ABSTRACT

Objectives  We aimed to identify individual and sexual partnership characteristics associated with partner notification (PN) among people with STI. We hypothesised that PN would be less likely in more casual sexual partnerships and in partnerships with intimate partner violence (IPV).

Methods  We conducted an observational study among the first 330 patients with STI enrolled in a trial of a behavioural intervention to reduce STI incidence, at a clinic in a poor, Cape Town community. We included 195 index patients (those reporting STI symptoms), and conducted longitudinal analyses using participant-completed questionnaires on the day of diagnosis and 2 weeks later. Using partnership data for five recent sexual partners, we assessed factors associated with reported PN with logistic regressions, adjusting for repeated measurements on the same participant for each partner.

Results  The sample included 99 males with 303 partners and 96 females with 158 partners. Males reported perpetrating IPV in 46.2% of partnerships. Females reported being IPV victims in 53.2% of partnerships. Males notified 58.1%, females 75.4% of partners during the 2 weeks following diagnosis. Type of partner was an independent correlate of PN for males and females, with the odds of PN lower in more casual partnerships. For males, reporting physical IPV perpetration in the partnership was an independent correlate of PN. For females, there was no association between IPV victimisation in a partnership and PN.

Conclusions  Efforts to decrease the pool of infectious partners need to have a strong focus on the promotion of PN in casual relationships and one-night stands. IPV was not identified as a barrier to PN. In future, we need to investigate the association between IPV with an objective measure of PN success such as partner testing or treatment, or index patient reinfection.

Clinical trial registration  PACTR201606001682364; Pre-results.

BACKGROUND

Partner notification (PN) is a process by which a person with a STI informs sexual partners of their possible exposure and the need to be tested or to obtain treatment. PN is designed to interrupt STI transmission through the identification and treatment of undiagnosed infections. STI PN and treatment services are essential to prevent re-infection of index patients and to decrease the pool of infectious partners. People with STIs other than HIV in settings of high HIV prevalence, such as South Africa, are among the highest risk populations for HIV infection because STIs are among the most significant factors that facilitate HIV transmission. PN and treatment are critical to the success of HIV prevention. Unfortunately, current methods of PN only reach a small proportion of partners. For example, among women in low/middle-income countries diagnosed with HIV, rates of non-disclosure of their HIV status to partners vary between 16% and 86% across studies.

Most studies investigating barriers to PN have focused on index patients as the unit of analysis. Sexual risk behaviours vary between individuals and across an individual’s sexual relationships. Studies have shown that condom use varies more across an individual’s partnerships than between individuals. PN behaviours might vary across an individuals’ partnerships. Investigations of the barriers to PN based on partnership-level data could inform interventions to promote PN tailored to the varying circumstances of index patients’ sexual partnerships.

There is evidence that the success of PN varies by relationship type with PN being less likely to occur in more casual partnerships. People report reluctance to disclose fearing that abandonment and intimate partner violence (IPV) will be consequences of PN. However, we know little about whether the presence of IPV in a relationship is a barrier to disclosure and PN. For women, IPV victimisation has been shown to be associated with incident HIV and HIV risk behaviours in some high prevalence settings, and it is conceivable that IPV victimisation will be a barrier to notifying partners of an STI. For males, IPV perpetration has been associated with engaging in a cluster of sexual risk behaviours linked to an ideology of successful masculinity, and men who perpetrate IPV might be less likely to notify partners of an STI.

We aimed to identify the individual and sexual partnership characteristics associated with PN among people diagnosed with an STI, using longitudinal partnership-level data. We hypothesised that PN would be less likely in sex partnerships that were more casual, and in which the index
### Table 1  Characteristics of participants and partnerships associated with STI partner notification 2 weeks after the baseline survey: prospective analysis (crude ORs)

