



Condoms “contain worms” and “cause HIV” in Tanzania: Negative Condom Beliefs Scale development and implications for HIV prevention

Aaron J. Siegler ^{a,*}, Jessie K. Mbwambo ^b, Frances A. McCarty ^c, Ralph J. DiClemente ^d

^a Department of Epidemiology, Rollins School of Public Health, Emory University, 1518 Clifton Rd NE, Suite 467, Atlanta, GA 30322, USA

^b Department of Psychiatry, Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania

^c Institute of Public Health, College of Health and Human Sciences, Georgia State University, Atlanta, GA, USA

^d Department of Behavioral Sciences and Health Education, Rollins School of Public Health, Center for AIDS Research, Emory University, Atlanta, GA, USA

ARTICLE INFO

Article history:

Available online 27 July 2012

Keywords:

HIV
Prevention
Condoms
Africa
Tanzania
Behavioral research
Survey research

ABSTRACT

Condom promotion remains a key component of HIV prevention programs, complimenting recent successes in biomedical HIV prevention. Although condom use has increased in much of East Africa, it remains substantially below optimal levels. Negative rumors about condoms have been documented in East Africa, yet the prevalence and effects of belief in the negative rumors have not been explored. This study evaluated levels of belief in negative rumors about condoms, developed a Negative Condom Beliefs Scale, and assessed its accuracy in predicting willingness to use condoms. A cross-sectional, cluster survey ($n = 370$) was conducted representing adults in two rural districts in Northern Tanzania in 2008. Item agreement ranged from 35 to 53% for the following rumors regarding condoms: causing cancer, having holes, containing HIV, having worms, and the worms causing HIV. Items loaded on a single latent factor and had high internal consistency and convergent validity. In a multivariate model, negative condom score ($AOR = 0.67$, 95% CI = 0.6, 0.8) was the strongest single predictor of willingness to use condoms, followed by greater perceived anonymity in acquiring condoms ($AOR = 4.36$, 95% CI = 2.2, 8.6) and higher condom self-efficacy ($AOR = 4.24$, 95% CI = 2.0, 8.9). Our findings indicate high levels of subscription to negative beliefs about condoms, with two out of three respondents affirming belief in at least one negative condom rumor. This study highlights the relation between condom rumor beliefs and willingness to use condoms, and indicates avenues for future research and means for improving the design of HIV prevention programs.

© 2012 Elsevier Ltd. All rights reserved.

Introduction

In addition to recent successful biomedical HIV prevention strategies such as circumcision (Gray et al., 2007) and antiretroviral treatment (Cohen et al., 2011), condoms remain an important component of HIV prevention programs. Reflecting this importance, condom promotion is a required part of HIV testing and counseling provided in tandem with ARV treatment and medical circumcision programs (Herman-Roloff et al., 2011; National AIDS and STI Control Programme, Kenya, 2008).

Despite these requirements, condom promotion interventions in low-income settings have shown mixed success in controlling the HIV epidemic (Foss, Watts, Vickerman, & Heise, 2004; Potts et al., 2008). In Cambodia and Thailand, the 100% condom program targeting sex workers has been identified as the main

reason for declining HIV prevalence (Rojanapithayakorn, 2006). In other settings, increased condom use has contributed to HIV prevalence declines, but has not served a primary role in epidemic changes (Potts et al., 2008). In Eastern Africa, however, increasing the level of condom use in high HIV prevalence settings has proven to be challenging. Despite a barrage of social marketing supporting condoms, use at last sex with non-marital, non-cohabiting partners is below 50%, and use at any last sex is below 20% in Kenya, Malawi, Tanzania and Zambia (MEASURE DHS, 2011). These rates remain low despite HIV prevalence levels ranging from 6 to 14% in these countries (UNAIDS/WHO, 2009a). For purposes of comparison, the United States has similar condom use rates, 41% and 31% respectively, while having an HIV prevalence of less than 0.5% (MMWR, 2008; Reece et al., 2010).

New data indicate that low condom demand, rather than low condom supply, is the primary factor limiting condom uptake in Eastern Africa (Papo, Bauni, Sanders, Brocklehurst, & Jaffe, 2011). A recent visit by the author to a rural Tanzanian District Hospital confirmed this; with tens of thousands of condoms donated by an

* Corresponding author. Tel.: +1 404 727 4209; fax: +1 404 727 8737.

E-mail address: asiegler@emory.edu (A.J. Siegler).

international agency piled in his office, the head doctor explained that about one individual each month came to pick up the free condoms.

Self-reported condom use, which could be considered a proxy for the combination of supply and demand, has been associated in low-income settings with socio-demographic variables, HIV risk perception, HIV knowledge, partner-related variables, self-efficacy and condom expectancies. The socio-demographic variables of more education (Baker, Leon, & Collins, 2010; Bogale, Boer, & Seydel, 2010; Cherutich, Brentlinger, Nduati, Kiarie, & Farquhar, 2008; Maharaj & Cleland, 2005; Msamanga et al., 2009), female gender (Papo et al., 2011; Schaalma et al., 2009), being unmarried (Bogale et al., 2010; Cherutich et al., 2008), older age (Cherutich et al., 2008) and non-Christian religion (Bogale et al., 2010; Maticka-Tyndale & Tenkorang, 2010) are positively associated with condom use. Whether they reflect life stage, such as age and marital status, or structural factors such as gender, education and religion, socio-demographics are difficult targets for short-term HIV prevention programs.

