

## Prevention of HIV and sexually transmitted diseases in high risk social networks of young Roma (Gypsy) men in Bulgaria: randomised controlled trial

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### Abstract

**Objective** To determine the effects of a behavioural intervention for prevention of HIV and sexually transmitted diseases that identified, trained, and engaged leaders of Roma (Gypsy) men's social networks to counsel their own network members.

**Design** A two arm randomised controlled trial.

**Setting** A disadvantaged, impoverished Roma settlement in Bulgaria.

**Participants** 286 Roma men from 52 social networks recruited in the community.

**Intervention** At baseline all participants were assessed for HIV risk behaviour, tested and treated for sexually transmitted diseases, counselled in risk reduction, and randomised to intervention or control groups. Network leaders learnt how to counsel their social network members on risk prevention. Networks were followed up three and 12 months after the intervention to determine evidence of risk reduction.

**Main outcome measure** Occurrence of unprotected intercourse during the three months before each assessment.

**Results** Reported prevalence of unprotected intercourse in the intervention group fell more than in control group (from 81% and 80%, respectively, at baseline to 65% and 75% at three months and 71% and 86% at 12 months). Changes were more pronounced among men with casual partners. Effects remained strong at long term follow-up, consistent with changes in risk reduction norms in the social network. Other measures of risk reduction corroborated the intervention's effects.

**Conclusions** Endorsement and advice on HIV prevention from the leader of a social network produces well maintained change in the reported sexual practices in members of that network.

This model has particular relevance for health interventions in populations such as Roma who may be distrustful of outsiders.

**Trial registration** Clinical Trials NCT00310973.

### Introduction

Although rates of HIV are rapidly increasing in many former Soviet countries,<sup>1,2</sup> few reports have described the results of interventions to reduce HIV risk behaviours within vulnerable populations in the region.

The largest ethnic minority group in eastern Europe, the Roma, are also one of the region's most marginalised and disadvantaged populations. Roma first migrated from northern India in the 10th century and today constitute 6-9% of the populations

of countries in south eastern Europe.<sup>3</sup> Distinguishable by appearance, culture, and customs, Roma are no longer nomadic but usually live in settlements set apart from the majority community and characterised by poverty, overcrowded and dilapidated housing, poor sanitation, and few public health services.<sup>4</sup> The circumstances of Roma in Bulgaria are typical of the region. Only 10% of Bulgarian Roma complete primary education, 80% are illiterate, unemployment rates are between 70% and 90%, and most employed Roma do menial work for little money.<sup>5-7</sup> Roma life expectancy is 10-15 years shorter than that of the majority population.<sup>8,9</sup> Roma have faced discrimination and persecution for centuries<sup>4,10,11</sup> and—even today—experience widescale social marginalisation and a lack of culturally appropriate education, health care, and social services.<sup>11</sup> At the same time, Roma communities are culturally insular and distrustful of external authorities.

Social health problems associated with poverty—including tuberculosis, nutritional deficiencies, hepatitis, and diphtheria—are widespread in Roma settlements.<sup>12-14</sup> There is also growing concern about the vulnerability of Roma to HIV/AIDS, sexually transmitted diseases, and other reproductive health problems.<sup>6,15</sup> Historically strong patriarchal and traditional family norms have weakened, reducing the social stabilising roles of kinship and historical culture on young peoples' behaviour.<sup>4</sup> Studies with community samples of young Roma men in Bulgaria have shown high rates of unprotected sexual intercourse, frequent multiple sexual partnerships with both women and men, low levels of condom use, and prevalent sexually transmitted diseases.<sup>16-18</sup> The social network friendship group to which a young Roma man belongs is a strong determinant of risk of HIV, underscoring the important part played by peer norms as an influence on sexual risk levels.<sup>17</sup>

