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The *esoto* dance, circumcision practices and negative condom beliefs:
A survey assessing HIV risk among the Maasai of Tanzania

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An abstract of a dissertation submitted to the Faculty of the
James T. Laney School of Graduate Studies of Emory University
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Abstract

The *esoto* dance, circumcision practices and negative condom beliefs:
A survey assessing HIV risk among the Maasai of Tanzania

by Aaron J. Siegler, MHS

This study addresses the intersection of Maasai culture and HIV prevention opportunities by designing and implementing a survey instrument that was tailored through interviews, focus groups and cognitive interviewing. This dissertation is comprised of three studies based on a survey of 370 adults in Siha and Ngorongoro Districts, Tanzania.

The first study applied the Dynamic Social Systems Model (DSSM) to the *esoto* dance. Esoto accounted for over two-thirds of participants' lifetime sexual partners. Participants reported multifaceted beliefs: a majority viewed the dance as exciting and essential, yet most men feared social stigma and three-quarters of women experienced physical punishment for non-attendance. Combining systems and ecological models, the DSSM was utilized to characterize esoto, revealing feedback loops and indicating avenues for future interventions.

The second study evaluated acceptability of improved instrument sanitation and medical male circumcision (MMC) among the traditionally circumcising Maasai. Traditional circumcision has higher rates of complications than MMC. We found inadequate instrument sanitation, with 56% circumcised with a shared knife rinsed in water between initiates and 16% circumcised with a knife not cleaned between initiates. Contrasting practice, 88% favored use of medical supplies for their sons' circumcisions. Acceptability of providing MMC to sons was 28%. Given traditional leadership support for MMC, this rose to 84%. Future interventions to address circumcision safety, including traditional circumciser training and MMC, are discussed.

The third study evaluated levels of belief in negative condom rumors, developed the Negative Condom Beliefs Scale (NCBS), and assessed how it predicts willingness to use condoms. NCBS item agreement ranged from 35-53% for the following rumors regarding condoms: causing cancer, having holes, containing HIV, having worms and the worms causing HIV. The NCBS loaded on a single latent factor, had high internal consistency and indicated convergent validity. In a multivariate model, NCBS score was the strongest predictor of willingness to use condoms.

By qualitatively tailoring a survey to incorporate cultural elements relevant to the Maasai, this dissertation has programmatic implications for HIV prevention programs targeting this group. Moreover, we found that local needs likely generalize to other populations. Study implications for broader HIV prevention efforts are discussed.

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Introduction

Specific Aims

The HIV epidemic continues to afflict Tanzania, causing 140,000 deaths in 2005

and making AIDS the country's leading cause of mortality (Setel, Unwin, Hemed, &

Team, 2000; UNAIDS, 2006). Culturally-appropriate HIV prevention interventions in

developing settings are particularly needed to prevent the spread of HIV. In my previous

research in Tanzania, I found a commonly held set of misconceptions regarding condoms

that illustrate the need for culturally-appropriate programs: (1) condoms contain tiny and

invisible worms, (2) worms grow to visible size if the condom is placed in the sun and (3)

worms facilitate the spread of HIV. Once discovered, the beliefs were easily changed, yet

failure to address them could render ineffective the most theoretically sound HIV

prevention programs (A. Siegler, unpublished data, 2006).

Despite the importance of culture and local beliefs to HIV transmission, there is

often a dearth of culture-specific information related to HIV. This is the case for the

Maasai of Tanzania. The Maasai are a semi-sedentary tribe living in Kenya and Tanzania,

with estimates of between 300,000 and one million members (Coast, 2001a). Compared

to most Kiswahili-speaking tribes in Tanzania, the Maasai are not well integrated into

present Tanzanian customs, language, and social institutions. Unpublished estimates of

HIV prevalence among the Maasai range from 4-6%, and preliminary data indicates

increasing prevalence levels over time (Coast, 2003; Sikar & Hodgson, 2006).

Qualitative studies of Maasai culture report unique sexual practices that may put

the group at particularly high risk for HIV transmission. These practices include (1)

unhindered sexual access to age-mates' wives (wife-sharing), (2) sanctioned sex between

unmarried warriors aged 15-29 and pre-pubescent girls aged 8-13, (3) female circumcision, (4) large age gaps between spouses and (5) group circumcision ceremonies utilizing a single, unclean blade (Coast, 2001b, 2003; Koros, 1992; Spencer, 2003; Talle, 1995). While *existence* of these practices has been extensively documented, it is imperative to determine their *prevalence* to guide the design efficacious HIV prevention programs.

Two small-scale, quantitative studies assessing partnership among the Maasai report markedly different findings: both studies focus on Maasai males, yet one reports 11-12 partners per year while the other reports 1.5-2 partners per year (Coast, 2006; Morley, 1991). These disparate results may be due to reporting bias or may indicate large variance in partnership patterns within the Maasai tribe.

This study conducted a randomized survey of HIV-related sexual behaviors and hypothesized psychosocial and cultural mediators of sexual risk behaviors among Maasai adults aged 15-55 in areas of two northern Districts, Siha and Ngorongoro, in Tanzania. The study sought to increase survey validity through adapting survey measures through a series of focus groups and cognitive interviews focused on developing a culturally- and linguistically-appropriate instrument. The study aims were:

Aim 1. Adapt a series of measures to create a culturally- and linguistically-appropriate survey instrument to assess sexual behavior among the Maasai

Aim 2. Describe and quantify sexual behaviors and other factors relating to HIV prevention opportunities among the Maasai

Aim 3. Assess demographic, social, and individual predictors of sexual behaviors and other factors relating to HIV prevention opportunities among the Maasai

Background

HIV/AIDS in Tanzania

The HIV epidemic has had profound effects on Tanzania. UNAIDS estimates that among 38.3 million Tanzanians, 1.4 million are HIV positive, with 6.5% of adults age 18-49 infected (UNAIDS, 2006). Each day 384 people die from AIDS, making it the leading cause of mortality among adults in Tanzania (Setel et al., 2000; UNAIDS, 2006). Over a million Tanzanian children have been orphaned due to the epidemic, and over 100,000 children are living with HIV (UNAIDS, 2006). The AIDS epidemic is overwhelming the Tanzanian health care system; estimates are that half of hospital beds in Tanzania are occupied by HIV-positive patients, and that treating all Tanzanian HIV positive patients with anti-retroviral medication would require over fifty-one percent of Tanzania's Gross Domestic Product (Bollinger, Stover, & Riwa, 1999; *Tanzania National Website: HIV/AIDS in Tanzania*, 2007).

The Maasai of Tanzania

The Maasai are a Nilotic tribe in Eastern Africa, with a large population in both Kenya and Tanzania. The exact number of Maasai is unknown, in large part because the government of Tanzania does not include ethnicity in censuses. A census in 1989 in Kenya enumerated 377,000 Maasai (Coast, 2001a). Published population estimates of Kenyan and Tanzanian Maasai range from 300,000 to 1 million, although the source of these estimates is unclear (Coast, 2001a).

Among rural dwellers, the predominant male occupation is cattle herding, while most urban Maasai work as security guards. Maasai are considered to be semi-nomadic,

with periods of permanent home-based living interspersed with periods of movement based on seasonal or environmental fertility. Among the Maasai in Tanzania, there are differential levels of movement, a range that spans fully nomadic herders to stable farmers. Siha District, one study area, contains primarily stable farmers, while Ngorongoro District contains herders who have stable homes, from which males depart seasonally to provide cattle herds with water. Siha has an estimated 260,000 residents, while Ngorongoro has an estimated 130,000 residents ("Tanzania: 2002 Population and Housing Census," 2003).

HIV/AIDS Among the Maasai

According to UNAIDS and DHS estimates, the generalized prevalence of the HIV epidemic in Tanzania is estimated at 6-8%(UNAIDS, 2006). Unpublished data gathered from antenatal clinics in the predominantly Maasai district of Ngorongoro indicate 5-6% prevalence (Coast, 2003). These estimates are similar to an analysis of DHS data from Kenya, in which 3 of 67 (4.5%) Maasai participants were HIV-positive (A. Siegler, unpublished data, 2006).

No published research measuring HIV prevalence among the Maasai has been conducted since 1992. Two studies using data from 1992 both found low prevalence levels, 0% and 1-2% respectively (Lopez Corral, Cour Boveda, Arguello Dominguez, & Beneit, 1992; Valadez, Loolpapit, Nyangao, & Dikir, 1999). Fourteen years later, these data reveal little about current epidemic levels. What extant estimates do indicate is that HIV prevalence has increased among the Maasai, from a range of 0-2% in 1992 estimates to 4-6% prevalence in more recent estimates. Preliminary antenatal clinic data also

indicates increasing HIV prevalence among the Maasai. During the 4-year span of 1992-1996, 126 cases of HIV were identified in four pastoral districts. In 2004 in just one of those districts, Simanjiro, 213 cases of HIV were identified (Sikar & Hodgson, 2006).

No published studies have looked at Maasai access to condoms, HIV prevention programs, HIV testing, and HIV treatment. The relationship between sexual partnership and access to essential services and materials such as condoms remains unexplored.

Importance of age-set and age-group among the Maasai

Age-set and age-group permeate passage through the lifecycle for the Maasai. Although age-set and age-group are only defined for men, women associate with a corresponding age-group of males as a kind of proxy age-group. Age-set and age-group influence occupation, sexual norms, social norms, political power, and individual identity(Spencer, 2003). For males, age-sets are roughly 15-year increments: boyhood (0-15), *moran* or warrior (15-30), young elders (30-45), firestick patrons (45-60), retired firestick patrons (60-75), and aging elders (75 and above) (Spencer, 2003). Age-sets are fluid, with time of transition negotiated by younger age sets seeking to move forward and elder age sets seeking to maintain their status in power. Within age-sets, there are generally two age-groups of 5-7 year spans. Age-group partners are allies, and an individual's age is viewed more as a function of their age-group membership than their aggregate years since birth (Spencer, 1993).

HIV risk-related behaviors among the Maasai

Variable reporting of numbers of sexual partners

The two extant studies that analyzed number of sexual partners among the Maasai reported markedly different findings. One study with a sample of 132 males found self-reports of 11-12 partners per year among males followed over a three year period (Morley, 1991). Other samples indicate lower rates of partnership. A purposive sample of 96 male rural-urban migrants and 51 male rural residents indicates low rates of partnerships in the previous 12 months, with 1.4 and 2.1 partners respectively (Coast, 2006). In the same study, Coast found approximately one third of males, 33 and 30% respectively, reported extramarital partners in the last 12 months (Coast, 2006).

Polygyny among the Maasai

Polygyny, the practice of one male marrying multiple wives, is widely practiced among the Maasai with 46% of currently married males being in polygynous marriages (Coast, 2001b). Overall rates of polygyny are best understood as a function of age. Until age 35, most married men, approximately 2/3, are in monogamous marriages. By age 50, nearly 70% of men have two or more wives and by age 79 the majority of men have three or more wives (Coast, 2001b). Polygyny may lead to increased rates of HIV transmission through increased concurrency of partnerships. Mathematical modeling has demonstrated the strong influence of concurrency on the speed of epidemic transmission (Kretzschmar & Morris, 1996). Another way polygyny may affect HIV transmission is by supporting larger age gaps between marital partners.

Sexual access to age-mates wives

Several authors note the presence of sexual access of wives based on male age group (Llewelyn-Davies, 1978; Mbonde, 2006; Talle, 1994). Also referred to as wife-sharing, the practice is based on mutual sexual access to wives of males in a common age-group. The practice of wife-sharing is also mentioned in a report commissioned by the Kenyan government (Keter & Adan, 2004) and in several instances of personal communication with Maasai leaders (Maasai state leaders and constituents, Dar es Salaam, oral communication, August 2006). In meetings between Maasai leaders and the applicant, wife-sharing was discussed as a normative practice among some, but not all, clans of the Maasai. This practice is observed by placing a spear in front of the door when an age-group mate is with another's wife (Spencer, 2003; Maasai state leaders, August 2006).

Although the practice of sexual access to wives is commonly reported, there is no published data on the prevalence of the practice. If free sexual access to wives is widely practiced, it could be considered a proxy for extremely high levels of concurrency of partners and thus high levels of HIV risk.

Low levels of HIV/AIDS knowledge among the Maasai

Among a small, village-based sample of Tanzanian Maasai, Coast found 98% of males reported having heard of HIV (Coast, 2001b). Few of these respondents, however, could identify ways to prevent infection. When prompted to list ways to prevent HIV, 23% of participants identified condoms, 37% identified monogamy, and 9% identified reducing partners. There are no other sources measuring HIV knowledge among the

Tanzanian Maasai, but data from the Kenyan Maasai may serve as the best available proxy because nomadic Maasai flow fluidly across the Kenyan/Tanzanian border. Data from the Kenyan DHS also indicated low levels of knowledge about HIV among Maasai respondents (A. Siegler, unpublished data, 2006). Most, 86%, Kenyan Maasai had heard of HIV. Few, however, could identify methods to prevent HIV when asked to list them, with 25% citing abstinence and 15% citing condom use. A particularly dangerous perception in this sample is that just over one-third (34%) of respondents believe a person with AIDS cannot appear healthy, and another 19% reported being uncertain about this question (A. Siegler, unpublished data, 2006).

