



Original article

## The Acceptability, Feasibility, and Effectiveness of a Population-based Intervention to Promote Youth Health: An Exploratory Study in Goa, India

Madhumitha Balaji, M.Sc., M.A.<sup>a</sup>, Teddy Andrews, M.Phil., M.A.<sup>b</sup>, Gracy Andrew, M.A.<sup>a</sup>, and Vikram Patel, M.D., M.R.C.Psych., Ph.D., F.Med.Sci.<sup>a,c,\*</sup>

<sup>a</sup> Sangath, Goa, India

<sup>b</sup> Department of Public Health, Manipal University, Karnataka, India

<sup>c</sup> Faculty of Epidemiology and Population Health, London School of Hygiene and Tropical Medicine, London, UK

*Article history:* Received March 30, 2010; Accepted July 30, 2010

*Keywords:* Population-based intervention; Youth; India

---

### A B S T R A C T

**Purpose:** To evaluate the acceptability, feasibility, and effectiveness of a population-based intervention to promote health of youth (age: 16–24 years) in Goa.

**Methods:** Two pairs of urban and rural communities were selected; one of each was randomly assigned to receive a multi-component intervention and the other wait-listed. The intervention comprised educational institution-based peer education and teacher training (in the urban community), community peer education, and health information materials. Effectiveness was assessed through before–after population surveys at baseline and at 18 months. Outcomes were measured using a structured interview schedule with all eligible youth. Logistic regression compared each pair, adjusted for baseline differences, on prevalence of outcomes in the domains of reproductive and sexual health (RSH), violence, mental health, substance use, and help seeking for health concerns.

**Results:** In both intervention communities, prevalence of violence perpetrated and probable depression was significantly lower and knowledge and attitudes about RSH significantly higher ( $p < .05$ ). The rural sample also reported fewer menstrual complaints and higher levels of help-seeking for RSH complaints by women, and knowledge and attitudes about emotional health and substance use; and, the urban sample reported significantly lower levels of substance use, suicidal behavior, sexual abuse, and RSH complaints. Although information materials were acceptable and feasible in both communities, community peer education was feasible only in the rural community. The institution-based interventions were generally acceptable and feasible.

**Conclusions:** Multicomponent interventions comprising information materials, educational-institution interventions and, in rural contexts, community peer interventions are acceptable and feasible and likely to be effective for youth health promotion.

© 2011 Society for Adolescent Health and Medicine. All rights reserved.

There are nearly 350 million people aged between 10 and 24 years in India [1]. Youth concerns have been recognized by the National Youth Policy [2]. Reproductive and sexual health (RSH) issues, in particular, have gained importance because of poor awareness levels among youth, high-risk sexual behaviors, early

marriages and adolescent pregnancies, and demands for abortion services [3–5]. There are marked regional variations in RSH indicators; these are better in southern and western states although improvement has been seen in most states over time, and urban youth fare better than rural youth [4]. In these contexts, RSH concerns such as unexplained genital discharges, or menstrual complaints and behaviors such as substance abuse, suicide, and violence, have become pressing concerns [6–9]. Research led by the authors in the state of Goa has reported strong relationships between reproductive tract complaints, tobacco

---

\* Address correspondence to: Vikram Patel, M.D., M.R.C.Psych., Ph.D., F.Med.Sci., Sangath, 841/1 Alto-Porvorim, Bardez, Goa 403521, India.  
 E-mail address: vikram.patel@sht.ac.uk (V. patel).

and alcohol use, depression, and experiences of violence, indicating that these diverse outcomes may influence each other and/or may share similar risk factors [7,8,10,11]. Conditions such as depression are associated with “non-traditional” lifestyles and urban residence [12]. These findings point to the need for youth health interventions to address a range of concerns concurrently, taking into account contextual variations.

There is a growing evidence base in developing countries of the effectiveness of interventions targeting health outcomes in youth [13–15]. These include school-based, curriculum-oriented psycho-education usually led by adults [16–20], information communication approaches [21,22], and community-based interventions delivered by peers, health workers, or provision of health services [23–28]. However, the bulk of interventions have focused on RSH, and all have targeted single outcomes. There is a dearth of evidence about the feasibility, acceptability, and effectiveness of interventions that address the wider health needs of youth. Multicomponent interventions addressing a variety of outcomes and involving the community in its planning and implementation are more likely to be acceptable, effective, and sustainable than specific outcome-focused interventions [29]. *Yuva Mitra* (“friend of youth” in the Konkani language) was a pilot project to assess the acceptability, feasibility, and potential effectiveness of a multicomponent, population-based intervention in improving a range of priority health outcomes for youth aged 16–24 years in urban and rural communities in Goa.

