EXPLORING LINKAGES BETWEEN AGRICULTURE AND HIV/AIDS: A MULTILEVEL STUDY OF THE IMPACT OF AGRICULTURAL-CONSUMPTION REGIMES ON WOMEN'S VULNERABILITY TO HIV/AIDS IN KENYA

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ABSTRACT

The recognition that the HIV/AIDS epidemic is a major threat to sub-Saharan Africa's economic development has prompted researchers to focus on the economic impacts of the disease. In particular, given the importance of agriculture for livelihoods in sub-Saharan Africa (SSA), researchers have investigated the impact of HIV/AIDS on agriculture. Relatively little research has focused on the role agriculture plays in fueling the spread of HIV/AIDS. This study addresses this gap in the literature and examines how agricultural contexts in Kenya influence women's vulnerability to HIV/AIDS. The study defines vulnerability in terms of upstream factors, that is whether and through what pathways poverty puts people at greater risk of being exposed to the virus.

The study involves regional analysis of Kenya using districts (similar to U.S counties) as administrative units and employs multilevel analysis to examine the impact of the regional agricultural contexts on women's vulnerability to HIV/AIDS. This study refers to regional agricultural contexts as agricultural-consumption regimes (ACRs). The term agricultural-consumption regimes (ACRs) draws from longstanding literature which examines how agricultural development in developing countries impacts women's agricultural productivity, hence their ability to fulfill the consumption needs of their households. ACRS encompass the key production-related factors in the women and development literature - agricultural commercialization (cash crop versus food crop production), land tenure, access to credit, and access to extension services. ACRs also include household survival strategies that women employ to counter constraints in agricultural production such as opportunities for wage employment, membership in cooperatives, and women's organizations. In examining the impacts of ACRs on women's vulnerability to HIV/AIDS, the study also takes into account women's decision-making autonomy and household food security. There is consensus in the HIV/AIDS literature that power imbalances in the household are a major factor driving women's vulnerability to this disease in SSA, thus, the importance of examining the links between women's decision-making autonomy and HIV/AIDS. Regarding household food security, researchers have suggested that people who are food insecure are less likely to act on their knowledge about HIV to prevent infection. Greater household food insecurity may thus increase women's vulnerability to HIV/AIDS.

This study assesses the extent to which ACRs influence women's vulnerability to HIV/AIDS net of individual and household-level characteristics such as women's decision-making autonomy and household food security.

The study finds that at the contextual level, after taking into account women's decision-making autonomy and household food security, women's tenure security, land holding sizes, cash crop production and membership in women's is associated with lower vulnerability to HIV/AIDS. By contrast, wage employment, access to credit (proportion of households that were able to access credit in the district) and land titling (proportion of household in the districts with title to land) is associated with women's increased vulnerability to HIV/AIDS.

This study shows that the agricultural context matters for women's vulnerability to HIV/AIDS. In terms of policy, efforts to safeguard women's rights to property such as land may be an important component not only for poverty alleviation, but also for HIV/AIDS prevention strategies. The study also points to the need for policy-makers to recognize that one of the critical

factors in enhancing HIV/AIDS mitigation strategies is to ensure that the agricultural sector remains an effective source of livelihoods.

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BACKGROUND

Sub-Saharan Africa (SSA) is home to almost 64 percent of all people living with HIV (UNAIDS 2006:15, 2007:15). In Kenya, about 7 percent of the adult population is infected with HIV, with most cases occurring in the most economically productive age group (Kenya Central Bureau of Statistics (CBS) 2003:217). Women are disproportionately affected, with a prevalence of nearly 9 percent for women age 15-49 compared to fewer than 5 percent for men age 15-54, indicating that women are particularly vulnerable to HIV infection in Kenya (CBS 2003:217).

Researchers focusing on HIV/AIDS studies in Africa have been concerned with the economic impacts of the disease, particularly the impact on agriculture, with findings that indicate that HIV/AIDS shrinks the available labor pool thereby impacting commercial agriculture, which is dependent on hired labor (Barnett and Blaikie 1990; Barnett and Haslwimmer 1993; FAO 1994; Rugalema 1999). HIV/AIDS has also been linked to: declining soil fertility (FAO 1994), adverse impacts on land tenure security and rights (Aliber and Walker 2006; Drimie 2002; Drimie et al. 2002; Muchunguzi 2002; UNIFEM 2006); decline in subsistence agriculture (Barnett 1998; Barnett and Haslwimmer 1993); failing rural support as it erodes that capacity of governments to deliver social services (FAO/UNAIDS 2003; Harvey 2004) and increased food insecurity (De Waal 2002; Hunter and Williamson 2000; Gillespie and Kadiyala 2005)

There has been far less research focusing on the role agriculture plays in fueling the spread of HIV/AIDS, with most research emphasizing the qualitative links between agriculture and the disease. This research has established links between high HIV/AIDS prevalence and agro-estates (Rugalema 1999, 2004); agricultural trading and marketing centers (Ngwira et al. 2001); and fishery sectors (Loevinsohn and Gillespie 2003). Researchers have also found that when agriculture fails to provide for people's livelihoods it impacts HIV exposure through increased food insecurity. People who are food insecure are less likely to act on their knowledge of risk to prevent infection (Loevinsohn and Gillespie 2003; Gillespie and Kadiyala 2005; Bryceson et al. 2004). Women, who are primarily responsible for household food security in Africa, are particularly vulnerable to situations of food insecurity (Gillespie and Haddad 2002). The impacts of a declining agricultural sector may also be largely displayed in the narrowing gap between urban and rural levels of HIV infection in most SSA countries. In the early stages of the epidemic, HIV was more prevalent in urban than in rural areas. These differences remain, but they are steadily narrowing (Cohen 2002; Kalipeni et al. 2004; Ngwira et al. 2001). The increased level of infection is attributed to factors, such as rural-urban linkages and disrupted sexual economies caused by conditions of migration and employment.

The current literature on agriculture, HIV/AIDS, and food security is limited: in the way it addresses specific rural contexts that contribute to the spread of HIV/AIDS, how these rural contexts affect variation in the prevalence of HIV/AIDS across regions, the influence of rural contexts on HIV/AIDS net of women's individual characteristics such as women's social position. Furthermore, despite recognizing the role food insecurity plays in increasing vulnerability, the two bodies of work focusing on agriculture and food security on the one hand, and agriculture and HIV/AIDS on the other, are often separated in the literature.

The purpose of this study is to address the gap in the literature linking agriculture, HIV/AIDS, and food security by quantitatively assessing how agricultural contexts in Kenya influence women's vulnerability to HIV/AIDS, and further investigating contextual influences on vulnerability to HIV/AIDS net of individual and household level characteristics such as women's social position, and household food security.

Vulnerability is defined in terms of upstream and downstream links between poverty and HIV/AIDS (Gillespie 2008). In this study, the focus is on the upstream factors, that is whether and through what pathways poverty puts people at greater risk of being exposed to the virus (Gillespie 2008; Gillespie and Loevinsohn 2003). As above-mentioned, the study focuses on agricultural livelihoods as contexts of vulnerability and in so-doing gives attention to what Gillespie and Loevinsohn (2003) refer to as the *mesoenvironment*. The mesoenvironment includes, but is not limited to, plantations and related agricultural industries, local agricultural systems, and local practices and customs relating to resource allocation.