Relative to other Kenyans, the Maasai in Kenya have consistently lower levels of knowledge, exposure, and testing for HIV/AIDS, despite a high HIV prevalence of 4.5% (A. Siegler, unpublished data, 2006). Low levels of exposure to HIV/AIDS may in part facilitate limited knowledge. More non-Maasai Kenyan respondents reported knowing someone with HIV than Kenyan Maasai respondents (73% vs 49%). This relationship likely stems from two factors. First, HIV rates among Kenyan Maasai were likely lower, 4-6%, than among the overall Kenyan population rates of 8.5% (A. Siegler, unpublished data, 2006). Second, a significantly lower level of Kenyan Maasai were tested for HIV (8.0%) than non-Kenyan Maasai (15.6%). Maasai knowledge about HIV is also reflected in significantly less conversation with spouses about HIV (64% vs 40) and less desire to be tested for HIV (67% vs 51%).

Limited data indicate low levels of condom use among the Maasai

In a convenience rural/urban sample in Tanzania, only 6% of Maasai respondents reported ever having used condoms, while only half reported ever having seen a condom (Coast, 2006). Data from the Kenyan DHS also indicated low levels of condoms use among the Maasai, with zero out of ninety-seven respondents reporting condom use at last sex (A. Siegler, unpublished data, 2006). Limited condom use is accompanied by significantly fewer Maasai approving of condom use being taught to children (50%) than other Kenyans (60%). It is not clear whether Maasai attitudes towards condoms are a result of cultural attitudes or simply limited exposure to HIV prevention programs that include condom promotion.

Limited validity of self-report sexual data in Tanzania

Three studies in Tanzania have assessed validity of self-reported sexual behaviors by comparing self-reports to biomarkers. Each of these studies found major flaws in the validity of self-report measures. Two of the studies analyzed adolescents in primary school grades 4-6, which generally consist of students aged 12-16 years. Both studies compared reports of virginity among students testing positive for biomarkers indicating sexual activity (sexually transmitted diseases or pregnancy). Todd and colleagues found that 69/114 (61%) of adolescent girls with biological markers for sex reported never having had sex (Todd et al., 2004). Even among pregnant girls in this sample, 34% (11/32) reported never having sex. Similarly, Plummer found 37/49 (76%) of adolescent girls and 5/12 (42%) of adolescent boys with biomarkers reported never having had sex in at least one of two surveys (Plummer et al., 2004).

When assessing validity of self-reported data from a sample of Tanzanian adults, Nilsen and colleagues found little evidence supporting construct validity (Nilsen et al., 2006). Construct validity was assessed by comparing samples of adult STI patients from Norway to STI patients from Tanzania. Number of lifetime partners >30 and age of first coitarch <15 were associated with STI prevalence for the Norwegian sample, but were not associated for the Tanzanian sample. Additionally, patients in the Norwegian sample reporting previous STI had significantly more partners than those without previous STI, while this relationship was not significant for the Tanzanian sample. Data from this study underscores the uncertain validity of Tanzanian self-reported sexual data.

Cognitive interviewing

Cognitive interviewing is a process aimed at improving survey response validity through analyzing cognitive processes respondents use to answer survey questions (Willis, 1999). Cognitive interviewing has been implemented to improve response validity in a variety of cultural and linguistic settings, including Mexican immigrants, Thai elders, low-income African-American women, children with chronic medical conditions, and Medicaid recipients (Agans, Deeb-Sossa, & Kalsbeek, 2006; Baars, Atherton, Koopman, Bullinger, & Power, 2005; Brown, Nederend, Hays, Short, & Farley, 1999; Cortes et al., 2007; B. L. Green, Chung, Daroowalla, Kaltman, & Debenedictis, 2006; Ingersoll-Dayton, Saengtienchai, Kespichayawattana, & Aungsuroch, 2004; Sullivan & Olson, 1995). Some studies have shown that cognitive interviewing may be problematic for some populations, with some respondents reporting confusion, the feeling of "being tested", or even anger (Goerman, 2006). These

problems, however, were not encountered in most cross-cultural studies and have been found to be alleviated through pre-testing and providing an explanation of the cognitive interviewing process to respondents (Goerman, 2006).

The framework of Tourangeau and colleagues is often used to structure the search for and identification of survey response error in cognitive interviewing. Tourangeau's model is a four-stage cognitive model of survey response that consists of Comprehension, Retrieval, Judgment, and Response (Tourangeau, Rips, & Rasinski, 2000). Comprehension involves identifying the information sought by the question, Retrieval consists of recalling information from long-term memory, Judgment involves inference in estimation, and Response entails mapping estimates onto response categories as well as response "editing" for acceptability or consistency. The Tourangeau model provides a broad and flexible framework that encompasses several narrower models of survey response such as the Satisficing Model, and the Two-Track Theory (Tourangeau et al., 2000). The flexibility of the model enables systematic investigation of respondent error.

Significance

The Maasai of Tanzania may have sexual practices that could lead to disastrously rapid transmission of HIV. Yet little is known about the prevalence of qualitatively reported sexual behaviors in this tribe that could be driving the epidemic. Given a quantitative picture of the prevalence and predictors of sexual behaviors related to HIV, appropriate and effective HIV prevention interventions can be designed for the Maasai.

The proposed project addresses an area of high priority identified by NIMH Division of AIDS and Health and Behavior Research in that it seeks to identify individual

and social factors that would impact HIV risk reduction. This project will be the first survey among the Maasai focusing on identifying HIV-related behaviors that may drive the spread of HIV in this unique population. The proposal also addresses an area of emphasis within the Research Training and Career Development Program: the goal of promoting global adoption of primary prevention interventions. It addresses this goal by providing a foundation of knowledge that is a necessary first step to providing culturally appropriate and relevant HIV prevention programs.

Preliminary Studies

During August of 2006, a series of three meetings were held in Dar es Salaam between the applicant and Maasai community members and leadership. The meetings were well attended by Maasai community members, including 42 attendees in the Sinza meeting, 20 attendees in the Makaburini meeting, and 44 attendees in the Keko (Chang'ombe) meeting. These meetings were also well attended by local leaders, with each meeting having several state representatives (*Ilaigwanak Loongajiki)* and one meeting including a regional president (*Ilaigwanak Lesirit)*. During these meetings, votes were held and unanimously passed to collaborate on future work to prevent HIV. All leaders expressed support for this project, and pledged their full cooperation, with the regional president noting "We will receive you with all hands … this disease has been in Tanzania a long time, but the Maasai have no representation of how to confront it."

Muhimbili University College of Health Sciences (MUCHS) will serve as a base for the study with Dr. Jessie Mbwambo, a Harvard trained psychologist, serving as mentor and advisor. Dr. Mbwambo has a wealth of experience in coordinating and

conducting research in Tanzania. Currently, she is the Director of the Muhimbili VCT clinic, Muhimbili Health Information Centre (MHIC), which has been a hub for VCT-related research in Tanzania.

Methods

Study methods overview

This study was a survey of behaviors related to HIV risk among the Maasai in the Loliondo area of Ngorongoro District and the Siha Magharibi area of Siha District, Tanzania. The survey measured HIV-related areas such as circumcision, sexual behaviors and socio/demographic variables that structure risk. Collecting this information allowed for univariate and multivariate analyses of predictors of behaviors related to HIV acquisition for this unique population. Prior to conducting the research, measures for the study were adapted to be culturally appropriate for and comprehensible by the Maasai. The adaptation process began with a series thirty in-depth interviews to address language and domain issues relevant to the questionnaire. Cognitive interviews using Tourangeau's four-stage model of survey response addressed item-specific issues. The final survey instrument included 177 items, and was completed by 370 randomly selected participants, with a 91% response rate.

Pre-survey procedures

In-depth interviews

In-depth interviews were conducted to assess language use, conceptualization of topics addressed in the survey, and how the interview process can be optimized for

participants. Interview questions and probes explored sexual norms, sexual partner selection, HIV among the Maasai, and reactions to the survey interview process. Thirty interviews were held, with purposive sampling procedures designed to ensure representation across age group, gender and occupation. Community members were recruited through sampling a pilot community in Siha Magharibi, the sub-village of Nga'aati.

Cognitive interviewing

Cognitive interviewing was utilized to improve items on the survey instrument. The cognitive interviewing process was structured by Tourangeau's four-stage model of survey response (Tourangeau et al., 2000). For each question on the survey instrument, respondents first answered the question and then were probed to assess the four stages of response: comprehension, retrieval, judgment, and response. Verbal probing was selected because it lessens the cognitive burden on the respondent, and allows for questions that are similar to a think-aloud process (Willis, 1999). A purposive sample of 15 community members was selected from a pilot community close to Siha Magharibi. Participants were purposively selected to include both genders and a range of age sets from warrior (*Moran*) through firestick patron (*Omorwo*). Cognitive interviewing was conducted iteratively, with three rounds of five interviews each. After each round of interviews, items from the survey instrument were edited based on Tourangeau's criteria, with the ultimate aim to improve item comprehensibility and response validity.

Target population, sample frame and sample size

The target population of the survey is semi-nomadic Maasai adults in age sets Warrior (*Moran*) to Firestick Patron (*Omorwo*) (approximately ages 15-55) living in Loliondo area of Ngorongoro District and the Siha Magharibi area of Siha District, Tanzania. These areas were selected because they were predominantly Maasai and because they represented a diversity of Maasai clans.

The sampling frame, a list of all households units for randomization in the study area, was created in Ngorongoro and Siha Districts. The primary sampling units (PSU) were local leaders (Balozi wa Nyumba Kumi) who theoretically each represent approximately ten households, but generally represent 15 or more households as demographics have shifted over time without sufficient updates to the balozi structure. The sampling frame was obtained from village offices and was supplemented by interviews with sub-village leaders, who enumerated all the ten-cell leaders in their jurisdictions for a total of 955 ten-cells.

The sample size of 360 was targeted based on power calculations and feasibility. A sample of 360 is suggested by calculations using Green's formula for detecting a medium effect size in multiple linear regression. The formula was based on predicting 23 variables in a regression analysis, assuming a design effect of 3.0 to account for clustered data (S. B. Green, 1991).

Sampling methodology and sample size

The survey used a three-tiered, cluster sampling strategy, with random selection occurring at each tier based on a random numbers table. The first sampling tier selected

37 PSU out of the 955 enumerated ten-cells. Each selected local leader (PSU) enumerated the households under their jurisdiction, and from each PSU 11 households were randomly sampled. Lastly, interviewers enrolled a capable household member to enumerate the household members, randomly selecting one for participation. Households were defined as a group of people who ate from the same pot of food, a method that had been successfully used for previous research among the Maasai. If a selected household member was not present during the first round of data collection, a meeting was scheduled; up to two additional visits were made to attempt to collect data from each selected respondent.

Measures

The final survey instrument included 177 items, measuring ten principle categories: demographic (18), marital information (22), HIV/AIDS knowledge (12), condom-related beliefs (15), circumcision (23), non-spousal partners (32), esoto-specific (22), violence against women (19), gender power scale (7) HIV-related stigma (7). The final survey instrument is attached in Appendix A.

Demographic, marital variables and HIV knowledge

General demographic variables, such as age, education, religion, literacy, marital status number of children and occupation were adapted from Sections 1 and 2 of the Tanzanian DHS survey (National Bureau of Statistics Tanzania and ORC Macro, 2005). The HIV knowledge scale also used adapted DHS items, in this case from Section 5. Several Maasai-specific demographic variables were created for the survey, including

items assessing age-set, subgroup and livestock wealth. Maasai-specific items were also created to assess post-partum resumption of sex, age set, and number of polygynous partners.

Condom-related beliefs and environment

Questions related to condom beliefs and the environment were created based on qualitative interview findings. Accessibility of condoms was assessed with a questions related to distance needed to travel for purchase. Privacy in obtaining condoms was a subject mentioned by several interviewees, so we included two items on this topic. Condom self-efficacy was assessed through perceived ability to use a condom. A broader assessment of condom self-efficacy, such as the CUSES scale (Brafford & Beck, 1991), was not used as this scale and others like it assess positive and negative overall perceptions towards condoms; we sought to measure condom beliefs in a more disaggregated way. To this end, a series of items was created regarding negative beliefs encountered during in-depth interviewing. This resulted in dichotomous statement items addressing beliefs that condoms have holes, contain worms, cause cancer, and have negative hedonistic qualities. A standard willingness wording was used to assess readiness to use condoms, as actual use numbers were less than 5%.

