partners were identified by men, as found by others,<sup>20 23 29 30</sup> homosexual men, and gonorrhoea patients. A lower number of partners for chlamydial patients was documented previously.<sup>22</sup> Because of the lower transmission probability of chlamydia compared with gonorrhoea, frequency of intercourse per partner may be of more importance than number of partners.<sup>22</sup>

The contact finding ratio of 0.48 was within the range of 0.3-0.9 found by others addressing similar STD,<sup>8 18 22 23 26-29 31 32</sup> although the methods of referral were often different. In Amsterdam the reported ratio was 0.66.<sup>8</sup> However, this figure included partners who visited the STD clinic before patient referral was initiated (excluded in our study) as well as partners with verified consultations elsewhere (not done in our study).<sup>8</sup> If we included partners visiting

the STD clinic before patient referral started, a ratio of 0.60 (135/226) was found. Higher ratios, ranging from 1.1 to 2.2 per index patient<sup>11-14 21 24</sup> were mainly obtained by intensified partner notification systems.<sup>11-13 24</sup> Except for the intensity of the referral programme, sexual behaviour and characteristics of partners and index patients might affect the contact finding ratio.

In our study, the number of self referrals was higher for chlamydia patients than for gonorrhoea patients, for heterosexual men versus homosexual and bisexual men, and for steady partners as opposed to casual partners. The latter has been documented repeatedly.<sup>8 25 32</sup> Also, a more efficient contact finding for chlamydia patients was observed before,<sup>8 18 22 27</sup> although one study found equal results for both STD.<sup>25</sup> Differences can be partially ascribed to differences in sexual partners; gonorrhoea patients reported fewer steady partners (28% of partners versus 37% of partners of chlamydia patients) and more "one night stands" (54% of partners versus 36%). The failure by homosexual patients in referring partners may be explained by the high frequency of anonymous sex contacts: 73% of homosexual relationships were "one night stands" compared with 42% of the heterosexual relationships. Patient referral also seemed less effective for index patients from Turkey or Morocco. In addition to a language barrier in understanding and in informing their partners, this might be caused by the high frequency of "one night stands" reported by this group (75% of partners versus 23-44% for the other native countries). Finally, contact finding was less effective for clients of CSW, for index patients who sometimes use condoms opposed to never use, and for index patients with a last sexual contact more than 1 week before consultation. On the contrary, repeated visits to the public health nurse to discuss progress in notification yielded more self referred partners. Index correlates of successful referral documented by others include no condom use,<sup>26</sup> female sex,<sup>8 32</sup> older age,<sup>22 32</sup> no ethnic minority,<sup>8 22 25</sup> report of one sexual partner only,<sup>25</sup> report of multiple sexual partners, multiple visits to a healthcare worker, and absence of symptoms.<sup>8</sup>

With regard to characteristics of the partnership, we found for steady partners that contact finding decreased if the last sexual contact was more than 30 days ago. These partners already might have been treated because of symptoms before patient referral was initiated; otherwise, the index patient might have anticipated that the last sexual contact with the steady partner occurred before the probable infectious contact. For casual partners, a similar association with delay since last contact was found, which again might be explained by partners already being treated, but also may refer to no longer existing, and therefore difficult to reach, partnerships. Furthermore, for casual partners, having had sexual contact just once (about half commercial contacts), age below 26, and a foreign native country hampered patient referral. Only two other studies report on partner characteristics in relation to referral outcome.

Whittington *et al* found that referral of partners failed more often if they had multiple sex partners, if they were CSW, if they involved short term partnerships, and, logically, if markers of access such as telephone number or address were not available.<sup>25</sup> Laar *et al* found that self referral of female contacts was worse if they had a foreign nationality, were CSW, had the assumed infective contact in the week before consultation, and if they were aged below 21 or above 25.<sup>8</sup> For male contacts it was found that casual partners were less referred if they had a foreign nationality and steady partners if the contact was the believed source of infection.<sup>8</sup>

Overall, it was found that patient referral worked best for steady partners, but was less effective for commercial sex contacts, "one night stands", sexual partners in the more distant past, ethnic minorities, and young partners. Supplementary strategies are needed for these groups, especially while some might be vital in the persistence of STD in the population; whereas sex clubs, brothels, sex saunas, street areas for CSW, and particular hotels and motels were sites involved in sex with difficult to reach partners, these locations seem appropriate for outreach programmes including promotion of prevention, increasing healthcare seeking behaviour, and providing screening or presumptive treatment. Also, untraceable partners often had met at places of entertainment; health education and the availability of condoms at these locations might help to control STD. In addition, to improve patient referral, frequent contact with the public health nurse was found to be useful in our study and in the previous Dutch study.<sup>8</sup> Published results state that there is "strong evidence" that simple forms of patients assistance, such as follow up by telephone, the use of referral cards, or in depth counselling can be effective in improving patient referral.<sup>3 8 33</sup> However, there is conflicting evidence regarding the effectiveness of labour intensive, provider and conditional referral compared with patient referral for gonorrhoea and chlamydial infections.<sup>3 26</sup> Consequently, until further research of the comparative efficacy of alternative referral strategies is executed, public health nurses should (continue to) assist in patient referral to their full potential by motivation of patients and arranging follow up visits or phone calls; provider referral should be reserved for accessible partners who are less likely to be notified by the index patient.

