



Entertainment-Education and HIV/AIDS Prevention: A Field Experiment in Tanzania

PETER W. VAUGHAN

Macalester College
St. Paul, Minnesota, USA

EVERETT M. ROGERS

University of New Mexico
Albuquerque, New Mexico, USA

ARVIND SINGHAL

Ohio University
Athens, Ohio, USA

RAMADHAN M. SWALEHE

Ministry of Community Development,
Women Affairs, and Children
Arusha, Tanzania

Entertainment-education is the process of designing and implementing an entertainment program to increase audience members' knowledge about a social issue, create more favorable attitudes, and change their overt behaviors regarding the social issue. The results of a field experiment in Tanzania to measure the effects of a long-running entertainment-education radio soap opera, Twende na Wakati (Let's Go with the Times), on knowledge, attitudes, and adoption of human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS) prevention behaviors are presented. Multiple independent measures of effects and the experimental design of this study confer strong internal and external validity regarding the results of this investigation. The effects of the radio program in Tanzania include (1) a reduction in the number of sexual partners by both men and women, and (2) increased condom adoption. The radio soap opera influenced these behavioral variables through certain intervening variables, including (1) self-perception of risk of contracting HIV/AIDS, (2) self-efficacy with respect to preventing HIV/AIDS, (3) interpersonal communication about HIV/AIDS, and (4) identification with, and role modeling of, the primary characters in the radio soap opera.

Introduction

"I have listened to your program and understood that this radio program

Address correspondence to Peter W. Vaughan, Visiting Assistant Professor, Department of Biology, Macalester College, 1600 Grand Avenue, St. Paul, MN 55105, USA. E-mail: vaughan@macalester.edu

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Twende na Wakati will save my life and that of my wife." (A male letter-writer to the radio soap opera in 1997)

In recent years, the entertainment-education strategy has been applied to address a variety of social problems, including unsupported population growth, gender inequality, environmental pollution, and HIV/AIDS prevention and control. *Entertainment-education* is the process of designing and implementing an entertainment program to increase audience members' knowledge about a social issue, create more favorable attitudes, and change their overt behaviors regarding the social issue (Singhal & Rogers, 1999).

The entertainment-education strategy has been consciously applied to HIV/AIDS prevention and control in the form of popular radio and television soap operas, for instance, *Soul City* in South Africa, *Twende na Wakati* (*Let's Go with the Times*) in Tanzania, *Tinka Tinka Sukh* (*Happiness Lies in Small Things*) in India, *Nshikakomona* (*I Have Not Seen It*) in Zambia, and *Kamisama Mo Sikoshidake* (*Please God Just a Little More Time*) in Japan; talk shows such as *Dialogo* in Costa Rica and *Good Times with DJ Berry* in Uganda; popular music and celebrity concerts, for instance, Franco Luambo's hit song "Beware of AIDS" in Zaire and the Hits for Hope concerts in Uganda; feature films such as *Philadelphia* in the United States and *It's Not Easy in Uganda*; animation films like *Karate Kids* targeted to street children in over 100 countries; and competitive events like bicycle rallies in Uganda, soccer matches in Cameroon, and condom-blowing contests in Thailand (Church & Geller, 1989; Johns Hopkins University Center for Communication Programs [JHU/CCP], 1995; Piotrow, Kincaid, Rimon, & Rinehart, 1997; Rogers et al., 1999; Singhal & Rogers, 1999; Van den Borne, Tweedie, & Morgan, 1996; Watts, 1998; Yoder, Hornik, & Chirwa, 1996).

Research evaluations of these programs suggest that the entertainment-education strategy—through its use of formative research, audience segmentation, a multimedia campaign approach, media celebrities, and other creative techniques such as humor, animation, claymation, and others—can be highly effective in promoting HIV/AIDS prevention and control (Church & Geller, 1989; Piotrow et al., 1997; Singhal & Rogers, 1999; Valente, 1997). Generally speaking, *evaluation studies have found that entertainment-education interventions have measurable effects on changing HIV prevention behavior.*

The present article investigates an especially intriguing case of an entertainment-education radio soap opera, *Twende na Wakati* in Tanzania, which demonstrated strong audience effects on HIV/AIDS prevention.

Theories of Human Behavior Change Related to HIV/AIDS Prevention

Behavioral studies find consistently that knowledge about the causes, consequences, and methods of prevention of HIV infection is necessary but insufficient to stimulate behavior change (Fishbein & Guinan, 1996; Kirby, 1985; Stiffman, Earls, Dore, & Cunningham, 1992). Positive relationships exist between (1) self-efficacy beliefs about control of one's sexual behavior, (2) interpersonal communication about condom use with sexual partners or opinion leaders, (3) feelings of personal susceptibility to HIV/AIDS, (4) belief in the efficacy of preventive behaviors, (5) perceived social norms with respect to preventive behaviors, and (6) perceived barriers to the adoption of preventive behaviors and adoption of HIV preventive behavior

¹ Although a meta-analysis conducted by Gerrard, Gibbons, & Bushman (1996) of 32 studies found little support for this relationship.

(Bandura, 1994; Dearing, Meyer, & Rogers, 1994; Rosenstock, Strecher, & Becker, 1994; Vanlandingham, Suprasert, & Grandjean, 1995).

These empirical findings suggest that HIV/AIDS prevention programs that emphasize social cognitive dimensions, rather than just informational aspects, should be more effective in achieving behavioral change (Jemmott & Jemmott, 1992). Several theories and models of human behavior change have been applied to mass media and other interventions to promote HIV prevention behaviors (DiClemente & Peterson, 1994; Leviton & O'Reilly, 1996). Cognitive models, such as the health belief model (Rosenstock, Strecher, & Becker, 1994) and the theory of reasoned action (Fishbein, Middlestadt, & Hitchcock, 1994; Vanlandingham et al., 1995), have been found to be highly relevant in explaining HIV prevention behaviors. The key intervening variables at the level of an individual have been identified as (1) perceived susceptibility to HIV infection, (2) perceived severity of AIDS, (3) perceived benefits of prevention behaviors, (4) perceived barriers of adopting prevention behaviors, and (5) the individual's perceived ability to adopt the prevention behavior (self-efficacy). Psychosocial models, such as social cognitive theory (Bandura, 1994, 1997a, 1997b), emphasize the importance of such concepts as (1) self-efficacy, (2) role modeling of behavioral change, (3) the consequences of alternative behaviors, and (4) beliefs about normative behavior within the local cultural setting. Diffusion theory (Dearing et al., 1994; Rogers, 1995) and social-movement theory (Friedman, Des Jarlais, & Ward, 1994) emphasize the importance of (1) interpersonal communication in social networks, (2) opinion leadership by trusted local individuals, (3) credible and homophilous change agents, (4) making the behavioral change compatible with local cultural standards, and (5) community organization and mobilization in promoting HIV prevention. Staged models of behavior change (Polacek, Celantano, O'Campo, & Santelli, 1999; Schnell, Galavotti, Fishbein & Chan, 1996) posit that there are discrete stages of change and processes of change and that interventions need to be stage appropriate for each individual. These various behavior change models are not mutually exclusive; they differ mainly in their emphasis on self-efficacy, interpersonal communication, efficacy beliefs about the behavior change, and the belief in the personal threat from AIDS. They recognize that the same behavioral outcome may be influenced by different factors in different populations. For example, self-efficacy may be more important in one population, whereas perceived social norms may be more important in another (Fishbein & Guinan, 1996).