HIV risk perception has frequently been associated with condom use (Cherutich et al., 2008; Maharaj & Cleland, 2005; Schaalma et al., 2009; Tassiopoulos et al., 2009; Thorpe, Ford, Fajans, & Wirawan, 1997). This association is supported by a meta-analysis that found that programs targeting high-risk populations, such as commercial sex workers/clients and male transport workers, had more success increasing condom use than programs targeting general populations (Foss, Hossain, Vickerman, & Watts, 2007). The association between HIV knowledge and condom use is less clear, with some studies finding a positive association (Ford, Wirawan, Reed, Muliawan, & Sutarga, 2000; Maticka-Tyndale & Tenkorang, 2010) and others no association (Kabiru & Orpinas, 2009; Zellner, 2003).

Partner-related variables are often related to condom use, as condom use decisions are rarely made in a vacuum. These variables encompass partner condom norms (Heeren, Jemmott, Mandeya, & Tyler, 2008), sexual decision-making empowerment (Lema, Katapa, & Musa, 2008; Tassiopoulos et al., 2009), inter-partner communication (Adebiyi & Asuzu, 2009; Hendriksen, Pettifor, Lee, Coates, & Rees, 2007), and self-efficacy of an individual to communicate to their partners (Hendriksen et al., 2007). Condom self-efficacy (a person's confidence in their own ability to use condoms) is also correlated with condom use in numerous studies (Babalola, 2006; Bogale et al., 2010; Kabiru & Orpinas, 2009; Maticka-Tyndale & Tenkorang, 2010; Schaalma et al., 2009; Thorpe et al., 1997).

Negative condom expectancies, also termed condom attitudes, are associated with lack of condom use in low-income settings (Kabiru & Orpinas, 2009; Maharaj & Cleland, 2005). Yet factors underlying negative condom beliefs in Africa are little understood. A qualitative study by Thomsen, Stalker, and Toroitich-Ruto (2004) identified 50 different negative condom beliefs held by men in Kenya, yet no ensuing research has identified which beliefs are most prevalent and whether they impact condom use. Current quantitative condom measures provide limited explication of negative beliefs because they address general approval, such as "using condoms will protect me from HIV" (Bogale et al., 2010), rather than specific beliefs regarding why condoms are perceived negatively. The lone exception is measurement of condom hedonistic beliefs, an actionable factor through interventions eroticizing condoms, which has been found to correlate to condom use (Heeren et al., 2008; Twa-Twa, Oketcho, Sizya, & Muula, 2008). Gaining a better understanding of factors that make condoms undesirable may have an important role to play in improving intervention designs.

During fieldwork for an HIV prevention study in Tanzania (Khumalo-Sakutukwa et al., 2008), youth told study staff about

several negative rumors regarding condoms. The most detailed rumor specified: (1) condoms contain worms, (2) worms are a fact because they will appear if you leave a condom in the sun and (3) the worms in condoms cause HIV. We found this rumor to be common in many areas of Tanzania; it was present in rural Kisarawe District, remote northern Ngorongoro District, and Dar es Salaam. Discussion with colleagues in South Africa, over 2000 miles from the site of our initial discovery, revealed they have encountered the same worm rumor (Personal communication, N. Christofides, Dec. 12, 2011). The impact of rumors may be important, as these two countries alone account for over 90 million people, and over 7 million people living with HIV/AIDS (The World Factbook 2009, 2009). The present study uses the Negative Condom Beliefs Scale (NCBS or negative condom scale) to provide the first quantitative description of belief in such specific condom rumors and to assess whether such beliefs are associated with decreased willingness to use condoms.

Methods

Study design

A cross-sectional, geographically stratified cluster survey of behaviors and beliefs related to HIV transmission was conducted among 370 Maasai residents of Siha and Ngorongoro Districts in Northern Tanzania. The present study was one component of a larger survey of HIV-related behaviors among the Maasai of Tanzania. Siha and Ngorongoro Districts were selected as they were predominantly Maasai, and they provided a diverse sample of Maasai sections (clans). All areas in both districts were eligible for selection with the exception of the Ngorongoro Conservation Area, which was excluded due to local conservation restrictions. The sampling frame consisted of a list of local "ten-cell" leaders; such ten-cell leaders are the lowest level of political administration in Tanzania, each representing a unique set of 6–24 households. The leader list totaled 955, and was obtained from village offices and updated based on consultations with sub-village and village leaders.

An adequate sample size for regression analyses (Faul, Erdfelder, Lang, & Buchner, 2007) was determined with alpha set at 0.05 and power at 0.80. As this was an exploratory study, a moderate sized R^2 of 0.18 was used to determine the effect size f^2 used in the calculation of the sample size. Based on the inclusion of approximately 23 predictors in the model, the needed sample was 120. Due to the cluster based sampling, a conservative design effect of 3 was used to inflate the target sample size to 360. To achieve a target sample of 360, random selection for participation occurred at three levels: 37 local leaders were randomly selected from the sampling frame, 11 households were randomly selected from each local leader's jurisdiction (for areas with <11 households, we sampled nearest neighboring unit), and one adult member was randomly selected from each household. For those consenting to participate, face-to-face interviews were conducted by native Maa speakers.