Circumcision experiences and beliefs

A series of measures were created to assess circumcision tradition and practice. We assessed age at circumcision, months of training following circumcision and circumcision group size continuously. Circumcision status and traditional training were

assessed with dichotomous items. Circumcision instrument sanitation was addressed with through items assessing blade sanitation. Binomial circumcision items assessed preferences for medical supply use, anesthesia use, circumcision location, and belief in safety of hospital-based circumcision

We assessed several variants of acceptability of MMC based on the known efficacy of MMC in HIV prevention. We initially measured willingness to provide medical circumcision. Two other acceptability items sought to decipher whether the greatest barrier to change would be (1) abandoning the traditional buttonhole penis morphology or (2) the violation of Maasai leader-regulated norms. Thus, one item assessed willingness to provide medical circumcision that maintains the buttonhole appendage and the second assessed willingness to provide medical circumcision given traditional leader support.

Non-spousal partners and esoto-specific items

Non-spousal partner items were directly adapted from the UNAIDS Questionnaire for Tracing Sexual Networks (Joint United Nations Programme on HIV/AIDS, 1998). The lone exception is number of sexual partners by type, a key variable for descriptive analyses, which was ascertained using emic partnership categories (Jewkes, Nduna, Jama, Dunkle, & Levin, 2002), a method designed to make partner reporting more accurate. This resulted in seven categories: "premarital boyfriend/girlfriend", "extramarital lover", "esoto partner", "emaho partner", "partner met at bar", "shared spouse" and "sex worker." Formative research for our project indicated that the esoto dance is particularly

important for development of Maasai sexuality, so we developed questions to assess

weekly frequency of esoto, esoto as location of first coitus,

Violence against women, gender-power and stigma

      Violence against women, gender-power and HIV-related stigma were each

assessed with adaptations of previously validated scales. Violence against women was

measured with a 17-item subscale from Section 7, "Respondent and Her Partner", of the

World Health Organization Violence Against Women Instrument (WHO, 2000). Gender-

power was measured with an adapted, 7-item version of the Sexual Relationship Power

Scale (Pulerwitz, Gortmaker, & DeJong, 2000). Stigma was assessed with a 7-item

adaptation from the Section 3, "Shame and Blame" subscale of the HIV Stigma

Instrument developed in Tanzania (UNAIDS, 2005).

Analysis

      Data analyses corrected for the hierarchical nature of the data by weighting and

statistically adjusting error terms for correlations within housing clusters and the natural

variation in household sizes. Exploratory, descriptive summaries were conducted

assessing unadjusted frequencies and adjusted proportions, means, medians and their

error terms. Modeling based on univariate and multivariate logistic regression analyses

was conducted based on methodology suggested by Hosmer and Lemeshow (2000).

Validity of scales was assessed through factor analysis, Chronbach's alpha for reliability

and regressions to assess convergent validity. All analyses were conducted in STATA

11.2 (StataCorp, 2011). Ethical clearance was provided by the Tanzanian National

Institute for Medical Research and Emory University's Institutional Review Board, and permission to conduct the study was gained from the National Council of Maasai (MARIA/Oreteti Loongaek).

Limitations

This study was cross-sectional, so relationships should be interpreted as associations that do not indicate causation. Moreover, data was limited by reliance on self-report measures of sexual behavior, without assessment of biological measures to triangulate the assessment. The study was conducted in Northern Tanzania among members of the Maasai tribe, and study results may not generalize to other populations. Translation errors may also limit study conclusions, despite efforts to mitigate this effect including team translation, back-translation and cognitive interviewing.

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Applying the Dynamic Social Systems Model to HIV prevention in a rural African context: The Maasai and the *esoto* dance

Abstract

The purpose of this study was to apply the Dynamic Social Systems Model (DSSM) to the issue of HIV risk among the Maasai tribe of Tanzania. We conducted a geographically stratified, cluster survey among 370 randomly selected participants from Ngorongoro and Siha Districts. A culturally-appropriate survey instrument was developed to explore traditions reportedly coadunate with sexual partnership, including "wife-sharing", fertility rituals and various traditional dances. One dance, *esoto*, accounts for over two-thirds of participants' lifetime sexual partners (n=10.5). The DSSM, combining structural and systems theories, was applied to systematize complex multilevel factors regarding esoto practice. Participants reported multifaceted beliefs regarding esoto; a majority viewed the dance as exciting and essential, yet most men feared social stigma and three-quarters of women experienced physical punishment for non-attendance. In multivariate logistic regression, esoto attendance was predicted by female gender (AOR 4.67 CI: 1.6, 13.2), higher positive beliefs regarding esoto (AOR 2.84, CI: 1.9, 4.2) and Maasai lifecycle events (AOR 0.06, CI: 0.01, 0.47). Combining systems and ecological models, the DSSM was utilized to characterize esoto, revealing feedback loops and indicating avenues for future interventions.

Introduction

Background

Cultural and environmental context structure dyadic sexual partnerships, and behavioral interventions to prevent HIV should be designed accordingly. On a national level, the CDC disseminates 26 tailored behavioral HIV prevention programs with proven effectiveness for various at-risk groups, ranging from gay African-American men to inner-city girls to Latino drug users to youth recently released from prison (Centers for Disease Control and Prevention CDC/AED, 2009). Yet in international settings programs are often not optimally tailored, in part because there is a dearth of quantitative, culture-specific information related to concurrent sexual partnerships (Leclerc-Madlala, 2009); this is the case for the Maasai of Tanzania.

The Maasai are a semi-sedentary tribe living in Kenya and Tanzania, with approximately 1,000,000 members (Phillips & Bhavnagri, 2002). Compared to most Swahili-speaking tribes in Tanzania, the Maasai are not well integrated into contemporary Tanzanian customs, language and social institutions. No proper epidemiological studies have been conducted; clinic-based estimates for HIV among the Maasai range from 4-8% (Siegler, 2006; Sikar & Hodgson, 2006).

Theoretical Model

The present investigation into Maasai tradition and HIV prevention is structured by the Dynamic Social Systems Model (DSSM) (Latkin, Weeks, Glasman, Galletly, & Albarracin, 2010). The DSSM is a structural model focused on behavioral interventions, and is unified by the concept that understanding distal structural factors is requisite to

understanding circumstances in which individuals can change their behavior. The DSSM builds upon Bronfenbrenner's Ecological Model, assessing the macro, meso and micro levels.

What differentiates the DSSM from other structural models is its emphasis on dynamic linkages between broader structural components and the more proximal social factors that are tied to specified health behaviors. These dynamic linkages are emphasized through a Systems Theory component. In this framework, the ties between elements and structural factors vary in strength, and interact through positive and negative feedback loops. By exploring multiple levels and their interactions, the DSSM seeks to clarify "black boxes" where inputs and outputs are observed, but the intermediate processes are unknown.

HIV-related Maasai Customs

Qualitative studies indicate there are several realms of Maasai custom that can lead to concurrent partnership, including "wife-sharing" (Saitoti, 1986; Spencer, 1988; Talle, 1994), the *esoto* dance (Spencer, 1988; Talle, 2007) and *emaho* ceremonies (Coast, 2001; Llewellyn-Davies, 1978, 1990; Talle, 2007). "Wife-sharing" is described in qualitative literature as consisting of unhindered sexual access to age-mates' wives. We could not find a single native Maa word, or customary phrase, to describe this custom. The esoto dance is reported as a common place for warriors (aged 15-30) and girls (aged 8-15) to find sexual partners. Numerous other ceremonies (emaho) entailing sexual partnership are also reported, such as *oloip* (daytime partnerships in the shade), *manyata* (warrior village), *inkipot* (gifting milk to selected lover) and *olamal* (fertility ritual).

Despite providing rich descriptions, qualitative studies on the Maasai provide a picture that is neither fully coherent nor sufficiently clear in relative risk magnitude to prioritize targets for HIV prevention interventions. One example of disagreement within this literature can be seen in the observations of Jacobs, who notes that "European mythology" has exaggerated descriptions of traditions related to sexual partnership among the Maasai, a position that Sindiga further supports with evidence of low Maasai fertility rates (Jacobs, 1973; Sindiga, 1987). Moreover, even if qualitative literature were consistent in identifying traditions related to sexual risk, it could not describe risk magnitude.

Only two quantitative studies of sexual partners among the Maasai have been conducted; both were small-scale and addressed only Maasai males. They report markedly different findings, echoing the dissension in qualitative literature; respectively the studies report averages of two and twelve partners per year (Coast, 2006; Morley, 1991).

This study seeks to fill the gap in the present literature by assessing the intersection of sexual partnership and Maasai ritual by (1) quantitatively identifying overall number of sexual partners and the number attributable to each custom, (MacQueen et al.) exploring descriptive statistics and correlates of ritual participation and (3) incorporating study findings into the rubric of the Dynamic Social Systems Model.

Methods

Overview

   This mixed qualitative-quantitative methods study was conducted in areas randomly selected from Siha and Ngorongoro Districts in northern Tanzania. A series of more than 30 semi-structured interviews with community members supplied a foundation of information that enabled development of a quantitative survey instrument intended to measure culturally-situated risks for HIV transmission. The survey instrument was translated directly from English into Maa by a team of two native Maa speakers, and then back-translated by a second tandem. The face validity of the instrument was improved based on three rounds of five cognitive interviews each, improving question design, clarity and cultural compatibility.

   Data were obtained from face-to-face interviews conducted by native Maa-speaking, gender-matched interviewers. The sample frame consisted of a set of local leaders (*balozi wa nyumba kumi*). From 955 balozi, representing an estimated population of 29,000 adults, 37 were randomly selected. Eleven households were subsequently randomly selected from each of 37 balozi units; all households were included for balozi with less than 11 households, and households from the nearest neighboring balozi were used to fill the remainder. One adult member in each participating household was randomly selected to complete the survey.

Measures

Demographic

Demographic variables not specific to the Maasai were adapted from the

Tanzanian DHS Survey (National Bureau of Statistics Tanzania and ORC Macro, 2005).

These include *gender*, *age*, *marital status*, *number of wives*, *religion*, *cell phone*

ownership, *radio ownership*, *education* and *literacy of any household member*. Items

were also developed to assess Maasai *livestock wealth*, *age grade* and *tribal section.*

HIV-related

Knowledge of HIV transmission scale was adapted from the Tanzanian DHS Survey,

consisting of true/false identification of fourteen potential pathways for HIV

transmission, such as "sharing needles" or "kissing". A seven-item dichotomously coded

stigma scale, adapted from the Tanzania Stigma Indicators survey (UNAIDS, 2005),

includes items such as, "HIV is punishment for bad behavior" and, " I would feel

ashamed if I were infected with HIV."

Sexual partnership

Number of lifetime sexual partners by type, a key variable for descriptive

analyses, was ascertained using emic partnership categories(Jewkes, Nduna, Jama,

Dunkle, & Levin, 2002), a method designed to make partner reporting more accurate.

This resulted in seven categories: "premarital boyfriend/girlfriend", "extramarital lover",

"esoto partner", "emaho partner", "partner met at bar", "shared spouse" and "sex

worker." These seven categories populated the question, "Did you have vaginal sex with

___ in your lifetime? [IF YES] How many different ___ ?" Emaho, or traditional ceremony, is used to assess partnership stemming from oloip, manyata, inkipot and olamal because field-testing indicated these practices vary by local, and emaho provides a universally understood concept in their stead. Formative research for our project indicated that the esoto dance is particularly important for development of Maasai sexuality, so we developed questions to assess *weekly frequency of esoto*, *esoto as location of first coitus*, *punishment for esoto non-attendance* and *fear of esoto punishment*.

Dependent and independent variables

For the logistic regression model, *esoto attendance* was assessed with the question, "Did you ever attend an esoto that ended with sexual partnership between warriors and girls?" Independent variables for the regression included general and Maasai-specific demographic variables described above. The regression also includes a short, three-item *positive esoto beliefs* scale we developed. Dichotomous scale items were: "Girls should attend esoto because they need the sperm to develop breasts", "Attending esoto is an essential part of being a Maasai youth", and "I was enthusiastic to attend esoto because it meant I was becoming a man [woman]". The average scale inter-item correlation is 0.49. The Kuder-Richardson coefficient, a dichotomous version of Cronbach's alpha, is 0.67,an expected low value because shorter scales have lower alpha coefficient values (DeVellis, 2003).