Many HIV/AIDS interventions in which these behavioral change models were applied have been at the individual, small group, or community level, rather than at the national level, such as through mass media communication. Vaughan and Rogers (1999) integrated elements of these behavioral models, such as stages of behavioral change (Prochaska, DiClemente, & Norcross, 1992), self-efficacy, and role modeling (Bandura, 1977a, 1997b), homophily, self-relevancy, and interpersonal communication (Rogers, 1995) in evaluating the effects of mass media interventions, particularly those based on the entertainment-education strategy (Singhal & Rogers, 1999).

The first randomized controlled study of an HIV prevention intervention in a general population was conducted in Tanzania. This study focused on the medical treatment of other sexually transmitted diseases (STDs) to prevent HIV/AIDS (Grosskurth et al., 1995). In a randomized controlled study of an AIDS education curriculum for primary students in Tanzania, Klepp, Ndeki, & Leshabari (1997) demonstrated that such programs can improve audience members' knowledge and

African societies, inhibit the ability of women to insist that their partner(s) use a condom (Gomez & Marin, 1996).

Radio is the most important source of AIDS information in Tanzania. In 1996, the Tanzania Demographic and Health Survey (TDHS) found that 64% of women (N = 8,120) and 87% of men (N = 2,256) cited radio as their primary information source about AIDS (Bureau of Statistics, 1997). The 1996 TDHS also demonstrated that 97% of women and 99% of men were aware of AIDS. However, some 35% of Tanzanians did not know how to prevent HIV in 1996. Some 55% of men and 39% of women knew that condoms could prevent HIV infection, and 25% of Tanzanians felt that the risk of HIV infection could be reduced by having a single sex partner (Bureau of Statistics, 1997). Widespread misunderstandings about HIV transmission exist in Tanzania. For example, many young people do not associate illness with sexual activity, or believe that they cannot contract HIV (International Planned Parenthood Federation [IPPF], 1994). Rumors such as that the condom lubricant contained HIV, that young or heavy people cannot have AIDS, and that it is possible to know who has HIV by casual observation are common (Sharif, 1993). Only 13% of women and 7% of men in Tanzania considered themselves to be at "great risk" of contracting HIV/AIDS in 1996 (Bureau of Statistics, 1997).

Given the absence of an AIDS vaccine or cure, communication campaigns to alter HIV-risky behaviors remain the only effective response (Potts, Anderson, & Boily, 1991; Gilks, 1993; Coates & Collins, 1998). Two main alternatives exist in Tanzania for an individual to reduce her or his risk of contracting HIV, neither of which is problem-free. First, an individual can limit the number of sexual partners or be abstinent. This behavioral approach has the advantage that it is not dependent on the availability or use of condoms. But abstinence and monogamy are difficult to maintain. Also an individual's personal risk is dependent on the sexual behavior of their partner(s). Thus a monogamous wife still may be at risk if her husband has other sex partners. Another alternative is to use condoms. This behavioral approach reduces the HIV risk for an individual, independent of the fidelity of one's partner, but is dependent on the reliability of condom supply, negotiation of use, and concerns about the efficacy, social acceptance, and safety of condoms.

Tanzania adopted a national policy on AIDS prevention and control in 1995 (Ministry of Health, 1995). Prevention programs emphasize behavioral changes such as abstinence, reduced number of sexual partners, and increased condom use. Awareness/knowledge of condoms is high in Tanzania: The 1996 TDHS indicated that some 72% of women (N = 8,120) and 95% of men (N = 2,256) were aware of condoms. But knowledge of where to obtain condoms is lower: Only 58% of women and 74% of men who know about condoms knew where to obtain them. The belief that condoms are an effective means of preventing HIV is lower still (39% of women and 55% of men), and only 5% of women and 16% of men had used a condom during their last sexual act with any partner (Bureau of Statistics, 1997). Further, condom availability can be irregular. Programs in Tanzania to promote condoms include an AIDS Control and Prevention (AIDSCAP) program that targeted truck drivers and barmaids along major highways (Finger, 1993; American Medical and Research Foundation [AMREF], 1992), nationwide distribution of condoms by the NACP, and social marketing of condoms by various nongovernmental organizations [NGOs].

Communication Intervention

Radio Tanzania (RTD), in collaboration with the Ministry of Health (MOH) and

behavioral intention to perform desired behaviors. Subsequently, few such randomized controlled studies of behavioral interventions to prevent HIV infection have been conducted, as generally they are expensive and complex undertakings. Also, the ethical dimensions of withholding potentially life-saving information from control group members can be troubling (Walters, 1988). Middlestadt et al. (1995) found that a radio advertising campaign in St. Vincent increased (1) self-efficacy with respect to preventing HIV infection, (2) interpersonal communication about condom use, and (3) normative beliefs about condom use among peers. However, this uncontrolled, retrospective study suffered important validity threats because of self-selection by comparing exposed and unexposed groups and by utilizing a small sample size. Yoder et al. (1996), who studied the effects of a radio serial drama in Zambia, *Nshikamona*, concluded that the intervention had minimal impact on AIDS prevention knowledge, attitudes, and behaviors, although the validity of their conclusions are compromised by a serious contamination of the control group, resulting in a low power to detect changes (Valente, 1997).

The present study of the Tanzanian entertainment-education radio soap opera, *Twende na Wakati*, represents the first field experiment design for evaluating a mass media HIV/AIDS prevention campaign at the national level among a general population. The effects of the radio soap opera are examined on the respondents' knowledge, attitudes, and practice of HIV prevention behaviors.

