

Can Radio Serial Dramas Change Attitudes about Gender Equality? Evidence from a Longitudinal Survey of Youth in Ethiopia

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Abstract

Radio serial dramas have been used in a number of contexts to effect attitudinal and behavioral change. In Ethiopia, partnerships between the government and non-governmental organizations produced a number of radio dramas targeting youth and families on topics related to sexual and reproductive health, yet little is known about their effectiveness. We use data from three waves of a longitudinal survey of youth to measure the impact of listenership to radio serial dramas in general in late adolescence, and to a specific serial drama in early adulthood, on change in attitudes regarding gender equality. We find strong evidence that youth who listened to radio serial dramas in general and to the drama *Yeken Kignit* experienced a significant shift toward more egalitarian gender attitudes over time relative to youth who did not listen to the radio dramas. Most promising of all, the effects of radio drama exposure are stronger for male than for female youth. We estimated a variety of model specifications to check the robustness of our results. We also tested for model assumptions, and corrected for the violation of assumptions when appropriate. Our results are consistent across models and hold up against tests for endogenous selection and unequal trajectories.

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Introduction

Radio serial dramas have been used in a number of national contexts as a means for effecting attitudinal and behavioral change on a wide range of outcomes including risky sexual behavior, contraceptive use, HIV/AIDS prevention and stigma reduction, and women's status, among others (Hornik and McAnany 2001; Farr et al. 2005; Smith et al. 2007; Westoff and Koffman 2011). Radio dramas adopt the format of popular television soap operas to attract and retain the target audience, and integrate educational messaging into the story lines. In Ethiopia, partnerships between the federal government and the non-governmental sector have produced and broadcast a number of radio serial dramas targeted at youth and adults addressing issues of sexual and reproductive health, harmful practices, and women's status. Ethiopia is poor country with a substantial proportion of the population illiterate and the vast the majority of the population residing in rural areas, often without electricity. Even though radio ownership is not universal, it is the most effective media channel for reaching the largest audiences in the country. The 2016-2010 National Adolescent and Youth Health Strategy identifies radio dramas as a mechanism for increasing youth's access to health information and education (Ministry of Health 2016:25). However, very little is known about the effectiveness of radio dramas in Ethiopia in generating change. We analyze data from three waves of a longitudinal survey of youth¹ conducted in southwestern Ethiopia to measure the impact of listenership to radio dramas in general, as well as one specific radio drama, on change over time in youth attitudes regarding gender equality. Our analysis provides evidence of significant positive effects of listenership to radio dramas on change to more equitable gender attitudes during the critical period of late adolescence when gender attitudes tend to solidify (Crouter et al. 2007).

Background

Media as a Change Agent

Mass media has the potential to impact knowledge and values in a population, leading to substantial change in norms and behaviors. Through ideational diffusion, mass media provide examples of different ways of being beyond what are seen in an individual's daily experience (Barber and Axinn 2004; Watkins 2000; Westoff and Koffman 2011). Exposure to mass media can prompt changes in ideas regarding many issues, including marriage, family planning and gender roles (Barber and Axinn 2004, Bekalu and Eggermont 2014; Bogale et al. 2011; Farr et al. 2005; Gage 2013; Masho and Matthews 2009; Westoff and Koffman 2011). The information about methods, services, policies, and new models of behavior that the media provide has the potential to even influence attitudes and behavior without specific targeting (Hornik and McAnany 2001; Thornton 2001; Westoff and Koffman 2011). Evidence of the effect of generic mass media was found across 48 countries with Demographic and Health Surveys (DHS), where mass media exposure was associated with fewer births in the 5 years prior to the survey (Westoff and Koffman 2011). Detailed analyses of the fertility decline in Brazil highlight the central role of mass media in that country's fertility decline. Idealization of the nuclear family by mass media, specifically in *telenovelas*, appears to have had a strong influence on Brazilians' values and behaviors related to fertility regulation (Faria and Potter 1999). Faria and Potter (1999) argue that the concurrent uptake of television and fertility regulation in Brazil amplified new values and behaviors that were already spreading through the population. The Brazilian government supported these changes by investing in the diffusion of television throughout the country, which led to television becoming a main source of entertainment and information (Martine 1996).

Given the power of the media, “edutainment” was developed to harness the role of media in health education. Edutainment television and radio dramas have educational messages driving the drama. Through edutainment, the audience becomes emotionally attached to characters whose behavior changes in response to the lesson in the episode (Kincaid 2002, Ryerson and Teffera 2004). Theoretical motivations for positioning gender and reproductive health education in mass media dramas draw from diverse theories, including social cognitive theory, drama theory, and theories of ideational diffusion (Bandura 2001; Kincaid 2002; and Watkins 2000). The core premise underlying this approach is that ideational diffusion is facilitated by the media by providing examples of different ways of living, new models of behavior, and new information (Barber and Axinn 2004; Faria and Potter 1999; Hornik and McAnany 2001; Watkins 2000; Westoff and Koffman 2011). While the details of each theoretical model differ, media exposure is generally seen as offering new ideas with the potential to change norms, attitudes, and motivations, increase self-efficacy, motivate discussions with others, and ultimately to influence behaviors.

Edutainment has been used to target health behaviors as diverse as the use of tobacco, alcohol, and other drugs, sexual behaviors, road safety, cancer screening, child survival, and blood donation (Wakefield et al. 2010). Research in developing countries largely focuses on the impact of edutainment on ideas about marriage, family planning, and gender norms (Barber and Axinn 2004; Bekalu and Eggermont 2014; Bogale et al. 2011; Faria and Potter 1999; Farr et al. 2005; Gage 2013; Masho and Matthews 2009; Westoff and Koffman 2011). In a review of family planning programs, Mwaikambo and colleagues (2011) found that mass media programs were likely to improve knowledge and attitudes.

Individual program analyses add support to these cross-national findings. Exposure to mass media was associated with preferences for smaller families and contraceptive acceptance in Nepal (Barber and Axinn 2004). Behavior change communication exposure was associated with both increased intention to use contraception and actual use of contraception in Uganda (Gupta et al. 2003). In Tanzania, behavior change communications were associated with an increase in the reported ideal age at first marriage for women (Rogers et al. 1999). Other studies have shown the importance of behavior change communications in generating conversations at the community level, leading to changes in attitudes or behaviors among both exposed individuals and the community at large (Gage 2013; Hornik and McAnany 2001; Paek et al. 2008).

Edutainment dramas are particularly important for gender equity and reproductive health programs because of their ability to address cultural barriers. Discussions with others and feeling good about contraception being right for one's self are key to family planning adoption (Kincaid 2000; Watkins 2000). Media can be particularly important in stimulating discussion, and can influence opinions among individuals with no prior program exposure (Hornik and McAnany 2001). Paek and colleagues (2008) found that community gender norms in Uganda were a significant predictor of family planning behavior, and that interpersonal communications had a stronger effect on individual norms in communities with higher listenership to public health programs.

