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Adolescents' Communication with Parents, Other Adult Family Members and Teachers on Sexuality: Effects of School-Based Interventions in South Africa and Tanzania

Francis Namisi · Leif Edvard Aarø ·
Sylvia Kaaya · Lusajo J. Kajula · Gad. P. Kilonzo ·
Hans Onya · Annegreet Wubs · Catherine Mathews

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Abstract Cluster-randomized controlled trials were carried out to examine effects on sexual practices of school-based interventions among adolescents in three sites in sub-Saharan Africa. In this publication, effects on communication about sexuality with significant adults (including parents) and such communication as a mediator of other outcomes were examined. Belonging to the intervention group was significantly associated with fewer reported sexual debuts in Dar es Salaam only (OR 0.648). Effects on communication with adults about sexuality issues were stronger for Dar es Salaam than for the other sites. In Dar, increase in communication with adults proved to partially mediate associations between intervention and a number of social cognition outcomes. The hypothesized mediational effect of communication on sexual debut was not confirmed. Promoting intergenerational communication on sexuality issues is associated with several positive outcomes and therefore important. Future research should search for mediating factors influencing behavior beyond those examined in the present study.

Keywords Adolescents · Intervention · Interpersonal communication · HIV/AIDS · Statistical mediation

Introduction

Increasing and improving adolescents' communication with parents, caregivers and other adults about sexuality is assumed to contribute to more healthy sexual practices among adolescents [1]. In this article we use data from a cluster randomized trial carried out in three sites in sub-Saharan Africa in order to examine intervention effects on such communication and, in one of the sites, to examine its role as mediators of programme effects on social cognition variables as well as on delayed sexual debut.

In many cultures in sub-Saharan Africa there is considerable room for improvement with regard to parent-offspring communication on sexuality. Qualitative studies illustrate some critical aspects. Discussions have been shown to almost always be initiated by parents and not the

F. Namisi
African Medical and Research Foundation (AMREF),
P.O. Box 27691–00506, Nairobi, Kenya

F. Namisi · L. E. Aarø · A. Wubs
Department of Health Promotion and Development, Faculty of
Psychology, University of Bergen, P.O. Box 7807, 5020 Bergen,
Norway

L. E. Aarø (✉)
Division of Mental Health, Norwegian Institute of Public Health,
Nydalén, P.O. Box 4404, 0403 Oslo, Norway
e-mail: Leif.Edvard.Aaro@fhi.no

S. Kaaya · L. J. Kajula · Gad. P. Kilonzo
Department of Psychiatry, Muhimbili University of Health and
Allied Sciences, P.O. Box 65001, Dar es Salaam, Tanzania

H. Onya
Department of Medical Sciences, Public Health and Health
Promotion, School of Health Sciences, University of Limpopo,
Turfloop Campus, Private Bag X1106, Sovenga 0727, South
Africa

C. Mathews
Health Systems Research Unit, Medical Research Council,
Tygerberg, P.O. Box 19070, Cape Town 7505, South Africa

C. Mathews
Adolescent Health Research Unit, Department of Psychiatry and
Mental Health, University of Cape Town, University Private
Bag, Rondebosch, Cape Town 7700, South Africa

adolescents, and the communication is basically unidirectional from parents to their children. Parents tend to be ambiguous and to use vague words and expressions [2–4]. Some topics, like condom use, are avoided [4]. Discussions on sexuality were in one study shown to be triggered by unconventional behaviour among the adolescents and events like loss of relatives due to HIV/AIDS and early pregnancies among other young people in the community [5]. Parents' communication style was in one study characterized as strict [6], and in other studies as authoritarian and didactic, and parents tried to warn and scare their children from practicing pre-marital sex [4, 5]. Adolescents have, however, not unexpectedly, been reported to dislike authoritarian and didactic parenting styles [5]. There are also reports about parents beating their children in order to make them obey [5]. Friends and peers were by many parents seen as a source of negative influence [6]. Some studies have shown that adolescents fear asking questions about sexuality issues, since it could be misunderstood by their parents as a sign that they were sexually active [2, 3, 6]. Parents and children have experienced discomfort talking to each other about sexuality [2, 3]. Some parents believed that communication about sexuality could influence adolescents to become more sexually active [2].

In one study several parents admitted that they were not sufficiently skilled with regard to communicating well on sexuality issues with their teenage children [5]. In another study parents said that they had made little effort to seek expert advice on issues like sexuality and HIV/AIDS [6]. In the former study mother–daughter sexuality communication was perceived as more bi-directional and interactive and embracing a wider range of sexuality issues than such communication between father and sons [5]. In the latter study it was found that same sex communication (between fathers and sons and between mothers and daughters) was preferred [6].

In many parts of sub-Saharan Africa young people have traditionally received sex information from an extended family member of the same gender, and not from their parents or caregivers. These traditions have largely disintegrated [7]. One of the findings from the SATZ study in Tanzania and South Africa was that many young people in their early teens are met with silence about sexuality issues, and this was particularly the case with adolescents from Tanzania. In Dar es Salaam 71 % of boys and 77 % of girls never or hardly ever talk with their parents about HIV/AIDS [8].

Wight et al. [9] have identified a number of contextual barriers to HIV prevention, distinguishing between economic barriers, barriers related to social status and identity, and cultural beliefs. Women's choices are limited and their behaviour constrained by their lower social status and their economic dependence on men and by sex representing an

important economic resource. An important obstacle to effective information and intervention is the poor quality of education and health services [9]. Interventions targeting youth are unlikely to succeed if they don't include contextual changes, and this is particularly the case in societies where the social status of youth is low [9]. For young men, the most important arena for demonstrating their masculinity is their relationship with women. This may even function as a pressure towards early sexual debut and multiple simultaneous partnerships [9].

In sub-Saharan Africa, communication between adolescents and parents/caregivers on sexuality issues takes place under varied circumstances and in a variety of contexts, some of which are characterized by violence [10, 11]. Violent behaviour and sexual abuse are supported by constructed gender inequalities forming an often negative and non-supportive environment for young people [12]. Adolescents who experience intimate partner violence have their sexual debut at a younger age than those who do not [13].

Wamoyi et al. [14] reported from a study in rural North Western Tanzania that parents and young people at present spend less time together than was the case with previous generations. Furthermore, as young people receive more education and contribute more to their families' income, parents' influence tends to wane.

Sexual behaviour, interpersonal communication on sexuality issues and social cognition factors related to sexual practices are embedded in a larger cultural context, which has been established over time, which changes gradually under the influence of new communication technologies and societal processes, but which may be difficult to change through interventions. Wight et al. suggest that a culture change approach may be needed in order to succeed with interventions aiming at promoting more healthy sexual practices [9].