People in former Soviet countries of eastern Europe have long relied on their personal social networks for support, essential services, and trusted advice, in part because official government pronouncements in the Soviet era were not trusted or seen as relevant.<sup>19-22</sup> This highlights the potential benefits of health interventions within naturally existing social networks where high risk sexual behaviour is prevalent. Specifically, it may be possible to locate high risk social networks in the community, identify the social leaders of these networks, and train and enlist natural trusted network leaders to counsel other members of the same networks to reduce HIV risk behaviours and create peer norms to support risk reduction.<sup>23</sup>

Behavioural research in AIDS has long shown that the norms believed to be held by close peers influence individuals' own levels of risk behaviour, and interventions to foster the development of safer sex norms at the community level have shown considerable promise.<sup>24</sup> Research with injecting drug users has also established the impact of peer driven interventions to lessen risk.<sup>25–27</sup> In recent trials undertaken with young men who have sex with men in Russia and Bulgaria,<sup>28 29</sup> we found that an HIV prevention approach that trains social network leaders to function as risk reduction counsellors and advocates significantly reduced levels of high risk sexual practices among others in the social networks.

Because of their distrust of authorities—but close ties with trusted members of the same community—Roma may consider health messages that come from known close peers as credible. The Roma also constitute a community that is hard for outsiders, including professional health educators, to reach. Approaches that identify and train indigenous natural leaders of social networks have the potential to reach others who may be hidden (or whose risk behaviour may be hidden) to those outside of the community. Many authorities in the region have observed that health and social service programmes are likely to be accepted only when tailored to Roma cultural circumstances.<sup>6 7 11 12</sup> HIV prevention messages delivered by social network leaders are likely to be culturally relevant.

## Methods

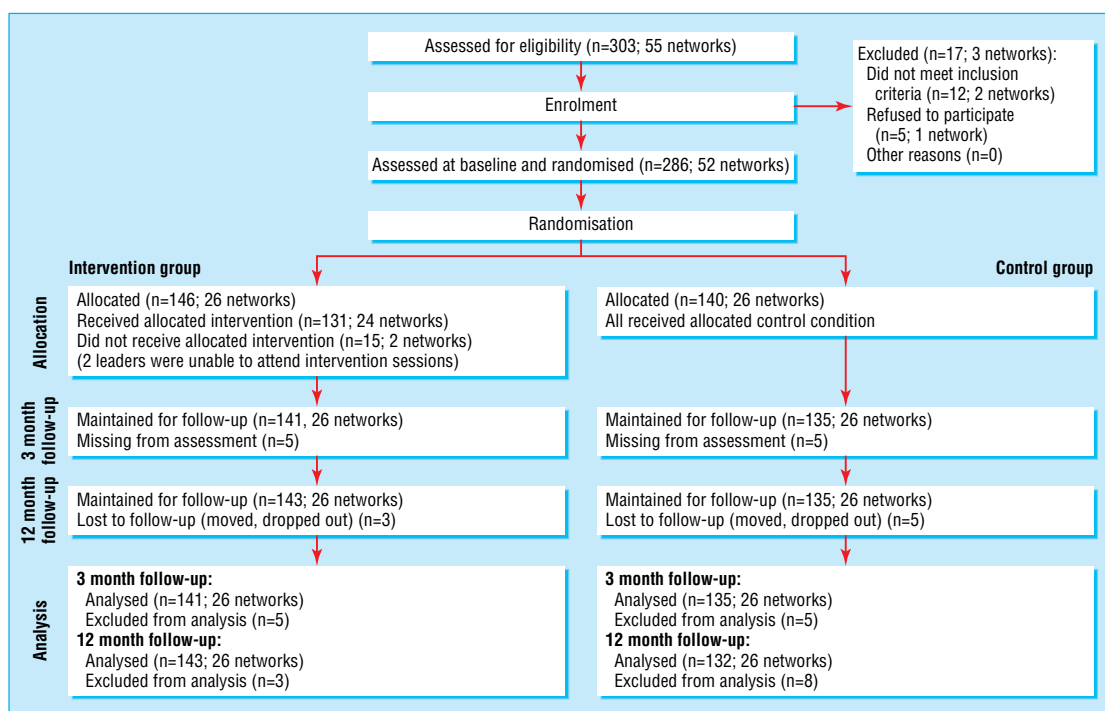
### Setting, social network recruitment, and participants

