Patterns of AIDS Awareness in Southern Africa: Examining the Role of Social Capital

Ruth Carlitz

April, 2004

Honors Thesis submitted in partial fulfillment of the requirements for Graduation with Distinction in Economics in Trinity College of Duke University

Abstract[*]

AIDS claimed an estimated 3 million lives in 2003 and HIV, the virus that causes AIDS, infected another 5 million people, bringing the total to 42 million people around the world living with AIDS – over 70 percent of them in Sub-Saharan Africa. As adult AIDS is an entirely preventable disease, one key element in the fight against it is the dissemination of information. While increased awareness of AIDS is not always coupled with behavior changes, it certainly serves to mitigate the tragic consequences of the AIDS epidemic, spurring public policy initiatives to fight the disease and making life easier for those living with AIDS. I examine patterns of information dissemination in Uganda (a "success story" country), as well as Zimbabwe (which is still mired in the AIDS epidemic) using survey data to see which sources of information have the greatest effect on increasing general knowledge of the disease. Then I examine how "social capital" – proxied by access to mass media and the religious homogeneity of social networks – contributes to patterns of AIDS awareness. My findings indicate that social capital matters in determining the spread of AIDS knowledge – as much or more than education and wealth. Thus my study points to the importance of investing in social capital as a key element in the fight against AIDS.

[*] Heartfelt thanks to Fernando Fernholz, Erin Fletcher, Alison Hagy, Stanislav Kolenikov, Malcolm McPherson and Alessandro Tarozzi for their help and encouragement .

I. Introduction

Twenty years ago, only a handful of people had heard of a virus called HIV and a disease called AIDS. In just two decades, the disease has exploded: AIDS claimed an estimated 3 million lives in 2003 and HIV, the virus that causes AIDS, infected another 5 million people, bringing the total to 42 million people around the world living with HIV/AIDS (UNAIDS, 2004). The disease, which preys upon people in the prime of their lives, currently has no cure and can go undetected for years – a factor that facilitates its spread. Precisely due to the fact that AIDS strikes people during the most productive periods of their lifetimes (though it can affect any person at any age), the disease has disastrous implications for productivity and economic growth. The worldwide epidemic is thus more than a public health tragedy; it can have dire economic implications as well, if left unchecked.

Though AIDS strikes indiscriminately, and has had an impact on people all over the world, a disproportionate number of AIDS cases are found in Africa. Sub-Saharan Africa is home to 26.6 million people living with AIDS – over 70 percent of the world's AIDS cases. In 2003, approximately 3.2 million people became infected with the disease and an estimated 2.3 million people in this region lost their lives to AIDS (UNAIDS, 2004). While the demographics of disease vary from country to country, the worst situations are found in a region of Southern Africa referred to as the "AIDS Belt," which stretches from Uganda and Rwanda to Zimbabwe and Botswana. Four countries in the region have adult HIV prevalence levels higher than thought possible at the beginning of the epidemic: In Botswana, Lesotho, Swaziland, and Zimbabwe, HIV prevalence exceeds 25 percent in adults (UNAIDS). Africa is also the only region in the world where women

have higher rates of AIDS infection then men. Heterosexual transmission is the primary source of new AIDS cases in Africa, and both biological and social factors place women at a greater risk (UNAIDS). Africa thus provides unique and important opportunities for study of the epidemic's devastating effects, though these effects – and responses to HIV/AIDS – vary across the continent.

The situation in Africa is not without hope, however. While the AIDS epidemic continues to spiral out of control in some African countries, there is clear evidence of declining prevalence and significant behavioral changes in others. Uganda is the most highly lauded success story in this case (Chabarika, 2003) and there have also been significant reductions in AIDS prevalence in Senegal, Zambia, and particular groups in Democratic Republic of Congo and Kenya (Mbulaiteye et al., p.41). Adult AIDS is an entirely preventable disease; thus one key element in the fight against it is the dissemination of information. While increased awareness of AIDS is not always coupled with behavioral changes, it certainly serves to mitigate the consequences of the AIDS epidemic, spurring public policy initiatives to fight the disease and making life easier for those living with AIDS (by normalizing the disease in everyday life). I examine patterns of awareness in Uganda (a "success story" country), as well as Zimbabwe (which is still mired in the AIDS epidemic). I measure the effectiveness of information dissemination by examining which sources of information have the greatest effect on increasing general knowledge. I find that while most people cite friends and family as their primary source of information about AIDS, this is not the most accurate source of information on AIDS knowledge. Across the two countries, radio broadcasts prove to be the most accurate

sources of information; schools, churches and community meetings are good sources of information as well.

It is important to understand how AIDS awareness patterns emerge and what contributes to behavioral changes in order to inform spending on AIDS prevention, which has emerged as an important component of aid packages to developing countries. I analyze how AIDS awareness spreads across communities using a social capital framework. I examine how "social capital" – proxied by access to mass media and the homogeneity of social networks – contributes to patterns of AIDS awareness. My findings indicate that social capital matters in determining the spread of AIDS knowledge – as much or more than education and wealth. Thus my study points to the importance of investing in social capital as a key element in the fight against AIDS. The next section identifies the theoretical and empirical work that has been done on social networks and social capital as it relates to the spread of information about AIDS. Section III presents the theoretical framework for my analysis. Section IV describes the data I use to conduct my analysis. Section V explains the empirical specification I use to estimate my model, and discusses my findings. Section VI states my conclusions and suggest possibilities for further research. Section VII is the data appendix.

II. Literature Review

The study of HIV/AIDS has recently emerged as an important topic in development economics. However, the bulk of the work being done in this area focuses on the macroeconomic impact of AIDS, primarily as it relates to growth. Recent research by Bell, Devarajan, and Gersbach (2003), Bonnel (2000), McPherson(2003) and a host of

other economists confirms that AIDS is detrimental to economic growth, since it strikes the most productive portion of the population, and blocks the accumulation of physical, human and social capital. McPherson identifies the channels through which AIDS affects growth as accumulation (investment), productivity (the efficient use of resources) and institutions (social capital).

Mainstream economic literature on how social capital affects the spread of AIDS awareness remains rather sparse, so I present a review of the literature on social networks to set the context for my study. In addition, some empirical studies are also informative, including a few that relate directly to social networks and HIV/AIDS.

Economic analysis of social interactions is a relatively new field in mainstream economics, supported primarily by those who subscribe to a broader view of the discipline as going beyond the study of markets (Manski, 2000, p. 115). Game theory offers new ways to think about social interactions, but economists are far from a consensus when it comes to defining social capital (p. 117). As Bowles (1999, in Manski, 2000, p. 122) writes, "Perhaps social capital, like Voltaire's God, would have had to be invented even if it did not exist. It may even be a good idea. A good *term* it certainly is not."

Uphoff (2000) has fewer qualms in defining social capital, breaking it down into categories that consistently appear in literature from the World Bank, USAID, and other international organizations concerned with health. He identifies social capital as an asset, like all forms of capital, that generates a stream of benefits to make future productive processes more efficient, effective, innovative, or expanded (p. 216). McPherson (2003) expands upon this definition: "Though not as readily measurable as physical or human

capital, social capital has all the elements of a capital resource. It requires finance, time, effort, and skill to create and maintain. Having been accumulated, social capital yields a valuable service" (p. 14). He goes on to cite its importance for economic growth and development of trust, reciprocity, cooperation, transparency, and accountability. Uphoff identifies the two main categories of social capital as structural and cognitive: structural social capital refers to the extrinsic and observable roles, rules, precedents, procedures and networks that facilitate "mutually beneficial collective action" (MBCA) and cognitive social capital refers to the unobservable norms, values, attitudes, and beliefs that predispose people to MBCA (p. 218).

Social capital may also be characterized using the language of game theory, where high levels of social capital indicate interactions among economic agents that are positive-sum games. That is, when social capital is high, the agents have positively interdependent utility functions and collective action is undertaken for the benefit of the whole group, rather than the individual alone (p. 222). Depending on the level of social capital present in a community, more or less weight will be assigned to others' benefits and one's own benefits in these utility functions.

We may think of AIDS awareness as a type of MBCA, generated by information dissemination (a part of structural social capital). McPherson (2003) states that information "has economic value if it modifies some decision maker's behavior" (p. 28) and explains that networks create value by lowering transaction costs. But the value of information and networks may be difficult to measure as "information has features of a capital good. It requires resources to generate and keep current (or relevant) and, like other capital goods, it depreciates (i.e., loses its relevance) over time" (p. 29).

However despite the inherent challenges, some economists have tried to quantify the effectiveness of social networks. Temple and Johnson (1998) revisit a socioeconomic development index from the early 1960s that identifies indicators of "social capability." They find that variables indicating the prevalence of mass communications (daily newspaper circulation, number of radios per capita) were the best proxies for the strength of civic communities (p. 986). Glaeser, Sacerdote, and Scheinkman (2002) define a "social multiplier" to capture the effects of social interactions, which often serve to amplify individual responses. Their research identifies social "spillover effects" in a number of areas (p. 2), which could conceivably be carried over to AIDS awareness. Elsewhere in the literature such effects are referred to as "peer effects," "herd behavior" or "contagion," to name just a few terms.