|                      | Males |                               | Females |                               |
|----------------------|-------|--------------------------------|---------|--------------------------------|
|                      | Partner notified 2 weeks after diagnosis | OR*  | 95% CI  | n  | %     | 95% CI  | n  | %     |
| Age                  |       |                                |         |                               |
| 24 years or younger  | 58    | 48.33                          | 1.00    | 48   | 64.86 | 1.00    |
| Older than 24 years  | 118   | 64.48                          | 1.94    | 71   | 84.52 | 2.96    | 1.26 to 6.97 |
| Education            |       |                                |         |                               |
| Not completed grade 12 | 105 | 62.13                          | 1.00    | 82  | 75.23 | 1.00    |
| Completed grade 12   | 30    | 53.57                          | 0.70    | 30  | 85.71 | 1.98    | 0.71 to 5.50 |
| Post-grade 12 education | 41  | 52.56                          | 0.68    | 7   | 52.63 | 0.33    | 0.11 to 0.99 |
| STI symptoms: ulcer  |       |                                |         |                               |
| No                   | 137   | 57.81                          | 1.00    | 102 | 73.91 | 1.00    |
| Yes                  | 39    | 59.09                          | 1.05    | 17  | 85.00 | 2.00    | 0.58 to 6.91 |
| STI symptoms: discharge |       |                                |         |                               |
| No                   | 76    | 63.33                          | 1.00    | 35  | 71.43 | 1.00    |
| Yes                  | 100   | 54.64                          | 0.70    | 84  | 77.06 | 1.34    | 0.54 to 3.36 |
| STI symptoms: burning urine |       |                                |         |                               |
| No                   | 47    | 59.49                          | 1.00    | 43  | 78.18 | 1.00    |
| Yes                  | 129   | 57.59                          | 0.92    | 76  | 73.79 | 0.79    | 0.34 to 1.80 |
| HIV status, participant report |       |                                |         |                               |
| Negative or unknown  | 154   | 57.89                          | 1.00    | 84  | 79.25 | 1.00    |
| Positive             | 22    | 59.46                          | 1.07    | 35  | 67.31 | 0.54    | 0.23 to 1.27 |
| Alcohol use, past 3 months |       |                                |         |                               |
| Non-drinkers         | 23    | 74.19                          | 1.00    | 29  | 80.56 | 1.00    |
| Drinkers             | 45    | 47.37                          | 0.31    | 42  | 75.00 | 0.72    | 0.22 to 2.44 |
| Heavy drinkers       | 108   | 61.02                          | 0.54    | 48  | 72.73 | 0.64    | 0.20 to 2.12 |
| Drug use past 3 months |       |                                |         |                               |
| No                   | 84    | 51.22                          | 1.00    | 111 | 76.55 | 1.00    |
| Yes                  | 92    | 66.19                          | 1.86    | 8   | 61.54 | 0.49    | 0.18 to 1.30 |
| Characteristics of partnerships |       |                                |         |                               |
| Age differential     |       |                                |         |                               |
| Participant younger  | 104   | 65.00                          | 1.89    | 13  | 81.25 | 1.06    | 0.28 to 3.98 |
| Similar age          | 56    | 49.56                          | 1.00    | 45  | 80.36 | 1.00    |
| Participant older    | 16    | 53.33                          | 1.16    | 61  | 70.93 | 0.60    | 0.30 to 1.17 |
| Type of sex partner  |       |                                |         |                               |
| Once-off             | 29    | 43.28                          | 1.00    | 6   | 42.86 | 1.00    |
| Casual               | 63    | 48.46                          | 1.23    | 26  | 57.78 | 1.82    | 0.39 to 8.48 |
| Main                 | 84    | 79.25                          | 5.00    | 87  | 87.88 | 9.67    | 2.02 to 46.35 |
| Transactional sex    |       |                                |         |                               |
| No                   | 133   | 58.33                          | 1.00    | 103 | 75.18 | 1.00    |
| Yes                  | 43    | 57.33                          | 0.96    | 16  | 76.19 | 1.06    | 0.36 to 3.13 |
| Victim of physical IPV, past 3 months |       |                                |         |                               |
| No                   | 78    | 72.22                          | 1.00    |     |      |         |         |
| Yes                  | 41    | 82.00                          | 1.75    | 0.82 to 3.76 |
| Victim of sexual IPV, past 3 months |       |                                |         |                               |
| No                   | 81    | 75.00                          | 1.00    |     |      |         |         |
| Yes                  | 38    | 76.00                          | 1.06    | 0.49 to 2.26 |
| Victim of emotional IPV, past 3 months |       |                                |         |                               |
| No                   | 72    | 71.29                          | 1.00    |     |      |         |         |
| Yes                  | 47    | 82.46                          | 1.89    | 0.87 to 4.14 |
| Perpetrator of physical IPV, past 3 months |       |                                |         |                               |
| No                   | 103   | 50.99                          | 1.00    |     |      |         |         |
| Yes                  | 73    | 72.28                          | 2.51    | 1.43 to 4.38 |
| Perpetrator of sexual IPV, past 3 months |       |                                |         |                               |
| No                   | 143   | 56.75                          | 1.00    |     |      |         |         |
| Yes                  | 33    | 64.71                          | 1.40    | 0.70 to 2.78 |
| Perpetrator of emotional IPV, past 3 months |       |                                |         |                               |
| No                   | 110   | 52.63                          | 1.00    |     |      |         |         |
| Yes                  | 66    | 70.21                          | 2.12    | 1.15 to 3.91 |