Media and Women's Status

Gender norms are an important and frequent target for edutainment behavior change communications. Women's empowerment — including women's general agency, economic empowerment, decision-making inside and outside the home, and a lack of restrictions on what they can do—is associated with numerous positive outcomes (Upadhyay and Karasek 2012).

Gender norms about women's rights, autonomy and appropriate behaviors are situated within local contexts, and rely on compliance and enforcement by both male and female community members. A review of programs designed to increase equitable gender norms and health suggests that programs that include a community education component, such as mass media campaigns, are more effective at changing behavior than campaigns that only include individual-level efforts (Barker et al. 2010).

Most research on women's empowerment focuses on women's attitudes regarding their ability to perform specific roles. Less attention has been given to men's attitudes towards women's roles, and men's contributions as allies in removing barriers to women. Men's attitudes are particularly important given that male authority often overrides women's preferences, especially as related to fertility and reproductive health in sub-Saharan Africa (Dodoo and Frost 2008; Snow et al. 2013). Programs that target men as partners often focus on interpersonal communication campaigns, trainings, and coalition building among men (see, for example, Peacock and Levack 2004). It is less common for studies to examine the impact of mass media communication on men's attitudes about gender norms. A study in Nicaragua found that young men with the highest level of exposure to a media campaign, including a television soap opera, showed greater change toward gender equity than young men with low levels of exposure (Pulerwitz et al. 2010).

The Ethiopian Context

Ethiopian Edutainment Radio Dramas

Improving the status of women to improve young people's health is a central aim of the Ethiopian Ministry of Health. The Ministry of Health defined as a goal empowering young people to "challenge gender stereotypes, discrimination and violence within peers/families,

educational institutions, workplaces and public space” in order to reduce female genital cutting, increase the median age at marriage, reduce child marriage, and reduce gender-based violence (Ministry of Health 2016: 29). Capitalizing on mass media to change norms and attitudes about gender equity is a priority area established by the Ministry of Health. With only 34.8 percent of Ethiopian women and 65.0 percent of Ethiopian men literate, radio is a critical mode for the spread of information (CSA 2012). Households are substantially more likely to have a radio (40.5% of households) than a television (10.4% of households), particularly in rural areas (33.7% have radio, 1.1% have television, CSA 2012). Despite the limited access to radios, evidence from Ethiopia suggests that general mass media influences attitudes, and that edutainment is particularly effective. For example, analysis of the Ethiopia DHS found that Ethiopian women with exposure to general mass media are less likely to support the continuation of female genital cutting (Masho and Matthews 2009).

Edutainment in Ethiopia has been found to be effective on a number of levels. Edutainment programs are cost-effective in areas of Ethiopia with low levels of literacy (Bogale et al. 2011), and can reduce the health knowledge gap between those with high and low levels of education (Bekalu and Eggermont 2014). Among residents in northwest Ethiopia, exposure to any HIV/AIDS mass media content was associated with greater intention to be tested for HIV (Bekalu and Eggermont 2015). Parents and guardians in the Amhara region who were exposed to mass media promoting delayed marriage were significantly more likely than other parents and guardians to believe that a daughter should choose when to get married, and were significantly more likely to believe a daughter should choose whom they marry (Gage 2013). Nationally, Ethiopians with greater exposure to one of the HIV prevention radio dramas had greater intentions to practice at least one preventive behavior (Smith et al. 2007).

Yeken Kignit Radio Drama

The Amharic language radio drama *Yeken Kignit* (Looking Over One's Daily Life) was developed by Population Media Center (PMC) in 2002 to address topics of women's roles in society, childbearing, and relations between men and women in Ethiopia (Ryerson and Teffera 2004). There were 257 episodes developed and broadcast over Radio Ethiopia and FM Radio (Ryerson and Teffera 2004). The main character in *Yeken Kignit* is Fikirte, who found her life changed when she was sent to live with her grandfather who enrolled her in school (Osnes 2013). Fikirte is regularly portrayed as trying to better herself and those around her. Episodes included storylines where she refused to have intercourse with her boyfriend and delayed their marriage because she first wanted to achieve financial stability. Over the course of the drama, Fikirte discussed education, family planning, gender-based violence, and HIV.

Yeken Kignit reached nearly half of all Ethiopians between 2002 and 2004 (Onuekwe 2015). A cross-sectional, population-based evaluation showed that three-quarters of respondents with access to a radio in the capital city of Addis Ababa and in the Amhara region knew of *Yeken Kignit* (Hailemariam 2005). The drama successfully targeted young adults, with most listeners under 30 years of age (Hailemariam 2005). Cross-sectional evaluations of the original airing found substantial differences between listeners and non-listeners (Hailemariam 2005; Ryerson 2011), including more egalitarian attitudes regarding girls' education, greater acceptance of a woman's right to marry a man of her choice, and lower acceptance of female circumcision among listeners compared to non-listeners (Hailemariam 2005). These studies, however, relied on cross-sectional data that did not provide measures of attitudes before and after radio drama exposure. In this analysis we use longitudinal survey data collected at three points in time to measure the impact of exposure to radio dramas on change in gender attitudes controlling for

selection into listenership. We assess the impact of general listenership to radio dramas in late adolescence as well as exposure to the radio drama *Yeken Kignit* on change in gender attitudes in late adolescence and early adulthood.

Methods

Survey Design

The data for this paper come from three waves of the Jimma Longitudinal Family Survey of Youth (JLFSY) conducted by investigators from Brown University and Jimma University. The JLFSY began in 2005-06 with a baseline household survey of 3,695 households, and an adolescent survey of 2,084 youth ages 13-17. Subsequent follow-up surveys of the youth were conducted in 2006-07, 2009-10, and 2012-13. The study area includes the city of Jimma, population 120,000; three outlying market towns with populations of approximately 5,000 or less each; and the rural areas immediately surrounding the market towns. Jimma Zone, which encompasses the study area, is in southwestern Ethiopia. The rural population is predominantly Moslem and ethnically Oromo, and the urban populations are religiously and ethnically diverse with a large presence of Ethiopian Orthodox and Protestant Christians. The city of Jimma is the zonal center for health and administrative services, a major market center, and the location of a regional university.

A multi-stage stratified sample design was used in the city of Jimma. The city is divided into three administrative units, and further subdivided into a total of 21 neighborhoods. In the first stage, two neighborhoods were randomly selected from each of the three large administrative units with selection probabilities proportionate to size based on the 1994 census. In each of the selected neighborhoods, sampling frames were constructed by conducting a street-by-street enumeration of all households. Simple random sampling was then used to select

households within each of the six neighborhoods. In the outlying towns and the surrounding rural areas, household registration lists maintained by the local authorities were used as sampling frames. A spot-check in the field of a subset of the household registration lists confirmed that they were accurate and complete. Simple random samples of households were independently drawn from each of the towns and rural areas. The total study sample includes 18 locations, six city neighborhoods, three towns, and nine rural communities. Sample weights were developed to account for differential sampling probabilities across the locations and are used to generate the descriptive statistics presented in this study.