Social network effects have also been documented for information dissemination and behavioral change regarding contraceptive options. Munshi and Myaux (2002) develop a learning-based model of social change, based on the assumption that "many aspects of individual behavior are socially regulated in a traditional economy" (p. 1). This characterization implies social change may be slow in traditional economies, even if awareness levels are high, since social norms have a strong effect on individual behavior. Munshi and Myaux model the effects of an exogenous economic intervention (in their case health care workers distributing contraceptive devices in Bangladesh) and model the individual's choice as dependent on the intrinsic utility he or she will derive from making that choice as well as the social pressure or sanctions that accompany the action. The model predicts a gradual transition from the "traditional" equilibrium to the "modern" equilibrium (in their case widespread use of contraceptives), as both knowledge about the

intervention and knowledge about peers' behavior regarding the intervention increases. Applying the model to a contraceptive distribution program in Bangladesh, they find that contraceptive prevalence changes slowly and that religious homogeneity has a strong effect on increasing contraceptive prevalence. Religious homogeneity played a key role in their study in determining how information about contraception traveled across communities. Munshi and Myaux find strong within-religion effects and almost no cross-religion effects, indicating that people were more likely to discuss contraceptive options with members of their own religious groups.

Behrman, Kohler and Watkins (2003) make the link to HIV/AIDS more directly, showing how social networks influence individuals' perception of AIDS risks as well as households' decisions about preventive behavior. They explain that "the process of network selection appears to be structured by a combination of homophily and strategic selection of network partners who have relevant knowledge or experience" (p. 5). Homophily refers to the tendency of an individuals to favor other individuals who share similar characteristics to themselves. Their empirical study, which uses survey data from rural Kenya and Malawi, finds that homophily played a key role in the selection of "network partners" (people with whom survey respondents had discussed AIDS in informal settings). In addition, the study finds that increases in social network size lead to significant increases in risk perception for both men and women (p. 16). Social interaction with "network partners" also increases the probability of spousal communication about AIDS (p. 18) Social network effects are characterized as being "nonlinear and asymmetric" (p. 19) meaning that interaction with at least one "network partner" who is perceived to have a great deal of concern about AIDS will greatly

increase risk perception, whereas interaction with subsequent "network partners" with similar levels of concern does not have as strong effects.

Outside the realm of mainstream economics, a body of work in public health journals and case studies examine "what worked" in Uganda offer insight into patterns of AIDS awareness. One of the first countries in Africa where the AIDS epidemic was first reported, Uganda has shown declining prevalence since the late 1990s, from about 28 percent to 8% percent(Mbulaiteye et al., 2002). The Ugandan "success story" has been well-documented by a number of studies, but Parkhurst (2002) cautions that it must be interpreted critically. First, he disputes the oft-cited claim that AIDS prevalence fell from 30 percent to 10 percent in the span of six years. In reality, this dramatic decline in AIDS prevalence, which is often attributed to the whole of Uganda actually occurred at only one site, Mbara. Mbara is an urban testing site, and thus not an accurate representative of the country as a whole – which is 87 percent rural (p. 78). Parkhurst also makes the important distinction between declining AIDS prevalence and declining AIDS incidence. Prevalence is the number of total cases for a given population; incidence is the number of new cases. Declining prevalence does not necessarily indicate that the epidemic is coming under control; for successful AIDS prevention to be cited, there must be a decline in incidence.

The fact that AIDS prevalence is declining among young people in Uganda, as well as other segments of the population, is a good sign that a decline in incidence is occurring as well. Young people have only recently become sexually active, so a fall in prevalence is unlikely to be due to AIDS-related mortality (p. 78) – the "die-off"

syndrome. Parkhurst further cautions against attributing declining AIDS rates to any specific government intervention, when a host of factors is more likely at play.

A case study commissioned by the United States Agency for International Development (USAID) attributes significant declines in Uganda's HIV prevalence to the interaction of "a complex set of epidemiological, socio-cultural, political and other elements," many of which have been absent or less significant in countries that have not seen significant declines in HIV prevalence (Hogle, 2000, p.3). The study showed that the existence of open networks played a defining role. The study found that "Ugandans are relatively more likely to receive AIDS information through friendship and other personal networks than through mass media or other sources" and that knowledge can diffuse rapidly in an environment of "open" personal networks (p. 10). Other studies point to evidence that "HIV/AIDS awareness campaigns…. are an effective weapon in the fight against AIDS" (ID21 Health, 2003). Thus, an understanding of how accurate information spreads should be useful in the debate as to how to best combat AIDS.

III. Theoretical Framework

Based on the above findings, I posit a model of individual AIDS awareness that is dependent on both individual characteristics and group characteristics. A number of studies have identified consistent differences in AIDS awareness across gender and wealth, so these parameters must be considered. Specifically, men tend to be more aware of AIDS than women, and awareness tends to increase with socioeconomic status. The poor-rich differential is distinctly smaller in Sub-Saharan Africa than many other regions (Gwatkin & Deveshwar-Bahl, 2001, p.4) – probably due to increased prevalence in this

area – but it is still persistent. Gender differentials vary across countries, but they are not notably smaller in sub-Saharan Africa (p. 6). Education levels and whether a person lives in an urban area also play a role in determining AIDS awareness. In addition to these individual characteristics, the behavior of the group which with an individual interacts should play an important role in determining his or her level of AIDS awareness. A first-order linear approximation to the model for the perceived risk of AIDS is:

$$Y_{it}=a*X_{it} + b*S_{it} + c*G_{it} + f_i + e_{it}$$

where Y_{it} is an individual's level of AIDS awareness at time t, X_{it} is a vector of individual characteristics (age, education, wealth) at time t, S_{it} is a vector of social capital indicators specific to the individual at time t, G_{it} is a vector of AIDS awareness levels for the individual's reference group, f_i is a vector of unobserved fixed factors that are assumed to determine AIDS awareness by individual and e_{it} is an i.i.d. disturbance term that affects AIDS awareness of individual i at time t.

This model is similar to the first-order linear approximation to the model for the perceived risk of AIDS presented by Behrman et al.(2003), although their model omits the vector S_{it} and replaces G_{it} with the vector N_{it} – which represents the social network for individual i prior to time t. In addition, they are working with panel data and so are better able to control for fixed effects, whereas my data is not panel data. Munshi and Myaux (2002) present a much more detailed "learning-based model of social change," in which they show what factors affect the process of social change and explain for time lags in this process. The primary theoretical conclusions I take from Munshi and Myaux are their propositions about individual decisions as being dependent upon group decisions. Like Behrman et al., Munshi and Myaux cite the importance of homophily in

social network selection, particularly highlighting the importance of religious homogeneity.

Thus, in constructing my empirical model, I determine the vector G_{it} as being composed of both the proportion of people within the individual's own religious group who are highly aware[1] of AIDS and the proportion of people in other religious groups who are highly aware of AIDS. I apply Temple and Johnson's (1998) findings to construct the social capital vector S_{it} as a vector of variables which indicate an individual's access to different forms of media. Due to certain limitations in the data, some of the variables identified above either had to be omitted or were proxied for by other indicators. This will be discussed further in Section III.

Empirical evidence and social capital theory predict that the signs of the coefficients should all be positive. That is, increases in education and wealth should increase AIDS awareness, as should access to various forms of mass media. Access to mass media serves to make an individual better informed, and also serves as an indicator of social capital. Finally, the model captures the peer effects that have been discussed above. The level of awareness of members of an individual's community should increase his or her own AIDS awareness. Assuming homophily plays a role in network selection, the effect should be stronger for awareness of members of the individual's own religious group. The model is estimated using maximum likelihood, which is described in further detail in Section V.

[1] "Highly aware" indicates that a respondent is aware of two or more correct methods of AIDS prevention.

III. Data

Despite some controversy over the complete accuracy of its claim to being a "success", Uganda has shown significant declines in AIDS prevalence, so looking at trends here should provide an important perspective on how AIDS awareness spreads. In addition, I want to look at AIDS awareness patterns in a country that has not had Uganda's success. This characterization applies to the majority of countries in sub-Saharan Africa; I chose to study Zimbabwe based on the availability of survey data similar to Uganda's.

Uganda has survey data available from a 1995 study and a 2000/2001 study[2], while Zimbabwe has data for 1994 and 1999. All survey data comes from nationally representative Demographic and Health Surveys; the DHS program was initiated by the USAID to provide data and analysis on the population, health, and nutrition of women and children in developing countries. Due to the scope of the DHS, surveys are conducted in each country only once every five years or so. The DHS surveys offer rich data on both AIDS knowledge (factual knowledge, sources of knowledge and knowledge of ways to avoid AIDS) and AIDS behavior. It would have been interesting to look at survey data from the beginning of the epidemic as well, but surveys prior to mid-nineties did not ask any questions about AIDS.

In addition to questions about AIDS, the surveys also include many other household and individual statistics (such as education rates, availability of services and maternal mortality rates). I am most interested in the variables relating to AIDS

[2] While the final report for the Uganda study has already been published, the final dataset has not been released. I contacted the administrators of the survey and was given access to their working dataset. It may contain some missing observations relative to the other datasets I used.

knowledge, as well as certain social capital indicators (religious homogeneity and access to mass media). Since each country has survey data for two different years, I am able to look at both levels and changes in these variables. Table 1 shows a summary of the four datasets I used to conduct my analysis.