## Methods

### Study design

This was an exploratory controlled evaluation of the intervention. Two rural and two urban communities were selected purposively based on their engagement with *Sangath*, the organization implementing this study. The pairs from each community were matched on urbanization and socio-economic development. One community from each pair was randomly selected to receive the intervention. The others were wait-listed and received the intervention after the study. Randomization was done using the “lottery method” by the principal investigator (V.P.). Paired communities were separated geographically by at least a kilometer so as to minimize possibilities of contamination, while allowing for matching for other contextual factors.

### Study settings

Goa is a small state on the west coast of India, with a population of over 1.4 million. Indicators of child and reproductive health are better in Goa than in most other states; for example, only 12% of women in Goa aged between 20 and 24 years are married by 18 years (compared with a national average prevalence of almost 50%), the fertility rate is 1.8 (the national average being 2.7), and women are better informed about HIV-AIDS than those in parts of central, eastern, and northern India [4].

The two chosen urban communities are located in 10 wards of Margao, the commercial hub of South Goa. There are several educational institutions and both government and private hospitals in this area. As Margao is well connected to national rail and road networks, the population includes a substantial number of migrants from neighboring states. Four wards (N = 17,700) were randomly selected to be the intervention community, and the remaining six (N = 16,685) were the comparison community.

The rural communities are the villages of Balli, Barcem, Morpila, and Fatorpa, in the catchment area of Balli Primary Health Centre in South Goa. The main occupation is agriculture. Villages lie on a hilly terrain, with poor transport facilities between wards. The largest village, Barcem (N = 5,555), was randomly chosen as the intervention community and the remaining three (N = 9,239) were the comparison community.

### The intervention

The intervention was systematically developed following the methodology for complex interventions [30]. The formative phase involved exploring the relevance of intervention components, identifying appropriate methods of intervention delivery, and developing methods for selecting and training peer leaders. Fifty-two in-depth interviews were conducted with youth, parents, teachers, and heads of institutions. The final intervention comprised three components (resource materials are available on [www.sangath.com](http://www.sangath.com)).

The first was the peer education program. This involved recruiting a selected number of youth (“peer leaders”) on the basis of pre-determined criteria and training them to provide information on intervention targets to other youth in their communities. Peer leaders were trained by psychologists and social workers experienced in the field of adolescent health. Training materials were developed from standardized manuals on adolescent health [31,32]. Peer leaders were given a resource guide for delivering the intervention to youth and were expected to conduct group sessions and perform street plays. They received moderate monetary and other incentives (certificates). In the rural community, this program was supported by a Community Advisory Board (CAB) comprising of key people such as village council leaders. In the urban educational institutions, it was supported by trained teachers and integrated within existing student forums.

The second component was the teacher training program. Teachers in educational institutions were trained on effective teaching methods, strategies to improve teacher–student relationships, detection and management of common problems faced by youth in school settings, and counseling skills. Each was given a “teachers’ toolkit,” a resource handbook [31]. This component could be implemented only in the urban community because in the rural community, educational institutions were located in the comparison arm.

The third component was health information materials. Handouts were developed by collating information on intervention topics from existing resource materials. They were distributed to youth through house to house visits. Posters on relevant topics were displayed in prominent locations which young people frequently visited.

The intervention team consisted of a social worker, two psychologists, and three peer educators. The duration of the intervention was 12 months, including an intensive engagement phase in the first 6 months. Quality of intervention delivery was monitored through on-site supervision and weekly review meetings.

### Evaluation of effectiveness

Youth from the chosen communities were enumerated through a door to door survey by trained researchers. Only those with visual or hearing impairment or severe mental illness were

excluded. The effectiveness of the intervention was assessed by collecting information on outcomes through a population-based baseline survey conducted 6–12 months after enumeration (March–July 2006) and a follow-up survey about 18 months later (August 2007–February 2008) from all eligible youth (16–24 years) in all four communities. In both surveys, youth who had not been enumerated but met eligibility criteria (“new subjects”), for example because they had migrated into the area after enumeration, were identified and invited to participate.

Outcomes were measured through a structured interview schedule administered by researchers, and developed on the basis of previous research studies conducted on youth in Goa and elsewhere in India [33]. This covered the following domains: demographic data; knowledge, attitudes, and behavior related to emotional health, self-harm, substance use, and RSH; violence; and help seeking for health problems. Mental health was assessed with the 12-item General Health Questionnaire (GHQ-12) [34], the local version of which had been used previously in Goa [35]. The period of reporting was between 3 and 12 months before the interview. There were a maximum of 107 questions that took 30–45 minutes to administer. We chose an interviewer-administered measure as our previous experience showed that self-report questionnaires were often incomplete and risked selection bias because of lower response rates from less literate participants. To increase reliability of self-reported data, researchers carried out extensive rapport-building with youth; they were trained by experts on interview methods in community-based studies with youth; and sensitive questions were asked later to minimize chances of desirability bias.

The tool was piloted with 87 youth from a comparable community and then translated and back-translated into local languages.