The study involves a regional analysis using districts (equivalent to U.S counties) as administrative units. Kenyan districts vary in relative size based on the agricultural sector, commercialization of agriculture, and employment opportunities. To understand districts as contexts for HIV/AIDS risky behavior, the challenge is to identify characteristics of potential relevance, which also vary in meaningful ways from one district to the next. Two general classes of variables are of interest: the first affects the economic well-being of women and consists mainly of the social and economic characteristics reflecting opportunity structure; the second consists of agricultural situations that directly impact household food security and also present situations of risk related to HIV/AIDS. To capture these variables, the study refers to regional agricultural contexts as agricultural-consumption regimes (ACRs). The term agricultural-consumption regimes, while not previously coined, draws from the longstanding development literature, which examines how agricultural development in developing countries has impacted women's agricultural productivity, hence their ability to fulfill the consumption needs of their households (Boserup 1970; Chaiken 1997; Davison 1988; Gladwin 1991; Guyer 1987; Peters and Herrera 1989; Spring 1995; Suda 1996). Researchers have focused on the adverse impact on women's livelihoods resulting from agricultural development such as introduction of cash crop production, privatization of land, women's limited access to credit and extension. Agricultural-consumption regimes (ACRs) encompass the key production-related factors in the agricultural development literature - agricultural commercialization (cash crop versus food crop production), land tenure, access to credit, and access to extension. More recently, the women and development literature has also focused on strategies that women employ to counter constraints in agricultural production that their ability to fulfill household consumption needs. ACRs, thus, also include household survival strategies, such as opportunities for wage employment, membership in cooperatives, and women's organizations. The aim, then, is to examine how each of these factors that comprise ACRs varies across districts in Kenya. The study is based on the assumption that the variation of these factors across regions (districts) will impact women's social position, household food security, and ultimately HIV/AIDS risky behavior.

Gender power imbalances in the household negatively impact women's negotiating power in sexual relations. Gender inequalities in sub-Saharan Africa, are displayed in power imbalances in

sexual relations (Kalipeni et al. 2004; Lwihula 1994; Nzioka 1994; Pesce1994; Pulerwitz et al. 2002; Tlou 2002; Turmen 2003). Women's subordinate socio-economic status also creates a situation of economic dependency on men (Akwara 2002; Bryceson and Fonseca 2005; Dinkelman et al. 2006; Hunter 2002; Kalipeni et al. 2004; Luke 2002; Schoepf 1993; Tlou 2002; Turmen 2003). These situations of lower sexual power and economic dependency increase women's vulnerability to HIV/AIDS risky behavior.

In addition to examining the impact of ACRs at the contextual level, the study also includes a measure of gender inequality at the district level. Using this measure, I seek to understand if contextual gender inequality translates to women's increased vulnerability to HIV/AIDS[1].

The study is significant for several reasons. First, the way it extends the literature examining contextual influences on health theoretically by focusing on agricultural contexts. The existing studies have paid more attention to urban contexts, particularly examining contextual factors, such as neighborhood disadvantage (Browning and Cagney 2002; Browning and Cagney 2003; Kawachi and Bergman 2003), and urban poverty in developing nations (Montgomery and Hewett 2005). Studies focusing on rural contexts in developing countries have used development indicators such as availability of tap water (Chen et al. 2005); the gender development index (Mathew and Ghubaju 2004); and access to education (Parashar 2005). A study by Entwistle et al. (1989) examines the impact of village agricultural commercialization on contraceptive behavior. My study goes beyond a single aspect of agriculture to examine the rural livelihood system, and further examines the impacts of regional variations in the livelihood system.

Second, studies applying the vulnerability perspective to the study of HIV/AIDS have largely been qualitative. These studies have focused on the geographic patterning of the disease based on structural and social risk factors (Craddock 2000; Kalipeni et al 2004; Lisa and Walker 2003; Oppong 1998). My study extends the application of the vulnerability perspective to the study of HIV/AIDS methodologically and conducts a quantitative multi-level analysis of vulnerability to HIV/AIDS risky behavior.

Third, my study develops the notion of agricultural-consumption regimes allowing the examination of agricultural context not only in terms of structure, but also in terms of household survival strategies allowed for by various contexts. The study's reference to agricultural contexts as agricultural-consumption regimes, and the extension of these contexts to health outcomes uniquely contributes to the agricultural literature.

[1]The gender inequality measure may also be an important control measure at the contextual level, given that the effects of aspects such as commercialization may depend on the gender relations inherent in society, and how these relations determine access to land and access to distribution of income from cash cropping (Dolan 1997; Hamilton 2000; Roos and Gladwin 2000).

The next section focuses on the impacts of seven agricultural-consumption regimes (ACRs): land tenure, commercialization, access to credit, membership in cooperatives, access to extension, membership in women's associations, and wage employment on HIV/AIDS risky behavior.

THE IMPACT OF AGRICULTURAL-CONSUMPTION REGIMES (ACRs) ON HIV/AIDS RISKY BEHAVIOR

The evidence of the direct impacts of ACRs on HIV/AIDS is largely limited to literature examining the impacts of commercialized agriculture. Research indicates that marketing and financial arrangements particularly for commercial crops, such as tea, coffee, tobacco and sugar cane, may increase situations of risk of HIV infection (Bota et al. 2001; Masanjala 2007; Ngwira et al. 2001; Rugalema 1999, 2004). First, cash crop marketing requires that farmers deliver their crop to trading centers for sorting and valuation purposes. Trading centers are poles where people congregate and sexual contacts are concentrated. These may create situations of risk, particularly if the contacts are asymmetrical i.e. a small number of women having unprotected sex with a large number of men or vice versa (Ngwira et al. 2001). Garnett and Anderson (1996) indicate that epidemiological models show that asymmetrical relationships hasten the speed of infection. In Malawi, a recent survey of villagers and agricultural sector employees noted that trading centers are important sites of social and sexual contact between rural and urban people, and among rural people themselves (Bota et al. 2001). Second, commercial cash crop production is also undertaken by large enterprises that have high and seasonal demands for labor. These types of production arrangements draw farmers away from their families for extended periods. Workers usually move on their own, sometimes from considerable distances, and few estates provide married quarters. This separation may create a situation of dependency of these farmers on occasional and or commercial sex (Masanjala 2007; Ngwira et al. 2001; Rugalema 1999, 2004).

The impacts of the other aforementioned ACRs and further impacts of commercialization on HIV/AIDS can be deduced from the indirect effects that occur largely through women's social position and household food security. The subsequent review thus, first examines the effects of ACRs on women's social position, and how women's social position in turn shapes vulnerability to HIV/AIDS risky behavior; and second, the impacts of ACRs on household food security and how household food security in turn influences HIV/AIDS risky behavior.

THE IMPACT OF AGRICULTURAL-CONSUMPTION REGIMES (ACRS) ON WOMEN'S SOCIAL POSITION

This section highlights the impacts of six ACRs- land tenure, commercialization, access to credit and extension, membership in cooperatives, membership in women's groups and wage employment- on women's social position.

The concept of women's status and women's social position are frequently used interchangeably (Mason 1986). According to Morris (1969:1260), women's status "refers to relative position or standing, especially social standing." What matters then for women's well being

is that women are in control of their lives and have say in matters affecting themselves and their families.

Women's social position is also conceptualized in terms of autonomy, which is defined as the capacity to manipulate one's personal environment through control over resources, and information in order to make decisions about one's own life and that of their family (Dyson and Moore 1983).

In this study, women's social position is defined based on the two concepts of status and autonomy used in the literature on gender to capture the degree of access, control, and independence in decision making that a woman has (Abadian 1996). In most developing countries, particularly in sub-Saharan Africa, women's social position derives largely from women's ability to achieve economic independence, allowing her to control decisions that affect her, as well as fulfill her reproductive roles, such as ensuring the well-being of the household. In terms of ACRs, women's social position is thus seen as deriving from the economic independence allowed by a particular ACR. In this regard then, I infer that women who are located within ACRs that allow their economic independence will be less vulnerable to HIV/AIDS.

LAND TENURE

Land tenure is an important component of agricultural-consumption regimes since women's access to land, is a critical factor in women's economic independence and thus their ability to fulfill their domestic roles. Land tenure is defined as the "set of rules that determine property rights which define or delimit the privileges granted to individuals with specific assets" (Alston et al. 1997:146).

In Kenya land tenure reforms have resulted in privatization of land, which requires registration of land titles under male heads of households (Boserup 1970; Davison 1988; Nzioka 2005; Suda 1996). As a result, very few women own title to land. Dankelmann and Davison (1988: 8-9) note that in SSA, women have title to 1 percent of the land. In Kenya, Feldman (19845: 71) indicates that women own in their names only 5 percent of the land. The paucity of land titles among women in Kenya has been observed, for the Luo in Nyanza province, where (Shipton (1988) a study that among the women he surveyed 7 percent of registered land parcels had women as joint or exclusive owners; in Central province where Davison (1988) found that among 101 women surveyed in Kenya's Mutira location, none reported owning land, in terms having land titled in their names; and among the Maragoli in Western province, where (Gwako (1997) found that among 120 farmers surveyed, only one woman had land titled in her name.