*ORs are adjusted for clustering. IPV, intimate partner violence.
patient was an IPV victim. We also examined the association between PN and other participant and partnership characteristics, including participant age, education, alcohol and drug use, age disparity in the partnership and transactional sex. These characteristics have been associated with STI incidence and risk behaviour. Finally, we investigated the prevalence of adverse partner responses to PN such as IPV.

**METHODS**

We conducted an observational study among the first 330 patients with STI enrolled in a trial of a behavioural intervention to reduce STI incidence, at a clinic in a poor, Cape Town community. In longitudinal analyses, we examined factors associated with PN during the 2 weeks following diagnosis.

We invited all people 18 years of age and older who were diagnosed with an STI at the clinic to participate in the trial. They were recruited on the day of their STI diagnosis, and could participate that day, or at most 2 days afterwards. After recruiting the first 330 trial participants, we had an armed robbery, which led us to change from electronic to paper questionnaires. In the process, we reduced the length of the questionnaire, removing the IPV questions. This determined the sample size for this study.

To limit the sample to 'index patients' and to exclude participants who had attended the clinic because they were a partner of someone with an STI, we excluded those who reported they did not have STI symptoms on the day of their clinic visit (discharge or unexplained fluid from genitals, open sore on genitals, or burning/pain on urination), and those who reported that their partners were already enrolled in the study (seven participants). Our analytic sample comprised 201 participants.

After consenting, participants completed the baseline questionnaire. A data collector asked participants to identify, by first name or nickname, up to five sex partners during the prior 3 months. Names were entered into an electronic questionnaire on a tablet computer, and participants self-completed the audio-assisted survey, in English or isiXhosa. We programmed questions about a partnership to include the partner name in the question wording. After the baseline survey, we randomly allocated participants to one of three single-session counselling interventions focusing on sexual risk behaviour and PN (the trial allocated participants to one of three single-session counselling interventions, reporting ORs and 95% CIs. Because the participants measured 2 weeks after baseline. We performed logistic regressions, reporting ORs and 95% CIs. Because the participants were enrolled in an randomised controlled trial (RCT) and were exposed to one of three single-session behavioural counselling sessions after baseline, we included allocation assignment as a variable in the multivariate regression model. Statistical significance was defined as P<0.05.

**RESULTS**

The first 330 participants enrolled in the trial comprised 62.5% of all patients with STI eligible to participate in the trial. Those who declined participation did so mostly due to time constraints. We excluded 45 participants because they were enrolled in the study more than 1 day their STI diagnosis. We excluded a further 84 participants because they did not report STI symptoms or they were a partner of someone already enrolled. The sample included 201 symptomatic participants (100 males and 101 females) who sought STI treatment between June 2014 and May 2015, and who had consented to participate in the parent study (trial). By the 2-week survey, we had retained 195 participants (97.0%) (99 males and 96 females), and these comprise the analytic sample. Most 155 (79.5%) were enrolled on the day of their STI diagnosis. The average age of males was 28.6 years (SD 7.23) and females 29.2 years (SD 7.73). Males reported an average of 3.1 partners for a total of 303 partners (106 main, 130 casual and 67 one-night stands) in the 3 months prior to baseline; females reported on average 1.6 partners for a total of 158 partners (99 main, 45 casual and 14 one-night stands).