In 2003–5 we carried out a randomised controlled trial of a social network-level HIV prevention intervention in the Fakulteta settlement in Sofia, Bulgaria. Fakulteta, with about 35 000 residents, is one of Bulgaria's three largest and poorest Roma communities and is a tenement neighbourhood crowded with ramshackle houses, muddy unpaved roads and alleys, and small cafes and informal social meeting spots. Many homes lack

plumbing, sanitation, and sewers, and generally consist of a single room occupied by many family members. Previous research has shown that risk of sexually transmitted diseases and HIV is mainly because of high risk sexual practices and multiple sexual partnerships in men rather than women.<sup>16 18</sup>

Field teams with two members conducted systematic ethnographic observations throughout meeting places, including street corners, cafes, disco clubs, and back yards. Because teams were composed of staff who had long carried out Roma community development service programmes, they were not regarded with suspicion. Field staff looked for the presence of “social circles,”<sup>30</sup> small socialising groups of people who knew one another, interacted closely in a positive way, and seemed socially cohesive. Almost all those observed in these settings were men. When researchers agreed that a group constituted a social circle, they decided who was the circle's social and affective centre of attention, termed the “index.” Indexes were the entry points for accessing and recruiting social networks.

Each index was approached and privately interviewed. After a brief description of the study, he was asked to indicate the first names of the friends with whom he most liked to spend time, talk to, felt close to, and trusted. These people were defined as members of the index's social network and were contacted and recruited for participation. Of 55 networks approached, two were ineligible because fewer than two members reported recent unprotected sex and one network declined to participate. Of the 55 networks (representing 303 individuals) approached, 52 networks (representing 286 individuals, all men) participated. This constitutes all people named as network members by the 52 indexes. Networks were enrolled in two recruitment waves (26 networks per wave) separated by a 12 month period. This allowed us to assess the entire sample at points close to scheduled follow-up dates. The figure shows details of recruitment and flow.



Flowchart depicting trial design

The mean size of social networks including the index was 5.3 men (range 3-9). Participants' mean age was 19.7 years, 68% (n = 194) were single, 92% (n = 263) did not have steady employment, mean education level was 6.3 years, but only 14% (n = 40) still attended school.

#### Baseline assessment

Each participant provided informed consent and attended one baseline assessment session lasting about 60 minutes in a neighbourhood research office. Participants completed a risk assessment interview and a sociometric survey to determine the social leader of each network, provided biospecimens for testing for sexually transmitted diseases, and received individual counselling in risk reduction. Participants received an incentive of \$8 (about £4 or €6) for attending each assessment session.

#### HIV/STD risk assessment

Participants completed scales measuring five psychosocial characteristics related to AIDS adapted from previous research.<sup>16 17 29 31</sup> Because many men could not read, all measures were read aloud. A 15 item scale measured knowledge about AIDS risk behaviour and risk reduction steps with responses (true, false, or don't know) to each statement (sample item: "If a man pulls out before orgasm, it protects from getting AIDS and venereal diseases"), score range 0-15. A seven item scale measured perceived safer sex peer norms (sample: "Condom use is accepted by my friends"), with respondents indicating their agreement (yes, somewhat, or no) with each statement (scale range 0-14, Cronbach's  $\alpha = 0.71$ , current sample). A 10 item scale with the same response format assessed attitudes toward condom use and safer sex (sample: "Using condoms interrupts the pleasure of sex," score range 0-20, Cronbach's  $\alpha = 0.61$ ), while 12 items measured intentions to reduce risk behaviour (sample: "A condom will be used if I have sexual intercourse with a casual partner," score range 0-24, Cronbach's  $\alpha = 0.59$ ). We assessed perceived self efficacy or self confidence in risk reduction with nine items (sample: "I am sure that I can overcome my partner's objections to safer sex or condoms," score range 0-18, Cronbach's  $\alpha = 0.53$ ). We also asked participants how often in the past three months they had talked with close friends about AIDS and, in a separate question, about safer sex.