Methodology and Data Collection

Research Site and HIV/AIDS

Tanzania, an East African country of 30 million people, is one of several countries that compose the so-called AIDS Belt, where 2% of the world's population live but where nearly 50% of the world's AIDS cases are found (Caldwell & Caldwell, 1996). The first three cases of full-blown AIDS were reported in Tanzania in 1983; by 1996, some 88,667 AIDS cases were reported (National AIDS Control Programme, Tanzania [NACP], 1997). This figure is a gross underestimate, however, as only 1 in 5 AIDS cases usually are reported. The actual number of AIDS cases in Tanzania, according to conservative estimates, approached 450,000 by 1996. HIV infection rates in Tanzania are among the highest in the world. An estimated 1.4 million HIV positive individuals lived in Tanzania in 1996 (NACP; Setel, 1996).

About 90% of HIV infections in Tanzania result from unprotected heterosexual intercourse. Secondary modes of transmission include perinatal transmission from mother to infant and infected blood supplies during blood transfusions (NACP, 1996). Homosexual intercourse and intravenous drug use are relatively less important modes of transmission than they are in many developed countries (Caldwell & Caldwell, 1993). The HIV epidemic is sustained through high levels of extramarital sex, especially by men engaging in casual sex (Caldwell, Caldwell, & Quiggan, 1989; Killewo, Dahlgren, & Sandstrom, 1994; Munguti et al., 1997; Phillips & Posner, 1995). In 1996, 19% of married men, versus 5% of married women, reported having more than one sexual partner in the previous year (Bureau of Statistics, 1997). Women have a somewhat higher HIV prevalence than men, which is consistent with the general observation that low status and marginalized social groups are at greater risk for contracting HIV (Mann & Tarantola, 1998; Whiteside, 1993).² Further, gender inequities in sexual power and control, prevalent in many

² The higher HIV seroprevalence in women may be related also to the higher probability of transmission from men to women than from women to men.

the Ministry of Community Development, Women Affairs, and Children (MCDWAC) broadcast a radio soap opera, *Twende na Wakati* (Let's Go with the Times) as a UNFPA-funded communication intervention to prevent the spread of HIV in Tanzania. *Twende na Wakati* was designed with technical assistance in the entertainment-education strategy provided by Population Communications International (PCI) of New York.³ The radio soap opera was broadcast in Swahili, the national language of Tanzania, twice per week for 30 minutes from July 1993 through the end of 1999. *Twende na Wakati* promoted family planning, gender equity, and other health themes in addition to HIV prevention (Rogers et al., 1999). Our content analysis showed that *Twende na Wakati* emphasized four key HIV/AIDS prevention themes: (1) that STDs should be medically treated (in 22% of episodes), (2) that condoms are efficacious in preventing HIV infection (21%), (3) that AIDS is an incurable disease that is spread by sexual contact (13%), and (4) that various rumors about AIDS are false (13%). Between 1993 and 1995, during its first two years, these themes collectively composed about 7% of the total educational content of the radio soap opera (Swalehe, Rogers, Gilboard, Alford, & Montoy, 1995).⁴ In the 52 episodes broadcast during the last six months of 1997, these four HIV/AIDS educational themes made up 15% of the total educational content of the program.⁵

Role modeling of characters discussing HIV/AIDS was intended to stimulate interpersonal communication about AIDS by audience individuals. The characters in *Twende na Wakati* were designed to provide negative, transitional, and positive role models for HIV prevention behaviors. Negative characters provide models of the consequences of HIV-risky behaviors. For example, the main negative role model in the storyline, Mkwaju (literally translated as "walking stick"), is a highly promiscuous truck driver who does not use condoms and who ultimately becomes sick with AIDS. Our content analysis showed that Mkwaju appeared in 96% of all episodes, frequently depicted in bars or consorting with various women, thus reinforcing the concept of his promiscuity and HIV/AIDS-risky behavior throughout the radio soap opera. Transitional characters are the key identification characters for the audience and provide self-efficacious models for how to change behavior for audience members to emulate. Shime, a transitional role model, is a friend of Mkwaju's, who warns him about AIDS and tries unsuccessfully to get him to change his sexual behavior, as he himself has done. Shime's wife, Pili, a positive role model, similarly warns Mkwaju's wife, Tunu (a transitional role model), that she is at risk of HIV/AIDS as long as Mkwaju is promiscuous. Eventually, Tunu separates from Mkwaju and is spared the disease. Positive characters act as opinion leaders who provide wise counsel to others. Bina, a nurse (a positive role model), provided accurate counseling to various characters about HIV/AIDS. A 30-second epilogue at the end of each episode summarized the educational content of the program, posed rhetorical questions for listeners to ponder, and urged them to tune in to the next episode.

³ The particular entertainment-education methodology used in Tanzania was based on the work of Miguel Sabido, which draws heavily on Albert Bandura's social cognitive theory. See Narinman (1993) and Singhal and Rogers (1999) for a more detailed description of the entertainment-education methodology.

⁴ Other important educational themes in *Twende na Wakati* included (1) family planning (31% of the educational content), (2) economic development (29% of the educational content), and (3) other medical or nutritional issues (12% of the educational content).

⁵ *Twende na Wakati* was awarded the Global Media Award by the Population Institute in 1996, in part for its HIV/AIDS educational messages.

Experimental Design

By prior agreement between the MOH, RTD, and the University of New Mexico (UNM), *Twende na Wakati* was not broadcast by the Dodoma regional transmitter from 1993 to 1995 to create a comparison area for our effects research.⁶ From 1995 to 1997, *Twende na Wakati* was broadcast nationwide, including a rebroadcast of the first two years of episodes in the Dodoma area. The first two years (1993–1995) of our study provide a field experimental design to evaluate effects of the radio program, and the second two years of broadcast (1995–1997) provide an opportunity to measure replicability of the radio program's effects in the Dodoma comparison area.

Personal Interview Surveys

Five personal interview surveys were conducted by POFLEP in Tanzania, with technical assistance from UNM, beginning just prior to broadcast of *Twende na Wakati* in mid-1993 and at one-year intervals through 1997. The survey instrument measured respondents' (1) personal characteristics, (2) exposure to and perceptions of *Twende na Wakati* and other HIV/AIDS information sources, (3) knowledge about HIV/AIDS, (4) relevant attitudes, and (5) the practice of HIV/AIDS preventive behaviors.

A sampling frame of districts was created by listing the 78 districts (out of 102 mainland districts) that unambiguously fell in either the treatment or comparison areas based on RTD's broadcast reach map for each of their regional transmitters. Of these, we selected five districts by random draw without replacement in the comparison area and nine districts in the treatment area. We then compiled lists of all wards in each of the selected districts and randomly selected three wards in each district. The same 35 wards⁷ were sampled in each of our five annual surveys. Two villages in each ward, 9 10-cell⁸ leaders in each village, 4 heads of household in each 10-cell, and one eligible respondent were randomly selected from lists of all possible sampling units at each stage.