Data Analysis

Data analyses corrected for the hierarchical nature of the data by weighting and

statistically adjusting error terms for correlations within housing clusters and the natural

variation in household sizes. Exploratory analyses were conducted assessing proportions,

means, medians and their error terms. Univariate analyses were conducted to build a

regression model assessing determinants of esoto participation. Model building

techniques for the logistic regression predicting esoto participation were implemented

based on methodology suggested by Hosmer and Lemeshow (2000). All analyses were

conducted in Stata 11.2 for Mac OS X. Each participant provided verbal consent to a

trained interviewer, a process approved by Emory University's Institutional Review

Board and Tanzania's National Institute for Medical Research.

Application of theoretical model

In addition to the analyses described above, the quantitative findings were further

analyzed from the perspective of applying the DSSM framework to the esoto dance. This

analysis was conducted to reveal factors that can be leveraged in future HIV prevention

interventions. The DSSM seeks to elucidate "black boxes" between model inputs and

outputs; in our case this involved inputs of Maasai culture/governance, Tanzanian

governance and environmental settings. The primary model output was esoto attendance,

as it entails unprotected sex with multiple partners. The DSSM was selected because it is

a structural model (requisite for the multi-level nature of esoto practice) specified for

behavioral interventions. The full model includes six dimensions that represent possible

arenas for theory building, but not all dimensions are considered pertinent for each

environment (Latkin et al., 2010). In applying the model to Maasai traditions, we assess three dimensions: Informal Social Influences, Formal Social Control and Settings. To explicitly incorporate the impact of traditional Maasai culture, we have divided the Formal Social Control category into Maasai Formal Social Control and Governmental Formal Social Control.

Quantitative survey findings were the primary source of information for applying the DSSM, and were supplemented by observations made by the PI during nine months of fieldwork in 2008. When possible, field observations were verified through literature, such as the local Tanzanian governmental system (United Republic of Tanzania President's Office, 2003) and traditional Maasai leadership structure (Spencer, 1993). Field observations of esoto customs were corroborated through correspondence with Maasai leadership (Kin'gori, 2009).

Results

Demographics

A sample of 370 individuals was consented and agreed to participate in the survey, a 91% response rate. The sample represented seven different Maasai tribal sections, with females comprising 53% (Table 1). The mean reported age was 29. The majority (78%) were married, with roughly half in a non-polygynous marriage, another quarter in a polygynous marriage with one husband and two wives, and the remaining quarter in a polygynous marriage with one husband and three to six wives. Most (59%) of the population held traditional Maasai religious beliefs, while a sizable minority subscribed to Lutheran or Catholic beliefs. Educational attainment of this sample was

low, with only 3% attaining education beyond the 7th year, and only 39% having ever attended school. Around 40% were very poor, having fewer than 20 cattle and goats.

HIV knowledge and condom use

Nearly all respondents (99%) were aware of HIV, yet many had limited understanding of HIV transmission. Transmission pathways of blood, vaginal sex and injections were each identified correctly by over 90% of the population. Yet false pathways were also posited, with kissing, mosquitos and saliva each incorrectly identified by over 40% as sources of HIV transmission. This resulted in low scores on the HIV knowledge scale. Stigma towards people living with HIV was common (mean 5.2 out of 7 point scale), although only 25% of respondents ever met someone they believed to have HIV. Regarding prophylactics, less than 3% ever used a condom, yet nearly one-third would be willing to use condoms if available.

Premarital sexual partnership and Maasai traditions

Table 2 displays mean lifetime non-marital sexual partners by partnership category. With a mean of 10.2 lifetime partners in all categories, 6.7 came from traditional sources, with 6.3 from esoto, 0.4 from emaho and <0.1 from wife sharing. Partners not encountered at Maasai traditional venues accounted for a mean of 3.5 total partners, with 2.4 from premarital boyfriends/girlfriends, 0.9 from long-term extramarital marital partnerships and 0.2 from all other sources. The esoto dance accounted for over twice the partnerships of all other modes of non-marital lifetime partners. Among those attending esoto, ranges of 0 to 280 partners were reported, with a mean of 10.5 and a

median of four esoto-specific partners. Outliers are included in our calculations, as reports of large partner numbers were consistent with field reports of popular males termed "dance heroes". Males attending esoto reported significantly more sexual partners than females. For instance, 43% of males and 6% of females reported ten or more esoto sexual partners. Excluding partners attributed to the esoto dance, esoto attenders nonetheless reported more mean overall lifetime non-marital partners (5.1) than non-attenders (1.8).

Esoto experience

Interviews indicate that esoto is closely linked to sex, with 80% of those surveyed reporting that the dance always ends in sexual partnership (Table 3). The esoto dance was attended by 61% of the sample; this number increases to 82% when the Ilarussa tribal section is excluded. All 93 members of the Ilarussa section reported never attending esoto, and are thus excluded from all subsequent analyses regarding esoto. In follow-up interviews with Ilarussa elders, they could not recall a time when esoto was practiced in their section. For non-Ilarussa, esoto is a common local for experiencing first coitus (92% females, 66% males).

Support for the esoto tradition in the abstract was strong, yet participants had mixed feelings about their own experiences. Agreement ranged from 85-89% for statements in the positive esoto beliefs scale, including, "I was enthusiastic to attend esoto", "esoto is essential to being Maasai", and "semen is necessary for girls to develop breasts". Despite agreement with these abstract statements, 80% of males and females feared the social consequences of non-attendance. In addition to potential social

ramifications, females faced physical ramifications, with three-quarters of females reporting physical punishment, by beating with a stick, for non-attendance. Moreover, 80% of females reported they would attend esoto less if there were no threat of physical punishment.

Correlates of esoto participation

A multivariate logistic analysis predicting ever attending esoto shows that positive beliefs regarding esoto, female gender, and adult lifecycle rituals are significant positive predictors (Table 4). The overall model is highly significant, with the global f-test (F=8.7e32, prob>F =0.000) indicating good model fit. For each point higher score on the positive esoto beliefs scale, the likelihood of a community member ever attending esoto is 2.84 times higher (AOR 2.84, CI: 1.9, 4.2). Average female likelihood of attending esoto is over four times higher than males (AOR 4.67 CI: 1.6, 13.2). Maasai who have not undergone adult lifecycle rituals, either male circumcision or female excision, have 94% lower chances of attending esoto (AOR 0.06, CI: 0.01, 0.47). The model had no significant interactions among independent variables.

Education's impact on esoto attendance was fully mediated by the positive esoto beliefs scale, based on Barron and Kenny's (1986) criteria. We hypothesized that the relation between education (IV) and esoto attendance (DV) was mediated by the positive esoto beliefs scale (MED), and tested this with a single mediation model. The Sobel value was -2.51 (p=.01), indicating a significant mediator effect. The indirect, mediated, effect accounts for 40% of the total effect, suggesting that positive esoto beliefs accounted for 40% of education's effect on esoto attendance.

Dynamic Social Systems Model of the Esoto Dance

The DSSM application to the esoto dance can be seen in Table 5. It explores the esoto system by detailing macro, meso and micro levels of factors that eventuate a positive, stabilized feedback loop in which esoto and attendant unprotected sex is practiced by most (82%) of the eligible population. This section details the esoto feedback loop, and potential areas for disruptive negative feedback, in the areas of informal social influences, Maasai formal social control mechanisms, governmental formal control mechanisms and settings.

Informal social influences serve as key reinforcing mechanisms for esoto practice. Entrenched as the normative source of first coitus, esoto is further bulwarked by norms of attendance, with most fearing stigma for lapses in attendance. HIV risk is standard when attending esoto, with multiple sexual partners and unprotected sex being the current practice. Those who equate the importance of esoto to Maasai identity, or who subscribe to the traditional belief that women need sperm gained from esoto to develop breasts, are most likely to participate.

Maasai formal social control mechanisms reinforce esoto practice, yet simultaneously provide potential inroads for destabilizing negative feedback to be added. Physical coercion of females by warriors is normative. Without explicitly endorsing this, Maasai tradition and current leadership implicitly sanction the beatings, as warriors face no repercussions. Females, unable to opt out of esoto, are more likely to participate than males.

Esoto is conducted at local host compounds, generally in groups of 15-30 participants. The "hosting" family controls the environment in numerous ways; for

instance, we observed one host sending home girls deemed too young to participate. Maasai formal social control mechanisms could provide inroads for leveraging change; at the meso-level hosting households are influential, while at the macro-level traditional leaders such as age group heads and traditional healers can instigate change.

Governmental formal control mechanisms have the potential to disrupt the esoto feedback loop. Educated participants were less likely to participate in esoto; basic investment in early education could yield a multitude of benefits. Expanding the government's legal presence could also provide utility. Both sex with minors (girls attending are pre-pubescent) and physical coercion are illegal in Tanzania (Interpol, 2003), yet no enforcement mechanisms exist to address known Maasai practices.

Settings frame the esoto dance, proscribing both limitations on its practice as well as on any programs seeking to alter it. Esoto is practiced only during the rainy seasons, as warriors periodically leave during the dry season in search of water. Cattle herding also impacts population density, with Maasai populations and local leadership being relatively dispersed based on herding needs. Due to low population density, transportation is limited. Few roads, and low road quality, are the norm. Any programs working with the Maasai must overcome transport, geographical and seasonal challenges in order to gain sufficient intervention penetration away from population centers.

One method of applying the DSSM involves identifying systems-based feedback loops across structural levels, with interventions designed to alter ties or build new disruptive loop elements. For instance, one positive reinforcing feedback loop involves esoto norms and physical beatings that coerce female attendance. The loop starts with individual esoto participation (micro), which strengthens esoto as normative Maasai rite

of life passage (macro), contributing to stigma surrounding non-attendance (macro) which manifests in values and customs that sanction physical beatings (macro), normatively enacted at host households (meso), leading to greater likelihood of individual esoto attendance (micro). This loop may be susceptible to macro level interventions that develop structural barriers to prevent beatings, such as implementation of governmental or Maasai regulations. Alternately, meso-focused interventions could involve parents, host households and local community leaders in reaching out to warriors to change behaviors surrounding non-attendance.

A different application of the DSSM could seek to increase connections between informal norms at the macro level, such as norms of sex without condoms, and formal Maasai social control mechanisms that currently don't engage these norms, such as Maasai age set leaders. This would be similar to a Popular Opinion Leader approach (Kelly et al., 1991), adapted to a Maasai context. Future structural interventions addressing esoto will likely collaborate directly with Maasai leadership, and may opt to focus on erecting a single key structural barrier, or to approach change with a multi-pronged approach.

Discussion

At a proximal level, this study has important indications for design of future HIV prevention programs for the Maasai. The esoto ritual is responsible for the vast majority of premarital partners for attendees. Future interventions, informed by survey and DSSM findings, would benefit from directly addressing this area of risk.

At a more distal level, this study demonstrates the utility of combining and tailoring qualitative and quantitative approaches to understand HIV-related practices in underserved rural areas. Given solely quantitative information, such as from a general knowledge, attitudes and practices (KAP) survey, the source of high levels of partnership and surrounding norms would have been obscured. Given solely qualitative information, however, the magnitude of different potential sources of risk would be unknown, making it nearly impossible to design targeted programs. Even if certain factors were identified properly by qualitative observation as key targets, the magnitude and directionality of pertinent cultural norms would be unclear. By establishing a qualitative foundation that informs quantitative assessment of magnitude, future behavioral HIV prevention studies can avoid these pitfalls.

The DSSM provides a flexible framework that can serve as a tool for community-based, structural interventions. By overtly characterizing structural factors, multifaceted interventions can be designed to alter connection patterns based on a systems approach. It may be possible to leverage DSSM flexibility by using it as a tool to engage communities in developing locally appropriate structural interventions. This study is the first we know of that applies the DSSM framework to developing country settings, and further

exploration of model implications for program planning and community participation are needed.

The present study has several limitations. One is that face-to-face interviews tend to increase levels of socially desirable reporting, compounding potentially unbiased recall error. Another is measurement error in translating a survey across languages and cultures, a process that is fraught with difficulty despite efforts to ameliorate this problem through reverse-translation and cognitive interviewing.

This study also has several strengths. It is the first study to quantitatively measure the intersection of ritual and HIV-related behaviors among the Maasai. It also provides a novel example of the utility of developing locally-appropriate quantitative survey items based on qualitative work. Lastly, the present study provides a foundation for future research and interventions aimed at preventing HIV transmission among the Maasai, while simultaneously highlighting areas for future research into application of the DSSM.