#### *Evaluation of acceptability and feasibility*

Process data were collected from all stakeholders. Semi-structured interviews were conducted and focus groups were held with peer leaders, teachers, and youth volunteers (four–six with each stakeholder group); one focus group was held with the rural CAB, 68 feedback interviews were held with youth in the rural community, 22 and 24 interviews were held with rural peer leaders and urban youth, respectively, who did not adhere to training sessions, and feedback forms were collected from peer leaders. Quantitative process indicators were monitored, for example, the number of peer leaders or youth who received the training/intervention. Output indicators assessing immediate effects of the intervention comprised self-report questionnaires to youth and peer leaders before and after training/intervention sessions.

#### *Analysis*

All outcome variables were recoded into binary categories. Categorical variables were recoded as “prevalence” (outcome occurring at any point within the recall period). For numerical variables, cut-off scores were used. Adverse outcomes included prevalence of substance use (tobacco, cigarettes, or alcohol), suicidal behavior (considering, making plans for or attempting suicide), experience of physical abuse (by family or teachers), sexual abuse (being molested, shown sex organs, or forced to have sexual intercourse), and RSH complaints of unexplained genital discharge or menstrual complaints. All these adverse

outcomes were assessed over the previous 3 months. Other adverse outcomes were perpetration of physical violence (attempting to or causing body harm to others) in the previous 12 months and probable depression (score of 4 and above on the general health questionnaire). Favorable outcomes were having high knowledge or appropriate attitudes about emotional health, substance use, and RSH (70% or more of answers correct); and help seeking from professionals for RSH complaints (last 3 months) and stress concerns (last 12 months). Missing values on outcomes for noneligible participants (for example, for teachers' abuse for respondents not in school) were not imputed. Missing values for participants who did not know or refused to answer were scored as “0,” i.e., not having experienced that outcome.

Binary logistic regression analysis was used in Stata 10 to compare each intervention-comparison pair on the prevalence of the outcome at follow-up, adjusted for baseline prevalence (command: xi:blogit cases sample i.arm i.time i.arm\*i.time). Statistical significance was assumed at a *p* value of .05. No adjustment for clustering was done as the number of clusters was small and our exploratory evaluation was not powered for a specified hypothesized effect size. Quantitative data for process evaluation were analyzed using MS Excel 2003 and Stata 10. For categorical data, prevalence of response categories was estimated while paired *t* tests were computed for continuous outcomes. Qualitative data were analyzed using thematic analysis [36] in ATLAS-ti 4.2. The coding categories were derived in an iterative manner from a small number of initial interviews, and the remaining narratives were coded using these categories.

#### *Ethics*

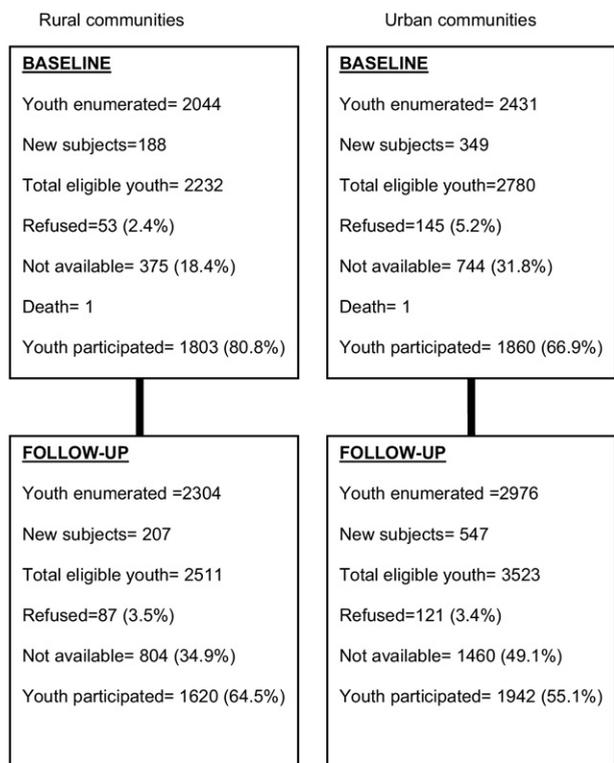
The study was approved by the Institutional Review Board at Sangath. Researchers undertook an online course on ethics, conducted by National Institutes of Health, the United States. Appropriate informed consent processes were followed. Youth who reported risk behaviors, such as suicide or sexual abuse, were offered information and referred for professional help. In the rural community, the CAB provided inputs regarding the needs of youth, foresaw risks and benefits of the intervention, and acted as a liaison between project staff and the community. The comparison communities were offered the intervention after the study.

#### **Results**

##### *Sample*

Of the 2,232 eligible youth in the rural communities at baseline, 1,803 (81%) consented to participate, and of the 2,511 eligible youth at follow-up, 1,620 (65%) consented (Figure 1). In the urban communities, these figures were 1,860 of 2,780 (67%) at baseline and 1,942 of 3,523 (55%) at follow-up. The main reason for nonparticipation was that youth were working or studying elsewhere.