Societal and cultural barriers to healthy sexual practices and barriers to obtaining good effects of interventions are easy to find. Ways to promote healthy sexual practices and facilitating intervention effects must, however, also be identified. Parents', caregivers' and teachers' concern for their children and pupils represents a possible resource in efforts to influence adolescents' sexual practices. And schools, where whole cohorts of young people can be reached rather easily, and provided that high quality materials and effective approaches are developed and offered, may serve well as a vehicle for delivery of interventions. School health services, police departments, NGOs and other relevant stakeholders may serve as important partners.

The evidence from RCTs does not always support the assumption that increasing and improving adolescents' communication with parents and other adults contributes to

more healthy sexual practices. In a systematic review of parent and family-based interventions which examined sexual outcomes in young people Downing et al. identified 17 relevant studies from 1990 to 2009 that satisfied the inclusion criteria [15]. They found that parent-based interventions had some impact on parent–child communication. Increasing parent–child communication did not, however, show any impact on sexual risk behaviours. This review did not cover studies from sub-Saharan Africa.

In another review of 44 intervention programmes [16], covering the same period (1990–2009), the conclusion was that whenever measured, parent–child interaction (as well as adolescents’ knowledge and attitudes) improved, but sexual behaviour outcomes only improved in approximately half of the studies. Only one of the studies reviewed by Wight and Fullerton was from sub-Saharan Africa (rural South Africa). In this study [17] they examined effects of an intervention which aimed at reducing levels of HIV and partner violence by promoting communication about sexuality issues between adult women and young people. Women in the intervention group reported communication about sexuality with children more often than women in a matched control group (80.3 vs. 49.4 %). They also found that the content of the communication shifted from “vague admonitions about the dangers of sex to concrete messages about reducing risks” [17]. To the best of our knowledge, in this study effects of increased communication on sexual practices were not reported. From the “Families Matter” program in Kenya it was reported that parents’ initially negative views about parent–child communication on sex changed towards being more positive, the amount of such communication with their children (age 10–12) increased, and significant improvements were also seen on aspects of parenting [7].

Wight and Fullerton [16] suggest a causal pathway which they claim to be implicit in many studies. Interventions with parents are assumed to influence parent child interaction (and communication), which in turn contributes to changing more proximal predictors of sexual behaviour such as knowledge, attitudes and skills. The assumption is that these proximal predictors have an impact on adolescent sexual behaviour. This mediation path has, to the best of our knowledge, not been empirically tested in previous studies. Prado et al. [18] came close when they used growth curve modelling to see if the path from intervention condition to the slope of an outcome variable was mediated by family functioning. Mediation was, however, not convincingly confirmed.

Other researchers, for instance Beveridge and Berg [19], have suggested that aspects of the adolescent–parent interaction such as warmth and the level of autonomy contribute to adaptive behaviour among adolescents. Darling and Steinberg [20] suggested that the effects of

parenting practices can only be well understood in the context of parenting styles, and the preferred parenting style is labelled “authoritative”. Essential features of authoritative parenting are warmth, autonomy granting, reciprocity of communication, use of reasoning and explanation, and the setting of boundaries [20, 21]. Collins and Laursen [22] add that also accepting attitudes among parents, bidirectional communication, and an emphasis on training social responsibility and concern for the impact of one’s action on others are important factors contributing to socially responsible behaviour among adolescents. Although the present study does not directly address the issue of parenting, the results of the study should be seen in a parenting perspective. Increasing the amount of inter-generational communication on sexuality issues is probably much more effective among families when parents’ relationships to their sons and daughters can be characterized as authoritative.

The purpose of the present study is to examine to what extent a school-based HIV prevention education programme, carried out in the context of a multi-site cluster randomized intervention study targeting high school adolescents, led to higher levels of interpersonal communication between adolescents and adults about sexuality issues. In one site (Dar es Salaam), where the intervention produced significant behavioural outcomes [23], interpersonal communication on sexuality issues is examined as a possible mediator of programme outcomes (reduced reported sexual transition and social cognition predictors of such transition). In this article, sexual transition means to have had no sexual intercourse (vaginal or anal) at a previous data collection, but to have reported intercourse at a later data collection.

As should be obvious from the presentation of previous research above, few studies have examined effects of school-based interventions on parent–offspring sexuality communication in a sub-Saharan African context, and there seems to be no study which has examined the mediating effect of such communication on social cognition and behavioural outcomes.

Methods

Intervention

The objective of the interventions was to promote more healthy sexual practices (delayed sexual transition and consistent condom use) through school-based interventions administered by teachers who were specifically trained by the programme for this purpose. The interventions were developed using the intervention mapping approach. Intervention mapping is a systematic method based on

empirical evidence, relevant behavioural change theory and formative research in order to develop effective and culturally sensitive interventions [24, 25]. In each site, the programme team developed the intervention, supported by the World Population Foundation and Youth Incentives. An important theoretical perspective for intervention development as well as for the development of evaluation instruments was the attitude–social influence–efficacy (ASE) model [26]. The ASE model is based on the assumption that behavioural intentions predict future behaviour and in turn are shaped by personal attitudes, social norms and self-efficacy. The ASE model is very similar to the more widely known theory of planned behaviour [27]. The most important difference is that ‘perceived behavioural control’ has been replaced by ‘self-efficacy’, a concept borrowed from social cognitive theory [28]. To ensure cultural appropriateness of the interventions, the development teams or staff in each site collaborated closely with students, parents, teachers, non-governmental organisations and educational authorities.

School-based interventions were carried out in three locations: Cape Town (South Africa), Mankweng (South Africa), and Dar es Salaam (Tanzania). Western Cape has a population of 5.8 million with 90 % of the population living in urban areas. Two thirds live in Cape Town [29]. In Western Cape 29 % have completed grade 12 education, which is close to the average level for South Africa [30]. The proportion living in poverty (under the food poverty line) was 9 % in 2008–2009 [31]. The official unemployment rate in 2011 for Western Cape was 22 % [29]. Forty nine percent of the people of the Western Cape describe themselves as “Coloured”, 33 % as “Black African”, 16 % as “White”, and 2 % as “Indian or Asian” [29]. The HIV prevalence in Western Cape was 3.8 % in 2008 [32]. Christianity is the predominant religious group (82 %). Muslims constituted about 6 % of the population. Nine percent reported to have no religion [33]. The schools involved in the SATZ project came from all the eight Cape Town sub-districts and they varied from very poor with predominant informal housing, to middle-to-low socio-economic status. None of the schools were situated in very wealthy areas, and none of the schools were private.