The household survey interviews were conducted with the household head and/or the spouse of the head by trilingual (Amharic, Afan Oromo, and English) interviewers recruited from the study area. The baseline household survey collected demographic information for all current household members and independent adult children of the household head. It also collected extensive information on household assets and access to resources and food. Up to one male and one female aged 13-17 were randomly selected from each household for inclusion in the longitudinal adolescent survey. The adolescent survey interviews were conducted by interviewers of the same gender as the respondent in a private space within the residential compound. Adolescent questionnaires collected information on educational, occupational and family expectations; health status and health seeking behavior; sexual knowledge, attitudes, and practices; and attitudes about women's roles and gender norms, among other topics. Each of the four adolescent survey waves included the same set of core questions for longitudinal analyses of change, as well as modules that were collected at one or two survey waves.

Table 1 presents response rates across the four adolescent survey waves. Participation was near universal for the first survey wave when the youth were ages 13-17, and remained high at

92 percent for the second wave survey. Response rates dropped to 73 percent at the third wave when youth were 17-21, and dropped to 60 percent at the fourth wave when youth were 20-24. The vast majority of youth lost-to-follow-up migrated out of the study area, and the large majority of out-migrants went to other countries or unknown destinations. The single largest international destination was Sudan. Efforts were made to interview out-migrant youth during return visits to their parents, and in selected places of destination. Refusal rates were low in all four adolescent survey waves, ranging from 1.0 to 2.4 percent.

[Table 1 about here]

Intervention

With the cooperation of Jimma Community Radio, an FM radio station based at Jimma University, and the Population Media Center in Ethiopia, the JLFSY coordinated the broadcasting of episodes of the radio drama *Yeken Kignit* starting in March 2011, after completion of the third wave of the adolescent survey, and continuing for more than two years until the completion of the fourth wave of the survey. Episodes were broadcast twice a week with a short call-in and discussion session following each broadcast. Jimma Community Radio is one of three FM radio stations broadcasting to the study area. As part of the study design, hand-cranked radios were randomly distributed to 50 percent of the study participants after completion of the wave 3 interviews. The remaining 50 percent of study participants received radios at the time of the wave 4 survey. The distribution of the radios was intended to address potential selection effects associated with prior radio ownership. However, the distribution of the radios at wave 3 had little net effect on the distribution of radio ownership at wave 4 because of the relatively high level of radio ownership overall, and countervailing changes in radio ownership between the survey waves. For example, one-quarter of youth who were given or already had a

radio at wave 3 did not have access to a radio at home at wave 4, and one-half of the youth who did not have a radio after distribution of the radios at wave 3, had a radio at home at wave 4.

Yeken Kignit was not the only radio serial drama airing in Jimma Zone during the study period; at least five other radio dramas addressing issues of reproductive health, sexual risk taking, and women's empowerment among other themes were developed and broadcast nationally between 2005 and 2014 (See Appendix Table A1). *Yeken Kignit* was first broadcast nationally from 2002 to 2004, when the study participants were between ages 9 and 15. However, during this period there were no local FM radio stations broadcasting in Jimma, although Ethiopia National Radio, which broadcast *Yeken Kignit* at the time, did reach many of the households in the study area. Between the wave 2 and wave 4 adolescent surveys radio coverage expanded substantially in Jimma with the establishment of two local radio stations. Because of the differential timing, duration and thematic content of the nationally broadcast radio serial dramas, we consider exposure to radio serial dramas in general at the time of the wave 3 survey, and exposure to *Yeken Kignit* in particular, at the time of the wave 4 survey.

Measures

We use data from the adolescent wave 1, 3, and 4 surveys to examine the impact of exposure to radio serial dramas in general, and *Yeken Kignit* in particular, on change in attitudes about gender equality. The wave 1, 3, and 4 adolescent questionnaires presented a series of statements regarding gender relations and women's roles to which respondents stated their level of agreement; wave 2 did not include this module. We used factor analysis to identify 10 statements that loaded strongly on a single factor, and then constructed a composite standard normal index of gender attitudes with high values corresponding to more egalitarian gender attitudes.² The value of the index indicates a youth's relative position in the distribution of

gender attitudes at each survey wave. An increase in a youth's index across survey waves indicates that a youth held more egalitarian attitudes relative to more of his or her peers over time. We treat this index as our dependent variable and examine how exposure to radio dramas impacted change in the index value, that is, change in one's relative position in the attitudinal distribution across survey waves.

We use questions from the household baseline survey and the adolescent wave 3 and 4 surveys to measure radio exposure. The baseline household questionnaire included a question on radio ownership, and the wave 3 and 4 adolescent questionnaires asked about radio ownership and the number of the last seven days that the respondent listened to the radio and to Jimma Community Radio. Based on a factor analysis of the three questions on radio ownership and listening habits, we constructed a standard normal index of radio listenership, with high values corresponding to higher levels of potential radio exposure. Cronbach's alpha for the three items from the wave 3 and wave 4 surveys were 0.690 and 0.624, respectively.³

The wave 4 questionnaire asked on how many of the last seven days have you listened to *Yeken Kignit*. We created two measures of exposure: a dummy variable that equals 1 if the respondent listened to *Yeken Kignit* at least once in the last seven days, and a pair of dummy variables that correspond to one day, and to two days. We use this second set of measures to test for dosage effects. We use the wave 3 question on how many of the last seven days have you listened to radio serial dramas to measure exposure to serial dramas in general at the time of the survey. Again, we constructed a single measure of exposure using a dummy variable and a set of two dummy variables to measure dosage (one day in the last seven days, and two or more days in the last seven days). We also include in our analysis as control variables, highest grade of school

completed, ever married, and the mean value of the gender attitude index among all surveyed youth in the community or neighborhood as of each of the respective survey waves.