Privatization of land has thus affected women's tenure security. Tenure security relates to access right as well as the ability to reap the benefits of labor and capital invested in land (Bruce 1993; Place et al. 1994). Tenure security is especially important for women in Africa because it means that they are able to access productive resources and services (Gwako 1997). Palmer (1985) found that when women hold recognized user rights to the land they farm and control any income, agricultural productivity is significantly improved. Privatization however, has impacted women's user rights previously guaranteed under customary law, thereby limiting women's access to land,

and therefore their ability to obtain cash from sale of surplus food crops, significantly impacting women's household income (Horenstein 1989; Nzioki 2005; Quisumbing et al. 1995).

Given that few women have land titled in their names, researchers examining the impact of land tenure on women farmers have focused on other direct or indirect measures of tenure security. Davison (1998) for instance examined how land holding sizes impact women's tenure security and how this in turn affects their ability to fulfill their reproductive roles. She found that smallholders with less land tended to allocate more of it to food production. Conversely those with more land assigned a larger percentage to the production of cash-value crops. She found that the size of the land holding had implications for women's income and their ability to provision for the household, given that women's agricultural productivity is directly affected by the amount of land their husbands are willing to assign for the production of food crops. On the other hand, there is evidence that indicates that women tend to have better access to land when it is abundantly available. Larger landholding sizes in this case favor women's access to land. Zuidberg (1994) observed that in Burkina Faso, when there is enough land, women do not seem to have a problem with access. In Mali however, as land has become less available, women become workers on family fields instead of farmers in their own right (World Bank 1995).

Gwako (1997), using a more direct measure of tenure security - the percent of plot yield in the previous season used or controlled by women- studied the impacts of land tenure on agricultural productivity among the Maragoli in western Kenya. He found that using this measure, tenure security was positively related to agricultural productivity, and this relationship held for married as well as widowed women.

It is important to note that women's tenure security may vary according to specific conditions in different regions, for instance the socio-cultural and socio-economic contexts, as well as the cultural and demographic conditions of individual households (Gwako 1997).

The literature seems to suggest that privatization of land and emphasis on land registration has largely had negative impacts on women's access to land, particularly because few women own land in their names. It is not immediately clear from this literature however whether women's tenure security is differentially impacted in situations when the male head of household owns titled land versus when the land is not titled. The literature does however suggest that for the most part, large landholding sizes may favor women's access to land.

AGRICULTURAL COMMERCIALIZATION

The impact of agricultural commercialization on women's social position is a contested issue. Some findings indicate that commercial agriculture has brought new opportunities for women in terms of income sources (Chaiken 1997; Roos and Gladwin 2000; Spring 2000); however other studies have found that commercialization may affect women's ability to fulfill their household domestic roles (Besteman 1995; Blumberg 1988; Davison 1988; Dolan and Sorby 2003; Hankson and Levine 1997; Horenstein 1989; Kennedy and Bouis 1993; Kennedy and Cogil 1987; Lastarria-Cornhiel 2006; Nzioki 2005; Sachs 1996). The general reasons of the contradictory findings are elaborated below.

The commercialization of agriculture, defined as cash crop production, has had both positive and negative consequences for women in developing countries. While cash cropping has enabled some women to obtain cash in an increasingly cash-based economy, the negative consequence of cash cropping are more prevalent (Besteman 1995). The negative impacts of cash cropping on women occur in a number of ways: first, it is now well documented that with the introduction of cash crops women lose access to land. As more productive land is dedicated to cash crop production, women's access to land is diminished as they are often pushed to marginal lands (Besteman 1995; Charltoon 1984; Dankelman and Davidson 1988; Dolan 1997; Fonchingong 1999; Nzioki 2005; Roos and Gladwin 2000; Sachs 1996). Evidence for women's decreased access to land due to cash cropping was documented in western Kenya for coffee production (Davison 1988) and sugar production (Lemmens 1987; Kennedy and Cogill 1987); in Kenya's Kisii district (Hankson and Robert de Levine 1997); as well as for other regions in SSA, for coffee production in Zambia (Muntemba 1982); and cotton production in Senegal (Savane 1986). In some cases, women have been threatened with complete loss of land. Dolan (1997) carried out a study in Kenya and found that one-third of the women were forced to use their usufruct plots to grow French beans for export, while their husband's either assumed control over the income derived from production, or retracted their wives rights to land completely. Women's diminished access to land means that less land is allocated to food production thus affecting women's ability to provide for the household (Davison 1988; Horenstein 1989; Kennedy and Cogill 1987; Lemmen 1987).

Second, cash cropping increases the demand for women's labor. While cash crops are designated men's crops, women are still required to provide labor for cash crop production. Raising cash crops thus diverts women's labor from growing food for their family and other subsistence activities (Sachs 1996). This was found to be the case for coffee production in central Kenya (Stamp 1990); and for coffee and cocoa in Cote d'Ivoire (Savane 1996).

Third, cash cropping has also impacted women's access to income. Lastarria-Cornhiel (2006) indicates that smallholder production of cash crops may decrease women's independent income, resulting in loss of bargaining power within the household. This is the case in most developing countries, particularly in SSA, because income from cash crop production is usually controlled by men (Blumberg 1988; Horenstein 1989; Kennedy and Bouis 1993; Lastarria-Cornhiel 2006; Nzioki 2005; Sachs 1996; Braun and Kennedy 1994). Dolan and Sorby (2003:52) for instance found that in Kenya, the income women received from French bean cash crop production was not commensurate with their labor. Women received only 38 percent of the income. Similarly in Guatemala, studies found that while women were involved in almost all aspects of vegetable cash cropping, male household members still controlled income from production (Blumberg 1985; Braun et al. 1989; Katz 1995).

The literature on commercialization also calls attention to another form of cash crop production, contract farming or out-grower schemes. Contract farming is defined as "agricultural production carried out according to an agreement between farmers and buyers that specifies production and marketing conditions of the commodity" (Spring 2000:238). Some researchers focusing on contract farming refute the notion that cash cropping negatively impacts women. In Kenya, contract farming is largely used for tea, sugar, tobacco, barley, hops, seed multiplication and horticultural crops (Spring 2000). Researchers observe that in general, contract farmers obtain

higher yields than non-contract farmers because of their easier access to information, inputs, credits and markets. This observation was made in Kenya's, Mwea division for smallholder bean out-growers scheme (Kimenye 1996); and Kericho district for contract tea production (Bulow and Sorensen 1993).

Contract farming's impact on women however, tends to reveal mixed results. Spring (2000) notes private sector firms for the most part have a stated preference for women, resulting in a high level of women's participation in private sector contract farming. She noted for example that at Frigoken, a processing plant that targets small-scale farmers, in Kenya's Muranga district, 40 percent of the contract farmers were women. Furthermore, the presence of private sector agribusiness also allows for growth of food microenterprises favoring women's income resources (Glover 1994; Spring 2000).

While private companies tend to have a preference for women, Bulow and Sorensen (1993) observe that this may not be the case for public sector contract companies. They note that in the public sector contracting tends to be male biased, and gives little recognition to women, for instance the case of Kenya Tea Development Authority (KTDA), which encouraged only men to engage in contract farming as independent growers. Davison (1988) notes that even in cases where women participate in public sector out-grower schemes, they are not appropriately compensated. The transfer of benefits, like participation in contract farming, also tends to be male-biased. Davison (1988) in Mutira division of central Kenya and Bulow and Sorensen (1993) in Kericho district found that women provided the bulk of the labor for tea production however the KTDA paid the bonus to the landowners- usually the men- rather than the individual harvesters.

The effects of contract farming, like other forms of cash cropping, may depend on the gender relations inherent in society, and how they determine access to land and access to and distribution of income from cash cropping. Where gender relations are based on strong patriarchal systems, women tend to benefit less from contract farming because such systems dictate access to land and the accruing income (Dolan 1997; Roos and Gladwin 2000), however in more egalitarian societies, women have been able to benefit from contract farming (Hamilton 2000).