Schools from the Kinondoni district of Dar es Salaam were involved in the SATZ project. Dar es Salaam is one of the fastest growing cities in Africa and Tanzania’s largest city (population 2012—4.4 million) and an important economic centre. Most Tanzanians are either Christian or Muslims. Sixteen percent of the population in Dar es Salaam experienced below basic need poverty in 2007 [34]. The unemployment rate among youth in Dar es Salaam was 32 % in 2006 [35]. The HIV prevalence in Dar was 6.9 % in 2011/2012, higher than the average for the country as a whole [34]. The Kinondoni district is a partly urban and

partly semi-urban area with a mixture of both poor and affluent residential areas. Seventy percent of the population lived in ‘informal’ settlements in 2002 [36]. Since only public schools were involved in SATZ, students from well off families were under-represented.

The Limpopo province has a population of about 5.4 million [29]. The HIV prevalence for the Limpopo province was 8.8 % in 2008 [32]. Among provinces in South Africa, Limpopo has the highest level of poverty with 49 % of the population living below the food poverty line in 2008–2009 [31]. The official unemployment rate was in 2011 close to 40 % [29]. In the Limpopo province 23 % have completed grade 12 in school, lowest in South Africa [30]. More than two thirds of the population in Limpopo are Christian, and 29 % have no religious affiliation [37]. Ninety seven percent of the population in Limpopo are black Africans [29]. The schools involved in the SATZ project came from Mankweng, which is a rural area 30 km from Polokwane.

Cape Town is a more urbanised and Western city, and is characterized by a more individualistic culture than the other two sites. Mankweng is a rural district with a culture characterized by a traditional way of life, and Dar es Salaam a large city more characterised by a collectivistic culture.

The interventions, which targeted students aged 12–14, took place during 11 (Mankweng) or 17 (Cape Town and Dar es Salaam) school hours. This difference in hours used on the intervention was not a result of careful considerations, but rather due to practical circumstances. Interventions in all sites were administered by teachers during school hours. Teachers were selected on the basis of which subject they were teaching (Life Orientation in Cape Town and Mankweng and Science teachers in Dar es Salaam) and their willingness or interest to be involved. Teacher manuals with lesson plans, student workbooks and homework worksheets were produced and used in all sites. Teacher training (4 or 5 days) involved two or more teachers (Life Orientation teachers or Science teachers) per school. Posters and condoms as well as dildos for demonstration were used in the two South African sites. In Cape Town they also distributed a booklet on substance use. Flip charts and manila cards were used in Cape Town and Dar es Salaam. The sessions involved teacher presentations, whole class and small group discussions (mixed sex and same sex), small group activities, and role-plays. Condom demonstrations were delivered in the Cape Town, but not in the other two sites. Song composition and a quiz were used in Mankweng only and drama in Dar es Salaam only. In addition, there were homework assignments to be accomplished at home with the help of parents.

Intervention materials, messages and activities aimed at influencing important predictors of behavioural intentions

such as attitudes, subjective norms and self-efficacy. Underlying such factors are beliefs, for instance beliefs about consequences of behaviours. By educating the students about consequences of for instance unprotected sex, it is expected that changes in such beliefs will lead to attitude change. Group activities and discussions with parents are assumed to change normative beliefs and thereby also subjective norms. And demonstration of condom use is supposed to contribute to an increase in self-efficacy related to condom use. These are just examples. The process of developing the interventions was guided by intervention mapping, and details about the process as it took place in one of the sites (Cape Town) has been published elsewhere [38].

In all three sites there were booster sessions which took place approximately 6 months after the completion of the main interventions. In Cape Town an hour-long booster workshop was delivered to the students at each intervention school to reinforce the programme objectives. The themes addressed by learners in the booster activities were related to lessons learnt within the SATZ intervention program. In Mankweng the booster session took place at the University of Limpopo venues. Teachers and students from the participating schools were responsible for presenting, each school on one topic chosen from a list of possible topics. The presentations were identical to the way it would have been done in a classroom setting. In Dar es Salaam planning for the intervention program booster began well in advance. All the intervention schools agreed to have an open day. Parents and learners from other grades were invited. Learners that had been exposed to the intervention were involved in preparing activities to communicate messages related to what they had learnt, using several strategies that included writing and acting plays, writing and presenting poems, drums and dance (Ngoma), and drawing and painting exhibitions. The themes addressed by learners in the booster activities were related to lessons learnt within the SATZ intervention program. For most schools the head teachers gave a speech that intended to summarize for parents and local government leaders of what had occurred during the implementation of SATZ in the school. Also in Dar es Salaam an important objective was to remind learners of what they had covered during the SATZ sessions.

Schools in the comparison arm received teacher training and the provision of the materials at the end of the study, that means after the completion of the second follow-up data collection.

Three activities were based on parental involvement: Homework worksheets, which in two of the sites (Mankweng and Dar es Salaam) had to be confirmed by parents' signatures; questionnaire for students to interview their parents; and assignments to involve parents in homework.

In Dar es Salaam parents were also invited to attend the booster activities. More details about the intervention content and delivery have been published elsewhere [23, 38].

Study Design and Data Collections

The total number of schools that participated in the whole study was eighty. This included 26 schools in Cape Town, 24 schools in Dar es Salaam, and 30 schools in Mankweng. After some simple matching or pairing procedures, schools were randomly allocated to intervention and delayed intervention groups. The delayed interventions took place shortly after the completion of the final data collection in each site. The total number of students participating in the baseline data collection and meant to be included in later data collections was 12,462. The gender distribution among these students was 47.8 % males and 51.6 % females (0.6 % missing on gender). Mean age at baseline was 12.9 years in Dar es Salaam, 13.4 years in Cape Town and 14.9 years in Mankweng. The corresponding standard deviations were 1.40, 1.26 and 1.70 years. The proportion in the age range 12–15 years was 83.5 %. Attrition was 9.5 % by the first follow-up data collection and 19.6 % by the final data collection.

Questionnaires were developed and piloted in all sites (after forward and back-translations). Data collections were carried out before interventions took place, 6 months later (all sites) and 12 months after baseline in Dar es Salaam, 13 months in Mankweng and 14–15 months in Cape Town. In two sites traditional printed questionnaires were used, in one site (Cape Town) electronic questionnaires on handheld computers were used. Data collections were carried out by members of the research teams. Teachers were not present in class during data collections.