Multivariate Models

We leverage the longitudinal nature of the data to estimate whether exposure to radio serial dramas in general at wave 3, and *Yeken Kignit* in particular at wave 4, are associated with positive change in the relative position of individuals in the gender attitude distribution. We present estimates from three multivariate linear regression models appropriate for panel data: the fixed effects (FE) model, the random effects (RE) model, and a random effects model with first-order autoregressive errors (RE-AR1). The fixed effects and the random effects model have the following general form:

$$Y_{it} = \alpha + T_{it}\lambda + D_{it}\delta + X_{it}\beta + u_i + \varepsilon_{it} \quad (1)$$

where Y_{it} is the gender attitude index for individual i at survey wave t ($t=1, 3, 4$), α is a constant, T_{it} is survey wave ($t=3, 4$), D_{it} is radio serial drama listenership for individual i at wave t ($t=3, 4$), X_{it} are time-varying individual characteristics, λ , δ , β are vectors of covariate effects, u_i is a time invariant unobserved individual effect, and ε_{it} is a random error term. In the random effects model the u_i are assumed to be the same for each individual across the survey waves, but randomly distributed across individuals with mean 0 and variance σ_u^2 . The u_i are also assumed to be uncorrelated with the observed X_{it} . In the fixed effects model the u_i are individual specific effects that are constant across survey waves, and may be correlated with observed X_{it} (Vaisey and Miles 2017). Rather than treating the u_i as individual specific error, the fixed effects model treats each u_i as an individual specific effect. If the u_i are uncorrelated with the X_{it} , then the random effects model provides both efficient and consistent estimates (An and Winship 2017; Greene 2012). The fixed effects model is not as efficient as the random effects model because it

only uses time-varying within person information, and does not use between individual information (Vaisey and Miles 2017). However, irrespective of the correlation between the u_i and the X_{it} , the fixed effects model always provides consistent estimates. Even though it is less efficient than the random effects model, the advantage of the fixed effects model is that it explicitly controls for all observed and unobserved time invariant individual and contextual characteristics across the survey waves so that estimates for any time-varying treatment effects are not contaminated by other unmeasured person specific attributes (Vaisey and Miles 2017). Both the random effects and the fixed effects versions assume that the ε_{it} are uncorrelated with one another. In the case of longitudinal data, and in particular attitudinal data, this assumption may not hold. Serial correlation among the errors can bias the estimates of the standard errors of the covariate effects and reduce efficiency (Drukker 2003:168).

To assist us in model selection and assessment we conducted tests of the following assumptions: (1) the variance of u_i equals 0, (2) the u_i are uncorrelated with the observed X_{it} , (3) the ε_{it} are homoscedastic, (4) the ε_{it} are uncorrelated with one another, (5) there is no endogenous selection into listenership of radio dramas based on prior gender attitudes, and (6) youth who listened to the radio serial dramas would have experienced the same general pattern of change over time in gender attitudes prior to the intervention as other youth (assumption of equal trajectories).

To test for endogenous selection we estimated the following model adapted from Morgan and Winship (2007: 267) for this purpose:

$$\log \left(\frac{\Pr[Yeken Kignit_{t=4}=1]}{\Pr[Yeken Kignit_{t=4}=0]} \right) = \alpha + \delta_1(Gender\ index_{t=3}) + \delta_2(Gender\ index_{t=1} + Genindex_{t=3}) + X_{i,t=4}\beta \quad (2)$$

The model uses the gender attitude index at wave 3, and the sum of the gender attitude indexes at waves 1 and 3 to predict listenership of *Yeken Kignit* at wave 4. Estimates of δ_1 and δ_2 that are

not significantly different from zero are evidence of no endogenous selection (see Vaisey and Miles 2017).

To test for equal trajectories in gender attitudes prior to wave 4, we estimated the following random effects model:

$$\begin{aligned} Gender\ index_{i,t=1,3,4} = & \alpha + \lambda_1 T_{i,t=3} + \lambda_2 T_{i,t=4} + \gamma_1 (YekenKignit_i \times T_{i,t=1}) + \gamma_2 (YekenKignit_i \times T_{i,t=3}) + \\ & \gamma_3 YekenKignit_{i,t=4} + \delta Radio\ dramas_{i,t=3} + X_{i,t} \beta + u_i + \varepsilon_{it} \end{aligned} \quad (3)$$

In this model λ_1 and λ_2 are the effects of waves 3 and 4, γ_1 and γ_2 are the differences in the gender index at waves 1 and 3 between to-be-listeners and to-be-non-listeners of *Yeken Kignit* respectively, γ_3 is the difference between listeners and non-listeners of *Yeken Kignit* at wave 4, δ is the effect of serial radio drama listenership at wave 3, and β is a vector of covariate effects associated with individual and community characteristics (radio listening index, highest grade completed, ever married, and community gender index). The model is a modification of Morgan and Winship's (2007: 269) model, and allows for change across time periods to be a non-linear function of time. The model allows to-be-listeners of *Yeken Kignit* to have values of the gender index different from to-be-non-listeners prior to exposure to *Yeken Kignit*. If listeners of *Yeken Kignit* are selected for more egalitarian gender attitudes starting at young ages, then estimates of γ_1 and γ_2 should be positive and significantly different from zero.

Results

Descriptive Statistics

Table 2 presents summary statistics for the measures of radio exposure and background characteristics by survey wave. Approximately two-thirds of the youth had a working radio in their home at the time of each of the three survey waves. Ownership of a radio is highest at wave 3, but then declines again by wave 4. The rise at wave 3 is not due to the distribution of the hand-cranked radios since the radios were distributed after the completion of interviews. Radio

listenership is higher among male than female youth, and there is some evidence that radio listenership actually declines among female youth between waves 3 and 4. Nevertheless, approximately, two-thirds to three-quarters of female youth listened to the radio on at least one of the last seven days, as did approximately 85 percent of male youth. Listenership of Jimma Community Radio, the local broadcaster of *Yeken Kignit*, was lower and dropped substantially between the two survey waves. At wave 3, 69 percent of female youth and 77 percent of male youth listened to Jimma Community Radio on at least one of the last seven days. However, by the wave 4 survey only 17 percent of female youth and 47 percent of male youth listened to Jimma Community Radio on at least one of the last seven days. The lower level of radio listenership among female youth compared to male youth is consistent with age-specific patterns of radio listenership found in the Oromia region by the 2011 Ethiopia DHS. The DHS survey found that 31 percent of females and 17 percent of males ages 17-24 in the Oromia Region (the region in which the study is located) did not listen to the radio at all (CSA and ICF International 2012).

[Table 2 about here]

Approximately 16 percent of female and male youth reported in the wave 3 survey that they had listened to a radio serial drama on one of the last seven days, and 34 percent of female youth and 27 percent of male youth reported listening to a drama on two or more of the last seven days. Listenership of *Yeken Kignit* at the time of the wave 4 survey was relatively low among female youth, around 7 percent or approximately 43 percent of females who listened to Jimma Community Radio. Among male youth, listenership to *Yeken Kignit* was higher, around 21 percent or approximately 45 percent of males who listened to Jimma Community Radio. In terms of background characteristics, the mean level of education increased across the three

survey waves, with both male and female youth having a mean of close to 6 years of schooling at wave 1, and progressing to a mean of approximately 10 years of schooling by wave 4. Also by wave 4, close to one-third of female youth were married, compared to only 3 percent of male youth.