Table 1 Demographic variables

	n	%, 95% CI
General Demographic		
Female gender	194	53% (49, 57)
Age: Mean, 95% CI	na	29 (28, 30)
Age set[a]		
Ilayiok (Boys)	15	9% (5, 17)
Ilmurran (Warriors)	79	44% (35,52)
Ilpayani (Junior Elders)	59	35% (26, 45)
Ilmoruak (Elders)	22	13% (8, 20)
Married	291	78% (72, 83)
Number of wives		
One	179	56% (48, 64)
Two	60	24% (18, 31)
Three-Six	56	20% (15, 27)
Religion		
Traditional	218	59% (50, 68)
Lutheran	94	26% (18, 36)
Catholic	39	10% (7, 15)
Other	17	5% (3, 7)
Education		
None	223	61% (54, 68)
Standard 1-7[b]	125	36% (29, 43)
> Standard 7[b]	12	3% (2, 5)
Literate household member	249	69% (63, 75)
Wealth		
Cattle < 20	204	51% (40, 61)
Goats < 20	197	52% (41, 63)
Cell phone	124	36% (29, 43)
Radio	153	41% (33, 50)
HIV-related		
Heard of HIV	354	99% (97, 100)
Met someone with HIV	82	25% (18, 34)
HIV Knowledge Scale[c]: Mean, 95% CI	na	9.0 (8.7, 9.3)
Stigma PLWHA Scale[c]: Mean, 95% CI	na	5.2 (5.0, 5.4)
Ever condom use	7	3% (1, 6)
Willing to try condoms	107	31% (22, 42)

Note: CI=Confidence interval ;

[a] Age sets are Maasai male life stages, each ≅ 15 years

[b] Standards in Tanzanian education approximate US grades

[c] Scales total 14- and 7-points for knowledge and stigma respectively, with higher values indicating greater levels

Table 2 Means of lifetime sexual partners in emic Maasai categories

	All	Esoto attenders	Non-attenders
	Mean (S.E.)	Mean (S.E.)	Mean (S.E.)
Maasai-specific			
Esoto	6.27 (1.9)	10.54 (3.2)	0 (NA)
Emaho	0.39 (.13)	0.61 (.21)	0.07 (.02)
Spouse sharing	0.06 (.02)	0.08 (.04)	0.03 (.02)
Non-maasai specific			
Premarital boyfriend/girlfriend	2.35 (.41)	3.17 (.60)	1.16 (.23)
Postmarital boyfriend/girlfriend	.91 (.14)	1.16 (.19)	0.31 (.06)
Sex worker	0.03 (.02)	0 (NA)	0.06 (.04)
Partner met at bar	0.09 (.03)	0.10 (.04)	0.07 (.03)
Other partner	0.14 (.04)	0.14 (.04)	0.14 (.06)
Total	10.2 (2.2)	15.8 (3.6)	1.8 (0.2)

Table 3 Esoto dance attendees' beliefs and sexual experiences regarding esoto by gender

	Total	Total Agreement	Male	Male Agreement	Female	Female Agreement
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Sex occurs at every *esoto*	145	80% (76, 84)	36	59% (49, 68)[a]	109	91% (81, 96)
First coitus occurred at *esoto*	154	83% (76, 89)	42	66% (49, 79)[a]	112	92% (80, 97)
Number of days per week[b] *esoto* is held: Mean, 95% CI	na	6.0 (5.5, 6.4)	na	6.6 (6.3, 6.9)[a]	na	5.7 (5.1, 6.2)
Number of days per week[b] *esoto* is attended: Mean, 95% CI	na	4.5 (4.2, 4.8)	na	4.8 (4.2, 5.5)	na	4.3 (3.9, 4.7)
Felt enthusiasm in attending *esoto* for the first time	193	88% (81, 93)	83	88% (80, 93)	110	88% (77, 94)
Attending *esoto* is essential to being Maasai	199	89% (82, 93)	87	87% (77, 93)	112	90% (80, 95)
Semen provided at *esoto* is necessary for female breast development	185	85% (78, 90)	76	77% (67, 85)	109	90% (81, 95)
Fear social stigma if not attending *esoto*	178	82% (74, 88)	75	79% (69, 86)	103	84% (74, 90)
Ever beaten for not attending *esoto*	95	75% (61, 86)	na[c]	na[c]	95	75% (61, 86)
Would attend *esoto* less if there was no punishment for non-attendance	99	80% (64, 90)	na[c]	na[c]	99	80% (64, 90)

Note: CI=Confidence interval

[a] Significant difference between males and females at the p=.05 level

[b] *Esoto* frequencies are for times of the year when the dance is held, during the rainy seasons lasting 4-6 months

[c] Male warriors may beat girls for not attending *esoto*, but are not themselves subject to such punishment.

Table 4 Logistic regressions predicting attendance of esoto dance with Maasai socio-demographic and esoto factors

	Unadjusted Odds Ratios (95% CI)	Adjusted Odds Ratios (95% CI)
Esoto Positive Beliefs Scale	2.73 (1.9, 4.0)	2.84 (1.9, 4.2)
Female gender	2.92 (1.1, 8.0)	4.67 (1.6, 13.2)
Has not received adult genital cutting ritual	0.07 (0.01, 0.32)	0.06 (0.01, 0.47)
Any education	0.25 (0.11, 0.56)	na[a]

Note: CI=Confidence interval.

[a] Education is fully mediated by the Esoto Positive Beliefs Scale

Table 5 Dynamic Social Systems Model of the Esoto Dance

	Macro	**Meso**	**Micro**
Informal social influences	*Esoto* is normative location of first coitus (92% females, 66% males), normative source of multiple sexual partners (mean=10.5, median=4). Customary social stigma for non-attendance (82% fear stigma) and nearly universal sex without condoms (3% ever condom use)	Population is aware of HIV (99%), yet only 1/4 believe they have met someone with HIV. HIV knowledge is low; over 40% believe mosquitos and kissing transmit HIV. Stigma towards people living with HIV is high (mean=5.2 on a 7-point scale).	Those with higher scores on the positive *esoto* beliefs scale are more likely to participate (AOR=2.84). (ie. believing *esoto* is essential to being Maasai, being enthusiastic to attend or believing girls need sperm to develop)
Maasai formal social control mechanisms	Normative beatings for non-attendance (75% women beaten). The Ilarussa section does not practice *esoto*. Influential cultural leaders include age group heads (Warrior, Jr. Elder, Elder), traditional healers and circumcisers, and the Maasai Council.	Frequent *esoto* dance availability (mean=6 days per week). Customs of hosting household, local leaders and parents influence participants. Implicit local sanctioning of beatings allows practice to continue.	Females are more likely to participate than males (AOR=4.67). Individuals enact norms: *esoto* "heroes" have many sexual partners. Visiting warriors access non-local *esoto*.
Governmental formal social control mechanisms	Low reach of education programs (61% no education, 97% less than 8th grade education), government leaders and medical officers influence local life at District, Village and Sub-Village levels. Low reach of national prevention programs (i.e. condom social marketing and VCT).	Tanzanian legal framework establishes sex with minors as illegal (female *esoto* participants are all pre-pubescent). Moreover, all physical coercion is illegal under Tanzanian statues.	Those with any education are less likely to participate (OR=.25); education is mediated by positive *esoto* beliefs scale in multivariate model. Local formal mechanisms, and political will, for law enforcement are limited.
Settings	Nearly half the population is very poor (51% own less than 20 cattle). Semi-nomadic population is influenced by droughts, seasonality and political allocations for cattle herding.	Availability of *esoto* sites in walking distance influences attendance, seasonality (dry versus rainy) influences migration of cattle, and thus the presence of men who herd.	Those who have not undergone adult rituals (female excision or male circumcision) are less likely (AOR=0.06) to have participated in *esoto*.

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Acceptability of improved instrument sanitation and medical male circumcision

among the traditionally circumcising Maasai of Tanzania

Abstract

By removing the foreskin, medical male circumcision (MMC) reduces female to male heterosexual HIV transmission by approximately 60%. Traditional circumcision has higher rates of complications than MMC, and protective effects may be mitigated if the foreskin is not fully removed. A stratified, cluster survey of circumcision instrument sanitation and acceptability of MMC was conducted among 370 members of the Maasai tribe in two Northern Districts of Tanzania. The Maasai practice 'buttonhole' circumcision that does not fully remove the foreskin. Most respondents had been circumcised in groups, with 56% circumcised with a shared knife rinsed in water between initiates and 16% circumcised with a knife not cleaned between initiates. Contrasting practice, 88% favored use of medical supplies for their sons' circumcisions. Willingness to provide MMC to sons was 28%; however, provided the contingency of traditional leadership support for MMC, this rose to 84%. Future interventions to address circumcision safety, including traditional circumciser training and MMC, are discussed.

Introduction

Three randomized, controlled trials demonstrate that voluntary medical male circumcision (MMC) reduces female to male HIV heterosexual transmission by approximately 60% (Auvert et al., 2005; Bailey et al., 2007; Gray et al., 2007), and scale-up programs for MMC are underway in 13 high priority countries identified by WHO/UNAIDS, including Tanzania (UNAIDS / WHO, 2009). Two out of three Tanzanian males are circumcised (Bollinger & Stover, 2009); of these, the best available estimate is that half (51%) were circumcised by a traditional practitioner (Wambura et al., 2009). Recent studies show MMC has desirable properties including low risks for participants (Auvert et al., 2005; Bailey et al., 2007; Gray et al., 2007; Lissouba et al., 2010), known HIV preventive properties (Auvert et al., 2005; Bailey et al., 2007; Gray et al., 2007) and sufficient demand (Bailey, Muga, Poulussen, & Abicht, 2002; Herman-Roloff, Otieno, Agot, Ndinya-Achola, & Bailey, 2011; Mattson, Bailey, Muga, Poulussen, & Onyango, 2005; M. Westercamp et al., 2010; N. Westercamp & Bailey, 2007) among traditionally non-circumcising communities. In contrast, traditional practitioner circumcision (TPC) is less studied, with existing evidence indicating more risk for recipients and potentially less benefit.

TPC is capable of providing protection against HIV transmission (Shaffer et al., 2007), yet the degree of protection is unknown if the foreskin is only partially removed. Complete removal of the foreskin through MMC greatly reduces male heterosexual acquisition of HIV (Auvert et al., 2005; Bailey et al., 2007; Gray et al., 2007); the foreskin's HIV-susceptible cells, tissue structure, surface area and microflora likely play important roles in this phenomenon (Dinh, Fahrbach, & Hope, 2011). Given these

findings, TPC that partially removes the foreskin may provide less protection against

HIV transmission. A longitudinal, observational study in Kenya assessed the efficacy of

TPC in HIV prevention, with unadjusted analyses indicating a 70% reduction in

transmission in a population where 75% was circumcised traditionally (Shaffer et al.,

2007). The generalizability of this study, however, is limited as there is no data on which

traditional circumcision method the study population received. The variation of TPC

methods can be seen in a study by Brown and colleagues that identified three distinct

types in one small geographic area of Kenya, each type removing differing amounts of

foreskin (Brown et al., 2001). Medical assessment in Lesotho found that of those

reporting MMC and TPC, 3% and 41% respectively still had foreskin covering at least

half the glans of the penis (Thomas et al., 2011). Unsurprisingly, national surveys

indicate circumcision in Lesotho is not correlated with lower rates of HIV (Thomas et al.,

2011).

TPC may place participants at substantial risk of complications including

infections, excessive bleeding and permanent sequelae such as scarring and deformity

(Bailey, Egesah, & Rosenberg, 2008; Peltzer & Kanta, 2009; Peltzer, Kanta, & Banyini,

2010; Peltzer, Nqeketo, Petros, & Kanta, 2008). In South Africa, a MMC scale-up

program found low overall complication rates of 1.8%, with only 0.06% (9/14,000)

requiring hospitalization and no deaths or permanent damage to any participants

(Lissouba et al., 2010). In contrast, rates of complications in a study of extant Kenyan

circumcision found complication rates of 35% and 18% for TPC and MMC respectively,

with 6% of all procedures resulting in permanent sequelae (Bailey et al., 2008). Although

most of these complications were resolved by the 90-day follow-up, the high rates of

complications indicate that even in medical settings complications can be common in the face of supply stock-outs, unsanitary conditions, and lack of proper training. In South Africa, following an intervention designed to train traditional practitioners, 37% of TPC resulted in an adverse event, with 4.7% hospitalized for excess bleeding (Peltzer et al., 2010).

High rates of infection in TPC are likely caused in part by poor instrument sanitation, although there is a dearth of information regarding the causes of high infection rates in traditional circumcision (Wilcken, Keil, & Dick, 2010). Instrument sharing for group circumcision is a traditional practice in many groups, such as the Xhosa (Naude, 2002), the Babukusu (Bailey & Egesah, 2006), and the Maasai (Kilima et al., 2012), although current rates of sharing are unknown. An intervention by Peltzer trained Xhosa traditional circumcisers in medical practices, yielding limited results; gloves were worn 85% of the time, yet 53% of procedures were done using a traditional spear instead of a surgical blade (Peltzer et al., 2008). Training of Ndebele traditional practitioners found similar limitations, with 93% of practitioners using a new instrument on each participant, but only 36% using surgical blades instead of a traditional knife (Peltzer et al., 2010).