Males reported IPV perpetration in 140 (46.2%) partnerships. Males reported perpetrating physical IPV in 101 (33.3%) partnerships, sexual IPV in 51 (16.8%) and emotional IPV in 94 (31.0%) partnerships. Males reported perpetrating IPV in 64 (60.4%) main partnerships, 57 (43.9%) casual partnerships and 19 (28.4%) one-night stands.
Table 2  Multivariate model of participant and partnership characteristics associated with notifying partner 2 weeks after baseline survey (prospective model)

| Characteristics of participants | Males | Females |
|---------------------------------|-------|---------|
| Adjusted OR* | 95% CI | Adjusted OR* | 95% CI |
| **Characteristics of participants** | | | |
| **Age** | | | |
| 24 years or younger | 1.00 | 1.00 |
| Older than 24 years | 1.34 | 0.59 to 3.03 | 1.49 | 0.61 to 3.62 |
| **Education** | | | |
| Not completed grade 12 | 1.00 | | 1.00 | |
| Completed grade 12 | 1.10 | 0.47 to 2.60 | 0.97 | 0.21 to 4.42 |
| Post-grade 12 education | 0.78 | 0.32 to 1.95 | 0.23 | 0.06 to 0.85 |
| **STI symptoms: ulcer** | | | |
| No | 1.00 | | 1.00 | |
| Yes | 0.36 | 0.11 to 1.32 | 1.34 | 0.24 to 7.40 |
| **STI symptoms: discharge** | | | |
| No | 1.00 | | 1.00 | |
| Yes | 0.62 | 0.29 to 1.33 | 1.28 | 0.35 to 4.72 |
| **STI symptoms: burning urine** | | | |
| No | 1.00 | | 1.00 | |
| Yes | 0.62 | 0.21 to 1.84 | 1.25 | 0.44 to 3.59 |
| **HIV status, participant report** | | | |
| Negative or unknown | 1.00 | | 1.00 | |
| Positive | 1.13 | 0.32 to 3.99 | 0.35 | 0.15 to 0.82 |
| **Alcohol use, past 3 months** | | | |
| Non-drinkers | 1.00 | | 1.00 | |
| Drinkers | 0.14 | 0.04 to 0.50 | 1.27 | 0.34 to 4.78 |
| Heavy drinkers | 0.30 | 0.09 to 1.02 | 1.66 | 0.46 to 6.01 |
| **Drug use past 3 months** | | | |
| No | 1.00 | | 1.00 | |
| Yes | 3.04 | 1.48 to 6.26 | 0.49 | 0.08 to 2.91 |
| **Characteristics of partnerships** | | | |
| **Age differential** | | | |
| Participant younger | 2.02 | 1.06 to 3.85 | 1.19 | 0.09 to 15.26 |
| Similar age | 1.00 | | 1.00 | |
| Participant older | 1.67 | 0.69 to 4.04 | 0.70 | 0.31 to 1.55 |
| **Type of sex partner** | | | |
| Once-off | 1.00 | | 1.00 | |
| Casual | 1.17 | 0.54 to 2.55 | 1.94 | 0.51 to 7.43 |
| Main | 5.18 | 2.37 to 11.33 | 20.41 | 4.64 to 89.72 |
| **Transactional sex** | | | |
| No | 1.00 | | 1.00 | |
| Yes | 0.73 | 0.28 to 1.95 | 2.98 | 0.84 to 10.59 |
| **Victim of physical IPV, past 3 months** | | | |
| No | 1.00 | | 1.00 | |
| Yes | 0.48 | | 0.11 to 2.19 |
| **Victim of sexual IPV, past 3 months** | | | |
| No | 1.00 | | 1.00 | |
| Yes | 0.49 | | 0.15 to 1.58 |
| **Victim of emotional IPV, past 3 months** | | | |
| No | 1.00 | | 1.00 | |
| Yes | 1.75 | | 0.38 to 7.99 |
| **Perpetrator of physical IPV, past 3 months** | | | |
| No | 1.00 | | 1.00 | |
| Yes | 2.22 | 1.00 to 4.93 | | |
| **Perpetrator of sexual IPV, past 3 months** | | | |
| No | 1.00 | | 1.00 | |
| Yes | 1.26 | 0.49 to 3.22 | | |
| **Perpetrator of emotional IPV, past 3 months** | | | |
| No | 1.00 | | 1.00 | |
| Yes | 0.85 | 0.39 to 1.86 | | |