Multivariate Analysis

We began our multivariate analysis by estimating the Breusch and Pagan Lagrangian test of the null hypothesis that the variance of u_i equals 0. We present the results of the tests of model assumptions in Appendix Table A2. The results of the Breusch and Pagan Lagrangian test provided evidence to reject the null hypothesis, and hence the random effects model that includes the person-specific error term u_i is preferred to an OLS model that only includes the individual survey wave specific ε_{it} term. We proceeded to estimate both random and fixed effects models with dummy variables for listenership to radio serial dramas at wave 3 and *Yeken Kignit* at wave 4, and dosage effect models. We also estimated separate models for females and males. We conducted individual Hausman tests to compare estimates of the coefficients for listenership to radio dramas in general and *Yeken Kignit* from the fixed and random effects models. The null hypothesis of the Hausman test is no difference in the alternative estimators of the covariate effect. The null hypothesis is the equivalent of assumption (2) that the u_i are uncorrelated with the predictors in the model. We did not compare all coefficients in the random and fixed effects models because our interest lies solely with the radio drama effects. Of the ten comparisons of coefficients between the FE and RE models, only two resulted in differences in covariate estimates that were significantly different (Appendix Table A2). Hence, the results provide strong evidence that the fixed and random effects models provide comparable estimates results of the radio drama effects. We also tested the assumption of homoscedasticity for the ε_{it} from the

fixed effects model and detected the presence of heteroscedasticity. We estimated both the fixed and random effects models with robust standard errors to correct for heteroscedasticity (Hoechle 2007). Finally, we conducted the test for serial correlation presented by Wooldridge (2002), and we rejected the null hypothesis of no correlation in the errors. To correct for serial correlation we estimated a random effects model with a first-order autoregressive disturbance term.⁴

The results from the tests of model assumptions 1-4 indicated that the random effects model with autoregressive errors is the preferred model. Nevertheless, we present in Table 3 estimates from the fixed effects, random effects, and random effects with autoregressive errors models to demonstrate the robustness of key results across alternative model specifications (An and Winship 2017). Models 1a, 1b, and 1c include dummy variables for listened to radio serial dramas on at least one of the last seven days at wave 3, and listened to *Yeken Kignit* on at least one of the last seven days at wave 4 to test for exposure effects of radio dramas on gender attitudes. The estimated effects of listenership to radio dramas at wave 3 and to the drama *Yeken Kignit* at wave 4 are positive, highly significant, and robust against the three alternative model specifications. The coefficients for listening to radio dramas in general at wave 3 range from a low of 0.142 in the fixed effects model to a high of 0.186 in the random effects models. The coefficients for listening to *Yeken Kignit* at wave 4 range from a low of 0.173 in the random effects model with autoregressive errors to a high of 0.233 in the fixed effects model. These results are net of overall radio exposure (radio listening index) at each wave, which is also associated with a significant rightward shift in the gender attitudes index in all models. The mean gender index at the community level (community gender index) is also positive and highly significant. The community level mean captures characteristics of communities and neighborhoods that are associated with variation in youth gender attitudes. As expected, youth

who live in places where more egalitarian gender attitudes tend to predominate, will themselves tend to have more egalitarian attitudes, even after taking into account individual level characteristics.

[Table 3 about here]

Two potential inferential concerns are first, youth with more egalitarian gender attitudes at younger ages selected themselves into radio drama listenership when they were older; and second, youth who listened to the radio dramas at older ages were already on different trajectories for change in gender attitudes than non-listeners irrespective of eventual exposure to the radio dramas. We found that neither of the estimates of δ_1 and δ_2 were statistically significant in equation 2 (Appendix Table A2), suggesting that gender attitudes at younger ages did not influence the likelihood of listening to *Yeken Kignit* at older ages. The test for endogenous selection requires measures from two time points prior to the treatment. Technically, we are only testing for endogenous selection with respect to listenership to *Yeken Kignit* and not endogenous selection into listenership of radio serial dramas in general at wave 3. Nevertheless, we feel it is reasonable to conclude that the absence of endogenous selection with respect to listenership to *Yeken Kignit* at wave 4 also extends to listenership to radio dramas in general at wave 3.

We also found that neither of the estimates of γ_1 and γ_2 in equation 3, testing the assumption of equal trajectories, were statistically significant (Appendix Table A2). Estimates of δ and γ_3 , the effects of radio dramas in general at wave 3 and *Yeken Kignit* at wave 4, were both positive and significant, which is consistent with our earlier result of significant radio drama effects (results not shown here). Similar to our test of endogenous selection, we only tested for different trajectories in the case of *Yeken Kignit* at wave 4, and not listenership to radio dramas in general at wave 3.

The results from the tests of endogenous selection and equal trajectories provide strong evidence that our findings regarding listenership to radio serial dramas and to *Yeken Kignit* are consistent with a causal linkage between exposure to radio dramas and change in gender attitudes over time. We find no evidence to suggest youth who listened to *Yeken Kignit* at wave 4 had different gender attitudes from other youth when they were younger, nor do we find any evidence that youth with more egalitarian gender attitudes at younger ages were more likely to listen to radio dramas or *Yeken Kignit* at older ages.

We next test for dosage effects and ask: does more frequent listenership to radio dramas have a bigger impact on gender attitudes than less frequent listenership? To test for dosage effects we replaced the single dummy variables for radio serial dramas and *Yeken Kignit* with a pair of dummy variables that correspond to listened one day, and listened two or more days in the last seven days. Results from the fixed effects, random effects, and random effects with autoregressive errors are shown in columns 2a, 2b, and 2c, respectively of Table 3. We find no evidence of dosage effects for listening to radio dramas in general. The differences in the coefficients corresponding to one day and two or more days across the three model specifications follow no consistent pattern and are not statistically significant in any of the three models. In the case of *Yeken Kignit*, only the coefficients for two days a week are statistically significant, and they are larger in magnitude than the coefficients for *Yeken Kignit* in the first set of models that did not differentiate dosage. The coefficients for listening to *Yeken Kignit* two days a week range from a low of 0.269 in the random effects model with autoregressive errors to a high of 0.313 in the fixed effects model.

The results from the dosage effects regressions, while not inconsistent with a dosage model, do not provide strong support of greater effects with greater exposure. The absence of

significant positive effects of listenership to *Yeken Kignit* on one day in the last week may reflect in part the relatively low levels of listenership at one day in the last seven days shown in Table 2. Less than 4 percent of youth reported listening to *Yeken Kignit* on one of the last seven days at wave 4. Listenership of *Yeken Kignit* twice a week was more common, especially among male youth.

Finally, we estimated non-dosage models for females and males separately to check for gender differences in the effects of radio listenership. In the fixed effects models presented in Table 3 the effect of gender is rolled into the person-level fixed effect term associated with u_i . However, not only do gender attitudes differ among male and female youth, but the responsiveness of those attitudes to radio drama listenership may vary as well. Table 4 presents results from fixed effects, random effects, and random effects with autoregressive errors models for females and males. The coefficients associated with listenership to radio serial dramas in general at wave 3 are positive and significant for female and male youth in all three models, and the coefficients are consistently larger for females compared to males. However, in the case of listenership to *Yeken Kignit*, the coefficients in the female models are negative and not statistically significant, whereas they are all positive and highly significant in the case of males. The effects of listenership to *Yeken Kignit* among males range from a low of 0.263 in the fixed effects model to high of 0.327 in the random effects with autoregressive errors model. The absence of any significant positive effects for *Yeken Kignit* in the female sample is likely due in part to the very low levels of listenership to *Yeken Kignit* at wave 4. Only 7 percent of female youth reported listening to *Yeken Kignit* at some time during the last week, compared to 50 percent of female youth who reported listening to any radio serial drama in the last week at the

time of the wave 3 survey. It is also possible that female gender attitudes are less amenable to change through radio exposure at older compared to younger ages.