Ethical considerations

Permission to conduct the study was obtained from the Tanzanian government at the national level (the Committee on Science and Technology and the National Institute for Medical Research), the regional level (Arusha and Kilimanjaro Regional Secretaries) and the District level (District Medical Officers). We also received clearance from Emory University's Institutional Review Board. Moreover, we obtained permission from traditional leaders in the national council of the Maasai (MARIA/Oreteti Loongaek) and from the Ngorongoro Conservation Authority. Consent forms were

translated from English to Maa, and back-translated to check for accuracy. Interviewers were trained using Family Health International's Research Ethics Training Curriculum for Community Representatives (Rivera et al., 2004).

Setting and inclusion criteria

The Maasai, a semi-nomadic and cattle-herding tribe with an estimated 1 million members (Phillips & Bhavnagri, 2002), are predominantly located in Northern Tanzania and Southern Kenya. Clinic-based HIV prevalence estimates among the Maasai range from 4 to 8%, which is in line with general estimates of HIV prevalence in rural Tanzania (UNAIDS/WHO, 2009b). This study was part of a broader behavioral survey addressing the intersection of Maasai culture and HIV risk. Inclusion criteria were membership in the Maasai tribe and either age 18–60 or membership in an eligible age-set group (see **Measures** section below).

Measures

All measures were team-translated from English to the Maa language, and a second translation team back-translated from Maa to English. Following revisions, the instrument was adapted through cognitive interviews designed to improve item comprehensibility and to clarify how to best map foreign concepts onto local language.

All socio-demographic variables, with the exception of age, were adapted from the Tanzanian Demographic and Health Survey (DHS) (National Bureau of Statistics: Tanzania and ORC Macro, 2005). Traditionally, the Maasai measured life solely in terms of a life-cycle system of age-sets, rather than using the metric of years of age. For males, age-sets are roughly 15-year units (Spencer, 2003): boyhood (0–15), *moran* or warrior (16–30), young elders (31–45), firestick patrons (46–60), retired firestick patrons (61–75), and aging elders (76 and above). For male participants unaware of their age in years, we considered warriors, young elders and firestick patrons to be eligible for the study; for purposes of analysis, we assigned them respectively to age groupings ≤30, 31–45 and >45. As females are not assigned age-sets, we categorized them into parallel categories, based on the age-set in effect when they were born (this was possible because each age-set group is given a unique name).

HIV risk perception was measured by number of non-marital partners, using the time periods of previous year and lifetime. Number of non-marital partners served as a proxy for HIV risk perception, as we sought to measure behavioral actuation of risk perception, thus addressing internalized, subconscious levels of risk calculation. Number of non-marital partners was ascertained based on strategies employed by Jewkes, Nduna, Jama, Dunkle, and Levin (2002) to increase accuracy of partnership reporting. This resulted in seven local partnership categories, roughly translated as (1) pre-marital boy/girlfriend, (2) extramarital lover, (3) partner from a night-dance for warriors and girls (*esoto*), (4) traditional ceremony partner (*emaho*), (5) partner met at bar, (6) shared spouse and (7) sex worker. These local partnership categories, represented by () populated the question, "Did you have vaginal sex with a () in the last year? [IF YES] How many different ()?"

HIV knowledge was measured with a scale adapted from the Tanzanian DHS, and consists of true/false identification of fourteen potential pathways for HIV transmission, such as "sharing needles" (National Bureau of Statistics: Tanzania and ORC Macro, 2005). *Condom self-efficacy* was measured by a single item evaluating self-efficacy of condom mechanics: "Could you show me how to use a condom if I brought you a condom and an anatomical model of a penis?" Broader measures of self-efficacy were avoided, such as

the CUSES scale (Brafford & Beck, 1991), because they assess general condom attitudes and expectancies as measured below.

Negative Condom Beliefs Scale

To develop the scale, we derived expectancies from thirty semi-structured qualitative interviews. Six commonly held negative beliefs about condoms were found: 1) new condoms contain worms, 2) the worms in condoms cause HIV, 3) new condoms have holes, 4) new condoms have HIV inside, 5) condom use can cause cancer and 6) using condoms is like eating candy in the wrapper, there is no pleasure. The scale included a reverse-worded item, namely condoms prevent HIV, which was reverse-coded for final scoring. Participants in semi-structured interviews also frequently expressed concern regarding anonymity in obtaining condoms. We assessed perceived *anonymity of condom acquisition*, "At the closest place where you could get condoms, do you feel that people getting condoms have: Complete privacy, Some privacy or No privacy?" All measures developed from semi-structured interviews were subsequently refined based on findings from three rounds of cognitive interviews, a survey item analysis method specified by Beatty and Willis (2007).

The dependent variable in the analyses, *willingness to use condoms*, was measured with the item: "If condoms were affordable, accessible, and my partner was ready to try them, I would use them". Willingness to use condoms, rather than actual condom use, was selected as the dependent variable, because levels of condom use were too low (3% of participants) to allow for sufficiently powered analyses. As the purpose of this study is to assess internalized condom rumor impact, we sought to ameliorate the known influence of partner-related variables and any potential supply-side influences by allowing participants to assume (based on item wording) a compliant partner and easy condom supply.