Eligible respondents included any female citizen aged 15 to 49 and any male citizen aged 15 to 60 (to match the TDHS sample of individuals of reproductive age)

⁶ The Dodoma broadcast area was chosen opportunistically, rather than randomly, because it was the only transmitter that broadcast its own programs for part of the day. Therefore, our design is a quasi-experiment, and we refer to Dodoma as a comparison area, rather than a control area. We know that some individuals traveled from Dodoma and listened to the radio program while visiting other areas. However, the difficulty of travel and low incomes of people in Tanzania suggest that such contamination would be minimal, and in our statistical tests we controlled for exposure to *Twende na Wakati* in all comparisons made at the ward level of analysis.

⁷ Wards are geographical areas roughly equivalent to a county in the United States. We experienced several sampling anomalies. One rural district (3 wards) in the comparison area was eliminated from these analyses because of violations of survey protocol by the interviewer. One ward in the treatment area was not sampled in 1993 because of a cholera outbreak. Two wards in the treatment area were not sampled in 1996 because of civil unrest, but the remaining ward in that district was triple sampled to compensate. Two wards were not sampled in the treatment area in 1997 because of a military incursion in that district, but the remaining ward in that district was triple sampled to compensate. In all statistical tests, we utilize only those 35 wards that were sampled in both 1993 and 1995. Our wards of study represent a random sample of our treatment and comparison areas, which were chosen for their known exposure to RTD broadcast signals, and thus are representative of our study areas but not of the nation as a whole. For nationally representative statistics, we utilize the Demographic and Health Survey done in 1996.

⁸ In Tanzania, households are organized in groups of about 10 households called 10-cells, with each 10-cell having an identifiable leader.

that had slept in the selected household the previous night. Each district had an average sample size of 214, and each ward had an average of 71 respondents. Listeners to *Twendé na Wakati* tended to be male, more urban, more likely to have electricity in their homes, more educated, of higher income, and of lower parity than nonlisteners. Listeners were nearly three times more likely to own a radio and were much more exposed to other HIV/AIDS radio programs than were nonlisteners (Rogers et al., 1999). Recruitment to *Twendé na Wakati* listenership was not a random process, but the result of a self-selection based in part on socio-economic status and radio access.⁹

Statistical Tests

For each dependent variable, three statistical tests of significance were computed to determine whether *Twendé na Wakati* had an effect on that variable. First, we used either logit or loglinear models for categorical dependent variables or analysis of variance (ANOVA) models for continuous dependent variables to test for a significant treatment-by-year interaction term using data from 1993 and 1995, the period of our quasi experiment. The purpose of these statistical tests was to assess whether observed changes in the dependent variables were greater in the treatment area than in the comparison area. These tests do not statistically control for other independent variables that might influence the result.

Second, we used either logistic regression for categorical dependent variables or ANOVA models for continuous dependent variables to test for a significant treatment-by-year interaction term while controlling for eight other independent variables and radio ownership. These statistical tests utilize the experimental design to avoid validity threats associated with self-selection to the radio program while allowing for statistical control over many important variables, but these tests do not control for exposure to other family planning radio programs because this variable was not measured in 1993 (most other radio programs, such as *Zinduka*, were not yet being broadcast at the time of our 1993 survey).

Third, we aggregated our individual respondents' data to the level of our 35 wards of study. Exposure to *Twendé na Wakati* varied widely by ward, even within our treatment area. In fact, exposure varied regionally from a high of 81% in Mtwara Region to 21% in Kigoma Region, and there was a slight contamination by listeners in the Dodoma comparison area (2% in 1995). We also measured regional variation in the baseline values for many of our dependent and independent variables expected to be related to the adoption of HIV prevention. By aggregating our survey data to the ward level, we could calculate change scores for the dependent and independent variables. Thus we statistically controlled, in part, for geographical differences in initial conditions and assessed the effects of ward-level exposure to *Twendé na Wakati* as a dose response in a natural experiment created by the geographic variation in exposure to *Twendé na Wakati*, with the expectation that the magnitude of any program effect would be linearly related to the percentage of a ward's population that listened to *Twendé na Wakati*.¹⁰ We used stepwise multiple

⁹ Such self-selection in exposure to *Twendé na Wakati* biases comparisons of listeners with nonlisteners. We conduct statistical tests for geographic units, such as treatment areas and wards that are not biased by this self-selection process.

¹⁰ This assumption of a linear relationship is violated for those dependent variables with high 1993 baseline levels (such as AIDS awareness) because of a ceiling effect but for other variables appears to be valid.

linear regression (MLR) analyses to regress ward-level change in the dependent variables of study (1995 values minus 1993 values) against ward-level listenership to *Twendé na Wakati* and 20 control variables, including exposure to the other family planning radio programs.¹¹

Results

Exposure to Radio-Based HIV/AIDS Information and Personal Experience with AIDS

Radio ownership was higher in our comparison area than in our treatment area by about 11 percentage points in each survey year and increased in both the treatment and comparison areas during our study. Radio was cited by about half of our respondents in both the treatment and comparison areas as being their "most important" source of HIV/AIDS information. Several other radio programs with HIV/AIDS educational content were broadcast during part or all of our five-year study period. These programs, *Ajya ya Jamii* (*Health Facts for Life*) and *Zinduka* (*Awake!*), were broadcast nationwide, and listenership to both radio programs was somewhat higher in our comparison area than in the treatment area, consistent with the relatively higher radio ownership in the comparison area.

Some 47% of respondents in the treatment area in 1994 reported exposure to *Twendé na Wakati*, which increased to 58% by 1997.¹² Approximately 60% of those exposed were regular listeners in that they reported listening to at least one of the two episodes broadcast per week and thus would have been able to follow the storyline and be exposed to the main educational themes of the radio program. Exposure to *Twendé na Wakati* was low in the comparison area from 1993 to 1995 (2% of respondents in 1995), the period of experimental design of our study, but increased sharply to 51% in 1996 and to 75% in 1997. Although a few people in the comparison area were exposed to *Twendé na Wakati* in 1994 and 1995, either by listening on short-wave radio or by travelling to areas where the radio program could be heard, contamination of our comparison area by listenership to the radio

¹¹ These control variables include (1) 1995 listenership to *Zinduka*, (2) 1995 listenership to *Ajya ya Jamii*, (3) 1995 listenership to other family planning radio programs, (4) access to local family planning services in 1993 and the difference between the 1993 and 1995 samples in family planning access (documented separately by Population Family Life Education Program (POFLEP) researchers in each village of study), (5) the difference between the 1993 samples in age, (6) religion in 1993 and the difference between the 1993 and 1995 samples in religion, (7) radio ownership in 1993 and the difference between gender, (8) the difference between the 1993 and 1995 samples in radio ownership, (9) the difference between the 1993 and 1995 samples in marital status, (10) the difference between the 1993 and 1995 samples in parity, (11) income in 1993 and the difference between the 1993 and 1995 samples in income, (12) electricity in the home in 1993 and the difference between the 1993 and 1995 samples in electricity in the home, (13) formal education in 1993 and the difference between the 1993 and 1995 samples in formal education, and (14) urban/rural residence in 1993 and the difference between the 1993 and 1995 samples in these control variables, to control for (1) ward-level differences in development at baseline, (2) differences in development rates over the period of study, and (3) sampling error.