[Table 4 about here]

Figure 1 puts the relative magnitude of radio drama effects for female and male youth in perspective. The horizontal bars present the effects of listenership to radio dramas and *Yeken Kignit*, and the effect of a three-year increase in the number of school grades completed, estimated by the random effects with autoregressive errors models presented in columns 3c and 4c of Table 4. In the case of female youth, the effect of listening to radio serial dramas in general on change toward more egalitarian gender attitudes is more than twice the magnitude of the effect of three additional years of schooling. Among male youth, the effect of listening to radio serial dramas in general is comparable to two additional years of schooling, and the effect of listening to *Yeken Kignit* is greater than the effect of three additional years of schooling. Put in the context of the relative effects of additional years of school, the estimated effects of radio dramas on youth gender attitudes are indeed impressive.

[Figure 1 about here]

Discussion

Our analysis examined the impact of radio serial dramas in general, and the radio drama *Yeken Kignit* in particular, on youth attitudes toward norms of gender equality in a region where women's status is comparatively low and traditional gender practices place women in a subordinate position to men. We leveraged the longitudinal design of the JLFSY and the availability of a multi-episode radio serial drama addressing issues of women's status and gender relations to test the impact of radio drama listenership on change in gender attitudes during a critical phase in young people's lives. We find very strong evidence that youth who listened to

radio serial dramas in general and to the drama *Yeken Kignit* experienced a significant shift toward more egalitarian gender attitudes over time relative to young people who did not listen to the radio dramas. Most promising of all, the effects of radio drama exposure are stronger for male than for female youth. We estimated a variety of model specifications to check the robustness of our results. We also tested for model assumptions, and corrected for the violation of assumptions when appropriate. Our results are consistent across models and hold up against tests for endogenous selection and unequal trajectories. We found no evidence to suggest that youth with more egalitarian gender attitudes at younger ages were more likely than other youth to listen to the radio drama *Yeken Kignit* at older ages. We also found no evidence to suggest that youth who listened to *Yeken Kignit* were already on a trajectory of change toward more egalitarian gender attitudes than other youth prior to program exposure. In addition, we included in our regression models an index of radio listening habits that controlled for selection into listenership of radio serial dramas and *Yeken Kignit* on the basis of radio listening habits. We did find that youth who were regular listeners of the radio held on average more egalitarian gender attitudes than other youth. The positive effects of exposure to radio dramas and to *Yeken Kignit* in particular that we detected in our models are above-and-beyond those associated with regular listening of any program type. Finally, the fixed effects models that we estimated measure change in gender attitudes net of individual and place characteristics that remain constant during the study period. Therefore, the results from these models are based on within person change and are not subject to sample selection bias or selective attrition.

Adolescence is an ideal life stage to use edutainment programming to promote long-term attitudinal change. Research from the United States suggests that adolescence is a critical time in the formation of attitudes about gender. A study of 402 siblings in the United States found that

adolescent gender attitudes became more flexible as adolescents moved from late childhood into early adolescence, and then reversed and became more rigid as the adolescents entered early adulthood and experienced greater pressure to conform to societal gender expectations (Crouter et al. 2007). Traditional gender attitudes in Ethiopia are highly patriarchal and place women in a subordinate position to men with respect to decision-making, freedom of movement, and subjugation to domestic violence, among other areas. The Ethiopia DHS found that close to one-half of women reported not being able make decisions about their own health care, major household purchases, or visiting their family (CSA 2012). Close to one-half of women agreed a husband was justified in beating his wife if she neglected the children (51.8%), if she burned the food (47.3%), or if she argued with him (45.4%; CSA 2012). While the median age at first marriage has increased slightly for Ethiopian women, half of women are still married by age 16.5 (CSA 2012). Fertility remains high in rural Ethiopia, with a total fertility rate of 5.5 among rural women (CSA 2012).

Improving young people's health through improving the status of women is a central aim of the Ethiopian Ministry of Health. The Ministry of Health outlined their goal of empowering young people to “challenge gender stereotypes, discrimination and violence within peers/families, educational institutions, workplaces and public space” in order to reduce female genital cutting, increase the median age at marriage, reduce child marriage, and reduce gender-based violence (Ministry of Health 2016, p 29). The Ministry of Health has identified increasing the use of mass media to change norms and attitudes about gender equity as a priority area in which the government can make substantial gains.

Prior studies have found edutainment in Ethiopia to be effective on a number of levels. Edutainment programs are cost-effective in areas of Ethiopia with low levels of literacy (Bogale

et al. 2011), and can reduce the health knowledge gap between those with high and low levels of education (Bekalu and Eggermont 2014). Among residents in northwest Ethiopia, exposure to any HIV/AIDS mass media content was associated with greater intention to be tested for HIV (Bekalu and Eggermont 2015). An important result from our analysis is that the estimated magnitude of the effects of listenership on positive change in attitudes regarding gender equality is comparable to three or more additional years of schooling (approximately six in the case of female youth and two to three in the case of male youth). This result highlights the cost effectiveness of radio dramas in the Ethiopian context in effecting change in gender attitudes. It is important to note that less than 50 percent of the youth in the JLFSY study reported listening to any radio drama in the week before the wave 3 survey, and that an even smaller percentage of youth (7 percent of females and 21 percent of males) reported listening to the drama *Yeken Kignit* at least once in the week before the wave 4 survey. While around one-in-three youth did not have a radio in their home, radio dramas will only reach a portion of those youth who even have access to radios, highlighting the point that radio dramas are one of multiple tools for disseminating new information and effecting attitudinal change.

Notes

¹In this paper we use the term youth, defined by the United Nations (1999) as persons between the ages of 15 and 24, to refer to the participants in our study.

²The ten statements are: 1. A woman should always listen to her husband. 2. A husband should have the final say in all major family matters. 3. Marriage by abduction is acceptable. 4. There is nothing a woman can do if her husband has a mistress. 5. Female circumcision is a practice that should continue. 6. Normally a man should not have to do housework. 7. A woman could be mayor. 8. A wife should be allowed to request a divorce. 9. A women should be allowed to marry a man of her choice. 10. It is acceptable for females to buy condoms. In wave 1 the responses were agree or disagree. In waves 3 and 4, the responses were strongly agree, agree, disagree, strongly disagree. In wave 1 agree was coded 1 and disagree was coded 0. In waves 3 and 4 strongly disagree was coded 1, disagree 2, agree 3 and strongly agree 4. Codes for

questions 1, 2, 3, 4, 5, and 6 were reversed coded. Statements 9 and 10 were not included in the wave 3 questionnaire. The absences of these two questions has no impact on differences in the index value across survey waves because the index is standard normal and estimated within survey rounds. Cronbach's alpha for items were 0.583, 0.709, and 0.681 in the three respective survey waves.