The mean age of participants (19 years) was similar in all communities (Table 1). The differences observed between the intervention and comparison arms at baseline were expected given the small number of clusters. Rural and urban differences, for example, in proportions in education reflect the greater opportunities available in the urban area.



- \* New Subjects= number of youth identified at the time of population surveys not in the original enumeration list
- \* Proportion who refused= number of youth who refused to participate divided by total eligible youth
- \* Proportion of those not available= number of youth enumerated who could not be contacted subsequently/ were not available to participate divided by total youth enumerated
- \* Proportion of youth participated= number of youth who participated divided by total number of eligible youth

Figure 1. Population surveys at baseline and follow-up.

Effectiveness of the intervention

Rural community

The intervention arm showed a favorable change for several adverse outcomes at follow-up when compared with the comparison arm. For example, probable depression and perpetration

of physical violence decreased in the intervention arm by 60.1% and 58.6%, respectively, whereas these increased by 1.1% and 32.7%, respectively, in the comparison arm. Similarly, menstrual problems decreased by 49.2% in the former compared with a 5.6% decrease in the latter. Logistic regression (Table 2), adjusting for baseline prevalence in both arms, showed that these differences were statistically significant—probable depression (odds ratio [OR] = .33, 95% confidence intervals [CI] = .23–.48), menstrual problems (OR = .39, 95% CI = .26–.60), and perpetration of physical violence (OR = .29, 95% CI = .15–.57). The prevalence of four favorable outcomes was also significantly higher in the intervention arm (Table 2)— help seeking for RSH complaints by women (OR = 2.09, 95% CI = 1.07–4.06) and knowledge and attitudes about emotional health (OR = 1.57, 95% CI = 1.18–2.10), substance use (OR = 3.83, 95% CI = 2.77–5.31), and RSH (OR = 1.55, 95% CI = 1.06–2.28). Knowledge and attitudes about RSH increased by a larger extent in the intervention arm; the remaining three increased in the intervention arm but reduced in the comparison arm. None of the outcomes showed a statistically significant favorable change in the comparison arm.

Urban community

The intervention arm showed substantial reductions in several adverse outcomes when compared with the comparison arm at follow-up, for example, suicidal behavior, perpetration of physical violence, and substance use decreased by over 40% in the intervention arm, whereas in the comparison arm, the reductions were 11.4%, 21.5%, and 8.2%, respectively. Similar trends were seen for probable depression and physical abuse. Sexual abuse showed the highest degree of proportionate reduction in the intervention arm (over 70%), whereas in the comparison arm this increased by nearly 38%. Symptoms of genital discharge also increased in the comparison arm. Most differences were statistically significant after adjusting for baseline prevalence (Table 3)—substance use (OR = .63, 95% CI = .45–.89), suicidal behavior (OR = .38, 95% CI = .17–.84), probable depression (OR = .57, 95% CI = .41–.79), experience of sexual abuse (OR = .19, 95% CI = .09–.41), perpetration of physical violence (OR = .59, 95% CI = .40–.87), complaints of penile discharge (OR = .36, 95% CI = .24–.55), and vaginal symptoms (OR = .49, 95% CI = .26–.93). Knowledge and attitudes about RSH increased by 25.1% in the intervention arm while in the comparison arm, this decreased by nearly 6% (OR = 1.46, 95% CI = 1.09–1.97). Only help seeking for stress

Table 1 Socio-demographic characteristics of samples at baseline and follow-up

Socio-demographic variable	Rural communities				Urban communities			
	Intervention arm	Comparison arm	Estimates of difference <sup>a</sup>	p value	Intervention arm	Comparison arm	Estimates of difference <sup>a</sup>	p value
Gender (male)								
Baseline	53.6%	47.8%	6.09	.02	50.1%	43.8%	7.12	.01
Follow-up	59.8%	53.3%	6.85	.01	45.6%	45.3%	.02	.90
Mean age (years)								
Baseline	19.8	19.8	.07	.94	19.2	19.2	-.08	.94
Follow-up	19.8	19.9	-.62	.54	19.4	19.4	-.26	.80
Marital status (married)								
Baseline	7.4%	7.5%	.01	.93	8.6%	3.8%	19.56	<.001
Follow-up	4.3%	4.8%	.28	.60	9.3%	2.8%	35.24	<.001
Proportion in education								
Baseline	24.7%	37.2%	33.18	<.001	49.3%	60.6%	23.56	<.001
Follow-up	27.9%	39.2%	23.19	<.001	39.9%	54.2%	39.66	<.001

<sup>a</sup>  $\chi^2$  test for differences in gender, marital status and proportion in education between intervention and comparison arms and independent samples t test for differences in mean age.