Data analysis plan

Preliminary analyses included assessment of descriptive statistics of scale items. We assessed scale validity by determining whether the scale loads on a single factor through exploratory factor analysis, using an oblique geomin rotation, calculated with weighted least squares mean and variance adjusted estimation. The model was built from a tetrachoric correlation matrix in order to account for dichotomously scaled items. Factor loadings for each scale item were considered, along with the percent variance of each item explained by the factor analysis, to determine items selected for inclusion in the final scale. Predictive validity of each scale item was assessed with correlational analyses using willingness to try condoms. Cronbach's alpha was used to assess internal scale reliability. Demographic, cultural, and HIV-related variables were initially analyzed with proportions and means, followed by analysis of proportions and univariate associations of items in the Negative Condom Beliefs Scale. A multivariate logistic regression was conducted to assess predictors of willingness to use condoms. All analyses were conducted in STATA 11.2, except the factor analysis, which was conducted in MPLUS 6.1. All analyses were adjusted to account for the clustered survey design.

Results

Item analyses

Table 1 shows that between 35% and 53% of respondents agreed with each negative condom rumor: condoms cause cancer (35% agreement), condoms have holes (53%), condoms contain HIV (47%), condoms contain worms (49%), and the worms in condoms

Table 1Condom rumors scale items: percent agreement, *n* and item-rest correlations.

"Do you agree or disagree with the following statements:"	Agree	Disagree	Don't know	Item-rest correlation	Univariate association with willingness to use condoms
	% (<i>n</i>) ^a	% (<i>n</i>) ^a	% (<i>n</i>) ^a	<i>r</i>	OR (95% CI)
<i>Items included in final scale</i>					
Condoms cause cancer.	35 (128)	45 (165)	20 (65)	0.63	0.63 (0.35, 1.14)
New, unopened condoms have small holes.	53 (188)	39 (148)	8 (25)	0.76	0.45 (0.23, 0.91)*
There is HIV in condoms.	47 (172)	42 (158)	10 (31)	0.73	0.70 (0.40, 1.24)
New, unopened condoms contain small worms.	49 (176)	46 (164)	5 (21)	0.73	0.39 (0.20, 0.74)**
Small worms in new, unopened condoms cause HIV.	49 (178)	46 (164)	5 (19)	0.71	0.32 (0.15, 0.66)**
Condoms prevent HIV transmission.	55 (208)	38 (130)	8 (23)	0.41 ^b	0.30 (0.15, 0.61)** ^b
<i>Items excluded from final scale</i>					
Wearing a condom during sex is like eating candy in the wrapper because it makes sex have no pleasure.	67 (251)	17 (56)	15 (53)	0.06	0.72 (0.32, 1.64)

^a*p* < 0.05, ***p* < 0.01.^a Weighted %, unweighted *n*.^b Item reverse-coded for correlations and final scale calculation.

cause HIV (49%). One reverse-worded item, condoms prevent HIV transmission (55% agreement), was also included in the final scale (values were reverse-coded for the composite score). The belief that using a condom is like eating candy in the wrapper, excluded from the final scale (see below), was supported by the majority of respondents, indicating most respondents held negative hedonistic beliefs. Nearly two out of three respondents (65%) agreed with at least one negative rumor included in the final scale.

Scale dimensionality, predictive validity and internal consistency

Exploratory factor analysis indicated a unidimensional scale, and supported including all items except the hedonistic item (condoms are like candy) in the final scale. The scree plot indicated loading on one factor, and this conclusion was supported by all eigenvalues for multi-factor models being below one. Item factor loadings above 0.4 and percent of variance explained above 20% indicated appropriate item fit for all items in the final model. Fit indices indicated good EFA model fit for the final scale. Hu and Bentler (1999) recommend reporting the standardized root mean square residual (SRMR) with values below 0.08 indicating good fit and the comparative fit index (CFI) with values above 0.90 indicating good fit. For the final EFA, SRMR = 0.059 and CFI = 0.996 both suggest that the model produced good fit.

Correlations indicated predictive validity. For four out of six final items, univariate χ^2 associations with willingness to try condoms were significant at *p* < 0.01. The two non-significant relationships were in the predicted direction. A total of seven people among the 370 sampled reported ever using a condom, so cells were too small to perform χ^2 analyses on this outcome. Cell counts indicated item validity, however, as five of six scale items had all seven condom users report no negative condom beliefs.

Internal scale consistency in this sample, as measured by Kuder-Richardson 20, was high for the entire sample and across demographic groups. For the whole sample reliability was 0.88, which is above the 0.7 cut-off. It was similarly high for those with no education (0.89) and those with some education (0.86), for those aged 30 or under (0.89) and those over 30 (0.88), and for males (0.77) and females (0.93).

Out of 370 survey participants, 268 (72%) completed all six items and 308 (83%) completed at least five of the six. The majority of incomplete items involved "don't know" responses, which were coded as missing. For participants who completed all but one item, simple mean imputation was conducted for missing scale values for the multivariate regression analysis. Scale variables were summed to create a final negative condom score, with higher scores indicating more negative condom beliefs.