³For wave 1, we assigned the positive value of the score coefficient for radio ownership estimated from the wave 3 data to youth who had a radio at home, and we assigned the negative value of the score coefficient to youth who did not have a radio at home.

⁴The $\varepsilon_{it} = \rho_{i,t-1} + \eta_{it}$, and η_{it} are identically and independently distributed with mean 0 and variance σ_{η}^2 . We use the Durbin-Watson estimator of ρ (Stata 2011).

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Table 1. Response Rates across Adolescent Survey Waves, Jimma Longitudinal Family Survey of Youth, Jimma 2005-2013.

	Wave 1 2005-06 ages 13-17	Wave 2 2006-07 ages 14-18	Wave 3 2009-10 ages 17-21	Wave 4 2012-13 ages 20-24
Respondents	98.9%	91.8%	72.7%	59.5%
Nonrespondents	0.1%	6.2%	25.4%	38.1%
Refusals	1.0%	2.0%	1.9%	2.4%
Total	100.0%	100.0%	100.0%	100.0%
Effective sample size	2,107	2,104	2,102	2,087

Note: Effective sample size excludes subjects who were disabled or died.

Table 2. Radio Exposure and Selected Background Characteristics, Percentages and Means, Jimma Longitudinal Family Survey of Youth, Waves 1, 3 and 4, 2005-2013.

	Females			Males		
	Wave 1 13-17	Wave 3 17-21	Wave 4 20-25	Wave 1 13-17	Wave 3 17-21	Wave 4 20-24
Exposure to radio ^a						
Have working radio in the house	68.2%	79.3%	71.2%	63.4%	67.5%	63.1%
In last 7 days listened to radio 0 days ^b		24.0%	31.0%		11.9%	16.4%
1-7 days		76.0%	69.0%		88.1%	83.6%
In last 7 days listened to JC radio ^c 0 days		31.3%	82.7%		23.1%	53.0%
1-7 days		68.7%	17.3%		76.9%	47.0%
Exposure to radio dramas						
Listened to radio dramas 1 day a week		16.3%			15.7%	
Listened to radio dramas 2+ days a week		34.2%			27.2%	
Listened to <i>Yeken Kignit</i> 1 day a week			3.2%			3.7%
Listened to <i>Yeken Kignit</i> 2 days a week			4.1%			17.2%
Background characteristics						
Highest grade of school completed	5.9	8.8	10.1	5.8	8.3	9.6
Ever married	1.0%	10.2%	31.9%	0.0%	0.8%	3.2%
Number of observations	1028	653	510	1056	876	731

Notes:

^a Cronbach's Alpha for the radio listening index constructed from radio in house, days listen to radio and days listen to Jimma Community Radio for females and males pooled is 0.690 for wave 3 and 0.661 for wave 4.

^b The 2011 Ethiopia Demographic Health Survey found in the Oromia Region that 30.9% of women and 16.6% of men ages 17-24 did not listen to the radio at all.

^c Jimma Community Radio, broadcaster of radio drama *Yeken Kignit*.

Table 3. Estimates from Fixed Effects, Random Effects, and Autoregressive Random Effects Linear Regression Models Predicting Gender Attitudes, Jimma Longitudinal Family Survey of Youth Waves 1, 3 and 4, 2005-2013.

	Radio Effects Models			Dosage Effects Models		
	Fixed effects	Random effects	Random effects AR-1	Fixed effects	Random effects	Random effects AR-1
	Model 1a	Model 1b	Model 1c	Model 2a	Model 2b	Model 2c
Survey wave						
Wave 1 (ages 13-17)	---	---	---	---	---	---
Wave 3 (ages 17-21)	-0.027	-0.219**	-0.219**	-0.028	-0.221**	-0.220**
Wave 4 (ages 20-24)	0.019	-0.256**	-0.259**	0.018	-0.258**	-0.261**
Radio dramas exposure (wave 3)						
1+ days a week	0.142**	0.186**	0.183**			
1 day a week				0.131†	0.207**	0.199**
2+ days week				0.151*	0.179**	0.179**
<i>Yeken Kignit</i> exposure (wave 4)						
1+ days a week	0.233**	0.178*	0.173*			
1 day a week				-0.032	-0.132	-0.142
2 days a week				0.313**	0.272**	0.269**
Control variables (waves 1, 3, 4)						
Radio listening index	0.102**	0.095**	0.090**	0.099**	0.093**	0.087**
Highest grade completed	0.006	0.068**	0.068**	0.006	0.068**	0.069**
Ever married	-0.201**	0.124*	0.122*	-0.195*	0.132*	0.130*
Community gender index	0.950**	0.728**	0.726**	0.949**	0.728**	0.725**
R ² overall	0.134	0.167	0.167	0.135	0.169	0.169
Number of observations	4,456	4,456	4,456	4,456	4,456	4,456
Number of subjects	1,700	1,700	1,700	1,700	1,700	1,700

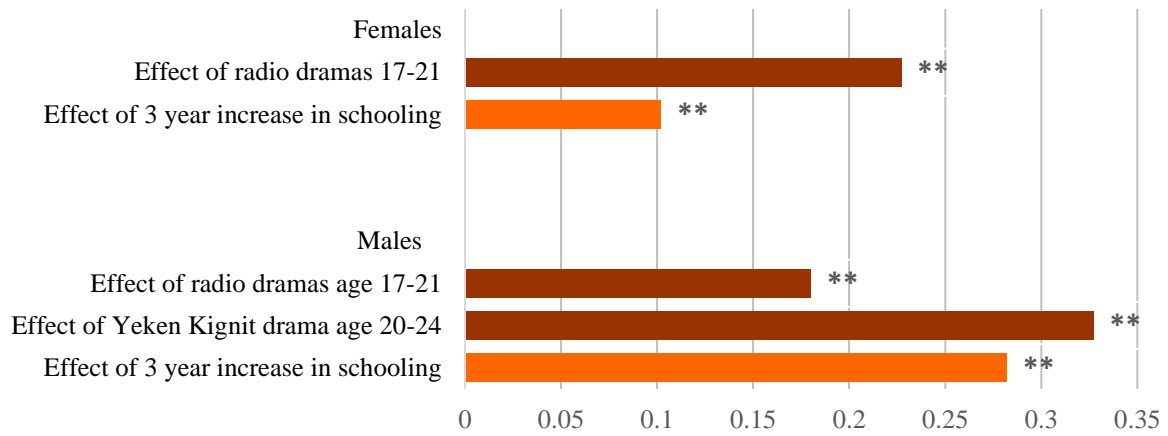
Note: ** $P < 0.01$, * $P < 0.05$, † $P < 0.10$.