While the foregoing literature suggests that women have been able to benefit from cash crop production, particularly in the case of contract farming, overwhelming evidence points to the negative effects of cash crop production on women's social position. The way in which cash crop production limits women's access to land for their own production and access to income (given that cash crop income is largely controlled by men) may increase women's economic dependency on men and thus their vulnerability to HIV/AIDS.

ACCESS TO CREDIT AND COOPERATIVES

Access to credit is critical for smallholders' agricultural productivity (Besteman 1995). Credit is particularly important for women farmers given their role as food producers and providers (Horenstein 1989; Quisumbing et al. 1995). The importance of credit for women's agricultural production; access to cash; and thus their social position; allowing them to provision for themselves and the household, makes access to credit an important indicator of agricultural-consumption regimes.

Credit is important for agricultural production because it allows for access to agricultural inputs. Among smallholders in SSA, however women are disadvantaged in their access to credit. In Kenya for instance, women's access to credit, particularly from formal sources such as banks, and other financial institutions, is limited (Horenstein 1989). A World-Bank executed project on Women's Agricultural Productivity in Africa (WAPIA) found that only 3 percent of the female farmers surveyed had obtained credit from a commercial bank, compared to 14 percent male farmers (Saito 1994). Not only do fewer women obtain credit, but loans to women also tend to be much smaller than those awarded to men. Saito (1994:87) found that in Kenya and Nigeria respectively, the mean size of loans to women was 61 and 42 percent those of men. Women's limited access to credit inhibits their access to inputs thereby impacting their agricultural productivity (Horenstein 1989; Quisumbing et al. 1995; Saito 1994). A study conducted in Kenya's Meru and Muranga districts, indicated that over half the women surveyed reported that lack of cash kept them from using fertilizer, seeds and other inputs (Maitha 1986).

A number of obstacles inhibit women's access to credit. First, women lack access to collateral required to obtain formal credit given that most women in SSA do not hold land in their names (Besteman 1995; Horenstein 1989; Quisumbing et al. 1995; Saito 1994: Suda 1996). Second, despite progress in female school enrollment in many countries in SSA, women still have lower levels of literacy. Women's lower literacy levels render women less able to comply with formal institution credit procedures (Horenstein 1989; Saito 1994).

To counter credit problems, women farmers have turned to informal sources of credit. Relatives, money lenders, and rotating savings and credit groups (ROSCAS) are by far the most important sources for women farmers (Saito 1994). In addition, governments have also introduced interventions to offset women's constraints. The emphasis on cooperatives is particularly noteworthy. According to Ouma (1980), a cooperative is an association of people formed for the benefit or the members and the community in general. In Kenya, the revisions of the Cooperative Act in the 1980s were designed to allow women access to credit facilities offered by growers' cooperatives. Following these revisions, the Kenya Women's Trust Finance, established in 1983 underwrote women's bank loans (Spring 1995). Cooperatives have been shown to have a positive impact on agricultural productivity, through their effects on the adoption of agricultural technology and inputs. Saito and Weidemann (1990) found in Kenya, having a cooperative in a village positively affected the decision of both male and female farmers to use fertilizers. They found however that more men than women were members of cooperatives, and posited that encouraging more women to become members of cooperatives would likely have a positive influence on their decisions to adopt new technologies, and hence their productivity.

The literature suggests a household's access to credit is important particularly for women farmers given their role as food producers. There is also evidence suggesting that women in sub-Saharan Africa have limited access to credit. The literature does suggest however that when women have been able to access credit, whether directly or through agricultural cooperatives, it has had a positive impact on agricultural productivity and household well being. Women's access to credit may thus be an important factor in reducing their vulnerability to HIV/AIDS.

ACCESS TO EXTENSION SERVICES

Access to extension is important for agricultural productivity and rural incomes because it bridges the gap between technical knowledge and farmers practices (Birkhauser et al. 1991; Doss 2001; Saito 1994). The transfer of technical knowledge is particularly important for women farmers, who do the bulk of farm work. Extension contributes to the realization of higher levels of agricultural output, improving women's social position and the economic well-being of their families and communities. The contribution of extension to agricultural productivity, women's social position and thus household well-being makes it an important indicator of agricultural-consumption regimes (ACRs).

In SSA, although women contribute significantly to agriculture, their access to extension services is limited (Doss 2001; Horenstein 1989; Quisumbing et al. 1995; Saito 1994). Women's access to extension is constrained by a number of factors. First, agents have tended to ignore women farmers because they perceive them as having little agricultural decision making authority (Saito 1994). Second, as earlier noted, women are less likely to have secure title to land. This discourages their participation in support services, such as extension (Saito and Weidemann 1990). Third, extension agents perceive women as less able to understand extension messages due to their generally lower levels of education (Saito 1994). Fourth, given that majority of extension agents are male, socio-cultural and religious factors may inhibit male extension agents' communication with women farmers (Saito 1994).

Some governments in SSA have designed intervention programs to offset the deficit of extension services to women farmers. In Kenya, the Training and Visit Systems (T&V) is such a program, designed to counter the shortfall of previous extension services which tended to work mainly with male farmers (World Bank 1989). Early reports nevertheless showed that nationally even with the T&V women still constituted less than 10 percent of all contact farmers (Horenstein 1989). Regional variations in the impacts of the T&V programs were however noted. In Kenya's Meru and Muranga districts, a World Bank (1989) study found that male extension agents worked effectively with women farmers. In particular, younger extension agents reported that they preferred to work with women farmers primarily because they considered them more likely to adopt their advice.

Some studies indicate that the gender of extension agents is an important factor influencing the involvement of women in extension services. Evidence from a number of African countries demonstrates that the transfer of information to women is usually enhanced when female extension agents are used (Evans 1989; Saito 1994; Skapa 1988). The World Bank-executed project on agricultural productivity in Africa (WAPIA) showed that female agents had contact with more female farmers than male farmers, and also addressed issues of concern to women for example subsistence production and household food security. Female agents are particularly favored in Islamic communities, for example among the Hausa in Nigeria, where contact is impossible between male extension agents and Islamic Hausa women (Saito 1994).

Despite the positive impact of female extension agents on women, some women farmers have reservations. Women surveyed in Kenya indicated that they preferred male extension agents because male agents provided more agricultural advice, while female agents concentrated on home economics (Saito 1994). The United Nations, Food and Agricultural Organization (FAO),

recognizing that female agents were likely to reach more women, took into account the reservations some women farmers had toward female extension agents' bias to home economics, and recommended that improving women farmer's position would require increasing the number of female extension workers, while reorienting the content of extension services from its home economics bias (FAO 1987). A recent study conducted in Nigeria showed possible incorporation of the FAO recommendations into the extension services. The study found that women farmers who had females for extension agents had relatively higher levels of awareness and participation of extension activities, adoption of technical knowledge and satisfaction with the quality of agents' services and credibility (Lahai et al. 2000).

In sum, the literature largely indicates that agricultural extension is important for agricultural productivity. Women in SSA have limited access to extension; however some studies have suggested that when female extension officers are used, women tend to have better access to extension. Women's increased access to extension increases their agricultural productivity, and thus their ability to provide for their households. Improved productivity may also mean that women are able to obtain cash from surplus food production, thus reducing their economic dependency on men. Women's economic independence in turn reduces their vulnerability to HIV/AIDS.

WOMEN'S ASSOCIATIONS

Women's associations are seen as a mechanism that enables women to cope with changes in their environment, for example challenges of participating in markets and in the cash economy (Bulow and Sorensen 1988; Quisumbing et al. 1995; Spring 1995; Thomas 1988). Women's associations are thus an important household survival strategy, and contribute positively to women's social position, which makes them an important indicator of agricultural-consumption regimes.

Women's associations are particularly important in Africa. Staudt (1986:199) points out that "Africa is the world region with the most extensive female solidarity organizations, an indication of the importance among women of ties outside household boundaries." Women in Africa view women's associations or groups as a mechanism that enables them ensure the welfare of their families. Thomas (1998:414) interviewed women from two associations in Kenya and found that "increased responsibilities for rural women in the context of marginalization processes leads to increased levels of activity in women's groups."