**Table 2**

Effectiveness analysis (rural community): Proportionate changes from baseline to follow-up and logistic regression comparing outcomes at follow-up adjusted for baseline differences

Outcome variable	Prevalence (intervention arm)	Prevalence (comparison arm)	Proportionate change (intervention arm)	Proportionate change (comparison arm)	Odds ratio	p value	95% Confidence intervals
Substance use							
Baseline*	23.3%	19.2%					
Follow-up	21.8%	16.3%	−6.4%	−15.1%	1.12	.52	.80–1.57
Suicidal behavior							
Baseline*	3.0%	5.1%					
Follow-up	.5%	.8%	−83.3%	−84.3%	1.05	.94	.28–3.95
Probable depression							
Baseline*	23.3%	17.9%					
Follow-up	9.3%	18.1%	−60.1%	1.1%	.33	<.001	.23–.48
Experience of physical abuse							
Baseline	4.5%	3.8%					
Follow-up	4.2%	3.6%	−6.7%	−5.3%	.96	.92	.49–1.91
Experience of sexual abuse							
Baseline	3.9%	5.0%					
Follow-up	.5%	1.7%	−87.2%	−66.0%	.39	.12	.12–1.30
Perpetration of physical violence							
Baseline	5.8%	4.9%					
Follow-up	2.4%	6.5%	−58.6%	32.7%	.29	<.001	.15–.57
Complaints of penile discharge							
Baseline	50.3%	54.0%					
Follow-up	66.2%	71.9%	31.6%	33.2%	.89	.55	.61–1.30
Complaints of vaginal symptoms							
Baseline*	5.0%	10.9%					
Follow-up	1.3%	3.1%	−74.0%	−71.6%	.92	.90	.26–3.24
Complaints of menstrual problems							
Baseline	47.6%	51.8%					
Follow-up	24.2%	48.9%	−49.2%	−5.6%	.39	<.001	.26–.60
Help seeking for RSH complaints by men							
Baseline	.4%	.4%					
Follow-up	.6%	.6%	50.0%	50.0%	1.07	.97	.04–32.19
Help seeking for RSH complaints by women							
Baseline*	37.2%	48.1%					
Follow-up	44.0%	37.0%	18.3%	−23.1%	2.09	.03	1.07–4.06
Help seeking for stress concerns							
Baseline	6.9%	13.4%					
Follow-up	5.0%	20.0%	−27.5%	49.3%	.44	.36	.07–2.59
Knowledge and attitudes (emotional health)							
Baseline*	26.0%	35.1%					
Follow-up	32.8%	32.3%	26.2%	−8.0%	1.57	.00	1.18–2.10
Knowledge and attitudes (substance use)							
Baseline*	69.5%	84.8%					
Follow-up	79.6%	71.3%	14.5%	−15.9%	3.83	<.001	2.77–5.31
Knowledge and attitudes (RSH)							
Baseline*	7.5%	17.3%					
Follow-up	18.4%	27.3%	145.3%	57.8%	1.55	.02	1.06–2.28

\* Significant differences between intervention and comparison arms at baseline ( $p < .05$ ).

concerns increased in the comparison arm; however, this difference was not statistically significant.

#### Acceptability and feasibility of the intervention

Table 4 summarizes the process evaluation results. A narrative summary is presented in the following section.

#### Community peer education

In the rural community, 28 peer leaders were trained; of these 20 attended more than 75% of the sessions. They then conducted 32 street plays and 46 group discussions for 767 youth. Over 90% of youth reported the street plays to be relevant and interesting. Peer leaders felt that training had been thorough; however, over 40% wanted more information on “self-esteem,” “attitudes and

values,” “violence,” and “public-speaking.” Most reported having received support from their friends and families. Nearly 93% of youth had learnt something new, and knowledge about HIV-AIDS was the most common response. Youth reported having learnt communication skills, decision-making skills, anger management, and having reduced smoking. Peer leaders also reported several areas of impact, the most frequent being increase in self-confidence and leadership ability; postsession scores showed statistically significant improvements on mental health, RSH, communication, stress management, conflict resolution, and anger management. None of the urban youth were interested in being peer leaders. Of the 65 registered for training, only four completed it and even they did not continue as peer leaders. The most common reasons for nonadherence in both settings were that peer leaders or youth were participating in village programs; they had school, house-work, or

**Table 3**

Effectiveness analysis (urban community): Proportionate changes from baseline to follow-up and logistic regression comparing outcomes at follow-up adjusted for baseline differences