Although numerous studies have assessed willingness to circumcise among non-circumcising communities (Bailey et al., 2002; Herman-Roloff et al., 2011; Mattson et al., 2005; M. Westercamp et al., 2010; N. Westercamp & Bailey, 2007), only one study has analyzed willingness to receive medical circumcision among TPC communities (Wambura et al., 2011). Among a population in Northern Tanzania in which 36% had received MMC, there was nearly universal (96%) support for providing sons with MMC. Given that Maasai TPC leaves significant amounts of foreskin (Brown et al., 2001;

Weiss, Bailey, Hankins, Halperin, & Schmid, 2007)_ENREF_15, and that traditional circumcision results in higher rates of complication, the present study aims to assess among the Maasai: 1) current instrument sanitation practices, 2) acceptability of improved instrument sanitation practices and medical circumcision, and 3) determinants of acceptability.

Methods

Setting

This study was conducted in 2008 among the Maasai tribe in Northern Tanzania, a semi-nomadic tribe of over 1 million in Northern Tanzania and Southern Kenya (Phillips & Bhavnagri, 2002). Traditional circumcision procedures vary greatly, utilizing different cutting methods and thus removing different amounts of foreskin. The Maasai were selected in part due to their use of the 'buttonhole' circumcision technique (Weiss et al., 2007). In buttonhole circumcision, the foreskin is partially removed, followed by a small slit cut transversely above the glans in the remaining attached foreskin. The glans of the penis is inserted through this slit, leaving a flap of foreskin as a permanent appendage hanging below the penis (Brown et al., 2001). Given this procedure's incomplete removal of foreskin, the Maasai may be a target for future programs seeking to broaden access to the safety and HIV prevention efficacy of MMC.

Survey Methodology

This cross-sectional study used a geographic stratification and cluster sample design to select 368 participants who completed the survey, representing an estimated population of 29,000 Maasai adults in Siha and Ngorongoro Districts, Northern Tanzania. Adults aged 18-50 self-identifying as Maasai were eligible to participate, and the survey response rate was 91%. Random selection occurred at three levels: 37 area clusters, 11 households per area and 1 adult member per household. The survey instrument was team translated from English directly into Maa language, and back-translated by a second team of Maa speakers. Three rounds of cognitive interviews, a qualitative method assessing respondent cognition of individual survey items, were conducted to improve survey validity. The final instrument was deployed with face-to-face interviews conducted by gender-matched, native Maa speaking interviewers.

Measures

All demographic measures were adapted from the Tanzanian DHS survey (National Bureau of Statistics Tanzania and ORC Macro, 2005). A set of measures assessing implementation of traditional circumcision relevant to HIV prevention was created, based on qualitative interviews: *age at circumcision* was assessed continuously, as was *months of training following circumcision* and *circumcision group size*. *Circumcision status* and *traditional training* were assessed with dichotomous items. *Circumcision instrument sanitation* was addressed with two items: "Were you circumcised with your own knife or with the circumciser's knife?" If circumcised with the practitioner's knife, the following question was asked: "Was the knife used to

circumcise you: (a) not used on anyone else at the circumcision ceremony, (b) used on others, and cleaned in medical solution in between uses, (c) used on others, and cleaned in water between uses, or (d) used on others, and not cleaned between uses."

Circumcision sanitation preferences and willingness to change circumcision technique were measured using dichotomous, agree or disagree, attitudinal statements. Cognitive interviews indicated that respondents in this population had better comprehension of dichotomous rather than Likert modalities. We measured preferences for *medical supply use, anesthesia use, circumcision location*, and *belief in safety of hospital circumcision*. For instance, anesthesia preference was assessed with the statement, "If anesthesia were free, I would choose to use it for my son's circumcision." A *traditional beliefs scale* of three dichotomous statement items assessed support for Maasai tradition, such as, "Attending (a traditional dance) is an essential part of being a Maasai youth." The scale had high average inter-item correlation, 0.49, but slightly below ideal Kuder-Richardson's coefficient, 0.67, which was expected as shorter scales have lower scores in this measure (DeVellis, 2003).

We assessed several variants of acceptability of MMC based on the known efficacy of MMC in HIV prevention. We measured *willingness to provide medical circumcision*: "If male medical circumcision that leaves no appendage was proven to provide partial protection against HIV, I would bring my son to receive this kind of circumcision." Two other acceptability items sought to decipher whether the greatest barrier to change would be (1) abandoning the traditional buttonhole penis morphology or (MacQueen et al.) the violation of Maasai leader-regulated norms. Thus, one item assessed *willingness to provide medical circumcision that maintains the buttonhole*

appendage, "If male medical circumcision that still leaves an appendage was proven to provide partial protection against HIV, I would bring my son to receive this kind of circumcision." The second assessed *willingness to provide medical circumcision given traditional leader support*, "If most traditional Maasai leaders agreed to change to male medical circumcision that leaves no appendage, and was proven to provide partial protection against HIV, I would bring my son to receive this kind of circumcision."

Data analysis plan

All data analyses were adjusted to correct for the clustered, hierarchical nature of data stemming from the survey design. Descriptive summaries of circumcision instrument sanitation, ritual and opinion are based on adjusted proportions and unadjusted frequencies. Gender differences in circumcision opinions were evaluated with p-values from chi-square tests. Associations between medical/ritual beliefs and willingness to use condoms were assessed with odds ratios from univariate and multivariate logistic regressions, controlling for significant demographic variables. All analyses were conducted in STATA 11.2 (StataCorp, 2011). Ethical clearance was provided by the Tanzanian National Institute for Medical Research and Emory University's Institutional Review Board, and permission to conduct the study was gained from the National Council of Maasai (MARIA/Oreteti Loongaek).

Results

All Maasai males in our population were either already circumcised or were intending to be circumcised in a ritual TPC ceremony. Of those who were circumcised, 82% were circumcised between the ages of 15 and 20 (Table 1). Maasai tradition dictates a cultural training period following circumcision; most initiates (84%) attended, with the training usually lasting one month or more.

Circumcision instrument sanitation was severely lacking, with the majority of TPC ceremonies conducted with shared knifes that were inadequately cleaned. Group TPC ceremonies were normative, with 91% circumcised in a group of two or more. For 76% of all respondents, a single traditional practitioner's knife was used on their circumcision group. Disaggregating this figure, 56% reported a single knife rinsed in water between participants, 4% reported a knife that was rinsed in sanitizing solution, and 16% reported a knife that was entirely not cleaned in any way between initiates. For the remaining quarter of respondents, the initiates either faced a previously unused knife of the circumciser (20%) or supplied their own knife (5%). We assessed whether TPC sanitation practices have changed over time, comparing circumcisions conducted from 2000-2008 to those from 1975-1999, and chi-square tests indicated no statistically significant differences.

In contrast to current sanitation practices, most Maasai were favorably disposed to more sanitized TPC for their children (Table 2). Use of medical supplies, such as gloves and clean surgical blades, was favored by 88%, while use of anesthesia was favored by 72%. Half preferred their son's TPC be conducted in a hospital, and the same number believed hospitals are safer than traditional venues. Males had significantly more

favorable beliefs surrounding hospitalized circumcision, but were less likely to support use of anesthesia, than women.

Acceptability of providing sons with MMC varied from 28 to 85% depending on hypothetical contingencies. Without any contingencies, only 28% of respondents were willing to provide MMC, despite stated benefits of partial protection against HIV. Given a MMC procedure that would maintain the physiological appearance of Maasai TPC (appendage below the glans of the penis), stated willingness to provide MMC increased to 56%. If instead the contingency were Maasai traditional leadership support for MMC, 84% would be willing to provide MMC. Willingness contingent on traditional leadership support was significantly higher (t=5.7, p<0.000) than the physiological contingency, which was in turn significantly higher than willingness in absence of contingencies (t=8.1, p<0.000). This indicates that while traditional custom was important, current doctrine of traditional leadership had more impact on acceptability of changing circumcision procedures.

A series of three logistic regression analyses predicted the three willingness items above; together, the models indicate that contingent environmental changes alleviated the association between willingness and cultural variables (Table 3). In the first model, overall willingness was predicted by cultural items, including a traditional beliefs scale (AOR 0.62, CI 0.45, 0.85) and Christian religion (AOR 2.10, CI 1.2, 3.6), and by medical concerns, including believing hospital circumcisions are safer than the bush (AOR 2.68, CI 1.2, 5.8). The latter two willingness items contingent on traditional appendage and traditional leader support were not predicted by cultural items, but instead were predicted by medical concerns. Acceptability given traditional appendage was predicted by

preference for medical supplies (OR 2.42, CI 1.1, 5,5) and willingness given leadership support was predicted by believing hospitals are safer than the bush (OR 2.65, CI 1.1, 6.6).

Discussion

This study found that the majority (72%) of Maasai circumcisions are conducted in group settings with a shared blade that is not sanitized between initiates. Despite current practices, there is high demand for proper sanitation, and high willingness to completely alter the circumcision procedure and location if traditional leaders support such a change.

Non-sanitized, shared circumcision instruments pose a risk for transmission of blood-borne pathogens such as HIV, hepatitis B and C, and syphilis. In addition to these risks, several studies have found traditional circumcision to result in higher rates of complication than MMC (Bailey et al., 2008; Peltzer et al., 2010). As MMC programs are scaled up in non-circumcising communities, efforts should be made to increase access to safe and efficacious circumcision among traditionally circumcising groups.

One path to achieve safer circumcision is to provide medical supplies, instruments and training to traditional practitioners. Given the high demand among our study population for improved sanitation, this strategy could be effective. Yet even if training is effective and prevents blood-borne transmissions, this intervention would not resolve higher rates of TPC complication or the unknown TPC HIV prevention efficacy. Moreover, one research team has had limited success in producing a sufficiently efficacious training intervention (Peltzer et al., 2010; Peltzer et al., 2008), indicating that circumcising customs of traditional practitioners may be intractable.

Another option to achieve safer circumcision is to perform MMC in hospitals; this approach would allow for optimal safety and certain HIV prevention efficacy. In a separate study conducted in Tarime District, Tanzania, 96% of respondents supported MMC for their children (Wambura et al., 2011). Participants in the present study were less supportive, with only 28% supporting MMC. Provided traditional leader support for MMC, however, support rose to 84%. Together, these studies indicate potentially high variation in demand, and the drivers of demand, for MMC among traditionally circumcising communities. This suggests that future MMC programs may need to be tailored to account for cultural differences between traditionally circumcising groups.

This study has several limitations. The sample contains males up to age 55, and circumcision practices have likely shifted to some degree over the last 25 years; yet in comparing circumcisions conducted between 2000-2008 to those conducted from 1975-1999, we found neither statistically nor clinically significant differences in instrument sanitation. Another limitation is reliance on self-report of initiates; direct observation of circumcisions would yield more accurate and timely recording of circumcision practices. Studies using contingent valuation methods (such as willingness) may over-estimate actual levels of action, although whether this would be the case for our study population is unclear, as contingency over-estimation does not apply to all cultures (Ehmke, Lusk, & List, 2008).

The levels of circumcision instrument sanitation found in this study indicate severe and unacceptable risk to initiates. Ministries of Health in countries with large groups performing traditional circumcisions should further investigate this problem, and how it can be mitigated. Until MMC programs can be brought to scale throughout traditionally

circumcising communities like the Maasai, a stop-gap measure of providing traditional circumcisers with training, sanitary blades, antiseptic solution and medical supplies to more safely circumcise initiates could prevent transmission of blood-borne pathogens. In the long-term, however, epidemiological studies assessing the efficacy of different traditional circumcision methods should be conducted. Currently, MMC for traditionally circumcising communities provides the best combination of safety and certain HIV prevention efficacy. As circumcision is an important rite of passage in many cultures, changing current practice will require balancing tradition and the benefits of MMC. Our results indicate that support from traditional leaders can be more important than adherence to tradition itself, and future programs will benefit from direct collaboration with traditional leaders in program design and implementation.