¹² The 1996 TDHS estimated national listenership to *Twendé na Wakati* at 23% for women and 37% for men. The national estimates are lower than our treatment and comparison area estimates because the TDHS's nationally representative sample frame included many districts of Tanzania where RTD's medium-wave radio broadcast signal could not be received, whereas our sample frame included only those districts covered by RTD's broadcast signal.

soap opera was quite small.¹³ Any such contamination effect would tend to reduce the apparent impact of the radio program in the treatment area and thus contamination would lead to a more conservative estimate of the radio program's effects.

Slightly more than half of our respondents personally knew of someone with AIDS. However, blood testing for HIV is rare, and most cases of AIDS in Tanzania are not medically diagnosed, so this measure of knowing someone with AIDS is a matter of perception, rather than of certain knowledge. *Twende na Wakati* listeners were more likely to report personally knowing someone with AIDS, and to have had a blood test for AIDS.

Listener Self-Reports of *Twende na Wakati* Effects

Seventy-three percent of *Twende na Wakati* listeners reported learning about AIDS from *Twende na Wakati* in the treatment area in 1994, which increased to 85% of listeners in 1997 (Table 1). Listener responses were similar in pattern and magnitude in the comparison area from 1995 to 1997. Thus the HIV/AIDS educational content

TABLE 1 Listeners' Self-Assessment of *Twende na Wakati*'s Educational Effect

Variable	Year	Treatment area (%)	Comparison area (%)
1. Percentage of <i>Twende na Wakati</i> listeners that learned about AIDS from listening to <i>Twende na Wakati</i> .	1994	73	NR
	1995	85	NR
	1996	84	77
2. Percentage of <i>Twende na Wakati</i> listeners who believed that Mkwaju had HIV/AIDS.	1996	85	89
	1997	45	34
	1997	44	67
3. Percentage of <i>Twende na Wakati</i> listeners who have talked about the AIDS content of <i>Twende na Wakati</i> .*	1995	15	NR
	1996	48	25
	1997	39	23
4. Percentage of <i>Twende na Wakati</i> listeners who reported adopting an AIDS prevention method as a result of listening to <i>Twende na Wakati</i> .**	1994	73	NR
	1995	82	NR
	1996	16	10
	1997	12	1

Note: Sample sizes in the treatment area were 896 listeners in 1994, 1,022 listeners in 1995, 1,100 listeners in 1996, and 1,113 listeners in 1997. Sample sizes in the comparison area were 422 listeners in 1996 and 467 listeners in 1997.

* The open-ended question, "What did you talk about?" allowed only a single response in 1994 and 1995, but up to three responses in 1996 and 1997, likely explaining some of the increase in these years.

** This question was asked in a prompted response format in 1994 and 1995, and in an unprompted format in 1996 and 1997, likely explaining much of the decrease from 1995 to 1996.

¹³ Only one letter was received from someone in Dodoma during the period from 1993 to 1995, and it was a request that the program be played on the Dodoma station so that the letter writer could listen.

was salient for nearly all listeners. The primary character in the HIV/AIDS storyline, Mkwaju, was the most salient character (50% of listeners mentioned Mkwaju's name without prompting, and 89% of listeners remembered him with prompting in 1995), and by 1996, 45% of listeners in the treatment area thought that Mkwaju was HIV positive, even though he did not become clearly sick with AIDS until after the 1997 survey.

One of the principal effects of *Twende na Wakati* was that it increased interpersonal communication about its educational content, HIV prevention (Rogers et al., 1999). Forty-six percent of listeners in our treatment area reported talking to someone about *Twende na Wakati* in 1994, which increased to 61% in 1995, and to 65% in 1997. These discussions were primarily with friends (55%) and spouses (37%), rather than with children (3%) or with others (5%). Many of these discussions were about HIV/AIDS, as 15% of listeners reported talking about the AIDS content of the soap opera in 1995, which increased to 48% in 1996, dropping somewhat to 39% in 1997 (see Table 1).¹⁴

In 1994, in response to a prompted question, 73% of our treatment area listeners reported adopting an HIV/AIDS prevention measure as a result of listening to *Twende na Wakati*, and this increased to 82% in 1995. Independently, the 1996 TDHS reported a similarly large percentage of men (91%) and women (82%) in the general population as having changed their sexual behavior to protect themselves against HIV (Bureau of Statistics, 1997). This suggests that our self-report data included many people who adopted HIV prevention for reasons in addition to listening to *Twende na Wakati* but who attributed this change mainly to *Twende na Wakati* in response to our survey question. To limit this problem, beginning in 1996, we asked two questions: First, listeners were asked the unprompted question, "What, if anything, have you done as a result of listening to *Twende na Wakati*?" Second, all respondents were asked the prompted question, "Have you adopted some means to protect yourself from HIV/AIDS?" In response to the unprompted question, the percentage of listeners saying that they adopted an HIV/AIDS prevention method because of *Twende na Wakati* was 16% in 1996 and 12% in 1997. In response to the prompted question in 1996, 88% of *Twende na Wakati* listeners reported having adopted an HIV/AIDS prevention method, while 71% of non-listeners reported having adopted an HIV/AIDS prevention method. The difference between listeners and nonlisteners on the prompted question, 17 percentage points, is similar in magnitude to the 16% of listeners who self-attributed their adoption of HIV/AIDS prevention to *Twende na Wakati*. Similarly, the difference between listeners and nonlisteners in 1997 was 14 percentage points, similar to the 12% of listeners who self-attributed their adoption to *Twende na Wakati*. Thus the unprompted questions posed to listeners in 1996 and 1997 are corroborated by comparing listeners with nonlisteners on the prompted question to provide a more conservative, and probably more accurate, estimate of *Twende na Wakati*'s impact on HIV/AIDS prevention behavior change.

Overwhelmingly, listeners who had adopted an HIV/AIDS prevention method reported reducing their number of sexual partners (77% in 1995) rather than adopting condom use (15% in 1995) or ceasing to share razors (6% in 1995). This finding is consistent with the 1996 TDHS, which reported that a reduction in the number of

¹⁴ Part of the reported increased rate of discussion of AIDS from 1995 to 1996 is because in 1995 only one response was allowed to the open-ended question, "What did you talk about?"; whereas in 1996 and 1997 up to three responses were allowed, increasing the response rate for all answers, including HIV/AIDS.

sexual partners was the most common method cited by those who reported having adopted an HIV/AIDS prevention method (76% for women and 96% for men), and that condom use constituted a small minority (3% for women and 13% for men) of respondents (Bureau of Statistics, 1997).