Outcome variable	Prevalence (intervention arm)	Prevalence (comparison arm)	Proportionate change (intervention arm)	Proportionate change (comparison arm)	Odds ratio	p value	95% Confidence intervals
Substance use							
Baseline*	23.2%	18.4%					
Follow-up	12.7%	16.9%	−45.3%	−8.2%	.63	.01	.45–.89
Suicidal behavior							
Baseline	4.3%	3.5%					
Follow-up	1.5%	3.1%	−65.1%	−11.4%	.38	.02	.17–.84
Probable depression							
Baseline	22.7%	19.4%					
Follow-up	13.9%	19.0%	−38.8%	−2.1%	.57	.001	.41–.79
Experience of physical abuse							
Baseline	6.8%	6.0%					
Follow-up	4.6%	5.4%	−32.4%	−10.0%	.73	.27	.42–1.28
Experience of sexual abuse							
Baseline	5.4%	2.9%					
Follow-up	1.5%	4.0%	−72.2%	37.9%	.19	<.001	.09–.41
Perpetration of physical violence							
Baseline*	18.6%	13.5%					
Follow-up	9.4%	10.6%	−49.5%	−21.5%	.59	.01	.40–.87
Complaints of penile discharge							
Baseline*	29.2%	22.6%					
Follow-up	25.8%	40.4%	−11.6%	78.8%	.36	<.001	.24–.55
Complaints of vaginal symptoms							
Baseline*	10.3%	6.7%					
Follow-up	7.1%	8.8%	−31.1%	31.3%	.49	.03	.26–.93
Complaints of menstrual problems							
Baseline	68.4%	69.9%					
Follow-up	51.1%	58.1%	−25.3%	−16.9%	.81	.26	.56–1.17
Help seeking for RSH complaints by men							
Baseline	6.0%	2.9%					
Follow-up	1.7%	2.9%	−71.7%	.0%	.26	.22	.03–2.25
Help seeking for RSH complaints by woman							
Baseline	43.1%	48.9%					
Follow-up	43.0%	41.6%	−.23%	−14.9%	1.34	.20	.85–2.09
Help seeking for stress concerns							
Baseline	15.8%	18.7%					
Follow-up	8.8%	20.2%	−44.3%	8.0%	.47	.15	.17–1.30
Knowledge and attitudes (emotional health)							
Baseline*	29.0%	42.2%					
Follow-up	26.3%	34.9%	−9.3%	−17.3%	1.19	.23	.90–1.56
Knowledge and attitudes (substance use)							
Baseline	79.8%	79.5%					
Follow-up	74.2%	74.1%	−7.0%	−6.8%	.98	.91	.72–1.33
Knowledge and attitudes (RSH)							
Baseline*	20.7%	28.7%					
Follow-up	25.9%	27.0%		−5.9%	1.46	.01	1.09–1.97

\* Significant differences between intervention and comparison arms at baseline ( $p < .05$ ).

other commitments; and timings, duration, and locations of sessions were inconvenient.

*Educational institution-based components*

A total of 98 peer leaders were trained; 75 attended more than 75% of the trainings. Peer leaders found the training interesting, useful, and interactive. Several wanted more information on “relationships,” “attitudes and values,” “self-esteem,” and “stress and suicide.” Only four, however, went on to conduct group sessions for other youth, reasons being school-work was demanding and interfered with intervention delivery, interaction between teachers and peer leaders was poor which resulted in a lack of sustained support for peer education, and the program was not integrated adequately with the regular school

curriculum. Despite this, youth and peer leaders reported several favorable outcomes in themselves and their peers: greater anger control, better communication skills, improved self-confidence and public-speaking skills, reduced smoking, and greater comfort in discussing sexual health issues with friends. Significant increases in knowledge levels were observed on the topic of mental health for youth and on topics related to RSH and conflict resolution for peer leaders.

Thirteen teachers were trained in two institutions. As in the case of peer education, teaching commitments and poor integration within the school system prevented staff from taking on project responsibilities. However, some teachers reported better teacher–student relationships after the training.

**Table 4**  
Overview of acceptability, feasibility and output of intervention components

	Rural community			Urban community		
	Acceptability	Feasibility	Output	Acceptability	Feasibility	Output
Community peer education	1	1	1	3	3	NA
Institution based peer education	NA	NA	NA	1	2	2
Teacher training program	NA	NA	NA	2	2	2
Information materials	1	1	1	1	1	1

NA = not applicable.

Scoring: 1 = Good, 2 = Average, 3 = Poor.

### Information materials

Handouts were distributed to over 80% of households with youth in the communities. Handouts were also kept at libraries of the institutions. Youth and peer leaders reported that the handouts were useful.

### Discussion

Although there is a growing evidence base for youth health interventions in developing countries, most of these have focused on RSH. To the best of our knowledge, our study is the first to use a multicomponent intervention to address diverse health needs of this population. Our findings show that the intervention was associated with improvements in a variety of outcomes, such as probable depression, violence, substance use, suicidal behavior, menstrual problems, and sexual abuse; all of which have been identified as priority health concerns for youth in our study context and in other developing countries [37].

We acknowledge three major limitations of the study. The first is the use of self-reported data. However, we took several steps to increase reliability of the data as described in the Methods section. The second limitation is the probability of observer bias, as researchers were not blind to the allocation status of the community. There were strategies used to minimize this: follow-up assessors were blind to baseline data, the intervention and the follow-up research teams were independent of each other, and the process evaluators were different from the evaluators of effectiveness. The third limitation is that the lack of power and lack of adjustment for clustering may have led to exaggerated results. This was explicitly acknowledged in the fact that this was a pilot evaluation of the likely effectiveness of the intervention. Moreover, the presence of several outcomes favoring the intervention arm (as opposed to none favoring the comparison) and the consistency of results across the two settings suggest a true effect. Findings are also consistent with results of process evaluation.