The case finding ratio of 0.2 and the STD prevalence of 42% in partners were relatively low compared with previous studies, mainly based on data from the 1980s; the case finding ratio varied between 0.3 and 0.8<sup>5 8 11-13 15 18 20-22 24 29 34</sup> (0.3 in Amsterdam),<sup>8</sup> and the percentage infected ranged from 47% to 87%<sup>5 8 17 18 21 24</sup> (48% in Amsterdam).<sup>8</sup> As the prevalence of gonorrhoea and chlamydia has decreased in the Netherlands over time,<sup>35 36</sup> lower case finding ratios might be found at present compared with previous decades. So, the contribution of partner notification in STD control might further decline under circumstances of decreasing STD prevalences. The

proportion of infected partners presenting without symptoms was constantly high at about 60–100% of cases.<sup>5 8 11-13 20 21 29 37 38</sup>

In summary, our study demonstrated that patient referral was more effective for certain subgroups, such as chlamydia patients and steady partners, but was inadequate for others, including commercial sex contacts, "one night stands", young partners, partners in the more distant past, and ethnic minorities. For these groups supplementary strategies are needed. Assistance by the public health nurse in patient referral by scheduling follow up visits might improve the outcome of partner notification.

The authors thank all medical, nursing, and clerical staff of the University Hospital Rotterdam STD clinic for their cooperation in the study. We especially thank A Diepeveen for her contribution in the interviewing of STD patients and their partners, and for checking inconsistencies in the data presented, and Dr J A R van den Hoek for comments on previous drafts of the manuscript.

- 1 World Health Organisation. Study group on management of sexually transmitted disease patients. *WHO Tech Rep Ser* 1991;**810**:1–103.
- 2 Potterat JJ, Meheus A, Galloway J. Partner notification: operational considerations. *Int J STD AIDS* 1991;**2**:411–5.
- 3 Oxman AD, Scott EAF, Sellors JW, *et al*. Partner notification for sexually transmitted diseases: an overview of the evidence. *Can J Public Health* 1994;**85**(Suppl 1):S41–7.
- 4 Cowan FM, French R, Johnson AM. The role and effectiveness of partner notification in STD control: a review. *Gentourin Med* 1996;**72**:247–52.
- 5 Matondo P, Johnson I, Sivapalan S. Morbidity and disease prevalence in male and female sexual contacts of patients with genital chlamydial infection. *Int J STD AIDS* 1995;**6**:367–8.
- 6 Rasooly I, Millson ME, Frank JW, *et al*. A survey of public health partner notification for sexually transmitted diseases in Canada. *Can J Public Health* 1994;**85**:S48–52.
- 7 Mooij A. Geslachtsziekten en besmettingsangst. Een historisch-sociologische studie 1850–1990. [in Dutch] Amsterdam: Boom, 1993:137–43.
- 8 Laar MJW van de, Termorshuizen F, Hoek JAR van den. Partner referral by gonorrhoea and chlamydial patients; case-finding observations. *Sex Transm Dis* 1997;**24**:334–42.
- 9 Duynhoven YTHP van, Laar MJW van de, Schop WA, *et al*. Different demographical and sexual correlates for chlamydial infection and gonorrhoea. *Int J Epidemiol* 1997;**26**:1373–85.
- 10 Andrus JK, Fleming DW, Harger DR, *et al*. Partner notification: can it control epidemic syphilis? *Ann Intern Med* 1990;**112**:539–43.
- 11 Potterat JJ, Phillips L, Rothenberg RB, *et al*. Gonococcal pelvic inflammatory disease: case-finding observations. *Am J Obstet Gynecol* 1980;**138**:1101–4.
- 12 Phillips L, Potterat JJ, Rothenberg RB, *et al*. Focused interviewing in gonorrhoea control. *Am J Public Health* 1980;**70**:705–8.
- 13 Potterat JJ, Woodhouse DE, Pratts CI, *et al*. Women contacts of men with gonorrhoea: case-finding yields. *Sex Transm Dis* 1983;**10**:29–32.
- 14 Douglas J, Judson F, Spencer N, *et al*. Multiple strains outbreak of penicillinase-producing *Neisseria gonorrhoeae*—Denver, Colorado, 1986. *MMWR* 1987;**36**:534–43.
- 15 Mestery K, Campbell AA. Outbreak of penicillin- and tetracycline-resistant *Neisseria gonorrhoeae* in Manitoba in 1991. *Can Commun Dis Rep* 1992;**18**:162–6.
- 16 Bethea RP, Muth SQ, Potterat JJ, *et al*. Gang-related outbreak of penicillinase-producing *Neisseria gonorrhoeae* and other sexually transmitted diseases—Colorado Springs, Colorado. *JAMA* 1993;**269**:1092–4.
- 17 Wigfield AS. 27 Years of uninterrupted contact tracing. The "Tyneside Scheme". *Br J Vener Dis* 1972;**48**:37–50.
- 18 Thelin I, Wennström A-M, Mårdh P-A. Contact-tracing in patients with genital chlamydial infection. *Br J Vener Dis* 1980;**56**:259–62.
- 19 Katz BP, Danos S, Quinn TS, *et al*. Efficiency and cost-effectiveness of field follow-up for patients with *Chlamydia trachomatis* infection in a sexually transmitted diseases clinic. *Sex Transm Dis* 1988;**15**:11–6.
- 20 Alary M, Joly JR, Poulin C. Gonorrhoea and chlamydial infection: comparison of contact tracing performed by physicians or by a specialized service. *Can J Public Health* 1991;**82**:132–4.
- 21 Ramstedt K, Forssman L, Giesecke J, *et al*. Epidemiologic characteristics of two different populations of women with *Chlamydia trachomatis* infection and their male partners. *Sex Transm Dis* 1991;**18**:205–10.
- 22 Katz BP, Caine VA, Jones RB. Evaluation of field follow-up in a sexually transmitted disease clinic for patients at risk for infection with *Neisseria gonorrhoeae* and *Chlamydia trachomatis*. *Sex Transm Dis* 1992;**19**:99–104.