Effects of Twende na Wakati on Respondents' Knowledge of HIV/AIDS

In all five of our annual surveys, more than 95% of the respondents were aware of AIDS, consistent with the high levels of AIDS awareness measured by the 1996 TDHS (Bureau of Statistics, 1997). There is no temporal trend in AIDS awareness in either the comparison or treatment areas, and no evidence of a *Twende na Wakati* effect in raising AIDS awareness, almost certainly because of a ceiling effect.

Knowledge that HIV/AIDS is spread by heterosexual intercourse was also nearly universal in 1993, with 96% of respondents indicating that they knew of this means of transmission. There is no substantive increase in this variable and no evidence of a *Twende na Wakati* effect in raising knowledge about this variable.

Belief that one can prevent HIV/AIDS by abstaining from sexual relations was high in 1993 but not universal. This level of knowledge remained approximately constant at about 80% in both the comparison and treatment areas from 1993 to 1995. Although the logistic regression and MLR tests suggest a slight negative effect of the treatment, this change is likely spurious or very small, as nearly all listeners and nonlisteners believed in abstinence as a means of prevention by 1997. Between 1995 and 1997, belief in abstinence as a mean to protect oneself from HIV/AIDS increased to 94% in the treatment area and to 95% in the comparison area, suggesting a change in this variable over time. However, the increase in the treatment area was greater among nonlisteners (from 76% to 94%, an increase of 18 percentage points) than among listeners (from 82% to 95%, an increase of 13 percentage points), suggesting that some other factor than the radio program of study caused this increase.

Belief in the pernicious rumor that one can contract HIV from condoms remained fairly level from 1993 to 1995 but increased in both the comparison and treatment areas from 1995 to 1997. This increase occurred exclusively among nonlisteners in the treatment area but among both listeners and nonlisteners in the comparison area. Conversely, the belief that condoms provide protection against HIV infection also remained fairly level from 1993 to 1995 in the comparison area and then increased from 1995 to 1997.¹⁵ The test for a treatment effect from 1993 to 1995 is significant, primarily because of a large decline in this belief in the comparison area in 1995, rather than because of its small increase in the treatment area.

An HIV/AIDS knowledge scale included (1) four questions about correct mechanisms of transmission (e.g., through heterosexual intercourse), (2) four questions concerning false rumors about HIV infection (e.g., through insect bites), (3) four questions about correct mechanisms of prevention (e.g., using condoms), and (4) two questions about incorrect means of prevention (e.g., by having sex only with young girls or boys). In 1993, the average score was 10.0 in the treatment area and 10.9 in the comparison area. From 1993 to 1995, the average score increased by 0.7 points in the treatment area and declined by 0.5 in the comparison area, with a

¹⁵ It is possible for an individual to believe both that condoms spread HIV and that condoms protect against HIV, depending on the brand, source, or cost of the condoms. Our survey instrument was not designed to measure differences in these perceptions among the various brands of condoms.

significant treatment effect indicated by the ANOVA tests but not the MLR test. Increases from 1995 to 1997 in both the comparison and treatment area are modest, about 0.2 points. Thus, *Twende na Wakati* had a statistically significant effect on increased knowledge about the spread and prevention of the disease, but it was rather modest, and some important misinformation, especially about the prevalence of HIV in condoms, actually increased nationwide among nonlisteners during the course of our study. In general, *Twende na Wakati* listeners scored about 1.5 points higher on the HIV/AIDS knowledge scale than did nonlisteners, but listeners' scores did not increase more than nonlisteners' scores from 1994 to 1997.

Effects of Twende na Wakati on Respondents' Attitudes about HIV/AIDS

The attitude among male respondents about the acceptability of men having more than one sexual partner prior to marriage declined in both the treatment area (8 percentage points) and in the comparison area (26 percentage points) from 1993 to 1995; the logit loglinear test indicates a greater decline in the comparison area than in the treatment area. The same pattern was observed for the acceptability of women (among female respondents) having more than one sexual partner prior to marriage, with a significantly greater decline in the comparison area (21 percentage points) than in the treatment area (5 percentage points). The greater decline in the comparison area may be attributed, in part, to the much higher baseline values for these attitudes in 1993. Neither the logistic regression nor the MLR test for either male or female respondents' attitudes about having more than one partner prior to marriage was significant for a *Twende na Wakati* effect.

The perception of personally being at risk of HIV infection increased in the treatment area from 55% in 1993 to 61% in 1995, while it declined from 72% in 1993 to 55% in 1995 in the comparison area. The logit loglinear test supports a *Twende na Wakati* effect, but this finding is partially because of a decline in the comparison area. Both the logistic regression and the MLR analyses also support a statistically significant *Twende na Wakati* effect. From 1995 to 1997, the self-perception of HIV risk increased by 8 percentage points in the treatment area and by 22 percentage points in the comparison area.

A more important indicator of risk perception is the percentage of people who feel that they are not at risk of HIV/AIDS but report having one or more risk factors for HIV infection (such as having more than one sexual partner or sharing razors). From 1993 to 1995, the percentage of respondents in the treatment area who felt they were not at risk but actually had a risk factor fell from 21% to 10%, whereas it increased from 10% to 15% in the comparison area. Both the logistic regression and the MLR analysis indicate a statistically significant *Twende na Wakati* effect. The level of this variable decreased from 15% to 4% from 1995 to 1997 in the comparison area, which provides further support for a *Twende na Wakati* effect.

To assess an individual's sense of efficacy (a belief that the individual can control his or her future) with respect to HIV/AIDS, respondents were posed the hypothetical question, "What would you do if a doctor told you that you had HIV/AIDS?" In 1993, 21% of respondents in the treatment area gave an efficacious response to this question (the individual would stop having sexual intercourse or always use condoms) as opposed to an inefficacious response (e.g., would do nothing different). Efficacious responses increased 10 percentage points in the treatment area by 1995, while they declined by 11 percentage points in the comparison area over

the same period, demonstrating a significant treatment effect (according to the logit loglinear, logistic regression, and the MLR tests). After 1995, however, the level of efficacious responses stabilized or eroded slightly in both areas, so the *Twende na Wakati* effect was not sustained after 1995. *Twende na Wakati* listeners were more likely than nonlisteners to give an efficacious response in all five of our annual surveys.