Women's groups contribute to women's improving status in several ways. First, women's associations tend to increase women's saving capacity, enabling them to circumvent some of the traditional constraints on women's abilities to save and make decisions about cash expenditures. Through these associations, women are able to save small amounts of cash until it is enough to meet a major need (Thomas 1988). Second, women's associations allow women easier access to extension services and important factor for their improved agricultural productivity. Studies have found that extension agents prefer to work with women's groups as a 'composite' contact farmer (World Bank 1989). Quisumbing (1996) found that in Kenya, where there is a strong tradition particularly among women farmers to form groups, women's groups have been used as 'contact

points' for extension workers. Third, membership in women's groups has implications for women's involvement in cash crop production. Bulow and Sorensen (1988) found that in Kenya's Kericho district, tea production when organized in the framework of women's groups is less threatening to husbands than if this production takes place in individual households. In most cases however, husbands supported the women's groups for their own personal interests- to gain the proceeds of group tea production. Fourth, beyond agricultural or income related benefits, membership in women's groups has also been linked to other aspects of women's well-being and empowerment. A study examining the impact of women's socio-economic status on contraceptive behavior found that in Togo, women who participate in women's savings groups are twice as likely to have used modern contraceptive methods. Koenig et al. (2005) also found that in Bangladesh, membership in savings and credit schemes was associated with lower risk of domestic violence.

In sum, the literature suggests that women's association are an important household survival strategy that contributes positively to women's social position. Through women's associations women, are able to save small amounts of money to take care of household needs; access extension which has implications on improved agricultural productivity; have access to cash crop production. Women's associations thus have important implications for women's economic independence, and their reduced vulnerability to HIV/AIDS.

WAGE EMPLOYMENT AND NON-FARM INCOME

In SSA, rural households commonly depend on off-farm income sources for 30 to 50 percent of their income (Mduma and Wobst 2005). In Kenya, about 50 percent of rural farming households are engaged in off-farm income generating activities and about 36 percent have at least one salary earner living away from the farm (Government of Kenya (GOK), 2002), and on average 70 percent of the rural incomes is derived from off-farm incomes which includes remittances (Gitu 2006). The importance of wage employment and non-farm income for rural livelihoods makes it an important indicator of agricultural-consumption regimes.

Non-farm income diversification is associated with higher household welfare measures. Non-farm income leads to more rapid growth in earnings and consumption indicators across more of rural Africa (Barrett et al. 2000; Bigsten and Ndung'u 1992; Block and Webb 2001; Canagarajah et al. 2001: Reardon 1997). Bigsten and Ndung'u (1992) indicate that in Kenya, wage and other non-farm earnings are very important for, smallholder household welfare, as well as their ability to purchase farm inputs, which can improve their agricultural operations. A number of studies have found a positive relationship between non-farm income and household welfare, for example Block and Webb (2001) for both income and nutrition; Barrett et al. (2000) for household income in Kenya and Cote D'Ivoire; Leibbrandt et al. (1996) for household income in rural South Africa; and Readon (1997) for household income in Rwanda.

The capacity of households to participate in rural off-farm activities may vary significantly across and within countries. Barrett, Reardon and Webb (2001) attribute variation to high entry barriers to certain rural off-farm activities, which makes certain activities accessible only to higher income groups. Canagarajah et al. (2001) show that in Uganda, non-farm income fuels income inequality because the poor, uneducated women, recent immigrants to a community, and other

lacking social ties rarely enjoy the same access to income-generating opportunities as do educated males with strong social networks in the community.

The literature largely suggests that wage employment contributes positively to household well being. Given women's domestic roles, we can infer that wage employment will have positive impacts on social position in the household, and thus their reduced vulnerability to HIV/AIDS.

The next section reviews the literature on women's social position and HIV/AIDS risky behavior.

WOMEN'S SOCIAL POSITION AND HIV/AIDS RISKY BEHAVIOR

In the aforementioned definition, women's social position is conceptualized in terms of autonomy, defined as the capacity to manipulate one's personal environment through the control of resources and decisions about one's own life and that of the family (Dyson and Moore 1983). Women's social position is further defined as the degree of a woman's access, control and independence in decision-making (Abadian 1996).

Gender-based inequities determined largely by cultural relations in a particular society shape women's social position, which may in turn influence women's vulnerability to HIV/AIDS and other sexually transmitted infections (Tlou 2002; Turmen 2003). Gender-based inequities are reflected in women's social position in a number of ways. First, gender inequities may shape power in sexual relationships. Power in sexual relationships refers to the ability of one partner to act independently, to dominate decision making to engage in behavior against the other partner's wishes (Pulerwitz et al. 2002). In most developing countries, particularly in SSA, power imbalances result in subordination of women's decision-making power, thus increasing women's vulnerability to sexually transmitted diseases such as HIV/AIDS (Pesce 1994). Inequality in power between men and women makes it difficult for women to have a say in sexual relationships. In some cultures, particularly in SSA, men dominate decision making in the household, and their dominance includes the "right" to sexual intercourse, making it nearly impossible for a woman to refuse sex from her husband even if she suspects that he is engaging in promiscuous behavior (Lwihula 1994). Women with little control over the sexual activities of their partners, are at an increased risk of being infected by these partners (Ingham and Holmes 1991; Reid 1999) Women's low level of decision-making power also means that women find it difficult to take health enhancing knowledge and translate it into preventive action (Nzioka 1994). Kalipeni et al (2004) observe that women in east and southern African countries by and large are not considered of equal status to men socially, nor does equity characterize women's personal relations with men. Where sexual exchange is concerned, women therefore lack the social power to dictate the terms of sex.

Power imbalances within the household can also influence women's vulnerability to sexual risk through gender based violence (Tlou 2002; Turmen 2003). Violence can indirectly influence the transmission of HIV/AIDS through women's fear of raising the issue of condom use (Heise et al. 1995; Khan et al. 1996). Women with a history of violence have been found to be more likely to engage in unprotected sex, have multiple partners and trade sex for money and drugs (Heise et al. 1999; Maman et al. 2000). In Tanzania, a study found that for some women the experience of violence could be a strong predictor of HIV. This study found that of the women who sought

services at voluntary HIV counseling and testing center in Dar-es-Salaam, those who were HIV positive 2.6 times more likely to have experienced violence in an intimate relationship than those who were negative (Maman et al. 2000). Similarly, a study in Kenya found that women who had been sexually coerced were 2.2 and 2.5 times more likely to have, multiple sexual partners and reproductive tract infections respectively (Erulkar 2004).

Second, gender inequalities are reflected in women's socio-economic status, which in turn influences their vulnerability to risky behavior. In SSA, gender differences in access to education, training and paid employment are factors that disenfranchise women and increase their vulnerability to poverty (Idele-Akwara 2002; Jewkes et al. 2003; Schoepf 1993; Tlou 2002; Turmen 2003 UNIFEM 2000). Additionally, in SSA, gender related differentials exist in women's and men's access to productive resources such as land and inputs. Customary laws for instance usually favor male ownership and control over family resources such as land (Boserup 1970; Davison 1988; Horenstein 1989; Quisumbing et al. 1995; Suda 1996; UNIFEM 2001). These factors contribute to women's low socio-economic status, resulting in women's economic dependence on men. Economic dependence on men results in power imbalances which in turn limit women's ability to negotiate safer sex, such as condom use with their partners (Kalipeni et al. 2004; Tlou 2002; Turmen 2003; Dinkleman et al. 2006).

Women's inferior economic situation also threatens their basic survival and subsistence needs, motivating them to engage in transactional sex (Hunter 2002; Luke 2002). Evidence from Malawi suggests that for many poor women, unequal access to productive resources limits their coping strategies creating conditions where transactional sex becomes a rational means of survival (Bryceson and Fonseca 2005). Kalipeni et al. (2004) note that whether it is in a marriage that a woman relies on for financial reasons, or in situations of commercial sex exchanges, women are not in a position to say no to a partner that will not assent to using condoms because the longer term possibility of HIV infection becomes subordinated to the more acute short-term necessities of economic survival. Furthermore, even in cases where women are knowledgeable about AIDS, they may not be able to act on this knowledge to prevent infection. Dinkelman et al. (2006) found for instance that in Botswana sexual behavior differs, between men and women with the same knowledge-sets, suggesting that there are other aspects of gender beyond knowledge that leave women at more risk.