Not all intervention components were acceptable or feasible. Community peer education was feasible and acceptable in the rural community and could have accounted for some of the findings; in the urban community, this was not feasible or acceptable. Peer education in educational institutions showed acceptability but limited feasibility; however, although peer leaders were unable to deliver the intervention through structured programs, they may have done so through discussions with friends, or acting as role models for behavioral change. Teachers were unable to play a supportive role and are unlikely to have had a large effect. Handouts were the most acceptable and feasible component, and may have important benefits in both settings.

There are several challenges in implementing a population-based program, especially in urban settings. Foremost among these is the integration of peer education into existing structures to ensure its long-term sustainability. Such challenges have been reported by other authors: peer education is expensive; peer leaders tend to be different from other youth in that they are high achievers and come from higher socio-economic backgrounds; and there are several logistical barriers regarding time, space, and effort in school contexts [38–40]. It may be worth considering an alternative model for youth health promotion focusing on young people in schools which, as school retention rates rise in most parts of India, will translate to higher levels of population coverage, and by introducing a dedicated human resource specifically trained to deliver the intervention. However, community peer-led interventions could play an important role in reaching out-of-school youth, especially in rural areas. In all settings, information materials should be retained as a critical component.

In conclusion, our study confirms the potential value of a population-based, context-specific, multicomponent intervention for youth health promotion, which addresses a wide range of health concerns and risk factors. There is a need for definitive trials of such interventions to strengthen the evidence base for youth health in developing countries, a major global policy imperative.

### Acknowledgments

The authors thank the John and Catherine MacArthur Foundation for funding the project. They would also like to thank all members of the project team, the Community Advisory Board and members in the communities, the schools that took part, and all participants of the study.

### References

- [1] Available at: <http://www.un.org.in/adolescentsfinalbook-800kb.pdf>.
- [2] National Youth Policy 2003 [Online]. Available at: <http://www.youth-policy.com/Policies/IndiaNATIONALYOUTHPOLICY2003.pdf>, 2003.
- [3] Population Council. Report in India 2007. Available at: <http://www.popcouncil.org/pdfs/ar07/AR2007.pdf>.
- [4] National Family Health Survey 2005–2006, International Institute for Population Sciences [Online]. Available at <http://www.nfhsindia.org>.
- [5] Ganatra B, Hirve S. Induced abortions among adolescent women in rural Maharashtra, India. *Reprod Health Matters* 2002;10:76–85.
- [6] Lakhani A, Gandhi K, Collumbien M. Addressing semen loss concerns: Towards culturally appropriate HIV/AIDS interventions in Gujarat, India. *Reprod Health Matters* 2001;9:49–59.
- [7] Patel V, Tanksale V, Sahasrabhojane M, et al. The burden and determinants of dysmenorrhoea: A population-based survey of 2262 women in Goa, India. *BJOG* 2006;113:453–63.
- [8] Andrew G, Patel V, Ramakrishna J. Sex, studies or strife? What to integrate in adolescent health services. *Reprod Health Matters* 2003;11:120–9.