Effects of *Twende na Wakati* on Respondents' Practice of HIV/AIDS Prevention

Table 2 indicates that in 1993, sexually active men reported that they had an average of slightly more than two sexual partners during the previous year. The number of reported partners declined in both the treatment and comparison areas from 1993 to 1995. However, the decline was greater in the treatment area (0.7 partners) than in the comparison area (0.3 partners), which is statistically significant in the ANOVA and MLR tests. In the treatment area, there was a further decline of 0.2 partners from 1995 to 1997, while the comparison area declined by 0.6 partners during this period (when *Twende na Wakati* was broadcast there). These data support the hypothesis of a *Twende na Wakati* effect on the number of sexual partners by men, which was in addition to a nationwide trend toward reporting fewer sexual partners.

In 1993, sexually active women reported an average of slightly fewer than two sexual partners in the previous year in both the treatment and comparison areas (see Table 2). The decline from 1993 to 1995 is greater in the treatment area (0.7 partners) than in the comparison area (0.5 partners), which is statistically significant in the ANOVA and MLR tests. After 1995, there was no further decline in the treatment area, but there was a decline in the comparison area to 1.0 partners. These data support the hypothesis of a *Twende na Wakati* effect on the number of sexual partners by women that was in addition to a nationwide trend toward reporting fewer sexual partners.

The percentage of respondents with more than one sexual partner who reported that they were currently using condoms increased from 6% in our treatment area in 1993 to 13% in 1995, while it declined from 15% in 1993 to 2% in 1995 in our comparison area.¹⁶ The logit loglinear and logistic regression tests for a *Twende na Wakati* effect are significant, but the MLR test is not, perhaps because of the lower sample size per ward ($N = 17$) in 1995 caused by the decline in the number of respondents reporting multiple partners. From 1995 to 1997, condom use increased to 16% in the treatment area, whereas in the comparison area it increased to 13%, providing further support for a *Twende na Wakati* effect on condom use.¹⁷

The sharing of razors and needles declined nationwide, but these declines were roughly equal in both the treatment and comparison areas, suggesting there was no *Twende na Wakati* effect on this dependent variable.

¹⁶ These data do not distinguish between condom use for family planning purposes or for STD prevention. However, the primary reason given by sexually active men for using condoms was to prevent infection by an STD (between 50% and 75%), which is in contrast to other modern family planning methods for which the primary reasons given for use include economic hardship (26 to 33%) or to space children (22 to 38%).

¹⁷ In addition, data from the National AIDS Control Programme (NACP) also support the hypothesis that *Twende na Wakati* stimulated demand for condoms in the treatment area from 1993 to 1995 and in both areas after 1995 (Rogers et al., 1999).

TABLE 2 Effects of *Twende na Wakati* on Four HIV/AIDS Prevention Behavior Variables

Variable	Treatment area		Comparison area	
	T	NL	T	NL
1. Number of sexual partners in the previous year reported by sexually active men (N, SE)	1.7 (0.8)	1.5 (0.6)	1.6 (0.7)	1.5 (0.6)
(a) ANOVA ($F = 6.2, p = .01$)				
(b) ANOVA2 ($F = 6.3, p = .01$)				
(c) MLR (Beta = $-0.44, p < .01$) [*]	1.4 (0.4)	1.5 (0.6)	1.6 (883, .04)	1.4 (10)
1997	1.4 (0.6)	1.4 (0.6)	1.4 (847, .03)	1.4 (12)
1996	1.6 (0.6)	1.5 (0.6)	1.6 (844, .04)	NR
1995	1.6 (0.6)	1.6 (0.7)	1.6 (844, .04)	NR
1994	1.7 (0.8)	1.5 (0.6)	1.6 (839, .05)	NR
1993	NR	1.5 (0.6)	2.2 (794, .04)	NR
2. Number of sexual partners in the previous year reported by sexually active women (N, SE)	1.3 (0.4)	1.2 (0.3)	1.3 (852, .03)	NR
(a) ANOVA ($F = 7.7, p < .01$)				
(b) ANOVA2 ($F = 6.6, p = .01$)				
(c) MLR (Beta = $-0.33, p = .01$)	1.1 (0.2)	1.2 (0.5)	1.2 (823, .03)	1.0 (0.2)
1997	1.1 (0.2)	1.1 (0.2)	1.2 (765, .03)	1.1 (0.3)
1996	1.3 (0.5)	1.1 (0.2)	1.2 (777, .03)	NR
1995	1.2 (0.3)	1.1 (0.5)	1.3 (852, .03)	NR
1994	1.3 (0.4)	1.2 (0.3)	1.3 (852, .03)	NR
1993	NR	NR	1.9 (790, .03)	NR
3. Percentage of respondents with more than one sexual partner who are currently using condoms (N)	12% (276)	5% (206)	9% (482)	NR
(a) Logit loglinear (LO = 2.8; $p < .05$)				
(b) ANOVA2 ($F = 6.6, p < .05$)				
(c) MLR (Not significant) ^{**}	23% (197)	7% (153)	16% (350)	13% (22)
1997	23% (197)	7% (153)	16% (350)	13% (22)
1996	6% (286)	4% (131)	5% (417)	5% (86)
1995	12% (250)	13% (186)	13% (436)	NR
1994	12% (276)	5% (206)	9% (482)	NR
1993	NR	NR	6% (1,150)	NR
4. Percentage of respondents who share razors or needles	NR	NR	NR	NR
(a) Logit loglinear (Not significant)	10%	10%	16%	NR
(b) ANOVA2 ($F = 3.0, p < .05$)				
(c) MLR (Not significant) ^{**}	11%	11%	12%	6%
1997	8%	14%	11%	9%
1996	11%	14%	12%	13%
1995	10%	22%	16%	NR
1994	10%	21%	16%	NR
1993	NR	NR	21%	NR

Note: These data were obtained from annual personal interview surveys conducted by POFELP researchers in eight regions of Tanzania from 1993 to 1997. Except where noted, sample sizes in the treatment area were 1,793 in 1993, 1,924 (listeners (L) = 896, nonlisteners (NL) = 1,028) in 1994, 1,940 (L = 1,022, NL = 918) in 1995, 1,919 (L = 1,100, NL = 819) in 1996, and 1,933 (L = 1,113, NL = 820) in 1997. Sample sizes in the comparison area were 859 in 1993, 861 in 1994, 831 (L = 422, NL = 409) in 1995, 824 (L = 467, NL = 157) in 1996, and 624 (L = 467, NL = 157) in 1997. "T" indicates the total (listeners and nonlisteners combined). "NR" indicates "not relevant." The statistical tests (logit loglinear, ANOVA, multivariate general ANOVA2, logistic regression, and MLR) are tests for a *Twende na Wakati* effect, as described in the text.