On the other hand, women who own property or otherwise control economic assets have greater bargaining power within their households and can better protect themselves against having to exchange sex to meet the essential economic needs (UNAIDS 2006).

The next section begins with a review of the literature on the impacts of agricultural-consumption regimes on household food security. Given women's significant role as food producers, the impacts of three ACRs - access to extension, membership in women's associations, and wage employment- on household food security, largely coincide with the previously reviewed impacts on women's social position. This section thus focuses on three ACRs - agricultural commercialization, land tenure regimes, and access to credit- for which a distinct body of literature, examining the impacts on household food security, exists. A link between this literature and the outcome of interest, women's vulnerability to HIV/AIDS is based on the earlier noted notion that people who are food insecure are less likely to act on their knowledge to prevent infection. In this

regard then, I infer that agricultural-consumption regimes that negatively impact household food security will in turn increase women's vulnerability to HIV/AIDS.

THE IMPACT OF AGRICULTURAL-CONSUMPTION REGIMES (ACRs) ON HOUSEHOLD FOOD SECURITY

Before embarking on the impacts of ACRs on household food security, it is important to define household food security, as applied to this study. In defining household food security, the study draws largely from two main definitions. First, Benson et al.'s (1986:2) definition, which refers to food security as a "household having assured assets of entitlements- from food production, cash income, and reserves of food/assets and or government assistant programs." This definition's focus on the means by which people are accessing food as well as the concentration on the notion of the household makes it suitable for the assessment of the impacts of ACRs on household food security. Second, the study draws from Calkin's (1988:4) definition which refers to food security as "the capacity of a population to produce or buy enough food even in the worst years, to satisfy basic food needs." Although this definition does not highlight the household, the way in which it calls attention to the notion of capacity to produce is important for this study.

AGRICULTURAL COMMERCIALIZATION

Agricultural commercialization, as understood here, means increased production for the market, notably through the production of cash crops. Commercialization means that households increasingly use significant proportion of their resources for cash crop production (Niemeijer and Hoorweg 1994).

The most contentious issues in the cash crop/food crop debate have revolved around the impact of commercial agriculture on household food security and the nutritional status of individuals. The debate has focused on the income effects of cash crop production (Bouis 1994; Haddad and Hoddinot 1991; Kennedy 1994; Braun 1994); the reallocation of land and labor that occurs with commercialization (Davison 1988; Gladwin 1991; Horenstein 1989; Braun 1994); and the synergistic effects of cash crop production on other forms of production (Govereh and Jayne 2003; Strasberg et al. 1999).

Studies suggest that effects of agricultural commercialization will operate through increased household incomes. Surrounding this claim are questions such as how average incomes are distributed among various economic and social groups; and whether household income necessarily leads to improved food consumption for all household members (Bouis 1994; Haddad and Hoddinot 1991; Kennedy and Bouis 1993; Kennedy 1994; Braun 1994).

In terms of the relationship between household income and household food security, a number of studies have examined the extent to which increased household income due to involvement in cash cropping has translated to household food security. A number of studies have found a positive relationship between income from cash cropping and household food security. Braun and Immink (1988) found production of export crops by smallholder farmers in Guatemala

to have a positive effect on household food security. Similarly findings from Southwestern Kenya suggested that participation in the sugarcane out-growers' program was associated with increased income, which in turn produced some positive effects on household energy consumption (Kennedy and Cogill 1987). These findings were also corroborated for tobacco production in Malawi (Peters and Herrera 1989). Kennedy (1994) using data from five countries- Guatemala, Philippines, Kenya, Rwanda, and The Gambia, investigated the effects of commercialization on preschooler nutrition. She found that increments in household income resulted in improvements in preschooler nutritional status. Furthermore, not only were negative effects not observed in the rather food-oriented Gambian and Rwandan commercialization schemes, but they were also not observed in the very non-food, cash- crop oriented Kenyan, Malawian, Philippine and Guatemalan cases. Kennedy and Bouis (1993) observe that the generally positive effect of cash cropping resulted in an increase in household caloric consumption. They do, however, note that the increases although significant were modest. For instance a doubling of household income in Kenya and Philippines resulted in an increase in preschooler energy intake of only 4 percent and 7 percent respectively, in areas where the average calorie deficit in the child's diet was 20 to 30 percent below recommended levels.

Other studies have revealed mixed findings of the income effects of cash cropping. Niemeijer and Hoorweg (1994) argued that it may not be the level of income from cash cropping that results in better nutrition, but the opportunity for diversified income sources associated with commercialization. In their study of rice production in western Kenya found differences in nutritional outcomes between scheme resident tenants, and individual rice growers outside the schemes. They observed poor nutritional outcomes among the resident tenants. Among the non-resident tenants, they found fewer nutritional problems and they attributed this to non-residents' opportunities for diversification of income. Similarly in Sierra Leone, off-farm income had a positive effect on children's weight-for-age, but the share of tree crop income had negative effect (Bellin 1994). In Bukidnon Province, Philippines, participation in sugar cash cropping was associated with significantly more stunting in children. Households seemed to use income to purchase nonfood items and higher priced calories, which resulted in preschoolers having less than recommended calorie intakes (Haddad and Bouis 1994).

While the previous studies found a generally positive income effect of cash cropping, there is evidence indicating that the household member who controls the income may influence household food security. Women's income, particularly in Africa, is more likely than men's income to be spent on food (Handa 1996; Haddad and Hoddinot 1991; Horenstein 1989; Kennedy 1994; Levin et al. 1999; Pitt and Khandaker 1998; Thomas 1997). In the case of cash cropping however, income is more likely to be controlled by men since cash crop income is by and large viewed as men's income (Boserup 1970; Davison 1988; Horenstein 1989; Nzioka 2005; Spring 1995). In the Gambia, with the introduction of rice as a cash crop, there was a shift in control over the crop from women to men. Holding household income constant, women's reduced crop control had an adverse effect on calorie consumption. The overall household income effect was, however, positive (Braun, Johm and Puetz 1994). In Kenya, Rwanda and the Gambia, the amount of female controlled income significantly increased household energy consumption, and effect was most pronounced in the lowest income groups (Braun and Kennedy 1994). Bouis (1994) claims that the negative

tendencies to spend less on food because of loss of income control by women, are generally small, more than often compensated for by increased incomes due to commercialization.

A number of researchers contend that in addition to the direct effect of cash cropping on household incomes, there may be important indirect effects of cash cropping on household activities such as food cropping (Govereh and Jayne 2003; Govereh et al. 1999; Strasberg 1997). The focus then is on potential household level synergies of cash crop production. Household level synergies occur when the participation in a commercialized crop scheme enables a household to acquire resources that otherwise would not be available, for use on other enterprises in the crop mix. Under conditions of constrained access to credit, household's ability to intensify food production may depend on their participation in cash crop schemes (Govereh and Jayne 2003). Strasberg (1997) for instance found that in Mozambique participation in cotton out-grower schemes was the primary means of acquiring cash inputs of use in food production. Similarly, in parts of Kenya's Central provinces smallholders engaging in coffee production obtained through their coffee cooperatives access to credit, inputs, equipment and extension services (Govereh et al. 1999). Evidence of household level synergies was also corroborated for groundnut cash cropping in Senegal (Dione 1989); cotton cash cropping in Mali (Goetz 1990); and sugar cash cropping in Kenya (Kennedy 1989). The argument on the synergistic effects views commercialization as being functional for other forms of household production, however does not take into consideration the constraints women face in their role as food producers. For instance even if inputs may spillover, if cash crop production makes land less available for food crop production, then these effects may not be significant.

Studies have also suggested that commercialization may impact household food security through demand on women's time and labor (Boserup 1970; Horenstein 1989; Kennedy and Bouis 1993; Lemmens 1987; Staudt 1976). Kennedy (1994) argued that the impacts on household food security may occur through impacts on child feeding patterns if increased demands are placed on a mother's time to provide agricultural labor for a specific cash crop. In her study on the impact on preschoolers, she however found no significant difference in the weaning age between participant and non-participant households suggesting that the entry of households into cash cropping schemes had no detrimental effects on child feeding patterns.