*ORs are adjusted for all other factors in the model, for clustering, and for trial condition. IPV, intimate partner violence.*
Behaviour

Females reported IPV victimisation in 84 (53.2%) partnerships. Females reported physical IPV in 50 (31.7%) partnerships, sexual IPV in 50 (31.7%) and emotional IPV in 57 (36.1%) relationships. Females reported being a victim of IPV in 67 (67.7%) main partnerships, 17 (37.8%) casual partnerships and 0 (0%) one-night stands.

Males notified 176 (58.1%) partners and females notified 119 (75.4%) partners during the 2 weeks following diagnosis. Table 1 presents participant and partnership characteristics by PN during the 2 weeks following diagnosis. Among males, the odds of PN were higher when the participant was over 24 years; when they were more than 3 years younger than their partner (compared with same age); when it was a main partnership; and when they reported perpetrating physical and emotional IPV in the partnership. Among females, the odds of PN where higher when the participant was over 24 years; when they had not completed grade 12 (compared with having post-grade 12 education); and when it was a main partnership.

Table 2 shows results of the multivariate models of factors associated with partner notification during the 2 weeks after diagnosis. Among males, adjusting for all other factors in the model, the odds of PN were higher in non-drinkers (compared with drinkers), in drug users, in main partnerships (compared with one-night stands), and in partnerships where the participant was younger than the partner and the participant reported perpetrating physical IPV. Among females, the odds of were PN higher among participants who had not completed grade 12 (compared with post-grade 12 education), among participants who reported being HIV negative/unknown HIV status and in main partnerships (vs one-night stands).

Male participants reported the following partner reactions to PN: violence, 16 (4.4%) partners; abandonment (partner told me to leave and did not want to see me again), 23 (6.3%); anger, 51 (14.0%); caring, 68 (18.7%); appreciation, 121 (33.2%); no reaction, 45 (12.4%). Females reported violent reactions, 2 (0.9%) partners; abandonment, 7 (3.3%); anger, 11 (5.1%); caring, 54 (25.2%); appreciation, 68 (31.8%); and 36 (16.8%) did not react. Participants could report one or more reactions per partner.

DISCUSSION

The strongest, independent correlate of PN was partner type. Male and female participants were more likely to notify their main partners compared with their one-night stands. Participants were somewhat more likely to notify casual partners compared with one-night stands although the association was not statistically significant. These findings are consistent with most other studies.

In other research, however, there is not a consistent association between more serious partnerships and behaviour that protects partners against STIs. For example, the prevalence of condomless sex is more common in more serious (vs casual) relationships. The participants reported high levels of IPV: over 50% of women reported IPV victimisation and almost 50% of men reported IPV perpetration. Our hypothesis that PN would be less likely in partnerships with IPV was not supported. Among men, physical IPV perpetration was an independently positively associated with PN. This could suggest that men who perpetrate physical IPV in a partnership are less likely that those who do not perpetrate such IPV to fear the consequences of PN. These findings show that IPV was not a barrier to self-reported PN. However, it is possible that IPV undermines successful PN outcomes in other ways. For example, IPV might undermine a partner’s ability to access STI diagnosis and treatment services.

Our findings are consistent with a survey conducted in US family planning clinics among young women who had ever had an STI: those exposed to IPV were no more or less likely to have notified their partner. If we regard PN as a behaviour that has the potential to mitigate STI risk, our findings are in contradiction to those of other studies which IPV leads to behaviours that put partners at greater risk of STIs. However, the study by Decker et al suggests that there might be other ways in which IPV undermines successful PN. Partners of women who had experienced IPV were less likely to subsequently seek care for their STIs, reinforcing the importance of investigating the association between IPV and successful PN outcomes such as partner treatment and index patient reinfection.