The assessment determined the respondent's number of female and male sexual partners and history of giving or receiving money or valuables for sex. More detailed questions then assessed sexual behaviour over the past three months. Participants indicated their number of female and male partners. For each female partner up to the most recent five, respondents indicated whether she was a main partner or someone else (hereafter referred to as a "casual" partner), how many times they had vaginal and anal intercourse with each partner, and on how many of these occasions a condom was used. If men reported male partners during the past three months, they were asked—for up to the most recent five—about the man's main or casual status, how many times they engaged in anal intercourse with him, and how many times they used a condom. Participants with over five sexual partners of one sex summarised their behaviour with all additional partners. Finally, participants indicated on how many days during the past three months they injected any drug or used alcohol or other substances.

#### Sociometric assessment to determine each network's social leader

Each participant was presented with a list of the names of all other members of the same network and indicated who, from that list, he most and least preferred in five domains (such as

spending time together, trusted for advice, discussion of important matters). A sociometric analysis program<sup>32</sup> determined which network member received most positive (and least negative) citations from all other members of the same network. We calculated a "social status indicator" score for each member in each domain. The network member with the highest score across leadership areas was designated as its leader. The sociometric procedures are described in greater detail elsewhere.<sup>23</sup>

#### Specimen collection, analysis, and treatment for sexually transmitted diseases

We tested urine samples for gonorrhoea and chlamydia with polymerase chain reaction. After the men had not urinated for at least four hours, we collected 10-15 ml of first catch urine. DNA was extracted with Amplicor CT/NG specimen preparation kits (Roche Molecular Systems, USA). Amplification and detection steps were performed with Amplicor CT/NG amplification detection kits with thermocycler GeneAmp 9600 (Perkin Elmer, USA) and a system for micro enzyme linked immunosorbent assay (ELISA) (Labsystems). We tested 5 ml blood serum samples for syphilis by the venereal disease research laboratory (VDRL) test, with positive cases confirmed by *T pallidum* haemagglutination assay (TPHA) (Randox, UK) or ELISA for anti-treponemal IgM/IgG antibodies (ETI-treponema screen, Dia Sorin, Spain). We treated all participants with positive results for sexually transmitted diseases (with 1 g intramuscular ceftriaxone single dose for gonorrhoea, 1 g oral azithromycin single dose for chlamydia, and 2 400 000 units intramuscular benzathine penicillin one to three doses for syphilis).

At the same session, each participant received about 15 minutes of individual counselling on HIV risk reduction. This provided information about HIV/AIDS, steps to reduce risk, and local resources for HIV testing. All participants received free condoms, which were also available continuously at a neighbourhood community centre. We used a randomisation table to assign the 52 social networks in equal numbers to intervention and control group conditions within each recruitment wave.

#### Social network intervention procedures

In the intervention group, leaders of each network received training on how to counsel and advise other members of the network on reducing HIV risk behaviour. Leaders attended small group training sessions each week for five weeks followed by booster sessions every two weeks and then every two months. Two facilitators led group sessions, which lasted about two hours and included six or seven leaders. Leaders received \$6 for attending each group. Sessions followed a detailed intervention manual.

Behavioural science theory<sup>33-35</sup> and empirical research—including previous studies in eastern Europe<sup>16 31</sup>—show that change in HIV risk reduction behaviour is predicted by knowledge about risk and by peer norms, positive attitudes, behavioural intentions, and perceived self efficacy concerning risk reduction and condom use. Each group session therefore trained all network leaders to emphasise one of these theoretically derived components in conversations with their network members during the week after the group session when it received attention. The first session focused on conveying to friends correct information about steps to reduce risk of HIV infection and making this topic a normative subject for discussion. Subsequent sessions addressed creating in others positive attitudes toward condom use, strengthening friends'

intentions to avoid risk, and helping others gain confidence to handle potential barriers to condom use.