Table 1: Survey Details

Country, year	Primary Administrator	Total number of respondents	Number of male respondents	Number of female respondents	Number of enumeration areas (clusters)
Uganda, 1995	Department of Statistics/Ugandan Ministry of Finance and Economic Planning	9,066	1,996	7,070	295
Uganda, 2001	Uganda Bureau of Statistics	8,741	1,894	6,897	298
Zimbabwe, 1994	Central Statistical Office of the Government of Zimbabwe	8,269	2,141	6,128	230
Zimbabwe, 1999	Central Statistical Office of the Government of Zimbabwe	8,516	2,609	5,907	230

Sampling under the DHS is done by enumeration areas (or "clusters"), which are chosen to give a representative picture of the entire country, and are located in both rural and urban areas. Appropriate weighting is then applied to yield accurate country estimates.

Each DHS was conducted over a period of three to five months. I will be examining the responses to two different questionnaires for each DHS, the individual survey, which questioned women only and the men's survey, which questioned men only. The individual survey contains more extensive questioning regarding fertility, family planning and birth history, as well as questions about household characteristics. For each DHS, interviews were conducted by teams of 10 to 11 trained interviewers.

The variables in which I am most interested are those that capture AIDS knowledge. In each of the surveys, respondents were asked a number of questions about AIDS. The responses to these questions form the basis of variables that capture AIDS knowledge. Respondents were first asked if they have ever heard of an illness called AIDS, then if they know if AIDS can be avoided, after which they are asked to identify the specific ways in which AIDS can be avoided. AIDS knowledge can thus be ranked on a scale from 1 to 4, which is what I did to construct my main dependent variable, "AWARE". A score of 1 means the respondent has not heard of AIDS, 2 means the respondent has heard of AIDS but knows of no way to avoid the disease, 3 means the respondent knows of only one way to avoid the disease, 4 means the respondent knows of more than one way to avoid it. The two most common responses are reducing the number of partners and using condoms, though other responses are given as well, such as avoiding needles or sex with prostitutes.[3] Table 2 shows the summary statistics for AWARE.[4] In general, AIDS awareness remained rather constant in each country over the years. The most notable increase is the proportion of individuals in Zimbabwe for whom AWARE=4.

Table 2: AIDS Awareness (Percentage)

	Uganda		Zimbabwe	
	1995	**2001**	**1994**	**1999**
AWARE=1	0.62	0.18	1.32	2.67
AWARE=2	10.64	9.72	15.31	12.89
AWARE=3	29.05	25.17	45.42	23.13
AWARE=4	59.69	64.93	37.95	61.32

[3] Some respondents said they know of a way to prevent AIDS but then cited an incorrect prevention method (such as avoiding mosquitoes). These incorrect responses were coded as no knowledge of prevention.

[4] A complete representation of summary statistics by survey is presented in the Data Appendix.

AIDS awareness presumably is somewhat dependent on AIDS prevalence, thus the statistics on AIDS prevalence for the years in which the surveys were conducted are presented in Table 3.

Table 3: AIDS Prevalence (Percentage)
Source: UNAIDS

Country, Year	AIDS Prevalence
Uganda 1995	12.24
Uganda 2001	5.0
Zimbabwe 1994	25.42
Zimbabwe 2000[5]	32.86

The surveys also ask respondents if they know how AIDS can be transmitted, and asks them to describe how it is transmitted. Though this falls under the category of AIDS knowledge as well, I did not include this in my "awareness" variable, since the questions related to behavior are more informative.

The earlier surveys also ask respondents to identify where they learned about AIDS. This provides an interesting clue as to which forms of information dissemination are the most effective and seems to support my hypothesis about the importance of social capital in determining AIDS awareness, since the majority of people learn about AIDS via their friends and relatives. Table 4 lists the statistics for the various forms of information dissemination for the Uganda 1995 survey and Table 5 lists the statistics for the 1994 Zimbabwe survey.

[5] UNAIDS did not conduct HIV sentinel surveillance for many testing sites during 1999, thus the 2000 figure is probably more accurate.

Table 4. Summary statistics for information sources, Uganda 1995.

Information Source	Mean
Radio	.4626897
TV	.0371434
Newspaper	.0625787
Pamphlet	.031835
Clinic or Hospital	.1626642
Church or Mosque	.1503305
School	.0998066
Community Meeting	.1997438
Friends or Family	.798559
Workplace	.0288771
AIDS victim	.1083809

Table 5. Summary statistics for information sources, Zimbabwe 1994.

Information Source	Mean
Radio	.6773972
TV	.2899852
Newspaper	.3267641
Pamphlet	.125726
Clinic or Hospital	.4312404
Church or Mosque	.0328933
School	.1517447
Community Meeting	.0964672
Friends or Family	.3990557
Workplace	.0348202

We see that for Uganda, the radio and friends and family are overwhelmingly the most commonly cited sources of AIDS information and when we examine the statistics for women only, the percentage who cite friends and family as an information source increases. In addition, slightly over half of the population cites the radio as a source of information as well. In Zimbabwe, the radio is also a highly cited source, but some interesting differences are notable across the two countries. Friends and relatives are still a commonly cited source of information in Zimbabwe, but only for about 40 percent of the respondents as opposed to 80 percent in Uganda. In addition, many more respondents in Zimbabwe indicate having heard about AIDS from television or newspapers. The

most commonly cited source in Zimbabwe is clinics or health workers; this source of information was far less commonly cited in Uganda.

Based on the variance in AIDS prevention knowledge, it is presumable that while many people hear of AIDS from friends or relatives, they may not be receiving complete information from this source. Regression analysis with the information sources as the independent regressors and AIDS awareness as the dependent variable shows what the "best" source of knowledge is in each country. However, even if a source of knowledge is "good" in terms of providing accurate information, it is less good if it is not very widely available.

The second part of my data analysis attempts to uncover the relationship between social capital in Uganda and Zimbabwe and AIDS awareness. The DHS data is collected from a number of different communities in each country, among which levels of social capital will presumably vary. One possible indicator of social capital is homogeneity of religion. Behrman et al. (2003) highlight the importance of homophily in network selection and Munshi and Myaux (2002) identify the presence of homophily in terms of religion, finding that people are much less likely to communicate across religions. Presumably, in a village where everyone shares a common religion, social cohesion will be higher.

For each survey, respondents were asked to identify their religion. For each survey, three or four major religious groups are identified, with remaining respondents lumped together under the specification "Other." The categorization of religious groups did not remain exactly the same in each country across the interval between the two survey rounds. Table 6 shows religious variation among the respondents. The majority

of respondents in Uganda identify themselves as either Catholic or Protestant. In Zimbabwe, the majority of respondents identify themselves as Christian. The number of Christians appears to have increased dramatically from 1994 to 1999 but this is probably due to the relabeling of the categories: presumably, some respondents who would have themselves as "Spiritual" in the 1994 survey, now identified themselves as "Christian." This likely stems from the fact that many adherents to Christianity in Zimbabwe follow a sort of syncretic Christianity that incorporates traditional elements (Central Intelligence Agency World Factbook, 2003). The fact that the categories change somewhat across the years will make it harder to evaluate changes in awareness patterns across time, since some of the variables will not be defined in precisely the same way.

Table 6: Religious Variation (Percentage)

Survey Country and Year	Number Religion Categories	Catholic	Protestant	Muslim	Seventh day Adventist	Traditional	Spiritual	Christian	None	Other
Uganda, 1995	5	42.99	40.77	12.12	1.44	N/A	N/A	N/A	N/A	2.68
Uganda, 2001	4	39.72	41.52	13.76	N/A	N/A	N/A	N/A	N/A	5.00
Zimbabwe, 1994	4	N/A	N/A	N/A	N/A	9.29	31.55	53.06	N/A	6.10
Zimbabwe, 1999	5	N/A	N/A	0.69	N/A	6.10	N/A	77.04	13.28	2.90

I created two new variables to test whether homophily plays a role in the spread of AIDS knowledge, using religion as a means of capturing the effects of homophily. The Demographic and Health Surveys divide countries first into regions of approximately equal size, and then break each region down further into "clusters" of approximately equal size and distribution across the region. The cluster level was the most important to consider in determining homophily effects, because network selection presumably takes

place within clusters (villages or urban communities) and not across them. Rather than calculate religious homogeneity by cluster as such[6] I specified two new variables, YOURAWARE and OTHERAWARE. YOURAWARE expresses the proportion of highly aware people who share the respondent's religion, and OTHERAWARE expresses the proportion of highly aware people who do not share the respondent's religion. Both variables can be included in a regression with AIDS awareness as the dependent variable, since YOURAWARE and OTHERAWARE do not theoretically sum to one. For instance, consider a cluster where all respondents identify themselves as either Catholic or Protestant. If the respondent is Catholic, YOURAWARE will be the proportion of Catholics who are highly aware of AIDS; OTHERAWARE will be the proportion of Protestants who are highly aware of AIDS. If the individual respondent is highly aware of AIDS, he will be subtracted from the proportion to calculate YOURAWARE. A numerical example in the data appendix should offer further clarification. A number of observations had to be dropped in the creation of YOURAWARE OTHERAWARE, since some clusters had no religious variation at all and other clusters had only one respondent for each given religion. The number of "problem" clusters for each survey is listed in the data appendix.