Implementation and process evaluation included observation of intervention activities in school, interviews with teachers, parents and health workers, forms for cost registration, diary checklists for teachers, implementation assessment forms for teachers, and forms for evaluation of teacher training sessions. Results from the process evaluation in Cape Town have been presented elsewhere [38]. Findings from the process evaluations will be referred to in the discussion.

Measures

The project partners collectively developed the final international English version of the questionnaire [39]. The translations into other languages (Afrikaans, Xhosa, Sepedi and Swahili) were conducted locally at each of the three study sites. Trained local research teams executed back translation, examination, pilot testing and revisions of the

instruments [40]. The final questionnaire consisted of 155 items, including socio-demographic factors, sexual behaviours, psychosocial variables (such as attitudes, social norms, self-efficacy, intentions), and interpersonal communication variables [41].

Reported Sexual Transition

Those who reported not to have had vaginal or anal intercourse at baseline and still reported the same at the first follow up were coded as 0 (zero). Those who reported to have had either vaginal or anal intercourse at the first follow up were coded as 1 (one). A similar sexual transition variable was constructed also for the second follow up.

Communication with Adults

Participants were asked how often parents/guardians talked with them on each of three topics: HIV/AIDS, abstinence, and condoms. Response categories were “never” (1), “hardly ever” (2), “sometimes” (3), “a lot” (4) to “all the time” (5). Similar questions were asked regarding communication with other adult family members and teachers. As described in an earlier publication [41] we computed mean scores (scale 1–5) of the three reproductive health items for communication with parents/guardians, other family members (OFMs) and teachers separately. In addition, we computed an overall communication mean score “total communication” across all three reproductive health topics and the three categories of adult communication partners. This was done for each of the three data collection occasions. Psychometric properties of the communication scale have been reported elsewhere [41]. The Cronbach alpha values for the subscales at baseline (based on 3 items each) vary between 0.83 and 0.87, and for the total communication sumscore the alpha was 0.91 at baseline. The test–retest correlations between two consecutive data collections in SATZ vary between 0.45 and 0.52.

Social Cognition Predictors of Reported Sexual Transition

Fourteen questions on HIV/AIDS and other sexually transmitted diseases formed the knowledge scale. Correct response was “Yes” on ten items and “No” on four items. An index was constructed by counting number of correct responses. Cronbach’s alpha in the Dar es Salaam sample (on which the mediation analyses are carried out) at baseline was 0.79. The psychometric properties of the SATZ knowledge scale has been described elsewhere [42].

For the remaining social cognition variables, simple unweighted sumscores (mean value across items, range 1–5) were constructed. Social outcome expectancies were

measured with four items, for instance “If I do not have sexual intercourse, I will lose some of my friends” ($\alpha = 0.69$). A meanscore for perceived severity of threat from sexually transmitted diseases was based on four items, such as “HIV is a big threat against my personal health” ($\alpha = 0.85$). Perceived susceptibility to sexually transmitted diseases was covered by three items, for instance “I am likely to get infected with a sexually transmitted disease if I have sex without using condom” ($\alpha = 0.80$). Subjective norms towards delayed sexual transition was measured with five items, such as “Most of my friends do not plan to have sex until they are older” ($\alpha = 0.83$). Self-efficacy with regard to delaying sexual transition was covered by eight items, one example being “I am able to wait until I am 18 years old before I have sexual intercourse” ($\alpha = 0.87$). All alpha values reported are for the Dar es Salaam sample.

Socioeconomic Status

The SES index, described in an earlier publication [8], was a meanscore (sumscore divided by number of items) based on three indicators: (i) number of assets in family (TV, bicycle etc.), (ii) number of people sleeping in the same room (logarithmic transformed and reversed) and (iii) a subjective report about the material wealth of the family (five categories from “not enough money for food” to “enough for luxury items”). All these three indicators were standardized (mean 0.00 and standard deviation = 1.00) before the meanscore calculation, and the final SES meanscore was also standardized. SES was treated as a metric predictor in the statistical analyses. The items included in the socioeconomic status sumscore were positively correlated at baseline with Pearson correlations in the range 0.23–0.27.

Statistical Analyses

Analyses of data were done with IBM SPSS version 20 and Mplus version 7. In order to control for the cluster effect (schools), complex techniques were applied. Regression models were analysed with SPSS (GLM and multiple logistic regression) and Mplus was used for path analysis with estimation of indirect effects. The robust maximum likelihood estimator (MLR) was used for all models except the model presented in Fig. 2 where weighted least squares with mean and variance adjustments (WLSMV) was used.

Since significant intervention effects on reported sexual transition were found for Dar es Salaam [23], analyses involving communication as mediator of programme effects are only presented for the Dar es Salaam site.

Results

Communication Outcomes

Since standard deviations for all measures of communication vary within a narrow range from 1.207 to 1.442, the estimated differences in change between the groups are slightly higher than the corresponding effect sizes. Since all communication sumscores have the same metrics as the original items (range 1–5), we decided to present results based on original scores and not effect size. It should be kept in mind that no correction for attenuation has been performed. Correction for attenuation would have increased effect sizes markedly.

Tables 1 and 2 show mean scores and standard deviations of all single items at baseline, mean scores in the intervention group and the control group at baseline and at both follow up data collections, change scores in both groups, and differences between intervention group and control group with regard to change in communication scores from T1 to T2 (Table 1) and from T1 to T3 (Table 2). All significant differences were in the same direction with a higher increase in communication among students in the intervention group.

For Cape Town differences in change were only significant for communication with teachers (three significant and two borderline out of six tested). For Mankweng 11 out of 18 differences turned out to be significant. The largest differences in change for Mankweng were observed for communication with teachers (0.33–0.47 across topics). Five significant differences were also found for communication with parents and other adult family members on HIV/AIDS (T1–T2) as well as condoms (T1–T2 and T1–T3) (0.19–0.29). In Dar es Salaam the largest number of significant differences in change was found for T1–T3 (eight of nine and one borderline significant). Also for Dar es Salaam the largest differences were found for teachers (0.44–0.59). The significant differences in change for parents and other family members varied between 0.17 and 0.27. Significance was tested with Wald's test and complete statistical tests shown in Tables 1 and 2.

A series of logistic regression analyses with group (intervention vs. control) as the dependent variable and the total (across topics and communication partners) communication sumscore as predictor was carried out (table not shown). For Dar es Salaam the difference between the intervention group and the delayed intervention group in total communication score, adjusted for communication at baseline (T1), was significant at the first follow up (T2) (OR 1.131; $F = 5.664$; $df = 1$ and 23 ; $p = 0.026$) as well as at the second follow up (T3) (OR 1.236; $F = 18.790$; $df = 1$ and 23 ; $p = 0.000$).