The facilitators instilled the expectation that network leaders could help others to protect themselves against HIV and sexually transmitted diseases. Each session introduced that week's topic, explained its rationale in promoting behaviour change, and encouraged group discussion about how messages, advice, and counselling reflecting the theme could be directed to others in a natural manner. The facilitators gave examples of messages that would educate friends about AIDS, create positive attitudes towards use of condoms, strengthen intentions to reduce risk, or promote self efficacy in risk reduction, depending on that week's focus. Network leaders raised communication examples and then used role play to show how they would convey similar messages to their network members in their own words. Network leaders kept grids listing the names of their network members. The grids guided leaders in planning the conversations they would have after each session with each network member. Grid forms were also marked to record conversations that took place for discussion in the next group meeting. Because network members were the leaders' close friends, leaders knew firsthand about their risk circumstances. They were encouraged to tailor advice to the specific issues for different friends.

Booster sessions integrated communication messages covered in the training phase and encouraged leaders to maintain conversations about risk reduction. The intervention's objective was for each network leader to have ongoing conversations about risk reduction—based on theoretically derived components—with as many network members as possible and tailored to the circumstances of each.

#### Follow-up assessments

Participants completed HIV risk assessments three months and 12 months after the intervention group's final training session. All psychosocial scales related to AIDS, the interview to assess sexual risk, and tests and treatment for sexually transmitted diseases were the same as at baseline.

#### Statistical methods

We assessed the effects of the intervention by examining changes in reported sexual risk behaviour and on the psychosocial scales between baseline and each follow-up point. We analysed dichotomous outcome variables in a logistic regression model and calculated incidence of sexually transmitted diseases as the number of follow-up visits when participants were diagnosed with a new infection.

For our primary outcome of participants' reports of having any unprotected intercourse during the past three months, we calculated that the 52 retained networks (with 26 networks per group, median of five members per network, and observed intra-class correlation coefficient range of 0.003 to 0.08 for the primary outcome among members of the same network) would have a power of 0.73 to 0.83 for detecting a 15% difference in prevalence of risk behaviour across the two groups.

Mixed effects linear regression and logistic regression analyses examined comparability of the intervention and control groups at baseline and tested the significance of the social network intervention at each follow-up. There were no baseline differences between groups. Because all members of each social network were randomised together as an intact group rather than individually, responses among members of the same social network were correlated. To control for the non-independence of responses among members of the same network we incorporated the network as a random effect factor in each model.<sup>36</sup> Because networks were recruited in two waves, we included

effects for wave and the wave by group interaction as fixed factors in each model. Thus, effects for experimental group were assessed by fitting models that included group, network, wave, and wave by group interaction factors. A significant wave by group interaction indicates that the magnitude or direction of the experimental group differs by wave. A significant overall group test is an indication of a differential experimental intervention effect when averaged across wave and network. We used SPSS (version 13.0; SPSS, Chicago, IL) for analyses of continuous and count outcomes, SAS macros Glimmix for linear regression models (version 8.0; SAS Institute, Cary, NC), and SAS macro Glimmix for logistic regression models for analyses of dichotomous outcomes.

## Results

### Participants' background sexual risk behaviour

Men in the sample at baseline had a lifetime mean of 27.5 (median 13) sexual partners including a mean of 7.1 (median 4) in the past year and 3.2 (median 2) in the past three months. Almost all men had female partners and described themselves as heterosexual, but many reported having sex with men in their lifetime (59%,  $n = 169$ ), the past year (35%,  $n = 100$ ), and the past three months (20%,  $n = 58$ ). Of the 286 men in the sample, 170 (59%) had multiple sexual partners during the past three months at baseline and 191 (67%) had sex with casual partners. Eight men (28%) said they had paid for sex and 110 (39%) reported being paid for sex during their lifetimes. Most participants (89%,  $n = 253$ ) reported using alcohol but only 10 (4%) had injected drugs during the past three months.