AIDS knowledge appears to be correlated with education, so it will be important to include this variable in my regressions. Respondents are asked to give their level of education as no education, primary education and secondary education. Thus most

[6] In my preliminary analysis I actually did specify religious homogeneity by cluster, as a proxy for social cohesion of the cluster. My variable RELHOG was constructed like the Herfindahl index for market share. The Herfindahl index is commonly used to check for monopolies and oligopolies for a given industry, and is constructed by summing the squares of each firm's market share. Further analysis led me to realize that religious homogeneity as such would not really capture the effects of social cohesion and network selection that I wanted to capture.

regressions include three categorical dummies indicating the respondent's highest education level. The dummy indicating no education is omitted from the regressions. Another important variable is income, however the DHS do not list any information on expenditures. Only the Uganda 2001 survey includes a wealth index among its variables. For my other regressions, I include a dummy variable equal to 1 if the respondent's household had electricity, which should be correlated to wealth[7]. In addition, I include "urban" dummy variables to capture the effects of certain characteristics specific to city. I also include regional dummies to account for other unobserved characteristics that might vary by region and affect AIDS awareness.

One of the biggest challenges I identified with my data stemmed from the fact that the surveys are constructed differently across years, so it was difficult to make completely accurate statements about the changes that have occurred over time. Fortunately, the 2000-2001 Uganda and the 1999 Zimbabwe surveys are structured rather similarly, as are the 1995 UDHS and the 1994 ZDHS, enabling me to make cross-country comparisons.

The DHS data is also subject to certain other weaknesses. As with all survey data, it is subjective, and respondents may not respond entirely truthfully, especially about sensitive topics such as sexual activity. In addition, analysis of social interactions often suffers from an identification problem in distinguishing between endogenous, correlated, and contextual effects. Another potential general problem with survey data is

[7] There is currently some debate in the development economics literature as to how to best proxy for wealth if no specific consumption data is given. Some researchers propose constructing a wealth index while others use the technique of principal components. Since I am not interested in wealth effects per se, I did not construct a wealth index of my own, or apply the principal components method. One proxy I have seen in my review of the literature on this subject is roof material, however these observations were omitted in this survey.

the clustering that may occur in responses, stemming from the fact that people who live in the same place often exhibit similar behavior. Clustering means that survey respondents cannot be thought of as completely independent, and thus estimation that assumes i.i.d. errors (such as maximum likelihood estimation) could yield biased estimates. Fortunately, that statistical package I used to conduct all of my analysis, STATA, takes this into account and corrects for within-cluster correlation.

V. Empirical Specification

I originally hypothesized that AIDS awareness would be highest where indicators of "social capital" were the highest, as knowledge should spread more easily in areas with higher levels of social cohesion. Prior to explicitly testing this hypothesis, I wanted to see which sources of information provide the most accurate information about AIDS. My first set of regressions test which source of information is the most effective by running a probit regression where MOREAWARE is the dependent variable. MOREAWARE is a dummy that equals 1 if AWARE is equal to 4. The independent variables are dummies that correspond to different sources of information.

My analysis involves probit and ordered probit regressions, which will be discussed briefly. The probit regression is a nonlinear regression model specifically designed for binary dependent variables. Since the variable MOREAWARE is a binary dependent variable, it makes more sense to use probit regression for my analysis than linear regression, as probit regressions forces the predicted values to be between zero and one. The probit regression has the form

$$Pr(Y=1|X_1, X_2,\ldots,X_k)=\Phi(B_0+B_1X_1 + B_2X_2 +\ldots+ B_kX_k)$$

where Y is the dependent variable, $X_1, X_2,\ldots,X_k$ are the regressors, and Φ is the cumulative standard normal distribution function. The values of the probit coefficients $B_0,B_1X_1,\ldots,B_k$ are estimated using maximum likelihood estimation. For each sample, there exists a likelihood function. Loosely speaking, the likelihood of a set of data is the probability of obtaining that particular set of data given the chosen probability model – in our case, the probit model. Maximum likelihood estimation calculates the values of the estimated parameters that would maximize the likelihood function (or often, in practice, the log of the likelihood function).

The values of the probit coefficients do not have simple interpretations and thus the model is best interpreted by computing predicted probabilities and the effect of a change in a regressor on the predicted probability of a certain outcome. This involves computing the predicted probability for the initial value of the regressors, then computing the predicted probability for the new or changed value of the regressors and finally taking their differences. Due to the difficulties in interpreting the coefficients, I am primarily concerned with their sign and significance. Furthermore, all regressions are adjusted for survey effects. The survey correction takes into account possible clustering effects that may appear in the data, correcting the standard errors and applying sample weights to obtain the correct point estimates.[8]

[8] This is more robust than the normal White heteroskedasticity robust standard error corrections that are reported in most statistical packages. The survey correction is necessary in this case since the design of the DHS, like that of almost all surveys, is such that the observations are not sampled independently. Sampling by cluster necessitates questioning people who live in the same village and thus who may share certain characteristics. Thus if the survey correction is not enacted, the standard errors reported may be too small. Footnote continues on next page

In Uganda, 1995, we find that across genders, friends and families are the most commonly cited sources of AIDS information, and the radio is the second most commonly cited source. The regression reported in Table 7 tests whether these and other sources of information are actually effective.[9]

Table 7

	moreaware
AIDS: radio	0.436
	(0.042)**
AIDS: television	0.063
	(0.086)
AIDS: newspapers/magazines	0.229
	(0.081)**
AIDS: pamphlets/posters	0.478
	(0.113)**
AIDS: clinic/health workers	0.280
	(0.049)**
AIDS: churches/mosques	0.363
	(0.058)**
AIDS: schools/teachers	0.342
	(0.070)**
AIDS: community meetings	0.349
	(0.053)**
AIDS: friends/relatives	0.102
	(0.048)*
AIDS: work place	0.048
	(0.112)
Constant	-0.662
	(0.080)**
Observations	8536

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

The results from this regression show that television is not a significant source of information for increasing knowledge of prevention methods, nor is the workplace. All of the other information sources significantly increased the probability that a respondent would be aware of two or more methods of AIDS prevention. To get a better sense of the

---

In addition, STATA applies the sample weights reported in the dataset to compute the correct point estimates, since the DHS may undersample or oversample certain populations.

[9] This regression also included education, gender and wealth variables in order to control for these parameters, but the coefficients on these regressors are not reported here.

magnitudes of effectiveness of each source of information, the marginal effects of each variable are calculated and reported in Table 7a.

Table 7a

variable	dy/dx
Radio	.1681896
Television	.0243872
Newspapers/Magazines	.0868931
Pamphlets/Posters	.1724426
Clinic/Health Workers	.1063232
Churches/Mosques	.1365115
Schools/Teachers	.128202
Community Meetings	.131998
Friends/Relatives	.0400386
Workplace	.018592

(*) dy/dx is for discrete change
of dummy variable from 0 to 1

From Table 7a, we see that the radio and pamphlets are of approximately equally important magnitudes when it comes to increasing factual knowledge of prevention methods, whereas friends and families contribute less to AIDS awareness. That is, if a person hears about AIDS on the radio or from a pamphlet or poster, he or she will be approximately 17 percent more likely to be highly aware of AIDS; if he or she hears about AIDS from friends and family, the probability of being highly aware decreases to only four percent. This result is especially interesting considering nearly 80 percent of respondents cite friends and relatives as their primary source of information. Though not as prevalent, the radio is still a widely cited source of information, thus its effectiveness is encouraging. Another interesting result is the effectiveness of pamphlets and posters, which were cited by only about four percent of respondents. We can compare these result with a similar regression for Zimbabwe, 1994, which is shown in Table 8. Table 8a shows the marginal effects for this regression.

Table 8

Sources of AIDS Information Zimbabwe 1994	
	moreaware
AIDS: radio	0.463
	(0.042)**
AIDS: television	0.096
	(0.047)*
AIDS: newspapers/magazines	0.319
	(0.039)**
AIDS: pamphlets/posters	0.212
	(0.060)**
AIDS: clinic/health workers	0.438
	(0.038)**
AIDS: churches/mosques	0.426
	(0.097)**
AIDS: schools/teachers	0.463
	(0.054)**
AIDS: community meetings	0.415
	(0.060)**
AIDS: friends/relatives	0.332
	(0.042)**
AIDS: work place	0.293
	(0.097)**
Constant	-1.663
	(0.070)**
Observations	7572

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

Table 8a

variable	dy/dx
Radio	.1704779
Television	.0367347
Newspapers/Magazines	.1230579
Pamphlets/Posters	.0823955
Clinic/Health Workers	.1671392
Churches/Mosques	.1680116
Schools/Teachers	.1814257
Community Meetings	.1627264
Friends/Relatives	.1273158
Workplace	.1149354

(*) dy/dx is for discrete change of
dummy variable from 0 to 1

Unlike the Uganda regression, this regression shows that all of the information sources matter. The magnitude of the effects for the different media sources is approximately the same. Pamphlets appear to be less effective sources of information, while family and friends are more effective sources. In general, the patterns of effectiveness for the different sources of information tend to mirror their popularity. For instance, the radio was the most commonly cited source of AIDS information among Zimbabwe residents, and it also appears to be the most effective. Clinics or health workers were the second most commonly cited source and they prove very effective as well.