^{*} One outlier ward was removed from this analysis because the standardized residual was greater than 3. ^{**} The average sample size per ward for this question was 49 respondents in 1993, but only 17 respondents per ward in 1995 because the number of respondents reporting more than one sexual partner was lower in 1995 than in 1993. This finding suggests that ward-level tests for this dependent variable may be unreliable.

The practice of monogamy by sexually active respondents is associated with five intervening variables in multivariate logistic regression analysis.¹⁸ These intervening variables include (1) respondents who score higher on our 14-item AIDS knowledge scale (log odds = .02, $p < .05$), (2) respondents who believe that condoms can prevent the spread of HIV are less likely to be monogamous than respondents who do not believe in the efficacy of condoms (log odds = .22, $p < .01$), (3) respondents who believe that condoms can spread HIV are more likely to be monogamous than respondents who do not believe this rumor (log odds = -.15, $p < .01$), (4) respondents who feel that they are not at risk of HIV are more likely to report that they are monogamous than respondents who are not sure whether they are at risk of HIV (log odds = .24, $p < .01$), and (5) respondents who report that they would take an efficacious action if a doctor told them that they were HIV positive are more likely to report being monogamous than those who gave a nonefficacious response to this hypothetical question (log odds = .11, $p < .01$). In similar analyses, current use of condoms by sexually active respondents is associated with four intervening variables, including (1) respondents who score higher on our 14-item AIDS knowledge scale are more likely to use condoms than those who score lower on this scale (log odds = .22, $p < .01$), (2) respondents who believe that condoms can prevent the spread of HIV are more likely to be using condoms than respondents who do not believe in the efficacy of condoms (log odds = .29, $p < .01$), (3) respondents who feel that they are at risk of HIV are more likely to report that they are using condoms than respondents who feel that they are not at risk of HIV (log odds = .26, $p < .01$), and (4) respondents who report that they would take an efficacious action if a doctor told them that they were HIV positive are more likely to report using condoms than those who gave a nonefficacious response to this hypothetical question (log odds = .33, $p < .01$).

Thus both of our behavioral dependent variables are associated with four of the same intervening variables. Increased knowledge about AIDS and having a self-efficacious response about being HIV positive both are associated with higher levels of our behavioral variables. However, self-perception of risk is positively associated with condom use but negatively associated with monogamy, whereas belief in the efficacy of condoms in preventing HIV transmission is positively associated with condom use and negatively associated with monogamy. In correlational analyses such as these, it is problematic to determine a causal relationship between variables. For example, it is difficult to know whether monogamy determines one's perception of self-risk of HIV infection or whether self-perception of risk determines the number of sexual partners one has.

Discussion

Our data support the hypothesis that an entertainment-education radio soap opera, *Twendé na Wakati*, stimulated adoption of HIV/AIDS prevention behaviors in the treatment area of Tanzania from 1993 to 1995, and then throughout our study area from 1995 to 1997. Supporting data include (1) statistically significant decreases in the number of sexual partners for both men and women during the 1993 to 1995 experiment, which were then replicated in the comparison area after 1995, (2) sta-

¹⁸ To assess the association between the intervening variables and our behavioral variables in these analyses, all five years of survey data from both treatment areas were combined ($N = 11,792$).

tistically significant increases in the number of sexually active respondents with more than one sex partner who report that they were current users of condoms during the 1993 to 1995 experiment, which was then replicated in the comparison area after 1995, (3) similar findings from cross-sectional analyses from the 1996 TDHS (not reported on here), and (4) self-reports of HIV prevention behavior by *Twendé na Wakati* listeners in our personal interview surveys.¹⁹ These diverse quantitative and qualitative data from independent sources all provide strong evidence for a *Twendé na Wakati* effect on the adoption of HIV/AIDS prevention. Our triangulation of data from independent sources, combined with the field experimental design of our study, confer high internal and external validity on the effects of exposure to the radio program of study.

We identify three important threats to the internal validity of our study. Non-random selection of our comparison area led to some differences in initial conditions between our treatment and comparison areas, especially with respect to our dependent variables of study. However, the multivariate statistical tests that we used aggregated data at the ward level and tested for the amount of change in the dependent variable, rather than in the absolute value of the variable, thereby helping to minimize the impact of these regional differences in initial conditions. Second, not everyone in our treatment area was exposed to *Twendé na Wakati*, and a few people in our comparison area were exposed to *Twendé na Wakati*. Our ward-level analyses help to control for the different levels of treatment exposure among the various ward populations by testing for a "dose response." Third, our study took place over five years in a large and diverse country with many development initiatives underway at any given time, leading to a concern that history could influence our results. To limit this history threat, to the extent possible, we controlled statistically for exposure to other radio programs with HIV/AIDS content and factors such as radio ownership and household electricity, which increased during the study period. We controlled on instrumentation bias by utilizing most of the same interviewers in each of our five survey years and screening questionnaire responses to look for internally inconsistent responses. Our study design avoids other internal validity threats, such as selection bias and maturation, because our main conclusions do not rest on a comparison of listeners to nonlisteners, and our samples were independently selected in each annual survey. Because (1) our samples were probability samples (below the level of district), (2) the same radio program was broadcast in each treatment area, (3) the intervention's target population was broad based (e.g., sexually active adults) rather than narrowly focused (e.g., injection drug users), and (4) survey respondents did not know whether they were in the treatment or comparison group, these potential threats to the external validity of our field experimental design were not serious.

Respondents' behavioral change was associated with increases in respondents' beliefs in personal risk of contracting the disease (even though the actual risk was declining because of the behavioral change in effective means of prevention and an increased sense of personal efficacy with respect to being able to prevent HIV/AIDS).²⁰ Further, the Tanzanian radio soap opera generated conversations among listeners about HIV/AIDS, an important behavior given the importance of interpersonal communication in the diffusion of innovations like HIV/AIDS prevention in

¹⁹ The personal testimony of letter writers to the soap opera reinforces this point. Also there was more demand and distribution of condoms (by the NACP) in our treatment area than in our comparison area from 1993 to 1995, which was then replicated in the comparison area after 1995.

²⁰ Forsyth et al. (1997) reported similar findings.

Tanzania (Mnyika, Klepp, Kvale, & Ole-King'ori, 1997). These findings are consistent with (1) the social cognitive and diffusion models and (2) the theoretical foundation of entertainment-education programs, which emphasizes the importance of social cognitive and diffusion theories (Vaughan & Rogers, 1999).

As HIV/AIDS cases continue to rise in developed and developing countries, the search for effective communication strategies to address this pandemic intensify. *The entertainment-education strategy represents a potentially viable approach to address the global public health crisis posed by AIDS.*

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