### Verification of conversations

Intervention group leaders attended a mean of 8.1 of the nine intervention sessions. Their monitoring grids showed that conversations related to AIDS took place with a given network member on a mean of 3.8 of the five weeks during the main intervention training period. These conversations were independently corroborated by group members' reports of more frequent ( $P = 0.02$ ) conversations about AIDS with close friends, from a mean of 2.5 during the three months before baseline to 6.8 at three month follow-up (compared with 1.2 to 2.2 for the control group). Conversations about safer sex also increased more ( $P = 0.007$ ) in intervention networks (from 5.5 to 11.8) than control networks (6.1 to 6.6), verifying that network leaders delivered the planned conversations.

### Effects of intervention on the primary behavioural outcome

The table shows findings at baseline and follow-up for reported sexual risk behaviour during the three months before each assessment point. There was a significant reduction ( $P = 0.01$ ) between baseline and the 12 month follow-up in the prevalence of unprotected intercourse reported by men in the intervention group compared with the control group. Over two thirds of men had casual partners. These men are especially vulnerable to HIV and STDs, and HIV prevention efforts may be more feasible if they aim to decrease men's unsafe sex with outside partners than promoting consistent condom use within established relationships with their main partner.<sup>37</sup> As the table shows, the prevalence of unprotected intercourse reported with casual partners declined in networks in the intervention group from 60% ( $n = 78$ ) at baseline to 28% ( $n = 33$ ) at three months and 29% ( $n = 35$ ) at 12 months. These reductions were significantly greater than those found in control networks ( $P = 0.02$  and  $P = 0.009$ , respectively). The values shown in the table for the intervention group include network leaders. When we repeated

Changes in HIV risk characteristics for intervention and control groups from baseline to three and 12 month follow-up. Figures are percentages (numbers) of participants, unless stated otherwise

Variable	Baseline		Three months			12 months		
	Intervention (n=145)*	Control (n=137)*	Intervention (n=141)	Control (n=135)	P value†	Intervention (n=143)	Control (n=132)	P value‡
<b>Primary behavioural outcomes—prevalence of reported unprotected intercourse in past 3 months</b>								
Unprotected intercourse	81% (118)	80% (109)	65% (92)	75% (101)	>0.10	71% (102)	86% (113)	0.01
Unprotected intercourse with casual partners‡	60% (78)	54% (68)	28% (33)	42% (47)	0.02	29% (35)	47% (53)	0.009
<b>Secondary sexual behavioural outcomes in past 3 months</b>								
Unprotected vaginal intercourse with >1 partner	32% (46)	30% (41)	15% (21)	26% (35)	0.03	15% (22)	29% (38)	0.01
Unprotected intercourse with multiple casual partners‡	43% (56)	39% (49)	16% (19)	29% (32)	0.03	13% (16)	26% (29)	0.01
Mean (SD) % of reported intercourse with condoms with casual partners‡	59.3 (42.6)	58.7 (43.5)	81.0 (35.6)	71.1 (39.8)	>0.10	84.0 (30.9)	68.4 (41.4)	0.08
Reduced rates of unprotected intercourse with casual partners at follow-up‡	—	—	85% (98)	74% (83)	0.10	85% (105)	70% (78)	0.007
Unprotected vaginal intercourse with casual partners‡	51% (66)	43% (54)	26% (30)	37% (41)	0.08	28% (34)	40% (45)	0.07
Unprotected anal intercourse with casual partners‡	42% (54)	38% (48)	17% (20)	21% (24)	>0.10	11% (14)	26% (29)	0.01
<b>Secondary psychosocial scale outcomes (mean (SD) score on scale)</b>								
Knowledge scale of risk of AIDS	8.8 (2.5)	9.4 (2.4)	11.5 (2.9)	10.8 (2.5)	<0.001	12.0 (2.4)	10.7 (2.6)	<0.001
Safer sex peer norms	8.2 (3.5)	7.7 (3.4)	9.4 (3.4)	8.0 (3.6)	0.07	10.0 (3.5)	8.2 (3.7)	0.03
Attitudes toward condom use	10.5 (4.1)	10.6 (3.8)	12.8 (4.0)	11.4 (4.1)	0.005	12.6 (3.9)	10.8 (4.0)	0.002
Intentions to reduce risk behaviour	10.6 (4.5)	10.7 (4.7)	14.7 (4.7)	13.0 (4.9)	0.02	14.6 (4.7)	12.5 (5.2)	0.007
Risk reduction self efficacy	11.1 (3.7)	11.3 (3.6)	13.4 (3.8)	12.8 (3.9)	0.06	14.3 (3.4)	12.9 (3.5)	0.002