The radio is a very effective information source across both countries, while television is insignificant or ineffective. The insignificance of television as an information source probably stems from the fact that many fewer people have access to television, as compared with other forms of media. In 2001, Uganda only had 500,000 televisions for its population of nearly 26 million people; Zimbabwe only had 370,000 televisions for its population of nearly 13 million people in 1997 (CIA World Factbook, 2003). Given that the surveys took place prior to the dates of these statistics, the number of televisions was probably even lower. The most notable differences between the two countries are the differences in effectiveness for pamphlets and posters, clinics, friends and relatives and the workplace. Pamphlets and posters are much more effective in Uganda; the other information sources are more effective in Zimbabwe.

I performed further analysis using AWARE as the dependent variable. AWARE is a variable with multinomial, ordered output, so ordered probit regression was used. The independent regressors in my AWARE equations capture individual characteristics, access to mass media (used to proxy for levels of social capital), and group knowledge of

AIDS. The individual regressors differ slightly across the regressions, but in general include a household electricity dummy (to proxy for wealth), three categorical education dummies (representing primary education, secondary education and post-secondary education as the highest level of educational attainment; the dummy equal to zero if the respondent had no education was omitted), an urban dummy, and in the case of Uganda, 2001, a wealth index. The expected sign on all of these regressors is positive. The media access variables dummies are each equal to one if the respondent accesses the particular form of media (radio, newspaper or television) at least once a week The expected sign on the coefficients for these variables is positive as well. Finally, the variables YOURAWARE and OTHERAWARE are included to see how the awareness levels of other people in an individual's community affect his or her level of AIDS awareness.

The expected signs on YOURAWARE and OTHERAWARE are positive, since I expect to see peer effects in patterns of AIDS awareness. In addition, according to my hypothesis, if both YOURAWARE and OTHERAWARE are included in my regression, their signs should be the same, but the coefficient on YOURAWARE should have significantly greater magnitude.

The ordered probit model was first developed by Aitchison and Silvey in 1957 (Cramer, 2003) and was modified to its present form by McKelvey and Zavoina in 1975. The ordered probit model is a generalization of the probit model in which the probabilities of each ordered outcome are modeled using the cumulative normal distribution. The ordered probit model may be explained in terms of a latent dependent variable Y, which takes on values from 1 to R ordered categories. The R ordered categories correspond to intervals of Y, separated by R-1 thresholds, $\alpha_1,\ldots,\alpha_{R-1}$. Thus,

$$\Pr(Y=1|X_1, X_2,\ldots,X_k)=\Phi(\alpha_1+B_0+B_1X_1+\ldots+B_kX_k)$$

$$\Pr(Y=2|X_1, X_2,\ldots,X_k)=\Phi(\alpha_2+B_0+B_1X_1+\ldots+B_kX_k)-\Phi(\alpha_1+B_0+B_1X_1+\ldots+B_kX_k)$$

.

.

.

$$\Pr(Y=R-1|X_1, X_2,\ldots,X_k)=\Phi(\alpha_{R-1}+B_0+B_1X_1+\ldots+B_kX_k)-\Phi(\alpha_{R-2}+B_0+B_1X_1+\ldots+B_kX_k)$$

$$\Pr(Y=R|X_1, X_2,\ldots,X_k)=1-\Phi(\alpha_{R-1}+B_0+B_1X_1+\ldots+B_kX_k)$$

where Φ is once again the cumulative standard normal distribution function[10].

The next set of regressions moves on to the main focus of my analysis and is my attempt to capture all of the individual and group characteristics to which I referred above. Table 9 shows the results I obtain when I regress AIDS awareness on certain household and individual characteristics for respondents in Uganda, 1995.[11,12]

[10] In estimating ordered probit regressions, STATA does not identify a constant. STATA calculates the appropriate α's and reports them in the regression as the different "cuts."

[11] I do not report the marginal effects for these regressions, since these would be much more difficult to interpret than the marginal effects for regular probit regressions. I would have to report the predictive probabilities for each outcome, and there is less intuition as to what I would expect for anything but the extreme values. Thus I am primarily concerned with the signs and significance of the coefficients in the following regressions.

[12] The coefficients on the regional dummies are not reported for any of the regressions, since they were not the focus of my analysis. The complete regressions can be made available by request of the author.

Table 9

Uganda 1995
Ordered Probit Regression

	(1) AIDS awareness	(2) AIDS awareness	(3) AIDS awareness	(4) AIDS awareness
Household level Electricity	0.013	-0.001	0.006	0.017
	(0.068)	(0.069)	(0.070)	(0.071)
Urban	-0.093	-0.094	-0.097	-0.048
	(0.047)*	(0.046)*	(0.046)*	(0.049)
Educ==1	0.283	0.273	0.248	0.255
	(0.038)**	(0.037)**	(0.042)**	(0.043)**
Educ==2	0.730	0.727	0.703	0.716
	(0.057)**	(0.058)**	(0.067)**	(0.068)**
Educ==3	0.555	0.611	0.078	0.031
	(0.327)	(0.334)	(0.421)	(0.422)
Reads newspaper once a week	0.197	0.196	0.193	0.213
	(0.042)**	(0.042)**	(0.042)**	(0.042)**
Watches TV every week	0.028	0.052	0.052	0.029
	(0.067)	(0.066)	(0.065)	(0.067)
Listens to radio every week	0.315	0.308	0.308	0.325
	(0.034)**	(0.034)**	(0.034)**	(0.035)**
youraware	0.549	0.554	0.565	0.927
	(0.103)**	(0.121)**	(0.122)**	(0.143)**
otheraware	0.653	0.853	0.856	
	(0.129)**	(0.172)**	(0.172)**	
gender==Male	0.132	0.754	0.567	0.302
	(0.073)	(0.244)**	(0.259)*	(0.237)
(gender==Male)*youraware		-0.002	-0.043	-0.671
		(0.253)	(0.252)	(0.323)*
(gender==Male)*otheraware		-1.153	-1.180	
		(0.327)**	(0.330)**	
gender==Male & Educ==1			0.261	0.231
			(0.130)*	(0.131)
gender==Male & Educ==2			0.248	0.186
			(0.168)	(0.169)
gender==Male & Educ==3			1.490	1.425
			(0.527)**	(0.528)**
Observations	8300	8300	8300	8411

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

A look at regression (1) shows some expected results and others that are a bit puzzling. I find a significant effect for education (though education beyond secondary

school does not seem to matter) and I also find that males tend to be more aware of AIDS than females. I had expected the coefficient on the household electricity dummy to be positive, but it is insignificant, indicating that household-level electricity may not have been the best proxy for wealth. Household-level electricity is also likely to be correlated with radio and television access. The urban is significant, but negative, which is odd. It is possible that living in an urban area and having electricity are highly collinear, which could explain this result. Or it is possible that the urban dummy is capturing the effect of some omitted variable that might decrease AIDS awareness. For instance, social networks may be weaker in urban areas.

The significant, positive coefficients on the radio and newspaper access variables partially support my hypothesis that access to mass media is important for determining AIDS awareness. The positive, significant coefficients on YOURAWARE and OTHERAWARE point to the presence of peer effects. However, the coefficient on OTHERAWARE is larger than the coefficient on YOURAWARE. This seemed odd to me, so I performed a coefficient test to test the null hypothesis that the coefficient on YOURAWARE is equal to the coefficient on OTHERAWARE. This test returned a value of only 0.29 (p-value: 0.5906), so I was not able to reject the null. That is, while peer effects appear to be playing a role, it does not seem to matter to which religious group your peers belong. This goes against the homophily assumption for social network selection.

In regressions (2) and (3), I added some interaction terms as additional regressors. The addition of the interaction term in regression (2) shows that peer effects are much weaker for males, though again a coefficient test proved that peer effects do not

vary significantly across religious groups. Finally, regression (4) omits OTHERAWARE as a regressor, since regressions that report both YOURAWARE and OTHERAWARE drop a considerable number of observations due to the inherent problems in constructing the variables, which were mentioned in Section III.

We now move on to the results for Zimbabwe 1994, which are reported in Table 10.