Given the prevalence of IPV reported by the participants in this study, it is surprising that so few of them reported violence as a consequence of PN. Yet, it is of concern that there were some reports of violence and abandonment. Interventions to facilitate safer disclosure of STIs might prevent these harmful consequences of PN; however, there is little evidence about what such interventions might look like. The rates of IPV as a consequence of disclosure are similar to those described in other studies.

Males were more likely to notify their partner when they were more than 3 years younger than their partner, compared with similar age. Age disparity, when the woman is younger than her male partner, has been hypothesised as an indicator of relationship power inequity and a risk factor for STI, but our findings do not bear this out. We found no evidence that transactional sex impedes PN. This contrasts to other studies with dyad-level analyses, showing that economic dependence on a partner is associated with sexual risk behaviours.

Individual-level factors associated PN included education and reported HIV status among women, and drug and alcohol use among men. Compared with female participants who had not completed grade 12, those with post-grade 12 education were less likely to notify partners. This is unexpected, given that more educated individuals tend to be early adopters of safer sexual behaviours. Women who reported they were HIV positive were less likely to notify partners compared with those who reported they were HIV negative or of unknown status. These participants might be at higher risk of transmitting infections, and it is critical to focus PN efforts on them. Male alcohol drinkers were less likely to notify partners, compared with non-drinkers, which is consistent with literature demonstrating that alcohol is a risk factor for HIV acquisition and further transmission. Men who reported that they used drugs were more likely than those who did not to notify partners. This is an unexpected finding given that drug use is associated with sexual risk behaviours.

Whether drug use interferes with successful PN outcomes such as partner treatment and index patient reinfection needs further investigation.

Limitations

We are unable to determine the accuracy of our assumption that symptomatic participants were ‘index cases’ and were not attending the clinic because they were referred by a partner. In the baseline survey, we did not ask whether they had been referred by a partner, and the patient electronic records do not discriminate between index patients and partners. A minority of participants were enrolled 1 day after their diagnosis which might have led to an underestimate of PN. In a sensitivity
STI partner notification (PN) is less likely in casual compared with main partnerships, and efforts to promote PN need to focus on casual relationships.

Male patients with STI had been a perpetrator of intimate partner violence (IPV), and females an IPV victim in approximately half of their recent sexual partnerships.

This study does not provide any evidence that IPV is a barrier to PN based on participants’ reports.

Harmful consequences of PN, abandonment and IPV, were reported in under 10% of notifications, suggesting the appropriateness of interventions to facilitate safer disclosure of STIs.

CONCLUSIONS

This study shows the individual and partnership-level dynamics influencing PN, and the findings can inform interventions to promote PN. PN is much more likely to occur in the context of main partnerships. This means efforts to decrease the pool of infectious partners need to focus on the promotion of PN in casual relationships and one-night stands. On average, successful PN needs to be achieved with more than one partner per index case to prevent onward transmission and PN successes with casual or ex-regular partners are more efficient at preventing onward transmission relative to successes with regular partners. Despite the high levels of IPV in partnerships of patients with STI in this setting, our study does not provide evidence that IPV is a barrier to PN measured by participants’ reports. In future, we need to investigate the association between IPV and an objective measure of PN success such as partner testing, treatment or index patient reinfection.

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Contributors CM, SCK and MOK conceptualised the study. MOK, SCK, CM, KN and ML contributed to the acquisition of data for the study. RL and CH performed the statistical analyses. CM drafted the manuscript. All contributors contributed to revising it and approved the final version.

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Competing interests None declared.

Analysis (not reported here), we excluded those not enrolled on the day of their diagnosis, and there were no substantial differences in the estimates or the interpretation of the findings. PN was self-reported, and not validated with an objective measure such as partner visits to STI clinics or index patient reinfection. We did not explore the relationship between male IPV victimisation and PN (nor female perpetration and PN). We speculated the harmful effects of victimisation would be more relevant to female patients with STI, given the prevalence of intimate partner homicide, the most severe form of IPV, is far more common in females compared with males (39% of female homicides were perpetrated by intimate partners vs only 6% of male homicides).26

Ethics approval The study was approved by the Ethics Committee of the South African Medical Research Council (EC018-10/2013) and the University of Connecticut Institutional Review Board (H12-340).

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