\*Excludes one participant in intervention group and three in control group who did not complete follow-up assessment at either time.

†Based on mixed liner models or logistic regression models for individuals nested within social networks. All reductions shown are from baseline levels. For condom use, analyses treated sexual abstiners as 100% condom users.

‡At baseline 255 participants (130 in intervention group and 125 controls) had  $\geq 1$  casual partners in past 3 months. At 3 month follow-up, 228 participants (116 in intervention group and 112 controls) had  $\geq 1$  casual partners in past 3 months. At 12 month follow-up, 235 participants (123 in intervention group and 112 controls) had  $\geq 1$  casual partners in past 3 months.

the analyses excluding network leaders we found similar values, indicating that improvements were among members and not accounted for only by change in the leader.

#### Effects of intervention on secondary behavioural outcomes

The table also shows reported change over time for secondary behavioural outcomes. These patterns paralleled those found for the primary outcomes. Prevalence of reported unprotected vaginal intercourse with more than one partner fell more in the intervention group than in the control group between baseline and three months ( $P = 0.03$ ) and 12 months ( $P = 0.01$ ), as did the prevalence with more than one casual partner at each follow-up ( $P = 0.03$  and  $P = 0.01$ , respectively). The prevalence of reported unprotected anal intercourse with casual partners declined significantly ( $P = 0.01$ ) in the intervention group compared with control group between baseline and 12 months. Use of a condom with casual partners increased more in the intervention group at 12 months but this trend only approached significance ( $P = 0.08$ ).

#### Effects of intervention on psychosocial scale secondary outcomes

Relative to the control group, men in the intervention group significantly increased in their knowledge of risk of AIDS ( $P < 0.001$ ), positive attitudes towards condoms ( $P = 0.005$ ), and strength of intentions to reduce risk behaviours ( $P = 0.02$ ) from baseline to three months. These differences were more pronounced at 12 months. Men in the intervention group also perceived stronger safer sex norms in their peer group ( $P = 0.03$ ) and had higher self efficacy in risk reduction ( $P = 0.002$ ) than men in the control group at 12 months.

#### Corroborative trends in incidence of sexually transmitted diseases

Because all sexually transmitted diseases were treated at baseline, positive results later represent incident infections. By 12 months, 18 (14%) men in the control group and 11 (8%) in the intervention group had contracted gonorrhoea ( $P = 0.09$ ), and three men (2%) in the control group and one in the intervention group had contracted syphilis.<sup>1</sup> The incidence of chlamydia at follow-up was similar in both groups (11% ( $n = 14$ ) *v* 12% ( $n = 16$ )).

#### Discussion

Few randomised trials on interventions for HIV prevention have been undertaken in former socialist countries of eastern Europe, even though disease rates are rising and primary prevention efforts for HIV in the region are urgently needed. We are unaware of previous scientific research evaluating the impact of health promotion interventions of any kind for Roma, a large minority population with severe pervasive social and public health needs. We chose the social network intervention model used in this study because of its relevance in cultures where vulnerable populations may distrust outside authorities but find advice and recommendations coming from personally known network leaders to carry credibility and influence.