Reported Transition Outcome: Dar es Salaam

A logistic regression analysis with control for the cluster effect showed that the odds for reported sexual transition (debut) was lower in the intervention group than in the control group (OR 0.648; $F = 7.939$; $df = 1$ and 23 ; $p = 0.010$) (model 1—Table 3). Controlling for gender (model 2) strengthened the association slightly. When age and socioeconomic status at baseline were added as predictors (model 3), the association was almost identical to the zero order association (OR 0.644; $F = 9.084$; $df = 1$ and 23 ; $p = 0.006$) and still significant ($p < 0.01$).

Reported Transition Outcome with Control for Communication: Dar es Salaam

Model 4 in Table 3 shows the intervention effect with control for communication at T1 as well as at T3. The OR for the intervention group (delayed intervention as comparison) was 0.611 ($F = 4.861$; $df = 1$ and 23 ; $p = 0.038$). When controlling for the communication variables as well as gender, age and socioeconomic status (model 5), the OR proved to be even lower (stronger association) (OR 0.569; $F = 6.455$; $df = 1$ and 23 ; $p = 0.018$).

Control for demographic variables did not affect the OR value much. Controlling for communication variables tended to strengthen the association between intervention and reported sexual transition. This is the opposite of what would be expected if change in communication mediated programme effects on reported transition, and not in the direction to be expected if communication served as a mediator of programme effects on reported transition.

Doing the same analyses with communication with parents on the predictor side, (instead of the total communication score) did not change the results much.

Mediation Models: Dar es Salaam

In order to examine to what extent an increase in communication from baseline (T1) to the second follow up data collection (T3) mediated the intervention impact on knowledge change a path model (Fig. 1) was estimated with Mplus. As shown in Table 4, similar analyses were carried out for changes (T1–T3) in five other outcomes as well: social outcome expectancies, perceived severity of threat from sexually transmitted diseases (STDs), perceived susceptibility to STDs, subjective norms towards delaying sexual transition, and self-efficacy with regard to delaying sexual transition. In these analyses the communication sumscore as well as all hypothesized mediator sumscores were standardized. All indirect paths proved significant ($p < 0.05$) with unstandardized coefficients

Table 1 Means and standard deviations for all communication variables at baseline, communication variables and change scores by group (intervention, control) and time (T1, T2), group by time interaction

Site	Topic	Communication with All		Intervention group				Control group				Group × time		Sign. p
		T1		T1		T2		T1		T2		Change intervention group minus change control group		
		Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	Mean	
Cape Town	HIV/AIDS	2.65	1.336	2619	2.682	2.717	0.035	1989	2.604	2.690	0.086	-0.051	1.486	0.234
	OAFM*	2.67	1.346	2588	2.701	2.731	0.030	1980	2.634	2.697	0.063	-0.033	0.384	0.541
	Teachers	3.12	1.288	2596	3.175	3.516	0.341	1978	3.040	3.204	0.164	0.177	3.475	0.074
	Not having sex	2.74	1.415	2603	2.771	2.824	0.053	1984	2.704	2.774	0.070	-0.017	0.165	0.688
	OAFM*	2.65	1.403	2562	2.643	2.701	0.058	1970	2.659	2.676	0.017	0.041	0.739	0.398
	Teachers	3.00	1.325	2585	3.060	3.425	0.365	1971	2.918	3.061	0.143	0.222	5.201	0.031
Dar es Salaam	Condoms	2.64	1.357	2585	2.639	2.680	0.041	1976	2.631	2.678	0.047	-0.006	0.034	0.855
	OAFM*	2.56	1.336	2564	2.548	2.598	0.050	1973	2.569	2.590	0.021	0.029	0.238	0.630
	Teachers	2.99	1.303	2573	3.031	3.462	0.431	1968	2.940	3.093	0.153	0.278	10.759	0.003
	HIV/AIDS	1.92	1.400	1230	1.898	2.021	0.123	1189	1.940	2.058	0.118	0.005	0.004	0.949
	OAFM*	1.74	1.270	1187	1.685	1.842	0.157	1162	1.791	1.871	0.080	0.077	1.505	0.232
	Teachers	2.02	1.387	1271	1.954	2.450	0.496	1273	2.090	2.137	0.047	0.449	24.472	0.000
Man- kweng	Not having sex	1.89	1.396	1224	1.843	1.973	0.130	1188	1.940	1.945	0.005	0.125	4.784	0.039
	OAFM*	1.76	1.311	1193	1.712	1.844	0.132	1140	1.801	1.829	0.028	0.104	2.691	0.115
	Teachers	2.03	1.392	1231	1.930	2.415	0.485	1235	2.121	2.163	0.042	0.443	24.434	0.000
	Condoms	1.62	1.228	1234	1.622	1.656	0.034	1193	1.616	1.632	0.016	0.018	0.073	0.789
	OAFM*	1.60	1.207	1215	1.574	1.700	0.126	1163	1.636	1.674	0.038	0.088	2.014	0.169
	Teachers	1.80	1.299	1234	1.720	2.162	0.442	1234	1.878	1.858	-0.020	0.462	17.222	0.000
Cape Town	HIV/AIDS	2.49	1.391	1607	2.414	2.614	0.200	1242	2.589	2.587	-0.002	0.202	5.914	0.021
	OAFM*	2.35	1.382	1592	2.303	2.524	0.221	1250	2.400	2.434	0.034	0.187	6.429	0.017
	Teachers	2.90	1.419	1549	2.832	3.158	0.326	1225	2.993	2.992	-0.001	0.327	5.695	0.024
	Not having sex	2.57	1.388	1599	2.520	2.620	0.100	1240	2.640	2.640	0.000	0.100	0.973	0.332
	OAFM*	2.46	1.384	1586	2.393	2.538	0.145	1237	2.541	2.525	-0.016	0.161	2.344	0.137
	Teachers	2.89	1.442	1568	2.846	3.161	0.315	1220	2.953	2.908	-0.045	0.360	5.593	0.025
Cape Town	Condoms	2.22	1.388	1539	2.159	2.373	0.214	1204	2.289	2.259	-0.030	0.244	10.773	0.003
	OAFM*	2.27	1.383	1523	2.202	2.486	0.284	1201	2.360	2.358	-0.002	0.286	11.290	0.002
	Teachers	2.57	1.352	1576	2.500	2.961	0.461	1222	2.664	2.658	-0.006	0.467	18.221	0.000

p values adjusted for the cluster effect (schools). Scale range: 1–5

* OAFM Other adult family members

** Degrees of freedom: Cape Town: 1 and 25; Dar es Salaam: 1 and 23; Mankweng: 1 and 29

Table 2 Communication variables and change scores by group (intervention, control) and time (T1, T3), group by time interaction