The literature on the effects of cash cropping on household food security reveals mixed findings with some studies finding increased household food security as households become more involved in cash crop production, while other studies point to negative effects. The studies suggesting a negative relationship between cash crop production and household food security have suggested that this relationship may depend on the household member who controls the income from cash crop production. In SSA studies have found that cash crop income is more likely to be controlled by men. Cash crop production may therefore limit the amount of cash available to women to fulfill their domestic roles. Furthermore, the labor demands exerted on women by cash crop production may negatively impact their role as food producers.

LAND TENURE

The concept of household food security as the capacity of a household to produce or to buy enough food at all times to satisfy nutritional needs, suggests that it is necessary to improve production capacities in order to increase household food security. Taylor and Philips (1990) note that the probability of the households' food security or the change in the state of insecurity depends on the resource endowment and entitlements. Entitlements in turn are based on access to resources (Sen 1981). Maxwell and Wiebe (1999) note that where land and food are explicitly conceptualized together, they generally fall within a linear framework that begins with access to resources and proceeds through production, income generation, and consumption to nutritional status.

Land tenure is typically conceptualized as "the set of rules that determine property rights, which define or delimit the privileges granted to individuals with specific assets (Alston et al. 1997:146). Land tenure systems are not static, and change from time to time to accommodate social, demographic, economic and political situations (Biru 1998). Barraclough (1991) refers to these changes as 'land reform' and notes that they vary widely. These reforms range from those that focus on redistribution of land resources, to those that focus primarily on privatization of land (Maxwell and Wiebe 1999). In Africa, land reform has involved evolutionary and legal changes that have propelled land tenure systems that were primarily based on customary tenure, toward private property regimes (Davison 1988; Maxwell and Wiebe 1999; Nzioka 2005; Orvis 1997; Suda 1996). These reforms are intended to increase efficiency and enhance tenure security with the hope that it will result in improved agricultural productivity (Barraclough 1991). In Kenya, for instance, the land titling program was intended to improve productivity incentives by restructuring property rights in land (Biru 1998).

Studies examining the links between land tenure and household food security have largely focused on agricultural productivity as an outcome. They suggest that the most plausible link between tenure and food security is that enhanced security of tenure in productive resources enables more efficient profitable and sustainable production, and hence greater income and access to food (Feder et al. 1988; Bruce and Migot-Adholla 1994).

Research on the relationship between tenure security, defined in this case as the holding a title deed, and agricultural productivity, is at best tenuous. Feder et al. (1988) contend that tenure security may impact agricultural productivity by: increasing farmers' confidence that they will benefit, over the long term, from investments in land improvements; and increasing access to credit with land as acceptable collateral. In a study conducted in Thailand, Feder et al. (1988) found a positive relationship between individual land rights and productivity. Biru (1998) set out to test the hypothesis that households whose lands are registered and titled would have higher production capacity, and thus increased household food security. He found a statistically significant relationship between the number of crops grown and landholding sizes; however his expectation that households whose parcels were registered would have better production capacity was not supported by the data. He further concluded that households' security of tenure does not necessarily lead to food security. Similarly in a study that included Ghana, Kenya and Rwanda, Migot-Adholla et al. (1991:172) found "no relationship between cross-sectional variations in land rights and productivity."

According the World Bank (2007:37) the size of the rural population in developing countries has experienced considerable growth and "is expected to continue to grow until 2020…Africa will begin a decline after 2030 at the earliest." Growing rural populations result in increasing landlessness, and smaller farm sizes, in other words tenure security is threatened (IFAD 2008). In East and Southern Africa, cultivated land per capita has halved over the last generation, and in a number of countries the cultivated area amounts to 0.3ha per capita (IFAD 2008:9). The knowledge that in farm size per capita is continuing to decline has motivated land tenure /food security studies to examine the relationship between farm size and agricultural productivity. There is empirical evidence that points to an inverse relationship between farm size and productivity (Kumar 1994). Plateau (1992) attributes this inverse relationship to input output markets, suggesting that in situations where off-farm employment opportunities are limited, there is intensive application of family labor to on-farm production. Since family labor has lower transaction costs, this translates to higher yields per acre. Some studies on the other hand suggest that in the absence of well functioning markets, large- scale farmers may have an advantage, given their superior access to resources such as, land, credit, inputs extension and new technology (Doss 2001; Maxwell and Wiebe 1999; Rohrback 1989). These benefits may result in large-scale farmers experiencing higher yields per acre. For example, Biru (1998) extended his study beyond an investigation of the relationship between farm size and agricultural productivity, and examined the links between land holding sizes and household food security in Malawi. He found that households with larger landholding sizes were more likely to be better off than those with smaller holding sizes. His study also revealed that households with landholding sizes of less than two hectares were more likely to be food insecure than their counterparts with more than two hectares of land. Other evidence indicates that where land is abundant, and landholdings are larger women tend to have better access to land, a factor that is important for women's ability to ensure household food security (Zuidberg 1994).

The literature suggests that the evidence on the relationship between land titling and household food security is inconclusive. In terms of landholdings sizes, the evidence largely suggests that larger landholdings sizes are associated with higher agricultural productivity. Improved agricultural productivity has important implications for household food security.

ACCESS TO CREDIT

Access to credit, either from formal sources (usually established financial institutions) or informal sources (credit merchants, relatives, friends or self-help groups), by smallholders has been linked to food security (Biru 1998; Diagne 1998; Horenstein 1989; Mbata 1991; Saito 1994; Zeller et al. 1997). Credit may impact food security through production-consumption linkages or it may impact consumption directly if loans are taken for consumption purposes (Zeller et al. 1997). The focus has largely been on production effects, however Bokosi (2004) indicates that a greater proportion of loans taken in rural communities have been used for consumption purposes, especially during pre-harvest period and bad production seasons.

In terms of agricultural productivity, credit can significantly increase the ability of poor households with little or no savings to acquire needed agricultural inputs and also allows

household to access labor-saving technologies thus raising labor productivity (Delgado 1995). Mbata (1991) made a distinction between formal and informal credit sources and noted that in Nigeria, farmers who had access to formal sources of credit utilized more inputs, obtained higher yields and realized greater margins per hectare, than their counterparts who obtained credit from informal sources

Access to credit not only positively impacts production, but credit also increases farmers' willingness to take risks. The awareness that credit will be available to cushion consumption against income shortfall should a potentially profitable, but risky investment turns out badly will induce the household to take the additional risk (Kotwal 1985).

Rural credit has also been shown to impact significantly on non-farm growth, employment and rural wages, increasing opportunities for income generation (Binswanger and Khandker 1993). Increased household income has, in turn, been shown to impact positively on household consumption (Bouis 1994: Kennedy 1989; 1991; Haddad and Hoddinott 1991).

While researchers have established mechanisms that point to a positive relationship between credit and food security, studies investigating this relationship have revealed mixed findings. A study conducted in China revealed access to formal credit increased per capita calorie consumption by 316 calories (Zhu et al. 1996). Biru (1998) conducted a study in Malawi also found a positive relationship between access to credit and household food security. He noted that households that were members of credit clubs were more likely to be food secure than non-members. Diagne (1998), making a distinction between formal and informal sources of credit, found that borrowing (not just from formal sources) was negatively correlated with both calorie and protein intake, however those who borrowed from formal sources were significantly worse off. He offered a possible explanation of the negative correlation and indicated that if smallholders have to repay the loan, and the loan granted is not enough for the intended investment, the household may reduce consumption to make up for the shortfall.

A number of researchers argue that the effects of credit on household welfare may depend on which household member has access to credit (Horenstein 1989; Quisumbing et al. 1995; Zeller 1997). Several studies have shown that increases in women's income significantly raise expenditures that lead to improvement of the nutritional status of children (Haddad and Hoddinott 1991, 1997; Kennedy 1991; Quisumbing et al. 1995 ; Thomas and Chen 1994). A study conducted in Taiwan showed that after controlling for household per capita income, women's income share has significant and positive effect on household budget shares of staples (Thomas and Chen 1994). In southwestern Kenya Kennedy (1991) found that for a given household income level, female controlled income share had a positive and significant effect on household caloric consumption.