Demographics and negative beliefs

As shown in Table 2, few demographics were predictive of the negative condom belief scores; only male gender was a significant predictor ($\beta = 1.17$, 95% CI: 0.4, 2.0). Roughly half the sample was female (53%), with 40% of respondents < age 30, 41% between 31 and 45, and 19% in the 46–60 range. Over half held traditional spiritual beliefs (59%); the balance was Christian. Most had no education (61%), were married (78%), and had a phone or radio (54%). Cattle were the principle source of wealth and savings among rural Maasai; about half (49%) reported less than 20 cattle, indicating negligible wealth. About one-third of respondents were in polygynous relationships. Male gender was predictive of willingness to use condoms (AOR = 2.13, 95% CI: 1.2, 3.7), as was higher education (AOR = 2.18, 95% CI: 1.1, 4.1); both demographic variables were controlled for in the final regression model predicting willingness to use condoms.

Condom use intentions predicted by negative condom beliefs

Predictors of willingness to use condoms are presented in Table 3. Negative condom score was a significant predictor of condom willingness in both univariate and multivariate models. Anonymity of condom acquisition and condom self-efficacy were also significant, whereas items related to risk perception and HIV knowledge were not significant predictors.

Controlling for gender and education, the odds of willingness to use condoms decreased by 33% for each one point gain in the six-point NCBS (AOR 0.67, 95% CI: 0.6, 0.8). Odds of willingness to use condoms was 4.36 times higher (95% CI: 2.2, 8.6) for individuals

Table 2

Demographic characteristics, mean NCBS values and associations with willingness to use condoms.

		Overall frequency	NCBS score	Willingness to use condoms
		% (n) ^a	Mean (95% CI)	AOR (95% CI) ^b
Gender	Female	53 (194)	2.73 (2.0, 3.5)	1.00 (ref)
	Male	47 (176)	3.91 (3.6, 4.2)*	2.13 (1.2, 3.7)*
Age	≤30	40 (152)	3.35 (2.9, 3.8)	1.00 (ref)
	31–45	41 (147)	3.08 (2.5, 3.6)	0.94 (0.5, 1.6)
Religion	>45	19 (70)	3.55 (2.6, 4.5)	0.52 (0.2, 1.4)
	Traditional	59 (218)	3.22 (2.8, 3.7)	1.00 (ref)
Religion: Attendance	Lutheran	26 (94)	3.62 (2.8, 4.5)	0.79 (0.3, 1.9)
	Catholic	10 (39)	2.54 (1.7, 3.4)	1.08 (0.5, 2.5)
Education	Other	5 (17)	3.76 (2.7, 4.8)	1.05 (0.3, 3.3)
	<1 day per week	63 (230)	3.29 (2.9, 3.7)	1.00 (ref)
Wealth: Cattle	1 day per week	23 (78)	3.63 (2.9, 4.4)	1.37 (0.7, 2.8)
	>1 day per week	14 (57)	2.55 (1.5, 3.6)	0.45 (0.2, 1.1)
Cell Phone or Radio	Education: None	61 (223)	3.31 (2.8, 3.9)	1.00 (ref)
	Education: 1–7	36 (125)	3.43 (2.9, 3.9)	2.18 (1.1, 4.1)*
Marriage type	Education: >7	3 (12)	2.02 (0.6, 3.4)	2.70 (0.8, 9.6)
	Household: 0–20 Cattle	49 (166)	3.11 (2.6, 3.6)	1.00 (ref)
Cell Phone or Radio	Household: >20 Cattle	51 (204)	3.44 (2.9, 4.0)	0.59 (0.3, 1.1)
	No phone or radio	46 (174)	2.75 (2.2, 3.3)	1.00 (ref)
Marriage type	Owes phone and/or radio	54 (196)	3.72 (3.1, 4.3)	0.89 (0.5, 1.6)
	Not married	22 (79)	3.87 (3.2, 4.5)	1.00 (ref)
Cell Phone or Radio	1 wife	45 (179)	3.61 (3.1, 4.1)	0.61 (0.3, 1.2)
	2 wives	17 (56)	2.37 (1.6, 3.1)	1.64 (0.7, 3.7)
Cell Phone or Radio	3–6 wives	16 (54)	2.43 (1.7, 3.2)	1.32 (0.5, 3.3)

* $p < 0.05$.

^a Weighted %, unweighted n .

^b Controlling for other significant demographic factors.

Table 3

Logistic regressions predicting willingness to use condoms.

	OR (95% CI)	AOR (95% CI) ^a
<i>Condom Expectancies</i>		
Negative Condom Beliefs Scale (6-point scale)	0.79 (0.7, 0.9)***	0.67 (0.6, 0.8)***
Perceived anonymity of condom acquisition		
Some or Complete	4.25 (2.4, 7.4)***	4.36 (2.2, 8.6)***
None	1.00 (ref)	1.00 (ref)
<i>Risk Perception</i>		
Non-marital partners		
Last year	1.05 (0.9, 1.3)	ns
Lifetime	1.00 (1.0, 1.0)	ns
<i>Condom Self-efficacy</i>		
Ability to apply condoms		
Agree	6.57 (3.7, 11.7)***	4.24 (2.0, 8.9)***
Disagree	1.00 (ref)	1.00 (ref)
HIV Knowledge		
HIV Transmission Scale (14-item scale)	0.97 (0.9, 1.1)	ns
A healthy person can have HIV		
Agree	0.92 (0.5, 1.7)	ns
Disagree	1.00 (ref)	ns
There is treatment for HIV		
Agree	0.56 (0.4, 0.9)*	ns
Disagree	1.00 (ref)	ns

* $p < 0.05$, ** $p < 0.001$.

ns: not significant, dropped from multivariate model.