Table 10

Zimbabwe 1994 Ordered Probit Regression				
	(1)	**(2)**	**(3)**	**(4)**
	AIDS awareness	**AIDS awareness**	**AIDS awareness**	**AIDS awareness**
Household level Electricity	0.085	0.084	0.086	0.087
	(0.055)	(0.055)	(0.055)	(0.055)
Household level Radio	0.132	0.132	0.132	0.132
	(0.032)**	(0.032)**	(0.032)**	(0.032)**
Urban	0.082	0.083	0.080	0.082
	(0.067)	(0.068)	(0.068)	(0.067)
Educ==1	0.355	0.354	0.371	0.373
	(0.058)**	(0.058)**	(0.061)**	(0.062)**
Educ==2	0.692	0.691	0.688	0.692
	(0.060)**	(0.060)**	(0.064)**	(0.064)**
Educ==3	1.080	1.079	1.088	1.093
	(0.148)**	(0.149)**	(0.176)**	(0.176)**
Reads newspaper once a week	0.167	0.167	0.167	0.167
	(0.035)**	(0.035)**	(0.035)**	(0.036)**
Watches TV every week	0.135	0.135	0.135	0.134
	(0.041)**	(0.041)**	(0.041)**	(0.041)**
youraware	0.232	0.218	0.223	0.233
	(0.122)	(0.141)	(0.141)	(0.136)
otheraware	0.026	0.050	0.054	
	(0.113)	(0.121)	(0.121)	
gender==Male	0.251	0.281	0.401	0.365
	(0.038)**	(0.091)**	(0.169)*	(0.170)*
(gender==Male)*youraware		0.054	0.042	0.005
		(0.211)	(0.213)	(0.194)
(gender==Male)*otheraware		-0.134	-0.149	
		(0.224)	(0.224)	
gender==Male & Educ==1			-0.162	-0.166
			(0.166)	(0.165)
gender==Male & Educ==2			-0.068	-0.077
			(0.168)	(0.167)
gender==Male & Educ==3			-0.115	-0.127
			(0.266)	(0.265)
Observations	7547	7547	7547	7547

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

The regression is more or less the same, though household-level radio is included since there were no observations reported for radio access. Not surprisingly, the coefficient on household-level radio is positive and significant; it is probably picking up some of the effects of listening to the radio. Otherwise, the main differences here are the significance of the third Education variable (indicating that in Zimbabwe, higher education – beyond the secondary level – is an important determinant of correct AIDS knowledge) and the insignificance of YOURAWARE and OTHERAWARE. YOURAWARE remains insignificant when OTHERAWARE is omitted. Thus there is no evidence of peer effects. In addition, none of the interaction terms are significant.

We now move on to analysis of the more recent DHS data. As stated earlier, the "new" surveys are structured slightly differently, and the population has changed, so we cannot make any direct comparisons. However, it is still possible to examine if and how patterns of AIDS awareness have changed by running approximately the same regressions. The first regression reported is Uganda, 2001 (Table 11). It is approximately the same as the first regression reported for Uganda 1995, with the inclusion of a wealth index variable[13]. This is the only dataset that offers explicit information on the respondent's income level.

[13] The wealth index breaks down the respondents into five ordinal quantiles (lowest 20%, next lowest 20%, etc.)

Table 11

Uganda 2001
Ordered Probit Regression

	(1) AIDS awareness	(2) AIDS awareness	(3) AIDS awareness	(4) AIDS awareness
Household level Electricity	0.071	0.064	0.060	0.042
	(0.054)	(0.054)	(0.054)	(0.056)
Household level Wealth	0.037	0.038	0.037	0.043
	(0.014)**	(0.014)**	(0.014)*	(0.015)**
Urban	-0.097	-0.098	-0.098	-0.058
	(0.045)*	(0.045)*	(0.045)*	(0.049)
Educ==1	0.262	0.258	0.257	0.270
	(0.043)**	(0.043)**	(0.045)**	(0.043)**
Educ==2	0.594	0.591	0.641	0.655
	(0.059)**	(0.060)**	(0.063)**	(0.062)**
Educ==3	1.025	1.031	0.991	1.008
	(0.116)**	(0.116)**	(0.129)**	(0.129)**
Reads newspaper once a week	0.296	0.297	0.297	0.306
	(0.054)**	(0.054)**	(0.054)**	(0.054)**
Watches TV every week	-0.089	-0.086	-0.084	-0.085
	(0.059)	(0.059)	(0.059)	(0.059)
Listens to radio every week	0.134	0.133	0.133	0.140
	(0.039)**	(0.039)**	(0.039)**	(0.039)**
youraware	0.604	0.641	0.637	0.789
	(0.105)**	(0.121)**	(0.121)**	(0.114)**
otheraware	0.484	0.564	0.562	
	(0.120)**	(0.142)**	(0.142)**	
gender==Male	0.288	0.670	0.698	0.588
	(0.054)**	(0.178)**	(0.242)**	(0.215)**
(gender==Male)*youraware		-0.193	-0.171	-0.348
		(0.247)	(0.252)	(0.227)
(gender==Male)*otheraware		-0.452	-0.435	
		(0.269)	(0.267)	
gender==Male & Educ==1			-0.021	-0.064
			(0.175)	(0.174)
gender==Male & Educ==2			-0.229	-0.317
			(0.188)	(0.190)
gender==Male & Educ==3			0.116	0.051
			(0.278)	(0.280)
Observations	8155	8155	8155	8313

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

The results of the Uganda 2001 regressions do not vary significantly from the Uganda1995 regressions. As with the Zimbabwe, 1994 regressions, the third Education categorical variable is now significant. Not surprisingly, the coefficient on Wealth is also positive and statistically significant. The main difference between this regression and the earlier one is that the interaction terms are insignificant, indicating that peer effects do not vary with gender.

The fact that the coefficient on YOURAWARE had a slightly greater magnitude than the coefficient on OTHERAWARE offers possible confirmation of my hypothesis (peer effects should be stronger within religious groups). However, when I tested the null that the coefficient on YOURAWARE was equal to the coefficient on OTHERAWARE, I was again not able to reject and thus could not confirm my hypothesis about homophily in social network selection.

Finally, we examine the results for Zimbabwe in 1999 in Table 12.

Table 12

Zimbabwe 1999 **Ordered Probit Regression**				
	(1) **AIDS awareness**	**(2)** **AIDS awareness**	**(3)** **AIDS awareness**	**(4)** **AIDS awareness**
Household level Electricity	-0.018	-0.022	-0.019	-0.000
	(0.060)	(0.060)	(0.061)	(0.060)
Urban	-0.050	-0.039	-0.049	-0.050
	(0.068)	(0.074)	(0.077)	(0.073)
Education in single years	0.095	0.095	0.097	0.097
	(0.005)**	(0.005)**	(0.006)**	(0.006)**
Reads newspaper once a week	0.165	0.163	0.165	0.166
	(0.044)**	(0.045)**	(0.045)**	(0.045)**
Watches TV every week	0.065	0.063	0.064	0.074
	(0.052)	(0.052)	(0.051)	(0.050)
Listens to radio every week	0.169	0.170	0.171	0.168
	(0.038)**	(0.038)**	(0.038)**	(0.038)**
youraware	0.592	0.638	0.633	0.701
	(0.117)**	(0.128)**	(0.129)**	(0.131)**
otheraware	0.276	0.234	0.233	
	(0.080)**	(0.091)*	(0.091)*	
gender==Male	0.272	0.259	0.321	0.392
	(0.050)**	(0.146)	(0.160)*	(0.142)**
(gender==Male)*youraware		-0.178	-0.159	-0.090
		(0.193)	(0.196)	(0.194)
(gender==Male)*otheraware		0.212	0.221	
		(0.176)	(0.175)	
(gender==Male)*Educyears			-0.011	-0.008
			(0.013)	(0.013)
Observations	7417	7417	7417	7428

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

The education variable is slightly different for this dataset, since education was not reported categorically, so Educyears measures the total number of years of education reported by the respondent. The effects of education appear to be the same, however, as this variable is significant and has a positive coefficient. The same pattern that characterized previous datasets emerges here as well. The main difference is the result of the coefficient test for Regression (1). This time, when I tested the null that the coefficient on YOURAWARE was equal to the coefficient on OTHERAWARE, I was

able to reject the null. Since the coefficient on YOURAWARE is greater than the coefficient on OTHERAWARE, this is a possible confirmation of my hypothesis.

My analysis offers tentative support for my hypothesis that increased levels of "social capital" will result in higher levels of AIDS awareness. In addition, certain household and individual characteristics are identified as being the most important for increasing AIDS awareness – particularly education levels and wealth. No major differences in AIDS awareness trends have emerged across the two countries in my study, though the explanatory power of the use of particular forms of media does vary between Uganda and Zimbabwe. In general, radio and newspapers are more significant sources of information than television, which again is probably related to the fact that so few people have access to this form of media.

Following theory from Behrman et al. and study design from Munshi and Myaux, I constructed my YOURAWARE and OTHERAWARE variables as indicators of social cohesion. In three out of the four surveys, regression analysis of these variables revealed them to be significant factors in determining AIDS awareness. This points to the evidence of peer effects. However, in two of those three regressions, there was not a significantly different effect for awareness of people in a respondent's own religious group and awareness of people in a religious group different to the respondent's own. Only the regressions for Zimbabwe 1999 show a possible confirmation of this part of my hypothesis, since the coefficients on YOURAWARE and OTHERAWARE were significantly different from one another and the coefficient on YOURAWARE had a greater magnitude. The fact that YOURAWARE and OTHERAWARE were significantly different in the later regression probably has to do with the fact that religion

was recoded for this later survey. In the older survey, respondents identified their religion as either traditional, spiritual, Christian or other. In the newer survey, the categories were Muslim, traditional, Christian, or other. About 25 percent more respondents identify themselves as Christian in the later survey; this probably does not mean that the Christian population increased dramatically but that some of the respondents who previously identified themselves as "spiritual" switched designations. Thus, there could be significant overlap between the two categories for the earlier survey, which could render YOURAWARE and OTHERAWARE less meaningful.