We found that the social network intervention had a positive impact on reported sexual risk practices relative to a control condition in which participants received standard individual counselling on risk reduction, a traditional public health standard of care. Our primary outcomes were participants' reported sexual behaviour during the three months before each assessment, and we found change across numerous indicators of risk. The magnitude of effects was strongest among men who

had casual partners, suggesting that benefits of the intervention were greatest among those who are at highest risk. Behavioural interventions typically show a weakening or decay in initial effects over time. By contrast, our data reflected greater robustness of changes reported at 12 months than at three months. This is heartening and consistent with patterns that would be expected if the norms of one's close social network changed over time to support the strengthening and maintenance of safer behaviour.

Confidence in the validity of participants' self reported change in sexual behaviour is strengthened by trends for a reduction in incidence of biologically assessed gonorrhoea during follow-up for men in the intervention group. Although the absolute number of newly diagnosed sexually transmitted diseases was modest, the almost twofold higher incidence of gonorrhoea found in the control group serves to validate the primary behavioural outcomes. In addition, significant change occurred between baseline and final follow-up for intervention versus control groups on knowledge related to AIDS, attitudes, and motivations to change. The fact that multiple measures all changed predictably, consistently, and in a well maintained fashion enhances confidence in the impact of the intervention.

Most behavioural interventions aimed at reducing risk of HIV infection rely on direct contact between participants and trained facilitators or counsellors. By contrast, we used an intervention delivered by indigenous leaders of social networks to members of their own networks. Peer driven approaches can be much more cost effective than professionally delivered counselling<sup>25</sup> and can potentially reach large numbers of "hidden" community members who might be difficult to engage in traditional public health counselling. High attendance in the intervention group and the large increase in conversations related to AIDS reported by leaders and network members indicate that the intervention was well received. This approach may be especially practical for use by HIV prevention non-governmental organisations (NGOs), which often have limited professional and counsellor staffing and rely on outreach based community programmes.

**Study limitations**

This study was carried out in a single site, and risk behaviours in the sample may not be characteristic of other Roma communities or other populations. The study was powered for behavioural outcomes, and trends in incidence of sexually transmitted diseases must be viewed as corroborative. Studies with larger samples are needed to definitively test the direct effects of behavioural intervention on incidence of disease. Although measures were piloted, self reports of private behaviour are potentially subject to inaccuracy in recall or presentation bias. The internal consistency of several of the psychosocial scales was modest. None the less, we have shown that an HIV prevention model at the level of social networks can be effective when it is tailored to the cultural circumstances of a disadvantaged population vulnerable to serious social health problems and highly understudied in public health.

Contributors: JAK (principal investigator and guarantor) and YAA (co-principal investigator) were responsible for the trial, intervention design, assessment protocol, and the primary writing. EK was the principal investigator and directed scientific activities in Bulgaria. SV was project coordinator, oversaw recruitment, and managed site data. TLMcA was senior biostatistician, and WJDif analysed the data. They planned and carried out the statistical analyses and wrote the statistical methods and results sections. RA and BV were responsible for overseeing delivery of the intervention and quality control. EP directed the laboratory testing, RAK planned and directed the sociometric network analyses, and BD directed treatment of sexually transmitted diseases.

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**What is already known on this topic**

Roma (Gypsies) are the largest ethnic minority group in eastern Europe, and social health problems related to disadvantage are pervasive and severe

Levels of sexual risk behaviours are high among Roma men

The effects of interventions for HIV prevention in Roma men have not been systematically studied

**What this study adds**

After identifying, training, and engaging the leaders of Roma men's social networks to endorse and counsel their own network members in HIV prevention, prevalence of unprotected intercourse reduced over a 12 month follow up

Effects were especially pronounced in risk behaviour with casual partners

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