Site	Topic	Communication with	Intervention group			Control group			Group × time				
			T1	T3	Change	T1	T3	Change	Change intervention group minus change control group				
			N	Mean	Mean	Mean	N	Mean	Mean	Mean	Mean	Wald's test**	Sign. p
Cape Town	HIV/AIDS	Parents/caregivers	2148	2.663	2.749	0.086	1553	2.628	2.726	0.098	-0.012	.065	0.801
		OAFM*	2117	2.670	2.723	0.053	1539	2.623	2.711	0.088	-0.035	.444	0.511
		Teachers	2120	3.187	3.466	0.279	1538	3.060	3.250	0.190	0.089	1.250	0.274
	Not having sex	Parents/caregivers	2132	2.768	2.818	0.050	1539	2.717	2.823	0.106	-0.056	1.946	0.175
		OAFM*	2095	2.613	2.678	0.065	1534	2.645	2.663	0.018	0.047	1.562	0.223
		Teachers	2101	3.054	3.352	0.298	1527	2.942	3.119	0.177	0.121	3.134	0.089
	Condoms	Parents/caregivers	2111	2.604	2.692	0.088	1542	2.620	2.677	0.057	0.031	0.394	0.536
		OAFM*	2105	2.521	2.637	0.116	1527	2.549	2.614	0.065	0.051	0.919	0.347
		Teachers	2100	3.025	3.396	0.371	1534	2.946	3.098	0.152	0.219	8.018	0.009
Dar es Salaam	HIV/AIDS	Parents/caregivers	1228	1.907	2.283	0.376	1216	1.905	2.113	0.208	0.168	9.137	0.006
		OAFM*	1191	1.700	2.157	0.457	1173	1.760	1.968	0.208	0.249	14.433	0.001
		Teachers	1256	1.942	2.674	0.732	1243	2.065	2.290	0.225	0.507	46.474	0.000
	Not having sex	Parents/caregivers	1229	1.849	2.277	0.428	1210	1.896	2.055	0.159	0.269	25.120	0.000
		OAFM*	1183	1.699	2.128	0.429	1155	1.765	1.939	0.174	0.255	11.558	0.002
		Teachers	1220	1.925	2.657	0.732	1196	2.086	2.282	0.196	0.536	39.214	0.000
	Condoms	Parents/caregivers	1233	1.619	1.902	0.283	1207	1.613	1.755	0.016	0.142	3.621	0.070
		OAFM*	1210	1.562	1.936	0.374	1180	1.619	1.773	0.154	0.220	7.745	0.011
		Teachers	1217	1.702	2.427	0.725	1202	1.855	1.989	0.134	0.591	32.817	0.000
Man-Kweng	HIV/AIDS	Parents/caregivers	1607	2.441	2.589	0.148	923	2.555	2.572	0.017	0.131	2.827	0.103
		OAFM*	1577	2.296	2.532	0.236	921	2.392	2.483	0.091	0.145	2.415	0.131
		Teachers	1538	2.869	3.164	0.295	896	2.959	2.815	-0.144	0.439	10.991	0.002
	Not having sex	Parents/caregivers	1592	2.525	2.607	0.082	920	2.648	2.562	-0.086	0.168	2.203	0.149
		OAFM*	1575	2.430	2.549	0.119	919	2.526	2.448	-0.078	0.197	3.370	0.077
		Teachers	1557	2.884	3.133	0.249	898	2.908	2.818	-0.090	0.339	5.695	0.024
	Condoms	Parents/caregivers	1541	2.156	2.368	0.212	877	2.286	2.312	0.026	0.186	3.276	0.081
		OAFM*	1497	2.212	2.490	0.278	876	2.344	2.426	0.082	0.196	4.257	0.048
		Teachers	1563	2.529	2.959	0.430	913	2.637	2.625	-0.012	0.442	12.541	0.001

p values adjusted for the cluster effect (schools). Scale range: 1–5

* OAFM other adult family members

** Degrees of freedom: Cape Town: 1 and 25; Dar es Salaam: 1 and 23; Mankweng: 1 and 29

ranging from 0.012 to 0.032. All test statistics are presented in Table 4.

Figure 2 shows a mediation model with reported transition as the dependent variable, intervention as the independent variable and increase in communication from baseline (T1) to the second follow up (T3) as well as knowledge change from T1 to T3 as mediators. It turns out that the direct effect of intervention on reported transition is still significant (-0.253; z = -3.532; p < 0.001), which is slightly higher than the zero order association (coeff. = -0.211; z = -2.863; p = 0.004). The indirect path involving first communication change and then knowledge change as mediators was not significant (coeff. = 0.002; z = 1.598; p = 0.110). The

indirect path from intervention via knowledge change to reported sexual transition is borderline significant (coeff. = 0.022; z = 1.907; p = 0.057) and the indirect path from intervention via knowledge to reported sexual transition is significant (coeff. = 0.018; z = 1.955; p = 0.051). The overall test of indirect effects is significant (coeff. = 0.043; z = 3.001; p = 0.003). The direction of the indirect associations is, however, reversed. The more communication increases and the more knowledge increases, the higher is the transition risk. The associations are, however, quite weak (standardized associations vary from 0.002 to 0.022), and are overshadowed by the reduced risk of transition associated with belonging to the intervention group.

Table 3 Dar es Salaam: Reported transition (vaginal and/or anal) by group (intervention vs. delayed intervention) and communication variables as possible mediators of programme effects on reported transition

Model	Predictors	Category labels	Odds ratio	Wald's F statistic (all df1 = 1; df2 = 23)	Significance (p)
1	Intervention	No	1.000		
		Yes	0.648	7.939	0.010
2	Intervention	No	1.000		
		Yes	0.625	9.563	0.005
	Gender	Male	1.000		
		Female	0.235	43.305	0.000
3	Intervention	No	1.000		
		Yes	0.644	9.084	0.006
	Gender	Male	1.000		
		Female	0.250	33.347	0.000
	Age		1.167	8.599	0.007
	SES		0.990	0.062	0.806
4	Intervention	No	1.000		
		Yes	0.611	4.861	0.038
	Communication T1		1.069	1.125	0.300
	Communication T3		1.248	16.896	0.000
5	Intervention	No	1.000		
		Yes	0.569	6.455	0.018
	Gender	Male	1.000		
		Female	0.241	29.574	0.000
	Age		1.112	2.508	0.127
	SES		0.973	0.261	0.614
	Communication T1		1.017	0.054	0.818
	Communication T3		1.347	27.755	0.000

Logistic regression analyses with adjustment for the cluster effect

Some additional mediational analyses were carried out (tables not shown) with change in outcome variables between T2 and T3 and change in mediators between T1 and T2. This was done in order to distinguish between mediators and outcomes with regard to temporal order. No significant mediation effects were detected when such a delay between mediators and outcomes was introduced.