Table 1 Circumcision instrument sanitation
and ritual

	%[a]	n[a]
Circumcision details		
Circumcised	89	156
Age of circumcision		
<15	6	6
15-17	35	39
18-20	47	53
>20	12	13
Received traditional training after circumcision	84	131
Length of training		
1 month or less	19	24
2-3 months	46	56
4 or more months	35	40
Circumcision group size		
1 (circumcised alone)	9	18
2 to 3	54	80
4 to 5	19	31
6 or more	18	26
Circumcision Instrument Sanitation		
Circumciser's knife used on group, uncleaned	16	26
Circumciser's knife used on group, rinsed in water	56	75
Circumciser's knife used on group, medical solution	4	5
Circumciser's knife not used on group	20	28
Own knife used	5	9

[a] Weighted %, unweighted n

Table 2 Circumcision practices and opinions by gender

	All % (n)[a]	Males % (n)[a]	Females % (n)[a]	χ^2 test p
Preferences for circumcision sanitation				
Prefer traditional practitioner use medical supplies	88 (322)	90 (159)	86 (163)	0.58
Use anesthesia for son if no cost	72 (262)	61 (106)	81 (156)	< 0.00
Prefer circumcision in hospital	51 (182)	69 (115)	35 (67)	< 0.00
Believe hospitals safer than traditional circumcision	51 (182)	58 (100)	46 (82)	0.1
Willingness to change circumcision technique for son				
Willing to provide medical circumcision	28 (99)	38 (63)	19 (36)	0.01
Willing to provide medical circumcision if it produces a buttonhole appendage	56 (199)	61 (99)	53 (100)	0.29
Willing to provide medical circumcision if traditional Maasai leaders support change	84 (307)	83 (144)	86 (163)	0.33

[a] Weighted %, unweighted n

Table 3 Logistic regressions predicting contingent willingness to provide sons with male medical circumcision (MMC)

	Predicting willingness to provide MMC		Predicting willingness to provide MMC with traditional appendage		Predicting willingness to provide MMC with traditional leader support	
	Univariate	Multivariate	Univariate	Multivariate	Univariate	Multivariate
	OR (95% CI)	AOR (95% CI)	OR (95% CI)	AOR (95% CI)	OR (95% CI)	AOR (95% CI)
Traditional beliefs scale	0.58 (.42, .79)**	0.62 (.45, .85)**	0.93 (.59, 1.5)	-	1.00 (.58, 1.7)	-
Christian Religion	2.22 (1.5, 3.3)**	2.10 (1.2, 3.6)**	1.35 (.87, 2.1)	-	1.79 (.92, 3.5)	-
Believe hospital circumcision is safer than bush	4.26 (2.6, 7.1)**	2.68 (1.2, 5.8)*	1.08 (.65, 1.8)	-	2.50 (1.4, 4.6)**	2.62 (1.4, 4.9)**
Prefer use of medical supplies	13.3 (1.6, 113)*	-	2.42 (1.1, 5,5)*	2.37 (1.0, 5.4)*	1.76 (.85, 3.6)	-

*p<.05, **p<.01
Multivariate analyses are adjusted for significant demographic variables

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Condoms "contain worms", "cause cancer" and "cause HIV" in Tanzania: Negative Condom Beliefs Scale development and implications for HIV prevention

Abstract

Condom promotion remains a key component of HIV prevention, complimenting recent successes in HIV prevention. Although condom use has increased in much of East Africa, it still remains substantially below optimal levels. Existence of negative condom rumors in East Africa has been documented, yet the prevalence of belief in negative rumors and their subsequent impact has not been explored. This study evaluated levels of belief in negative condom rumors, developed the Negative Condom Beliefs Scale (NCBS), and assessed how it predicts willingness to use condoms. A geographically stratified, cluster survey (n=370) was conducted representing adults in two rural districts in Northern Tanzania in 2008. NCBS item agreement ranged from 35-53% for the following rumors regarding condoms: causing cancer, having holes, containing HIV, having worms and the worms causing HIV. The NCBS loads on a single latent factor, has high internal consistency and indicates convergent validity. In a multivariate model, NCBS 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 condom beliefs, with two out of three respondents affirming belief in at least one negative condom rumor. This study highlights the relationship between condom rumor beliefs and condom use, and indicates avenues for future research and HIV prevention program design.

Introduction

Despite new successes in HIV prevention such as circumcision (Gray et al., 2007), ARV treatment effects (Cohen et al., 2011) and PrEP (Grant et al., 2010), condoms still remain an important component of HIV prevention programs. In fact, condom promotion as part of HIV testing and counseling is currently required to be provided in tandem with ARV treatment and medical circumcision programs (Herman-Roloff et al., 2011; National AIDS and STI Control Programme, 2008). Yet condom promotion interventions in low-income settings have shown mixed success in controlling the HIV epidemic (Foss et al., 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, increasing levels of condom use in high HIV prevalence settings has proven to be challenging. For instance, 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 6-14% in these countries (UNAIDS / WHO, 2009a). For purposes of comparison, the United States has similar condom use rates, 41% and 31% respectively, while having a HIV prevalence of less than ½ of 1 percent (MMWR, 2008; Reece et al., 2010). New data indicates that low condom demand, rather than low condom supply, is the primary factor limiting condom uptake in Eastern Africa (Papo et al., 2011). A recent visit by the Principle Investigator to a rural Tanzanian District Hospital confirmed this.

With tens of thousands of condoms donated by an international agency piled in his office, the head doctor explained that, despite the many people passing through his office, about one individual each month came to pick up free condoms.

Self-reported condom use, 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. *Socio-demographic variables* of education (Baker et al., 2010; Bogale et al., 2010; Cherutich et al., 2008; Maharaj & Cleland, 2005; Msamanga et al., 2009), female gender (Papo et al., 2011; Schaalma et al., 2009), unmarried status (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 represent 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 et al., 1997). This association is supported by a meta-analysis that found 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 et al., 2007). The association between *HIV knowledge* and condom use is less clear, with some studies finding a positive association (Ford et al., 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 et al., 2008), sexual decision-making empowerment (Lema et al., 2008; Tassiopoulos et al., 2009), inter-partner communication (Adebiyi & Asuzu, 2009; Hendriksen et al., 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 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 basal to negative condom beliefs in Eastern Africa are little understood. A qualitative study by Thomsen and colleagues identified 50 different negative condom beliefs held by men in Kenya (Thomsen et al., 2004), yet no ensuing research has identified which beliefs are most prevalent and whether they impact condom use. Current quantitative condom measures are limited in explicating 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 correspond to condom use (Heeren et al., 2008; Twa-Twa et al., 2008). In order to improve intervention designs, gaining a better understanding of factors that make condoms undesirable may have an important role.

During fieldwork for a previous 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, (MacQueen et al.) worms are a fact because they will appear if you leave a condom in the sun and (3) the worms in condoms cause HIV. Upon further inspection, we found the rumor to be widespread. We verified its presence in rural Kisarawe District, remote northern Ngorongoro District, and Dar es Salaam. Discussion with colleagues in South Africa, over 2,000 miles from the site of our initial discovery, revealed they have encountered the same worm rumor. The present study seeks to explore such negative condom attitudes by providing the first quantitative description of belief in specific condom rumors, developing the Negative Condom Beliefs Scale (NCBS), and assessing whether the NCBS is associated with decreased willingness to use condoms.

Methods

Study Design

A 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. 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, 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. Random selection for participation occurred at three levels: 37

local leaders were selected from the sampling frame, 11 households were selected from

each local leader's jurisdiction (for areas with <11 households, we sampled nearest

neighboring unit), and one adult member was selected from each household. For those

consenting to participate, face-to-face interviews were conducted by native Maa speakers.

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 4-8%, 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 age 18-60. Males and females were eligible if they knew their age to

be 18-60. If age was unknown, age was estimated based on relevant information such as

age set of the participant or their father.

Measures

All measures were team-translated from English to 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, are adapted from the

Tanzanian DHS Survey (National Bureau of Statistics Tanzania and ORC Macro, 2005).

As the Maasai often do not measure age by years, we created age ranges that roughly align with emic Maa age categories. *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 was ascertained based on strategies employed by Jewkes et. al. (Jewkes et al., 2002) to increase accuracy of partnership reporting. This resulted in seven local partnership categories, roughly translated as (1) pre-marital boy/girlfriend, (MacQueen et al.) extramarital lover, (3) esoto partner, (4) traditional ceremony partner, (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 Survey, 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 valuating 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 as part of efficacy, thus infringing on the condom expectancies measures below.

Condom expectancies measures were created based on a series of thirty semi-structured qualitative interviews that provided data for NCBS creation. 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. Participants in semi-structured interviews also frequently expressed concern regarding anonymity in obtaining condoms. We created a perceived anonymity measure, "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.

The dependent variable in the analyses, *willingness to use condoms*, was measured with, "If condoms were affordable, accessible, and my partner was ready to try them, I would use them." 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 (WLSMV) 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. Convergent validity of each scale item was assessed with

correlational analyses using willingness to try condoms. Cronbach's alpha was used to assess scale reliability. Demographic, Maasai 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 (NCBS). A multivariate logistic regression, guided by procedures recommended by Hosmer and Lemeshow, was conducted to assess predictors of willingness to use condoms (Hosmer & Lemeshow, 2000). All analyses were conducted in STATA 11.2, except the factor analysis conducted in MPLUS 6.1. All analyses were adjusted to account for the clustered survey design.

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).

Results

NCBS Item Analyses

Table 1 shows that between 35% and 53% of respondents agree with each

negative condom rumor that comprises the NCBS. Five items addressing condom rumors

were included in the final NCBS: condoms cause cancer (35% agreement), condoms have

holes (53%), condoms contain HIV (47%), condoms contain worms (49%), and the

worms in condoms cause HIV (49%). One positively worded item, condoms prevent HIV

transmission (55% agreement), was also included in the final scale. The belief that using

a condom is like eating candy in the wrapper, excluded from the final scale (see below),

shows that the majority of respondents hold negative hedonistic beliefs. Nearly two out of

three respondents (65%) agree with at least one negative rumor included in the final

scale.

Scale dimensionality, convergent validity and internal consistency

Exploratory factor analysis (Refaat) indicates a unidimensional scale, and supports

including all items except the hedonistic item (condoms are like candy) in the final scale.

The scree plot indicates loading on one factor, and this conclusion is supported by all

eigenvalues for multi-factor models being below one. Item factor loadings above 0.4 and

percent of variance explained above 0.2 indicate appropriate item fit for all items in the

final model. Fit indices indicate good EFA model fit for the final scale. Hu and Bentler

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 (Hu & Bentler, 1999). For the final EFA model, SRMR=0.059 and CFI=0.996 both suggest good fit.

The NCBS correlations indicate convergent validity. For four out of six final NCBS items, univariate χ^2 associations with willingness to try condoms are significant at p<.01. The two non-significant relationships trend in the predicted direction. A total of seven people reported ever using a condom, so cells were too small to perform χ^2 analyses. Cell counts indicate item validity, however, with five of six scale items having all condom users reporting no negative condom beliefs.

Internal scale consistency in this sample, as measured by Kuder-Richardson 20 (KR20), is high for the entire sample and across demographic groups. KR20 is an internal reliability measure similar to Cronbach's alpha that is appropriate for use with scales consisting of dichotomous items. Measures of KR20 above 0.7 are considered to have good internal consistency. For the whole sample, KR20=0.88. It is similarly high for those with no education (KR20=0.89) versus those with some education (KR20=0.86) and for those age 30 or under (KR20=.89) versus those over 30 (KR20=.88). Consistency is slightly lower for males (KR20=0.77) than females (KR20=0.93), although both scores fall in the range of having good internal consistency.

Out of 370 survey participants, 268 (72%) completed all six NCBS items and 308 (83%) completed at least five of six items. 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 NCBS score, with higher scores indicating more negative condom beliefs.

Demographics and the NCBS

As seen in Table 2, roughly half the sample is female (53%) and the age of respondents is evenly split among those under 30 and those 31-45, with a one-fifth remainder in the 45-55 range. Over half hold Maasai traditional spiritual beliefs (59%); the balance is Christian. The majority hold no education (61%), are married (78%) and have a phone or radio (54%). Cattle are the principle source of wealth and savings among rural Maasai; about half (49%) report less than 20 cattle, indicating negligible wealth. Few demographics are predictive of the NCBS scores, with only male gender servings as a significant predictor (β=1.17, 95%CI: 0.4, 2.0). Male gender is predictive of willingness to use condoms (OR=2.13, 95%CI: 1.2, 3.7), as is higher education (OR=2.18, 95%CI: 1.1, 4.1); both demographic variables are controlled for in the final regression model predicting willingness to use condoms.

Condom use intentions predicted by NCBS

Predictors of willingness to use condoms are presented in Table 3. The NCBS was a significant predictor of condom willingness in both univariate and multivariate models. Items relating to *condom expectancies* (NCBS and anonymity of condom acquisition) and *condom self-efficacy* were significant, while 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 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 indicate that, in our model, the NCBS has the strongest value in predicting condom willingness (-0.39), followed by anonymity (0.31) and self-efficacy (0.26). Receiver Operating Characteristic (Papo et al.) curves similarly demonstrate utility of the NCBS. ROC area scores allow for assessment of model fit; scores of $0.5 \leq ROC < .7$ suggest poor discrimination, $0.7 \leq ROC < 0.8$ adequate discrimination and $0.8 \leq ROC < 0.9$ excellent discrimination (Hosmer & Lemeshow, 2000). The full model including NCBS (ROC=0.81, SD=.03) fit significantly better (χ^2=27.24, df=2, p<.000) than models containing anonymity and self-efficacy variables (ROC=0.77, SD=.03), or the self-efficacy only model (ROC area=.69, SD=.03).