- 23 Langille DB, Shoveller J. Partner notification and patient education for cases of Chlamydia trachomatis infection in a rural Nova Scotia health unit. *Can J Public Health* 1992;**83**: 358–61.
- 24 Ruden AK. Endemic versus non-endemic gonorrhoea in Stockholm: results of contact tracing. *Int J STD AIDS* 1993;**4**:284–92.
- 25 Whittington WL, Stoner BP, Hughes J, et al. Correlates of success in sex partner referral and evaluation among persons with gonococcal or chlamydial infection. In: Abstract monograph. Eleventh Meeting of the International society for STD research. New Orleans, Louisiana 1995:223.
- 26 Oh MK, Boker JR, Genuardi FJ, et al. Sexual contact tracing outcome in adolescent chlamydial and gonococcal cervicitis cases. *J Adolesc Health* 1996;**18**:4–9.
- 27 King D, Chown R, Clarke J. Forty years on—contact tracing in Wakefield. *Int J STD AIDS* 1996;**7**:362–4.
- 28 Carlin EM, Barton SE. Azithromycin as the first-line treatment of non-gonococcal urethritis (NGU): a study of follow-up rates, contact attendance and patients' treatment preference. *Int J STD AIDS* 1996;**7**:185–9.
- 29 David LM, Wade AAH, Natin D, et al. Gonorrhoea in Coventry 1991–1994: epidemiology, coinfection and evaluation of partner notification in the STD clinic. *Int J STD AIDS* 1997;**8**:311–6.
- 30 Faxelid E, Tembo G, Ndulo J, et al. Individual counseling of patients with sexually transmitted diseases. A way to improve partner notification in a Zambian setting? *Sex Transm Dis* 1996;**23**:289–92.
- 31 Njeru EK, Eldridge GD, Ngugi EN, et al. STD partner notification and referral in primary level health centers in Nairobi, Kenya. *Sex Transm Dis* 1995;**22**:231–5.
- 32 Steen R, Cherif S, Bucyana S, et al. Partner referral as a component of integrated sexually transmitted disease services in two Rwandan towns. *Genitourin Med* 1996;**72**:56–9.
- 33 Ogunbanjo BO, Asuzu MC, Edet EE, et al. Reinforcement of health education and counselling by doctors in treatment and control of sexually transmitted disease. *Genitourin Med* 1986;**62**:53–5.
- 34 Rothenberg R, Voigt R. Epidemiologic aspects of control of penicillinase-producing Neisseria gonorrhoeae. *Sex Transm Dis* 1988;**15**:211–6.
- 35 Duynhoven YTHP van, Laar MJW van de, Fennema JSA, et al. Development and evaluation of screening strategies for Chlamydia trachomatis infections in an STD clinic. *Genitourin Med* 1995;**71**:375–81.
- 36 Laar MJW van de, Duynhoven YTHP van, Santen M van, et al. Surveillance of antibiotic resistance in Neisseria gonorrhoeae in the Netherlands, 1977–1995. *Genitourin Med* 1997;**73**:510–7.
- 37 Fish ANJ, Fairweather DVI, Oriel JD, et al. Chlamydia trachomatis infection in a gynaecology clinic population: identification of high-risk groups and the value of contact tracing. *Eur J Obstet Gynecol Reprod Biol* 1989;**31**:67–74.
- 38 Singh G, Blackwell A. Morbidity in male partners of women who have chlamydial infection before termination of pregnancy. *Lancet* 1994;**344**:1438.