Table 4. Estimates from Fixed Effects, Random Effects, and Autoregressive Random Effects Linear Regression Models Predicting Gender Attitudes among Female and Male Youth, Jimma Longitudinal Family Survey of Youth Waves 1, 3 and 4, 2005-2013.

	Radio Effects Models					
	Females			Males		
	Fixed effects Model 3a	Random effects Model 3b	Random effects AR-1 Model 3c	Fixed effects Model 4a	Random effects Model 4b	Random effects AR-1 Model 4c
Survey wave						
Wave 1 (ages 13-17)	---	---	---	---	---	---
Wave 3 (ages 17-21)	0.161 [†]	-0.078	-0.077	-0.176*	-0.300**	-0.301**
Wave 4 (ages 20-24)	0.154	-0.136*	-0.136*	-0.103	-0.304**	-0.309**
Radio exposure (round 3)						
Serial dramas 1+ days a week	0.188*	0.233**	0.227**	0.143*	0.183**	0.180**
Radio exposure (round 4)						
<i>Yeken Kignit</i> 1+ days a week	-0.014	-0.214	-0.233	0.263**	0.324**	0.327**
Control variables (waves 1, 3, 4)						
Radio listening index	0.028	0.044	0.042	0.130**	0.143**	0.138**
Highest grade completed	-0.040*	0.033**	0.034**	0.039*	0.093**	0.094**
Ever married	-0.160 [†]	-0.040	-0.044	-0.353 [†]	-0.186	-0.204
Community gender index	0.797**	0.721**	0.714**	1.033**	0.661**	0.660**
R ² overall	0.074	0.131	0.132	0.191	0.215	0.215
Number of observations	1,921	1,921	1,921	2,535	2,535	2,535
Number of subjects	763	763	763	937	937	937

Note: ** $P < 0.01$, * $P < 0.05$, [†] $P < 0.10$.

Figure 1. Estimated Effects of Radio Dramas on Change in Gender Attitudes Index for Female and Male Youth, Jimma Longitudinal Family Survey of Youth, 2005-2013, Results from Random Effects with Autoregressive Errors Regressions (Models 3c and 4c).



Note: ** $P < 0.01$, * $P < 0.05$, † $P < 0.10$.

Table A1. Radio Serial Dramas Broadcast in Ethiopia, 2002-2014.

Radio Programs	Frequency	Period	Program contents	Jimma Longitudinal Family Survey of Youth (JLFSY)
<i>Journey of Life</i>	Once a week 45 minutes 26 episodes	November 2001-June 2002	Contraceptive use and safe sex, HIV/AIDS, gender equality and gender-based violence.	
<i>Looking Over One's Daily Life (Amharic) Yeken Kignit</i>	Twice a week 20 minutes 257 episodes	2002-2004	Reproductive health, family planning, HIV/AIDS, harmful traditional practices and the elevation of women's status, the education of girls, and spousal communication about issues of reproduction.	
<i>Getting the Best Out of Life (Oromifa)</i>	Twice a week 20 minutes 140 episodes	2002-2004		
<i>Crossroads</i>	Twice a week 20 minutes 208 episodes	2005 – 2007	HIV/AIDS and sexual and reproductive health.	October 2005-April 2006 Wave 1 Adolescent Survey
<i>The Team</i>	50 episodes	July 2009-July 2010	How to manage and resolve conflict; issues of ethnicity, religion, and class; themes of violence, dialogue, tolerance, mutual respect, social responsibility, and empowerment.	November 2009-June 2010 Wave 3 Adolescent Survey
<i>Trauma</i>	Twice a week 25 minutes 266 episodes	2009-2011	Issues relevant for women in Ethiopia, such as female genital mutilation, reproductive health, HIV/AIDS, and early marriage and childbearing.	March 2011-April 2013 <i>Looking Over One's Daily Life</i> Twice a week Jimma Community Radio
<i>New Beginning</i>	Twice a week 25 minutes 180 episodes	June 2010-November 2011	Disease prevention, especially HIV/AIDS, tuberculosis, and sexually transmitted infections; hygiene and sanitation.	
<i>Broken Dreams</i>	130 episodes	2012-2014	Gender equality, female genital mutilation, drug and alcohol abuse, HIV/AIDS.	October 2012-April 2013 Wave 4 Adolescent Survey

Table A2. Tests for Fixed Effects and Random Effects Regression Model Assumptions.

Test	Null hypothesis	Test result <i>p</i> -value	Conclusion and response
Breusch and Pagan Lagrangian test (Rabe-Hesketh and Skrondal 2012: 89-90)	$\sigma_{u_i}^2 = 0$	$p = 0.000$ from model with Serial dramas 1+ and <i>Yeken Kignit</i> 1+	RE is preferred to OLS
Hausman test for a single parameter (Rabe-Hesketh and Skrondal 2012: 157; Wooldridge 2002: 290) $\frac{\hat{\beta}_{FE} - \hat{\beta}_{RE}}{[se(\hat{\beta}_{FE})^2 - se(\hat{\beta}_{RE})^2]^{1/2}}$	$\beta_{FE} = \beta_{RE}$	Model 1a vs. Model 1b Radio dramas 1+ $p = 0.095$ <i>Yeken Kignit</i> 1+ $p = 0.152$ Model 2a vs. Model 2b Radio dramas 1 $p = 0.020$ Radio dramas 2+ $p = 0.312$ <i>Yeken Kignit</i> 1 $p = 0.101$ <i>Yeken Kignit</i> 2+ $p = 0.280$ Model 3a vs. Model 3b Radio dramas 1+ $p = 0.294$ <i>Yeken Kignit</i> 1+ $p = 0.066$ Model 4a vs. Model 4b Radio dramas 1+ $p = 0.263$ <i>Yeken Kignit</i> 1+ $p = 0.039$	$p > 0.05$, RE preferred to FE $p > 0.05$, FE preferred to RE In 8 of the 10 comparisons, the difference between the estimated coefficients from the RE and FE models are not significantly different from 0.
Modified Wald test for groupwise heteroscedasticity (Baum 2001)	$\sigma_{FE(i)}^2 = \sigma_{FE}^2$ for all i	$p = 0.000$	Estimated models with robust standard errors.
Wooldridge test for autocorrelation (Drukker 2003)	No first-order correlation of errors	$p = 0.000$	Estimated RE model with first-order autoregressive errors.
Endogeneity test	$\delta_1 = 0$ $\delta_2 = 0$	$p = 0.945$ $p = 0.909$	No evidence of endogenous selection into <i>Yeken Kignit</i> listenership (treatment) at wave 4 by gender attitudes at wave 1 and wave 3.
Equal trajectories	$\gamma_1 = 0$ $\gamma_2 = 0$	$p = 0.227$ $p = 0.682$	No evidence of differences in wave 1 and wave 3 gender attitudes by exposure to <i>Yeken Kignit</i> (treatment) at wave 4.