- [9] Patton GC, Coffey C, Sawyer SM, et al. Global patterns of mortality in young people: A systematic analysis of population health data. *Lancet* 2009;374:881–92.
- [10] Patel V, Andrew G. Gender, sexual abuse and risk behaviours: A cross-sectional surveys in schools in Goa. *Natl Med J India* 2001;14:263–7.
- [11] Patel V, Pednekar S, Weiss H, et al. Why do women complain of vaginal discharge? A population survey of infectious and psychosocial risk factors in a south Asian community. *Int J Epidemiol* 2005;34:853–62.
- [12] Pillai A, Patel V, Cardozo P, et al. Non-traditional lifestyles and prevalence of mental disorders in adolescents in Goa, India. *Br J Psychiatry* 2008;192:45–51.
- [13] Speizer IS, Magnani RJ, Colvin CE. The effectiveness of adolescent reproductive health interventions in developing countries: A review of the evidence. *J Adolesc Health* 2003;33:324–48.
- [14] Ross DA, Dick B, Ferguson J; UNAIDS Inter-Agency Task Team on Young People. Preventing HIV/AIDS in young people: A systematic review of the evidence from developing countries. Geneva, Switzerland: World Health Organization, 2006.
- [15] Kirby D, Laris BA, Roller L; ETR Associates. The Impact of Sex and HIV Education Programs in Schools and communities on sexual behaviors among young adults. Research Triangle Park, NC: Family Health International (FHI)/YouthNet Project, 2006.
- [16] Aplasca MR, Siegel D, Mandel JS, et al. Results of a model AIDS prevention program for high school students in the Philippines. *AIDS* 1995;9(1):7–13.
- [17] Caceres CF, Rosasco AM, Mandel JS, Hearst N. Evaluating a school-based intervention for STD/AIDS prevention in Peru. *J Adolesc Health* 1994;15:582–91.
- [18] Fawole IO, Asuzu MC, Oduntan SO, Brieger WR. A school-based AIDS education programme for secondary school students in Nigeria: A review of effectiveness. *Health Educ Res* 1999;14:675–83.
- [19] Okonofua FE, Coplan P, Collins S, et al. Impact of an intervention to improve treatment-seeking behavior and prevent sexually transmitted diseases among Nigerian youths. *Int J Infect Dis* 2003;7:61–73.
- [20] Chen X, Fang X, Li X, et al. Stay away from tobacco: A pilot trial of a school-based adolescent smoking prevention program in Beijing, China. *Nicotine Tob Res* 2006;8(2):227–37.
- [21] Mbizvo MT, Kasule J, Gupta V, et al. Effects of a randomized health education intervention on aspects of reproductive health knowledge and reported behaviour among adolescents in Zimbabwe. *Soc Sci Med* 1997;44(5):573–7.
- [22] Kim YM, Kols A, Nyakauru R, et al. Promoting sexual responsibility among young people in Zimbabwe. *Int Fam Plan Perspect* 2001;1:11–9.
- [23] Speizer I, Oleko Tambahse B, Tegang SP. An evaluation of the “Entre Nous Jeunes” peer educator program for adolescents in Cameroon. *Stud Fam Plan* 2001;32:339–51.
- [24] Kagimu M, Marum E, Wabwire-Mangen F, et al. Evaluation of the effectiveness of AIDS health education interventions in the Muslim community in Uganda. *AIDS Educ Prev* 1998;10(3):215–28.
- [25] Merati TP, Ekstrand ML, Hudes ES, et al. Traditional Balinese youth groups as a venue for prevention of AIDS and other sexually transmitted diseases. *AIDS* 1997;11:1111–9.
- [26] Lou C, Wang B, Shen Y, Gao ER. Effects of a community-based sex education and reproductive health service program on contraceptive use of unmarried youths in Shanghai. *J Adolesc Health* 2004;34:433–40.
- [27] Reddy KS, Arora M, Perry CL, et al. Tobacco and alcohol use outcomes of a school- and family-based intervention with young adolescents in New Delhi, American. *J Health Promot* 2002;26:173–81.
- [28] Bowles JR. Suicide in Western Samoa—An example of suicide prevention programme in a developing country. In: Diekstra RFW, Gulbinat W, Keinhorst U, De Leo D, eds. *Prevention Strategies in Suicide*. Leiden, the Netherlands: Brill, 1995.
- [29] Wellings K, Collumbien M, Slaymaker E, et al. Sexual behaviour in context: A global perspective. *Lancet* 2006;368:1706–28.
- [30] Campbell M, Fitzpatrick R, Haines A, et al. Framework for the design and evaluation of complex interventions to improve health. *BMJ* 2000;321:694–6.
- [31] Facilitators' Handbook for Training of Trainers. Adolescent Education Programme. India: NACO, UNICEF and Ministry of Human Resource Development, 2004.
- [32] Bhattacharjee P, Abraham C, Girish M. Stepping stones—A training package on HIV/AIDS communication and relationship skills (Indian adaptation). India Canada HIV/AIDS project (ICHAP), Strategies for Hope and Actionaid International India, Bangalore, Bangalore, India, 2004.
- [33] National Family Health Survey 1998–1999, International Institute for Population Sciences [Online]. Available at <http://www.nfhsindia.org>.
- [34] Goldberg DP, Gater R, Sartorius N, et al. The validity of two versions of the GHQ in the WHO study of mental illness in general health care. *Psychol Med* 1997;27:191–7.
- [35] Patel V, Pereira J, Mann A. Somatic and psychological models of common mental disorders in India. *Psychol Med* 1998;28:135–43.
- [36] Taylor SJ, Bogdan R. Introduction to qualitative research methods: The search for meanings. New York, NY: John Wiley & Sons, 1984.
- [37] Patel V, Flisher AJ, Hetrick S, McGorry P. Mental health of young people: A global public-health challenge. *Lancet* 2007;369:1302–13.
- [38] Borgia P, Marinacci C, Schifano P, Perucci CA. Is peer education the best approach for HIV prevention in schools? Findings from a randomized controlled trial. *J Adolesc Health* 2005;36(6):508–16.
- [39] Strange V, Forrest S, Oakley A. Peer-led sex education—Characteristics of peer educators and their perceptions of the impact on them of participation in a peer education programme. *Health Educ Res* 2002;17(3):327–37.
- [40] Strange V, Forrest S, Oakley A and the RIPPLE study team. What influences peer-led sex education in the classroom? A view from the peer educators. *Health Educ Res* 2002;17(3):339–49.