VI. Conclusions and Discussion

My goal in this study was to determine the role of social capital in patterns of AIDS awareness. Social capital is a controversial topic in economics that receives perhaps equal levels of scorn and reverence. Whether we like the term or not, the structure of communities and the interactions between individuals is an important factor in determining the spread of knowledge. A host of studies point to the importance of AIDS awareness in determining AIDS-related behaviors, thus I wanted to see how patterns of AIDS awareness differ for a country that has been "successful" in the fight against AIDS and a country that is has had less success.

In my examination of which sources of information were the most effective, I find significant differences between the popularity of a given information source and its effectiveness at substantially increasing levels of AIDS awareness. The main exception to this finding is the consistent popularity and effectiveness of the radio for respondents in both Uganda and Zimbabwe. However, some other patterns emerge across the two

countries. In Uganda, "high-tech" methods of information are more effective than "low-tech" methods. The differences across the two countries probably stem from two main sources: the institutional response to HIV/AIDS in each country, and differing levels of AIDS prevalence. The fact that the Ugandan government made more of an initial, concentrated effort to combat AIDS would support Ugandan literature being a more effective source of information. On the other side, the fact that AIDS prevalence was considerably higher in Zimbabwe than in Uganda at the time of these surveys would perhaps affect the quality of information passed among friends and family members. If more people see the effects of AIDS, or come into contact with health workers due to AIDS, they will be better suited to tell their friends and families about AIDS. Higher prevalence levels in Zimbabwe would also possibly explain the greater significance of the more "low-tech" means of information dissemination. The fact that friends and family are both popular and somewhat effective sources of information in both countries points to the importance of analyzing the spread of information across informal social networks.

I hypothesized that certain social capital indicators (access to different forms of mass media) would significantly increase AIDS knowledge. In addition, I hypothesized that there would be significant peer effects in determining AIDS awareness, and that these peer effects would be strongest within similar religious groups. My analysis of the four surveys revealed a partial confirmation of my hypothesis. In all cases, access to different forms of mass media had a positive, significant effect on increasing AIDS awareness. Peer effects were also found to be present for three out of the four surveys, although homophily only played a role for the Zimbabwe 1999 data. I also found that

peer effects are weaker for men, which is not surprising as we may expect women to rely more on informal social networks.

In general I do not find significantly different effects across the two countries in my study, and thus am not able to point to why Uganda has been relatively successful in the fight against AIDS while Zimbabwe has not. However, the fact that many determinants of AIDS awareness *are* the same across the two countries implies that Zimbabwe could reasonably study the way in which Uganda has responded to the AIDS epidemic – both institutionally and at the grassroots level – and apply some of these lessons. The current economic and political state of affairs in Zimbabwe may preclude its being able to fully able to focus on combating the AIDS epidemic, but studying the case of Uganda is still relevant for those who do want to work to fight AIDS in the country.

The limitations of my study account for much of the discrepancy between my hypothesis and my findings. I believe the primary limitation is the construction of the YOURAWARE and OTHERAWARE variables, which were plagued by very small sample sizes in some cases that resulted in the omission of many observations. In addition, the categorization for religion changed significantly across the two Zimbabwe surveys, which probably affected the effects being captured by YOURAWARE and OTHERAWARE. It is also possible that religion is not the best determinant of homophily. It seems quite likely that individuals would choose their social networks based mainly on homophily, but they could use different characteristics – such as ethnicity or wealth – to choose network partners. The lack of data on these parameters thus hindered my study. Access to panel data would have also made my study more

robust, since I could have regressed current levels of awareness on lagged values of social network awareness in order to obtain a clearer picture of peer effects.

Further research in this area might try to identify other indicators for social cohesion and see how they facilitate AIDS awareness. In addition, since basic levels of AIDS awareness are becoming nearly universal in many African countries, further research should involve looking at patterns of behavior changes and identifying the driving forces. I would expect behavior to vary with AIDS awareness, especially since high levels of awareness probably lower stigma. Munshi and Myaux explain that social change in developing countries is often characterized by a slow response to external interventions, since individual behavior is often closely linked to group behavior (or often just *perceptions* of group behavior).

Despite its limitations, my study still has some interesting implications for policy. The first part of my study pointed to a discrepancy between individuals' primary sources for AIDS knowledge and the most effective sources of AIDS knowledge. While many people first heard of AIDS through rather "low-tech" means, the "high-tech" means often proved more effective. This points to the strategy of making the "high-tech" means more accessible to larger segments of the population. Furthermore, it suggests that AIDS prevention must be approached in a nuanced way. Education and wealth are important determinants of AIDS awareness, but this does not imply that these are the only means of spreading knowledge or changing behavior. Clearly this is not the case, with the AIDS epidemic continuing to run rampant in many of the richest and most highly educated countries in the world.

References

Baylies, C. (2002). "The Impact of AIDS on Rural Households in Africa: A Shock Like Any Other?" Development and Change. 33(4). 611-632.

Bell, C., Devarajan, S. & Gersbach, H. (2003). "The Long-run Economic Costs of AIDS: Theory and an Application to South Africa." World Bank Group.

Behrman, J.R., Kohler, H. & Watkins, S.C. (2003). "Social Networks, HIV/AIDS and Risk Perceptions." Penn Institute for Economic Research Working Papers.

Bonnel, Rene. (2000). "HIV/AIDS: Does it Increase or Decrease Growth in Africa?" ACTAfrica. World Bank.

Chabarika, S. (2003). Lessons from Uganda's AIDS Success Story. [Electronic version.] The Daily News. Feb. 26, 2003. Retrieved January 6, 2004 from All Africa Global Media via COMTEX.

Cramer, J.S. (2003). Logit Models From Economics and Other Fields. Cambridge: Cambridge University Press.

Demographic and Health Surveys 2000/2001 MEASURE DHS+ Uganda dataset and final report. Retrieved January 5, 2004 from http://www.measuredhs.com/countries/country.cfm?ctry_id=44.

---------. 1995 DHS-III Uganda dataset and final report. Retrieved January 5, 2004 from http://www.measuredhs.com/countries/country.cfm?ctry_id=44.

---------. 1999 MEASURE DHS+ Zimbabwe dataset and final report. Retrieved January 5, 2004 from http://www.measuredhs.com/countries/country.cfm?ctry_id=47.

---------. 1994 DHS-III Zimbabwe dataset and final report. Retrieved January 5, 2004 from http://www.measuredhs.com/countries/country.cfm?ctry_id=47.

Glaeser, E. L., Sacerdote, B. I., Scheinkman, J. A. (2002). "The Social Multiplier." NBER Working Paper #9153. Retrieved January 14, 2004 from http://www.nber.org/papers/29153

Gwatkin, D.R. & Deveshwar-Bahl, G. (2001). "Inequalities in Knowledge of HIV/AIDS Prevention." Initial discussion draft. Retrieved April 2, 2004 from http:// poverty.worldbank.org/ files/8971_Bellagio_AIDS_Paper_-_Text_Gwatkinfinal.pdf.

Haacker, M. (2002). The Economic Consequences of HIV/AIDS in Southern Africa. IMF Working Paper. Authorized for distribution by Hugh Bredenkamp.

Hogle, J. A. (2002). "What Happened in Uganda? Declining HIV Prevalence, Behavior Change, and the National Response." U.S. Agency for International Development Project Lessons Learned Case Study.

ID21 Health. (2003). "Fighting HIV/AIDS with awareness: the case of rural Uganda." id21 Research Highlight. Retrieved April 2, 2004 from http://www.id21.org/zinter/id21.zinter.exe?a=8&i=h5jw3g11&u=406dd5fl

Manski, C.F. (2000). "Economic Analysis of Social Interactions." The Journal of Economic Perspectives. 14:3. 115-136.

Mbulaiteye, S.M., Mahe, C., Whitworth, J.A.G., Ruberantwari, A., Nakiyinki, J.S., Ojwiya, A., & Kamali, A. (2002). "Declining HIV-1 incidence and associated prevalence over 10 years in a rural population in south-west Uganda: a cohort study." The Lancet, 360. 41-46.

McPherson, M. F. (2003). "Non-Linear Macro Effects of HIV/AIDS: An Overview." Draft. Last revised May 8, 2003. Received by e-mail from author.
-------- (2003). "Human Capital, Education, and Economic Growth: The Impacts of HIV/AIDS." Final draft. October 20, 2003. Received by e-mail from the author.
Munshi, K. & Myaux, J. (2002). "Development as a Process of Social Change: An Application to the Fertility Transition." Working paper. Retrieved February 1, 2004 from author's Web site, http://www.econ.brown.edu/fac/Kaivan_Munshi/
Parkhurst, J.O. (2002) "The Ugandan success story? Evidence and claims of HIV-1 prevention." The Lancet. 360. 78-80.
Temple, J. & Johnson, P.A. (1998). "Social Capability and Economic Growth." The Quarterly Journal of Economics. 113:3. pp. 965-990.
UNAIDS (2003). AIDS Epidemic Update 2003. Retrieved January 6, 2004 from http://www.unaids.org/Unaids/EN/Resources/Publications/Corporate+publications/AIDS+epidemic+update+-+December+2003.asp
-------- (2003).Fact Sheet: Sub-Saharan Africa. Retrieved January from http://www.unaids.org/en/other/functionalities/ViewDocument.asp?href=http%3a%2f%2fgva-doc-owl%2fWEBcontent%2fDocuments%2fpub%2fPublications%2fFact-Sheets03%2fFS_SSAfrica_en%26%2346%3bpdf on January 6, 2004.
Uphoff, N. 2000. "Understanding Social Capital: Learning from The Analysis and Experience of Participation." *Social Capital: A Multifaceted Perspective.* P. Dasgupta and I. Serageldin (eds.). Washington, D.C.: The World Bank. Retrieved January 29, 2003, from Duke University, Duke University Libraries, netLibrary Web site: http:://www.netlibrary.com

Works Consulted

Ambert, Cecile. (2002). The Economic Impact of HIV/AIDS on the Construction Sector: Supply Side Implications for Housing Policy. 70(7): 1235-61.