^a Model adjusted for significant demographic variables.

with some or complete perception of privacy in obtaining condoms, and was 4.24 times higher (95% CI: 2.0, 8.9) for those with perceived self-efficacy in applying a condom. Standardized regression values indicated that, in our model, the NCBS had the strongest value in predicting condom willingness (-0.39), followed by anonymity (0.31) and self-efficacy (0.26). Receiver Operating Characteristic (ROC) curves also demonstrated the utility of the negative condom score. ROC area scores allow for assessment of model fit; scores of $0.5 \leq \text{ROC} < 0.7$ suggest poor discrimination, $0.7 \leq \text{ROC} < 0.8$ adequate discrimination and $0.8 \leq \text{ROC} < 0.9$ excellent discrimination (Hosmer & Lemeshow, 2000). The full model including NCBS (ROC = 0.81, SD = 0.03) fit significantly better ($\chi^2 = 27.24$, df = 2, $p < 0.001$) than the model that contained only the anonymity and self-efficacy variables (ROC = 0.77, SD = 0.03), and the self-efficacy only model (ROC area = 0.69, SD = 0.03).

Discussion

The results demonstrate remarkably high levels of negative condom beliefs, with two out of three respondents affirming belief in at least one condom rumor. Not surprisingly, belief in such unattractive condom rumors is negatively associated with willingness to use condoms. The two rumors relating to worms in condoms had the strongest negative univariate associations; we speculate that this may be due to the concrete visual nature of the rumor.

Individual NCBS items and the scale as a whole were consistently negatively associated with willingness to use condoms. In our multivariate model, the NCBS was the best single predictor of willingness. The second strongest predictor was perceived anonymity of condom acquisition. Risk perception and knowledge were relatively unimportant in comparison. Our study also found condom self-efficacy to be associated with willingness to use condoms, which echoes findings from other research (Babalola, 2006; Bogale et al., 2010; Kabiru & Orpinas, 2009; Maticka-Tyndale & Tenkorang, 2010; Schaalma et al., 2009; Thorpe et al., 1997). Also, as in previous studies (Kabiru & Orpinas, 2009; Zellner, 2003), HIV knowledge was not predictive of willingness to use condoms. HIV risk perception was also not a significant predictor. Other studies finding this variable significant frequently measured perceived susceptibility (Maharaj & Cleland, 2005; Schaalma et al., 2009; Tassiopoulos et al., 2009; Thorpe et al., 1997). One potential limitation of this finding is that our measure for risk perception assessed actual risk, total number of sexual partners, which may not reflect risk estimation.

Results from survey scale items indicate a substantial underlying uncertainty regarding the utility of condoms. At first glance, it might seem contradictory that 65% of respondents agreed with at least one negative rumor, yet 55% agreed that condoms prevent HIV. This could be a comprehension issue, yet extreme item agreement (98% have heard of HIV) and disagreement (3% ever condom use) in expected directions indicate good comprehension of survey items. In addition, multiple rounds of cognitive interviewing should have exposed problems with individual item comprehension if such problems were present. Acquiescence bias likely explains a portion of this contradiction; 7% of respondents agreed with all items (including reverse-coded items) in the scale. Yet this still leaves a large number of respondents (13%) who gave answers that seem contradictory. One possible explanation is that some respondents believe condoms are not only dangerous but also that they provide a level of protection. Another potential explanation is that some respondents might be uncertain about whether condoms work and also about whether condom rumors are true. The latter view is supported by the large number of respondents providing "don't know" responses to at least one scale item (28%),

despite “don’t know” not being an option read aloud by interviewers. If uncertainty regarding condom rumors contributes to the contradictory data, it could indicate negative condom beliefs are not indelible, but rather might be amenable to change.

Our results underscore the importance of developing locally appropriate items for behavioral studies in international settings. Locally developed items can augment previously validated scales and instruments. For our study, this was done through a qualitative assessment that informed development of items such as those used on the NCBS. The value of this process is seen in the regression model predicting willingness to use condoms, which considered three independent variables developed for our study and thirteen independent variables derived from previous scales or instruments. Out of three non-demographic predictors in the final regression model, two (NCBS and perceived anonymity in purchasing condoms) were among the three variables developed specifically for our study’s population. While DHS surveys allow for cross-country comparison, and thus have an important role in program design, surveys aimed at incorporating location-specific information may also play an important role in developing effective HIV prevention interventions.

The variables we found to be associated with willingness to use condoms, including negative condom beliefs, self-efficacy, and perceived anonymity in obtaining condoms, are modifiable. Perhaps most easily remedied is perceived privacy, which could largely be addressed via structural changes at condom point of service venues. Strategies for increasing condom self-efficacy and decreasing belief in condom rumors may be targeted through other HIV-related services, including Voluntary Testing and Counseling (VCT) and HIV education conducted in school or community settings. Negative condom beliefs may also be addressed directly. When meeting with local leaders about an HIV prevention program, we left condoms in the sun for later inspection. Post-meeting inspection revealed that condoms did not grow worms, effectively beginning the process of debunking the worms rumor in that community.