Discussion

Overview

To our knowledge, this is the first quantitative study of condom rumors in Africa. Study results demonstrate remarkably high levels of negative condom beliefs, with two out of three respondents affirming belief in at least one condom rumor. Condom rumors seem widespread, as we studied them in Tanzania, while colleagues encountered similar rumors over 2,000 miles away in South Africa. Condom rumors are not only widespread, but also pernicious; believing condoms have worms, contain HIV or cause cancer is likely to make them highly unappealing to potential users. Not surprisingly, belief in 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 detailed nature and concrete visual of the rumor.

Despite some respondent uncertainty regarding condom rumors, individual NCBS items and the scale as a whole are 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, perceived anonymity of condom acquisition, was like the NCBS a component of *condom expectancies*. This finding indicates that condom expectancies may play a key role in condom use, and merits further research into the impact of both localized and global expectancy factors. Our study also found *condom self-efficacy* to be associated with condom willingness, which echoes other research (Babalola, 2006; Bogale et al., 2010; Kabiru & Orpinas, 2009; Maticka-Tyndale & Tenkorang, 2010; Schaalma et al., 2009; Thorpe et al., 1997). *HIV knowledge* in our study, as in other previous studies (Kabiru & Orpinas, 2009; Zellner, 2003), was not predictive. *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). Our measure for risk perception assessed actual risk, total number of sexual partners, which may not impact risk estimation as strongly as perceived susceptibility.

Results from survey scale items indicate a substantial underlying uncertainty regarding the utility of condoms. At first glance, that 65% of respondents agreed with at least one negative rumor while 55% agreed that condoms prevent HIV seems contradictory. 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 general respondent comprehension of survey items, and multiple rounds of cognitive interviewing should have exposed serious problems with individual item

comprehension. Acquiescence bias likely explains a portion of this contradiction; seven percent 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 are mutually exclusive. A potential explanation is that some respondents may feel uncertainty regarding whether condoms work, and in turn 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 may be amenable to change.

Our results underscore the importance of developing locally appropriate items for behavioral studies in international settings. Locally developed items can provide useful supplementation for previously validated scales and instruments. For our study, this was done through a qualitative assessment period that informed development of items such as the NCBS. The impact 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 devised from previous scales or instruments. Out of three non-demographic predictors in the final regression model, two (NCBS and perceived anonymity in purchasing condoms) came from the small pool of variables developed specifically for our study population. While DHS surveys allow for cross-country comparisons and thus have an important role in program design, our results indicate surveys aimed at incorporating new and location-specific information may also

play an important role in planning and developing efficacious 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. For instance, in one village the

principle investigator simultaneously met with local leaders about an HIV prevention

program and 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 relationships should be interpreted as

associations that do not indicate causation. 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 may not generalize to other populations. Condom use

was low in the study population, so NCBS association with willingness to use condoms,

an imperfect proxy, rather than actual condom use was necessary. The survey was

translated from English into a transliterated Maa, and thus errors in translation may

impact results despite efforts to mitigate this effect including team translation, back-translation and cognitive interviewing.

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. Creation of the NCBS provides an important inroad for future research into this topic. The six-items on the NCBS load on a single latent factor, have high internal consistency and convergent validity is indicated in univariate and multivariate models. Future research should assess geographic generalizability, rumor associations with actual condom use, NCBS validation and strategies to alter negative condom beliefs.

Table 1

Condom 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
	% (n)[a]	% (n)[a]	% (n)[a]	r	OR (95% CI)
Items included in final scale					
"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]
Items excluded from final scale					
"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)

Table 2

Demographic characterstics, mean NCBS values and association with willingess to use condoms

		Overall	NCBS	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)
	>45	19 (70)	3.55 (2.6, 4.5)	0.52 (0.2, 1.4)
Religion	Traditional	59 (218)	3.22 (2.8, 3.7)	1.00 (ref)
	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)
	Other	5 (17)	3.76 (2.7, 4.8)	1.05 (0.3, 3.3)
Religion: Attendance	< 1 day per week	63 (230)	3.29 (2.9, 3.7)	1.00 (ref)
	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)
Education	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)*
	Education: >7	3 (12)	2.02 (0.6, 3.4)	2.70 (0.8, 9.6)
Wealth: Cattle	Household: 0-20 Cattle	49 (166)	3.11 (2.6, 3.6)	1.00 (ref)
	Household: >20 Cattle	51 (204)	3.44 (2.9, 4.0)	0.59 (0.3, 1.1)
Cell Phone or Radio	No phone or radio	46 (174)	2.75 (2.2, 3.3)	1.00 (ref)
	Owns phone and/or radio	54 (196)	3.72 (3.1, 4.3)	0.89 (0.5, 1.6)
Marriage type	Not married	22 (79)	3.87 (3.2, 4.5)	1.00 (ref)
	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)
	3-6 wives	16 (54)	2.43 (1.7, 3.2)	1.32 (0.5, 3.3)

[a] Weighted %, unweighted n

[b] Controlling for other significant demographic factors

* p<.05

Table 3

Logistic regressions predicting willingness to use condoms

	OR (95% CI)	AOR (95% CI)[a]
Condom Expectancies		
Negative Condom Belief Scale		
(6-point scale)	0.79 (0.7, 0.9)***	0.67 (0.6, 0.8)***
Perceived anonymity of condom acquistion		
Some or Complete	4.25 (2.4, 7.4)***	4.36 (2.2, 8.6)***
None	1.00 (ref)	1.00 (ref)
Risk Perception		
Nonmarital partners		
Last year	1.05 (0.9, 1.3)	ns
Lifetime	1.00 (1.0, 1.0)	ns
Condom Self-efficacy		
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-point 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)	
There is treatment for HIV		
Agree	0.56 (0.4, 0.9)*	ns
Disagree	1.00 (ref)	

[a] Model adjusted for significant demographic variables.

*p<.05, ***p<.001

 ns: not significant, dropped from multivariate model.

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<u>Conclusion</u>

Summary of key sub-study findings

Negative condom beliefs scale

     Our study indicates the pervasiveness of belief in negative condom rumors in the study population, and found an association between these beliefs and lower willingness to use condoms. Creation of the NCBS provides an important inroad for future research into this topic. The six-item NCBS loaded on a single latent factor, had high internal consistency and indicated convergent validity in univariate and multivariate models. Future research should assess geographic generalizability, rumor associations with actual condom use, NCBS validation and strategies to alter negative condom beliefs.

Esoto

     The esoto ritual was responsible for the vast majority of premarital partners for attendees. Future interventions among the Maasai, informed by survey and DSSM findings, would benefit from directly addressing this area of risk. The DSSM provided a flexible framework that can serve as a tool for community-based, structural interventions. By overtly characterizing structural factors, multifaceted interventions can be designed to alter connection patterns based on a systems approach. It may be possible to leverage DSSM flexibility by using it as a tool to engage communities in developing locally appropriate structural interventions. This study is the first we know of that applies the DSSM framework to developing country settings, and further exploration of model implications for program planning and community participation are needed.

Circumcision

This study found that the majority (72%) of Maasai circumcisions are conducted in group settings, with a shared blade that was not sanitized between initiates. Despite current practices, there was high demand for proper sanitation, and high willingness to completely alter the circumcision procedure and location if traditional leaders supported such a change. As MMC programs are scaled up in non-circumcising communities, efforts should be made to increase access to safe and efficacious circumcision among traditionally circumcising groups. One path to achieve safer circumcision is to provide medical supplies, instruments and training to traditional practitioners. Yet even if training is effective and prevents blood-borne transmissions, this intervention would not resolve higher rates of TPC complication or the unknown TPC HIV prevention efficacy. Another option to achieve safer circumcision is to perform MMC in hospitals; this approach would allow for optimal safety and certain HIV prevention efficacy. Our data indicated support from traditional leaders can be more important than adherence to tradition itself, and future programs will benefit from direct collaboration with traditional leaders in program design and implementation.

Utility of a mixed-methods approach

This study used a mixed-methods study design to elucidate HIV-related behaviors of the Maasai of Tanzania. The mixed approach entailed 30 purposively sampled in-depth interviews to develop the survey, 15 purposively sampled cognitive interviews to refine the instrument and a cluster-randomized selection of 370 respondents to complete the survey instrument. Data from in-depth and cognitive interviews was recorded with

interviewer notes exclusively, in order to facilitate real-time data analysis. Real-time, emergent analysis allowed iterative changes to the facilitator guides. These changes allowed researchers to instruct interviewers to seek depth on topics that would become essential to the survey, including the esoto dance, rumors regarding condoms and circumcision practices. The research design could best be categorized as a partially mixed sequential dominant design (1). There was partial mixing in that qualitative data analysis informed, but was separate from quantitative analysis, sequential in that it occurred in stages over time, and dominant in that quantitative analysis served as the dominant form of final data analysis.

This partially mixed sequential dominant design allowed for adaptation of previously validated items and scales, and also for development of new, locally appropriate items. Although quantitative methods were dominant, the qualitative components had equal influence on study findings. The three resultant studies seem disparate, addressing diverse topics of circumcision sanitation, the *esoto* dance and condom rumors, yet they are interrelated in that the principle findings stem from newly developed items, and are complemented by extant scales. The qualitative phase of survey development was necessary to identify areas of inquiry, while the quantitative deployment allowed for a better understanding of the magnitude and population-level context of each issue. Mixed-methods studies are increasingly common (2), and the utility of a mixed approach in our study is that neither method alone would be sufficient. In absence of a mixed methods approach, important findings such as the *esoto* dance being the largest source of lifetime sexual partnerships, or negative condom rumors being the best predictor of willingness to use condoms, would be entirely absent. Furthermore,

this project indicates that mixed methods studies can be done in resource-constrained settings; even abbreviated, note-based qualitative data can fundamentally alter a quantitative survey approach.

Utility of culturally-tailored studies

Interestingly, the mixed-methods yield of detailed, location- and culturally-specific information actually allows for appropriate construction of macro structural interventions. For instance, understanding the magnitude of risk allows future programs to target the high concurrent partnership esoto dance rather than other qualitatively identified, but low magnitude, risks such as wife-sharing. Moreover, the micro-level data indicates how to implement structural programs; understanding that female gender and adherence to traditional esoto beliefs predict esoto attendance indicates that structural programs should incorporate elements to address gendered roles and traditional norms.

Items culturally-tailored to the Maasai yielded data that highlighted problems that may generalize to other populations. For instance, we found the rumor that condoms have worms to be present not only in rural Districts, but also in the Tanzanian capital of Dar es Salaam; colleagues report that the rumor is present in South Africa, 1200 miles away from our study site. Likewise, circumcision instrument sanitation issue may be problematic in other traditionally-circumcising populations, as previous research has indicated that traditional blades are often used (3), and that traditional circumcision results in higher rates of infection than medical circumcision (4). Both instrument sanitation and condom rumors merit further research to assess generalizability, yet these findings have implications for the conduct of cross-cultural behavioral research. In order

to understand broad trends, such as low rates of condom use, standardized surveys like the DHS may not be sufficient. Future research should incorporate analysis of granular, culturally-specific data when investigating intractable problems embedded in cultural mores.

Study implications for future research

Future research into condom rumors would be useful; the NCBS should be assessed in terms of test-retest reliability, as well as external validity in other populations. Moreover, future studies should address the utility of the NCBS in predicting actual condom use. Subsequent studies, if the NCBS were shown to have validity in other populations, would be the design and evaluation of interventions to address negative condom rumors.

Future research on circumcision should address two areas: HIV prevention efficacy of various traditional circumcision methods and efforts to improve instrument sanitation and circumcision outcomes. Epidemiological studies are needed to assess whether traditional circumcision that does not remove all the foreskin provides the same level of protection as medical circumcision. Moreover, efforts to improve circumcision sanitation, and decrease rates of complications, are needed. These interventions should include assessments of programs to train traditional practitioners and programs to encourage communities to adopt medical male circumcision.

Study implications for future programs among the Maasai

The esoto dance is the principle source of sexual partnerships among the Maasai, and structural interventions should be designed and implemented to address it. Addressing negative condom beliefs will likely be an important part of this program, as will changing eligibility to prevent participation of female minors. One advantage of structural programs is that they can simultaneously address other areas of risk for the Maasai. Traditional practitioner circumcision has health risks, and a structural program could easily impose more restrictions on practitioners of traditional circumcision, requiring use of disposable surgical blades and gloves. Traditional leaders hold an important role among the Maasai, and future interventions should involve collaborations that directly incorporate their influence.