Case, A., Paxson, C. & Ableidinger, J. (2002). "Orphans in Africa." NBER Working Paper 9213. Retrieved from http://www.nber.org/papers/w9213 on November 10, 2003.

Cullen, M. and Whiteford, H. (2001). "The Interrelations of Social Capital with Health and Mental Health." Discussion Paper published by the Commonwealth of Australia. Retrieved from http://www.health.gov.au/hsdd/mentalhe/pdf/inter.pdf on January 13, 2004.

Isham, J., Kelly, T. & Ramaswamy, S., eds. (2002). *Social Capital and Economic Development*. Massachusetts: Edward Elgar Publishing.

James, S. A., Schulz, A. J., and van Olphen, J. (2001). "Social capital, poverty and community health: an exploration of linkages." Social capital and poor communities. Saegert, S., Thompson, J. P. and Warren, M. R., Eds. New York: Russell Sage Foundation.

Pratt, C.B., Obeng-Quaidoo, I., Okigbo, C. & James, E.L. (2000). Health Information Sources for Kenyan Adolescents: Implications for Continuing HIV/AIDS Control and Prevention in Sub-Saharan Africa. The Western Journal of Black Studies. 24(3), 131.

Rosen, S.B., MacLeoad, W.B., Vincent, J.R., Fox, M.P., Thea, D. & Simon, J.L. (2002). Investing in the epidemic: The impact of AIDS on businesses in southern Africa. Abstract of presentation at Aids2002 conference. Abstract retrieved December 1, 2003 from http://www.aids2002.com/Program/ViewAbstract.asp?id=/T-CMS_Content/Abstract/200206290750471662.xml

Rosen, S. & Simon, J. L.. (2003). Shifting the burden: the private sector's response to the AIDS epidemic in Africa. Bulletin of the World Health Organization. 81(2).

Solow, R. (1957). Technical Change and the Aggregate Production Function. The Review of Economics and Statistics. 39(3), 312-320 .

World Bank. (2000). Intensifying action against HIV/AIDS in Africa: Responding to a Development Crisis. Washington: World Bank.

Wilkins, M. and Vasani, D. (2002). Mainstreaming HIV/AIDS. Looking beyond awareness. VSO Experience in Focus, Voluntary Service Overseas, London.

VII. Data Appendix

A. Summary Statistics by Country and Year

Summary Statistics: Zimbabwe, 1999

Variable	Obs	Weight*[14]	Mean	Std. Dev.	Min	Max
aware	8466	8.4640e+09	3.450278	.801924	1	4
youraware	8304	8.2822e+09	.6222823	.1899675	0	1
otheraware	8436	8.4297e+09	.620593	.2570426	0	1
hhElec	7578	7.5272e+09	.4039677	.4907235	0	1
Urban	8467	8.4652e+09	.2670804	.4424608	0	1
Educyears	8457	8.4544e+09	8.099372	3.422931	0	18
Newsweek	8467	8.4652e+09	.3216636	.4671423	0	1
Radweek	8467	8.4652e+09	.5894791	.4919574	0	1
TVweek	8467	8.4652e+09	.3452291	.475471	0	1

Summary Statistics: Uganda, 2001

Variable	Obs	Weight*	Mean	Std. Dev.	Min	Max
aware	8733	8.7114e+09	3.491336	.7025137	1	4
youraware	8613	8.5796e+09	.6119375	.2103289	0	1
otheraware	8570	8.5124e+09	.6187709	.2016079	0	1
hhElec	8445	8.4447e+09	.1059104	.3077412	0	1
hhWealth	8454	8.4564e+09	3.206951	1.408271	1	5
Urban	8741	8.7206e+09	.1636517	.3699804	0	1
Educ	8740	8.7198e+09	1.056746	.7075206	0	3
Newsweek	8741	8.7206e+09	.1671554	.3731359	0	1
Radweek	8741	8.7206e+09	.5743232	.4944735	0	1
TVweek	8741	8.7206e+09	.1042101	.3055504	0	1

Summary Statistics: Uganda, 1995

Variable	Obs	Weight*	Mean	Std. Dev.	Min	Max
aware	9057	9.0578e+09	3.41999	.7418073	1	4
youraware	8912	8.9180e+09	.5634381	.2221708	0	1
otheraware	8943	8.9174e+09	.5580999	.2294862	0	1
hhElec	8593	8.6262e+09	.0924893	.2897322	0	1
Urban	9066	9.0660e+09	.1473439	.3544679	0	1
Educ	9066	9.0660e+09	.9000169	.6517535	0	3
Newsweek	9038	9.0410e+09	.2258729	.418179	0	1

[14] *Weights given in DHS datasets. STATA automatically performs appropriate weighting to calculate survey mean.

Radweek	9066	9.0660e+09	.4590783	.4983501	0	1
TVweek	9064	9.0637e+09	.0612667	.2398322	0	1
Heardrad	9009	8.9860e+09	.4626897	.4986337	0	1
HeardTV	9009	8.9860e+09	.0371434	.1891235	0	1
Heardnews	9009	8.9860e+09	.0625787	.2422171	0	1
Heardpamph	9009	8.9860e+09	.031835	.1755705	0	1
Heardclinic	9009	8.9860e+09	.1626642	.3690795	0	1
Heardchurch	9009	8.9860e+09	.1503305	.357415	0	1
Heardschool	9009	8.9860e+09	.0998066	.2997585	0	1
Heardmtg	9009	8.9860e+09	.1997438	.3998299	0	1
Heardfriend	9009	8.9860e+09	.798559	.401099	0	1
Heardwork	9009	8.9860e+09	.0288771	.1674705	0	1
Heardvictim	7015	6.9924e+09	.1083809	.310883	0	1

Summary Statistics: Zimbabwe, 1994

Variable	Obs	Weight*	Mean	Std. Dev.	Min	Max
aware	8263	8.2617e+09	3.239565	.7194945	1	4
youraware	8168	8.1630e+09	.396611	.1921541	0	1
otheraware	8266	8.2658e+09	.3939905	.1810906	0	1
hhElec	7681	7.6672e+09	.2879347	.45283	0	1
hhRadio	7679	7.6655e+09	.5012663	.500031	0	1
Urban	8269	8.2690e+09	.3352573	.4721089	0	1
Educ	8269	8.2690e+09	1.381251	.6829156	0	3
Newsweek	8261	8.2581e+09	.5240058	.4994536	0	1
TVweek	8234	8.2285e+09	.3134032	.4639049	0	1
Heardrad	8159	8.1841e+09	.6773972	.4675008	0	1
HeardTV	8159	8.1841e+09	.2899852	.453783	0	1
Heardnews	8159	8.1841e+09	.3267641	.4690589	0	1
Heardpamph	8159	8.1841e+09	.125726	.3315606	0	1
Heardclinic	8159	8.1841e+09	.4312404	.4952799	0	1
Heardchurch	8159	8.1841e+09	.0328933	.1783683	0	1
Heardschool	8159	8.1841e+09	.1517447	.3587952	0	1
Heardmtg	8159	8.1841e+09	.0964672	.2952489	0	1
Heardfriend	8159	8.1841e+09	.3990557	.4897343	0	1
Heardwork	8159	8.1841e+09	.0348202	.1833353	0	1

B. The Construction of YOURAWARE and OTHERAWARE

The following numerical example should put to rest any doubts that YOURAWARE and OTHERAWARE are perfectly collinear. Consider a cluster where all respondents are either Catholic or Protestant. Assume 21 of the respondents are Catholic, 15 of which are highly aware of AIDS, and 20 of the respondents are Protestant, 2 of which are highly aware of AIDS. For a given Catholic respondent, YOURAWARE

will be equal to 15/20 (0.75) if that respondent is not highly aware of AIDS (subtract 1 from the total number of Catholics in the denominator to account for the respondent) and will be equal to 14/20 (0.70) if the respondent *is* highly aware of AIDS. It is important to subtract 1 from the numerator to account for the respondent; otherwise we would be regressing an individual's level of awareness on his level of awareness! For this same respondent, OTHERAWARE will be equal to 2/20 (0.10), regardless of his level of awareness. A copy of the STATA code for generating YOURAWARE and OTHERAWARE is available from the author upon request.