Limitations

This study was cross-sectional, so relations should be interpreted as associations that might or might not be causal. The study was conducted in Northern Tanzania among members of the Maasai tribe, and despite discovery of the same condom rumors in other areas, study results might not generalize to other populations. Condom use was low in the study population, so our outcome was willingness to use condoms, an imperfect proxy for actual condom use. Condom use could have affected condom perceptions, rendering uncertain the generalizability of the findings to populations with higher levels of condom use. The survey was translated from English into a transliterated Maa, and thus errors in translation may have impacted results despite efforts to mitigate this effect that included team translation, back-translation and cognitive interviewing. An unexpected difficulty of face-to-face interviewing was that interviewers had trouble smoothly articulating the transliterated survey instrument. Although all interviewers were fully fluent in Maa, sounds in Maa do not always have a direct Roman-alphabet equivalent. To alleviate this issue, we standardized how different sounds were transliterated, and then provided intensive workshops for interviewers to practice reading the transliterated Maa-language instrument.

Conclusions

Our study indicates the pervasiveness of belief in negative condom rumors in the study population, and finds an association

between these beliefs and lower willingness to use condoms. Development of the negative condom belief measure provides an important tool for future research. The six items loaded on a single factor, had high internal consistency, and predictive validity.

Acknowledgements

This study was supported by Grant Number F31MH082647 from the National Institute for Mental Health, and was facilitated by the Center for AIDS Research at Emory University (P30 AI050409). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Mental Health or the National Institutes of Health.

References

- Adebiyi, A. O., & Asuzu, M. C. (2009). Condom use amongst out of school youths in a local government area in Nigeria. *African Health Sciences*, 9, 92–97.
- Babalola, S. (2006). Gender differences in the factors influencing consistent condom use among young people in Tanzania. *International Journal of Adolescent Medicine and Health*, 18, 287–298.
- Baker, D. P., Leon, J., & Collins, J. M. (2010). Facts, attitudes, and health reasoning about HIV and AIDS: explaining the education effect on condom use among adults in sub-Saharan Africa. *AIDS and Behavior*, 15, 1319–1327.
- Beatty, P. C., & Willis, G. B. (2007). Research synthesis: the practice of cognitive interviewing. *Public Opinion Quarterly*, 71, 287–311.
- Bogale, G. W., Boer, H., & Seydel, E. R. (2010). Condom use among low-literate, rural females in Ethiopia: the role of vulnerability to HIV infection, condom attitude, and self-efficacy. *AIDS Care*, 22, 851–857.
- Brafford, L. J., & Beck, K. H. (1991). Development and validation of a condom self-efficacy scale for college students. *Journal of American College Health*, 39, 219–225.
- Cherutich, P., Brentlinger, P., Nduati, R., Kiarie, J. N., & Farquhar, C. (2008). Condom use among sexually active Kenyan female adolescents at risk for HIV-1 infection. *AIDS and Behavior*, 12, 923–929.
- Cohen, M. S., Chen, Y. Q., McCauley, M., Gamble, T., Hosseinipour, M. C., Kumarasamy, N., et al. (2011). Prevention of HIV-1 infection with early antiretroviral therapy. *New England Journal of Medicine*, 365, 493–505.
- Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39, 175–191.
- Ford, K., Wirawan, D. N., Reed, B. D., Muliawan, P., & Sutarga, M. (2000). AIDS and STD knowledge, condom use and HIV/STD infection among female sex workers in Bali, Indonesia. *AIDS Care*, 12, 523–534.
- Foss, A. M., Hossain, M., Vickerman, P. T., & Watts, C. H. (2007). A systematic review of published evidence on intervention impact on condom use in sub-Saharan Africa and Asia. *Sexually Transmitted Infections*, 83, 510–516.
- Foss, A. M., Watts, C. H., Vickerman, P., & Heise, L. (2004). Condoms and prevention of HIV: are essential and effective, but additional methods are also needed. *British Medical Journal*, 329, 185–186.
- Gray, R. H., Kigozi, G., Serwadda, D., Makumbi, F., Watya, S., Nalugoda, F., et al. (2007). Male circumcision for HIV prevention in men in Rakai, Uganda: a randomised trial. *Lancet*, 369, 657–666.
- Heeren, G. A., Jemmitt, J. B., 3rd, Mandeya, A., & Tyler, J. C. (2008). Sub-Saharan African University students’ beliefs about condoms, condom-use intention, and subsequent condom use: a prospective study. *AIDS and Behavior*, 13, 268–276.
- Hendriksen, E. S., Pettifor, A., Lee, S. J., Coates, T. J., & Rees, H. V. (2007). Predictors of condom use among young adults in South Africa: the Reproductive Health and HIV Research Unit National Youth Survey. *American Journal of Public Health*, 97, 1241–1248.
- Herman-Roloff, A., Llewellyn, E., Obiero, W., Agot, K., Ndinya-Achola, J., Muraguri, N., et al. (2011). Implementing voluntary medical male circumcision for HIV prevention in Nyanza Province, Kenya: lessons learned during the first year. *PLoS One*, 6, e18299.
- Hosmer, D. W., & Lemeshow, S. (2000). *Applied logistic regression*. Hoboken: John Wiley & Sons, Inc.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling*, 6, 1–55.
- Jewkes, R., Nduna, M., Jama, P., Dunkle, K., & Levin, J. (2002). Steadys, roll-ons and hit and runs: using indigenous typology to measure number of sexual partners. In: XIVth international conference on AIDS, Barcelona.
- Kabiru, C. W., & Orpinas, P. (2009). Correlates of condom use among male high school students in Nairobi, Kenya. *Journal of School Health*, 79, 425–432.
- Khumalo-Sakutukwa, G., Morin, S. F., Fritz, K., Charlebois, E. D., van Rooyen, H., Chingono, A., et al. (2008). Project Accept (HPTN 043): a community-based intervention to reduce HIV incidence in populations at risk for HIV in sub-Saharan Africa and Thailand. *Journal of Acquired Immune Deficiency Syndromes*, 49, 422–431.