Discussion

The only significant behavioural effect of the SATZ intervention was found for reported sexual transition among students in the Dar es Salaam site. In this site the effects of the intervention on adolescents' interpersonal communication on sexuality issues with parents, other adult family members and teachers was quite pronounced. It is important to note that this is the site where the highest proportion of students reported silence on sexuality issues from parents, other family members and teachers [8]. In Dar es Salaam, significant or borderline significant

intervention effects were also found for all relevant social cognition factors. Communication proved to be a significant mediator between intervention and all the social

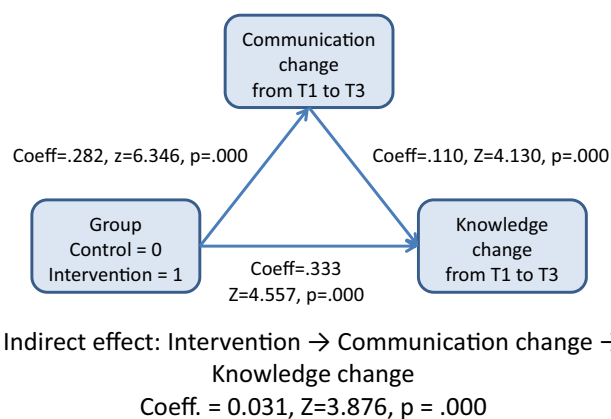


Fig. 1 Reported sexual transition by intervention and increase in communication with adults on sexuality issues—a mediation model (n = 2946)

Table 4 Dar es Salaam: change in interpersonal communication as mediator of programme effects on changes in social cognition outcomes

	Zero order associations			Mediation models								
	Dependent variable on group			Dependent variable on communication		Dependent variable on group		Communication on group		Indirect association: Group – Communication – Dependent variable		
	Coefficient	z	N	Coefficient	z	Coefficient	z	Coefficient	z	Coefficient	z	N
Knowledge	0.364***	5.034	2909	0.110***	4.130	0.333***	4.557	0.282***	6.346	0.031***	3.876	2946
Attitudes towards delayed transition	0.055	1.486	2853	.042*	2.126	0.043	1.102	0.284***	6.309	.012*	2.056	2928
Perceived severity of threat from STDs	0.159*	2.408	2840	0.072***	3.607	0.138*	2.076	0.281***	6.249	0.020***	3.417	2918
Perceived susceptibility to STDs	0.137*	2.117	2795	0.107***	5.277	0.106	1.632	0.283***	6.399	0.030***	4.212	2904
Subjective norms with regard to delaying sexual transition	0.119*	1.974	2814	0.070**	3.080	0.099	1.649	0.281***	6.284	0.020**	2.934	2905
Self-efficacy with regard to delayed sexual transition	0.136**	2.745	2631	0.113***	4.439	0.104*	2.158	0.281***	6.267	0.032***	3.886	2817

Standardized sumscores–unstandardized coefficients. Robust likelihood estimator (MLR)

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

cognition outcomes, but not for the association between intervention and reported sexual transition. A small positive (inverse) mediating effect between intervention and reported sexual transition was registered for the interpersonal communication sumscore.

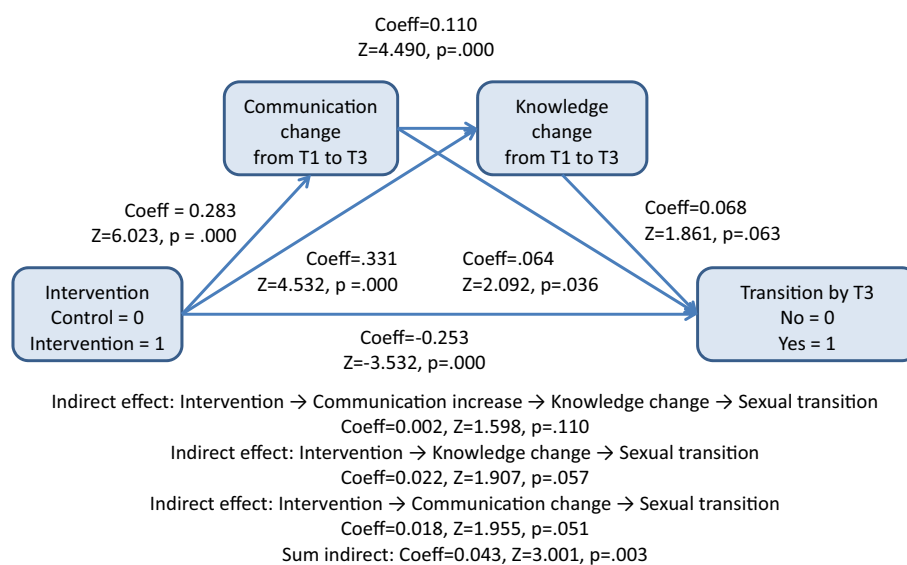
The effects of the intervention on communication found for Dar es Salaam are consistent with findings from other studies [17, 18, 43]. Some previous studies have, however, reported inconsistent findings between adolescents' and parents' reports. Analyses based on parents' reports provided stronger evidence for communication effects of interventions than reports based on reports from their children [44, 45].

The effects found in our study were based on students' reports, and in spite of rather modest parental involvement in the intervention, adolescents' communication with parents and other adults increased significantly in Dar es Salaam. An important difference between the Dar es Salaam intervention and the interventions in the other two sites was the inclusion of parents in the booster sessions and the amount of involvement required by the students and the teachers in preparing for these sessions. In an unpublished report from Dar es Salaam it was said about the booster session that "parents who initially resisted involvement of learners in the program later became very positive about the SATZ program". And it seems that the booster session activities contributed to this change in attitudes among some parents.

In the process evaluation from Cape Town it is found that the success of the implementation varied within and across the schools, with some teachers implementing the intervention with more fidelity than others. Proper implementation was hindered by large class sizes, too many activities taking place in the intervention, teacher resistance and inexperience in using participatory methods, the low status of life orientation compared to other subjects, and a general disregard for life orientation among students [38].