- Lema, L. A., Katapa, R. S., & Musa, A. S. (2008). Knowledge on HIV/AIDS and sexual behaviour among youths in Kibaha District, Tanzania. *Tanzania Journal of Health Research*, 10, 79–83.
- Maharaj, P., & Cleland, J. (2005). Risk perception and condom use among married or cohabiting couples in KwaZulu-Natal, South Africa. *International Family Planning Perspectives*, 31, 24–29.
- Maticka-Tyndale, E., & Tenkorang, E. Y. (2010). A multi-level model of condom use among male and female upper primary school students in Nyanza, Kenya. *Social Science & Medicine*, 71, 616–625.
- MEASURE DHS. (September 29, 2011). *HIV/AIDS survey indicators database*. <http://www.measuredhs.com/hivdata>.
- MMWR. (2008). HIV prevalence estimates – United States, 2006. *Morbidity and Mortality Weekly Report*, 57, 1073–1076.
- Msamanga, G., Tchetgen, E., Spiegelman, D., Fawzi, M. K., Kaaya, S., Urassa, W., et al. (2009). Determinants of condom use among antenatal clinic attendees in Dar es Salaam, Tanzania. *East African Journal of Public Health*, 6, 175–183.
- National AIDS and STI Control Programme, Kenya. (2008). *Guidelines for HIV testing and counselling in Kenya*. Nairobi: NASCOP.
- National Bureau of Statistics: Tanzania and ORC Macro. (2005). *Tanzania demographic and health survey 2004–05*. p. 381. Dar es Salaam, Tanzania: National Bureau of Statistics and ORC Macro.
- Papo, J. K., Bauni, E. K., Sanders, E. J., Brocklehurst, P., & Jaffe, H. W. (2011). Exploring the condom gap: is supply or demand the limiting factor – condom access and use in an urban and a rural setting in Kilifi district, Kenya. *AIDS*, 25, 247–255.
- Phillips, J., & Bhavnagri, N. (2002). The Maasai's education and empowerment: challenges of a migrant lifestyle. *Childhood Education*, 78, 140–146.
- Potts, M., Halperin, D. T., Kirby, D., Swidler, A., Marseille, E., Klausner, J. D., et al. (2008). Public health. Reassessing HIV prevention. *Science*, 320, 749–750.
- Reece, M., Herbenick, D., Schick, V., Sanders, S., Dodge, B., & Fortenberry, J. (2010). Condom use rates in a national probability sample of males and females ages 14 to 94 in the United States. *Journal of Sexual Medicine*, 7, 266–276.
- Rivera, R., Borasky, D., Carayon, F., Rice, R., Kirkendale, S., Wilson, W. L., et al. (2004). *Research ethics training curriculum for community representatives*. Research Triangle Park: Family Health International.
- Rojanapithayakorn, W. (2006). The 100% condom use programme in Asia. *Reproductive Health Matters*, 14, 41–52.
- Schaalma, H., Aaro, L. E., Fisher, A. J., Mathews, C., Kaaya, S., Onya, H., et al. (2009). Correlates of intention to use condoms among Sub-Saharan African youth: the applicability of the theory of planned behaviour. *Scandinavian Journal of Public Health*, 37(Suppl. 2), 87–91.
- Spencer, P. (2003). *Time, space, and the unknown: Maasai configurations of power and providence*. New York: Routledge: Taylor and Francis Group.
- Tassiopoulos, K., Kapiga, S., Sam, N., Ao, T. T., Hughes, M., & Seage, G. R., 3rd (2009). A case-crossover analysis of predictors of condom use by female bar and hotel workers in Moshi, Tanzania. *International Journal of Epidemiology*, 38, 552–560.
- The World Factbook 20092009. Washington, DC: Central Intelligence Agency. <https://www.cia.gov/library/publications/the-world-factbook/index.html>.
- Thomsen, S., Stalker, M., & Toroitich-Ruto, C. (2004). Fifty ways to leave your rubber: how men in Mombasa rationalise unsafe sex. *Sexually Transmitted Infections*, 80, 430–434.
- Thorpe, L., Ford, K., Fajans, P., & Wirawan, D. N. (1997). Correlates of condom use among female prostitutes and tourist clients in Bali, Indonesia. *AIDS Care*, 9, 181–197.
- Twa-Twa, J. M., Oketcho, S., Siziya, S., & Muula, A. S. (2008). Prevalence and correlates of condom use at last sexual intercourse among in-school adolescents in urban areas of Uganda. *East African Journal of Public Health*, 5, 22–25.
- UNAIDS/WHO. (2009a). *AIDS epidemic update: November 2009*. pp. 1–100.
- UNAIDS/WHO. (2009b). *Tanzania epidemiological fact sheets on HIV and AIDS (2008 update)*. 1–22.
- Zellner, S. L. (2003). Condom use and the accuracy of AIDS knowledge in Côte d'Ivoire. *International Family Planning Perspectives*, 29, 41–47.