In Cape Town, where no significant effects on communication with parents and other adult family members were observed, parental signatures on learners' take away assignment worksheets were not required. The differences in intervention effects on communication among the three sites can, however, only partly be explained by examining properties (design, delivery and level of parent involvement) of the intervention programmes. In Cape Town there was a rather high level of teacher turnover during the implementation of the intervention-programme. The age of Dar es Salaam students, where the best effects on communication with adults were obtained, was on the average lower than for the other two sites. Convincing younger students to postpone sexual debut may be easier than convincing older students [46]. It is also possible that comparatively in Dar es Salaam there were fewer competing activities taking place during the implementation of the intervention than in the other two sites. Competing

Fig. 2 Reported sexual transition by intervention, increase in communication with adults on sexuality issues and increase in knowledge—a mediation model (n = 2977)



activities in this case could include, among others, coverage of sexuality and HIV/AIDS issues in the media and other sex education activities in schools. The more silent the community is on sexuality issues, the easier it may be to obtain effects of interventions on interpersonal communication.

Communication with parents, other adult family members and teachers partly mediated the relationship between intervention and all social cognition variables (knowledge, self-efficacy etc.). This confirms what has been demonstrated repeatedly in research on mass mediated health education campaigns: If the campaigns succeed in stimulating interpersonal communication on the issue of the campaign, the more likely it is that the campaign will influence members of the target populations [47, 48]. This finding is also consistent with relevant conceptual models on effects of mass media [49].

In order to identify mediators of intervention effects on reported sexual transition (Dar es Salaam only), communication with adults as well as all the social cognition variables were examined. No positive mediation effects on reported sexual transition were found. Two variables turned out to function as inverse mediators, namely communication with adults and knowledge. Increase in communication with adults and knowledge increase were higher in the intervention group than in the comparison group, but both were associated with increased risk of reported sexual transition. The coefficients were quite low, but the combined effect of all indirect paths was significant. The causal order of the variables is, however, not crystal clear. The way the model is tested is based on the assumption that communication with adults and knowledge come between intervention and reported transition. It is, however, possible that behaviour change in

many cases came before knowledge and communication. The intervention led to lower levels of reported transition, but among those who had their sexual debut, a small increase in knowledge and an increase in communication on sexuality issues with adults may have taken place. Since there is no clear temporal order, both explanations are possible. And perhaps more important, the possible inverse effect of the intervention on reported transition is overshadowed by the pronounced reduction in reported transition among those who are students at intervention schools.

The intervention in Dar es Salaam influenced a number of possible mediators, none of which have functioned as mediators of the behavioural outcome. The mechanisms whereby intervention has influenced reported sexual transition therefore remain unknown. This is consistent with a recent evaluation of an anti-alcohol campaign which was carried out among adolescents in Norway. The campaign had significant effects on alcohol use, but among a large number of strong mediator candidates, none obtained significance in an analysis of mediation [50]. Chen [51] and McKinnon [52] have made a distinction between conceptual theory, which shows what factors influence outcomes such as health behaviours, and action theory, which refers to how these factors can be influenced. This is consistent with the assumption that the factors that mould behaviour under daily life circumstances are the ones we have to target in our interventions. Based on the findings from the present study it seems, however, justified to ask if there are other pathways to health behaviour change beyond those that are modelled in conceptual theory. One possibility is that exposure to interventions may motivate behaviour change directly, even without changes in hypothesized social cognition mediators. Interventions may be

perceived as a strong signal that health and educational authorities regard the issue to be important. This conviction may represent a motivation to comply with recommendations communicated. Another possible pathway may be through self-perception and cognitive dissonance processes. Own involvement tends to create processes that could lead to behaviour change [53].

The present study has some obvious strength. First of all the evaluation of the SATZ intervention is based on a study with a strong research design which included cluster randomization, and with baseline and two follow up data collections. Instruments were carefully translated, back-translated and piloted. The interventions were developed according to principles derived from intervention mapping. The instruments were based on a conceptual framework adapted from the ASE model. The samples were large and our estimates therefore rather accurate. An important limitation is related to the way sexual transition is measured. As shown by Plummer et al. [54] in a study from northern Tanzania, self-reported sexual behaviour data are fraught with inconsistencies. In-depth interviews were shown to be more effective than assisted self-completion questionnaires. Provided that the biases function the same way in the intervention group and the control group, differences between the groups may still reflect real world differences.

Another possible limitation is related to the temporal order of the communication variables and measured outcomes when analysing mediation processes. Questions on communication with parents, other adult family members and teachers were phrased in the present tense, but must be understood as covering an unspecified period of time before the data collection took place. Questions related to social cognition measure students' cognitions the moment they fill in the questionnaire. With regard to the analyses of mediation, change scores therefore reflect changes which have taken place between T1 and T3. We can conclude that communication is accompanied by positive changes in social cognition variables. But it could also be the other way around: positive changes in social cognition variables are accompanied by increased communication with adults on sexuality issues. Or both processes could operate simultaneously. With regard to the delayed sexual debut outcome, the situation is similar. More increase in communication and more increase in knowledge were associated with higher risk of sexual debut. This finding makes more sense if a reverse causation is assumed: sexual debut is accompanied by more communication on sexuality issues and an increase in level of knowledge. If increase in communication at all contributed to reducing the risk of sexual debut, it was more than neutralized by the processes taking place under this reversed causation.

Conclusion

As shown in a previous publication from the SATZ study [23], the Dar es Salaam intervention seems to have successfully contributed to delayed sexual debut. A number of social cognition factors were also significantly influenced by the SATZ intervention. From the results presented in this paper we can conclude that the intervention in Dar es Salaam also led to more interpersonal communication between the adolescents targeted and three categories of adults: Parents/caregivers, other adult family members and teachers. Such communication was associated with positive changes in all the significant social cognition outcomes. We were, however, not able to identify mediators of intervention effects on reported sexual transition.

Positive effects of parental involvement in interventions targeting adolescents could probably be strengthened by promoting positive qualities of parenting and by inclusion of educational components that aim at improving the quality of adolescent–parent communication. The mechanisms by which interpersonal communication with adults could contribute to delay the sexual debut of the younger adolescents deserve closer attention in future research. And, more generally, the processes through which interventions influence sexual debut among adolescents should be studied more closely.

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Conflict of interest None.

Ethical Approval Ethical clearance was provided by the Western Norway Regional Committee for Medical Research Ethics, the Research Ethics Committee of the University of Cape Town (South Africa), the Senate Research and Publications Committee of the Muhimbili University of Health and Allied Sciences in Dar es Salaam (Tanzania) and The Ethics Committee of the Faculty of Health Sciences, University of the North (South Africa). Participating students signed assent forms.

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