A household member's access to formal and informal credit however depends on a range of societal, community, household and individual variables. Major individual variables include gender, age, education and an individual's control over assets suitable for collateral (Zeller 1997). Women's limited access to credit for instance may present serious obstacles to improving agricultural productivity and hence household food security (Horenstein 1989; Quisumbing et al. 1995; Saito 1994; Suda 1996).

The literature, for the most part, points to positive effects of credit on household food security, with the caveat that the relationship between credit and household food security may depend on which household member has access to credit.

The next section examines the relationship between household food security and HIV/AIDS.

THE IMPACT OF HOUSEHOLD FOOD SECURITY ON HIV/AIDS

Food insecurity may increase vulnerability to risky sexual behavior and the risk of HIV infection particularly for women who may exchange sex for food and income (Bryceson 2004; Loevinsohn and Gillespie 2003; Weiser et al. 2006). Women in dire economic circumstances agree to sexual relationships with men in exchange for financial support (Adams and Marshall 1998: Kelly and Parker 2000). According to Abdool Karim (1998) in South Africa, the exchange of sex for money means that sex happens on the man's terms- usually without a condom, which may increase a woman's risk of infection. For women engaging in this behavior however, protecting themselves from possible future illness may be of lower priority than meeting immediate economic needs (MacPhail and Campbell 2000).

Weiser et al. (2006) conducted a study in Botswana and Swaziland to examine the relationship between food security and HIV risk behavior. They found that of all the study participants 32 percent of women and 22 percent of men experienced food insufficiency in the preceding 12 months. Food insufficiency was associated with increased HIV risk behavior, and this association was stronger for women. Risk behavior included unprotected sex, transactional sex, intergenerational sex, and lack of control over sexual relationships. Bryceson et al (2004) observed that in Malawi during the 2002 food crisis, women would routinely travel for miles to grain mills to collect bran left behind after milling. During these trips, the women would engage in transactional sex with men working at the mills.

Researchers also find that the relationship between household food insecurity and vulnerability to risky sexual behavior may also exist for other members of the household. Adolescents from food insecure households might be more likely to adopt livelihood strategies that are conducive for the spread of HIV such migrating work and exchanging sex for money or food (Adams and Marshall 1998; Kelly and Parker 2000). A study conducted among adolescents in Tanzania found that adolescents from highly food insecure households appeared to be at greatest risk of HIV infection (Cordeiro 2007).

The next section focuses on the theoretical perspective guiding this study.

CONCEPTUAL PERSPECTIVE

POLITICAL ECONOMY OF HIV/AIDS

In the past, behavioral studies had a tendency to focus on rational- action models, for instance the health belief model (Rosenstock 1966); information-motivation behavioral skill

models (Fisher and Fisher 2002); theory of planned behavior (Azjen and Fishbein1975; Montano and Kasprzyk 2002) and social-cognitive theory (Bandura 1977, 1994; DiClemente and Peterson 1994; Wingwood and DiClemente 1996); AIDS reduction model (Catania et al. 1990). Rational action models emphasize the ability of the individual to play a role in one's health protection and enhancement (DiClemente and Raczynski 1999). Tone and Green (2004) note that the notion of individual responsibility results in "victim blaming," and the essence of behavior change lies in trying to persuade individuals to take responsibility of their own health while ignoring the fact that individuals are victims of certain social and environmental circumstances.

Until recently, HIV/AIDS studies emphasized rational action models, focusing largely on "risk" groups such as military men, truck drivers, migrant workers and prostitutes visible for their sexual practices involving multiple partners (Craddock 2004). Attempts to discern the driving mechanisms of the epidemic thus focused on the sexual behavior of these risk groups, for migrant labor (Brockerhoff and Biddlecom 1999; Campbell 1997; Lurie et al. 1997); for truckers (Jackson et al. 1997; Bwayo et al. 1991, 1994); sex workers (Abdool Karim et al. 1995; Gysels et al. 2001). Studies also focused on cultural explanations of the high prevalence rates in Africa, focusing mainly on the cultural determinants of the epidemic (Runganga and Kasule1995; Wijgert et al. 2001).

Craddock (2004) notes that the emphasis on risk groups however gives the impression that only those in these risk occupations need to worry about HIV and thus leaves unexamined the vulnerability of individuals outside these "risk groups." Simmons et al. (1996) note that the term risk behavior unless carefully contextualized exaggerates individual agency and leaves unacknowledged and unexplained the ways in which large scale social and economic factors that structure risk, for individuals and groups who are systematically marginalized from access to goods, services and opportunities. A focus limited to risk groups is not appropriate particularly for SSA, where poverty drives the epidemic, such that in the poorest of households, women will turn to prostitution sometimes as regular sex workers, but more often as occasional ones who work when they or their dependents need money (Cohen 2001). Kalipeni et al. (2004) in their assessment of the AIDS pandemic in east and southern Africa found that one of the problems of educational outreach programs - based on the notion of rational behavior, that with knowledge comes automatic adjustment in sexual practices - is that it elides the broader context of power relations, economic necessity and resource limitation within which HIV transmission occurs.

A number of researchers thus advocate for a cultural political economy of vulnerability framework that reflects the understanding of AIDS as resulting from discursive forces that effectively constrain the opportunities and choices available to individuals and potentially creating conditions of vulnerability for large sectors of regional populations (Craddock 1999, 2000; 2004; Kalipeni 2000; Kalipeni et al. 2004; Oppong 1998). The political economy approach is located firmly in the interaction of institutional, cultural, economic and historical contingencies of place (Craddock 1999). Entwistle (2007) advocates for "putting people in place"- that is explaining individual outcomes in relation to a potentially changing local, social and spatial context. The political economy approach gives paramount attention to more accurate exploitation of the social and economic causes of vulnerability and at best can discern the structural components such as employment or access to resources that might place some individuals at risk for HIV (Craddock 1999; Kalipeni 2000, Kalipeni et al. 2004; Oppong 1998).

The next sub-section focuses on a specific perspective within the political economy framework, the vulnerability perspective, which has important implications for this study.

Vulnerability Perspective

The vulnerability perspective derives from an approach to vulnerability elaborated by Watts and Bohle (1993), drawing largely from Sen's (1981) entitlement theory. Sen (1981) in his theory defines an entitlement "as the set of different commodity bundles that a person can acquire through the use of various legal channels of acquirement open to someone in his position." According to Sen, entitlement derives from the political and social status a person holds vis-à-vis the household or community. Sen's theory is applicable to the study of health because it focuses on the importance of access to resources in averting vulnerability (Craddock 2000).

Watts and Bohle (1993:53) extend Sen's entitlement theory and propose a tripartite causal structure which defines vulnerability through the intersection of three causal powers: command over food (entitlement), empowerment and the structural-historical form of class relations within a specific political economy. Empowerment is the component from which entitlements derive. It focuses on those institutions that regulate access to or control over resources, and examines the rules and rights by which individuals claim social power. Empowerment thus focuses on people or groups denied critical rights in various domains, which include the domestic domain (Watts and Bohle 1993).

Political economy refers to the framework within which entitlements and empowerment work. According to Watts and Bohle (1993:51), "political economy in other words privileges the historical and structural, attempting to account for how and why particular patterns of entitlement and empowerment are produced and reproduced in society." The focus then is on the particular mode of production characterizing a particular place and how it is shaped by historical and local contingencies.

While the vulnerability perspective was initially proposed for the study of hunger and famines and other natural hazards, it is applicable to the study of HIV/AIDS because vulnerability to HIV/AIDS, as with vulnerability to other hazards, is a function of class relations and power, including gender relations, and political relations, and not just a function of biological susceptibility (Gould 2005). According to Oppong (1998), the vulnerability perspective takes in to account that adverse life circumstances such as hunger and disease do not affect social groups uniformly. In the study of HIV/AIDS, the perspective thus departs from a focus on individual sexual behavior to a focus on the social, economic, and political contingencies that makes some groups vulnerable, thus giving emphasis to issues of differential access to resources (Craddock 2000; Kalipeni 2000, 2004; Oppong 1998). Kalipeni and Craddock (1997) for instance indicate that in eastern and southern Africa, for women in particular, employment opportunities are limited, resources such as government training or agricultural extension projects are directed toward men, and local income earning opportunities are unavailable. The result is that prostitution is the only income earning occupation open to many women, who must find a way to feed not just themselves but their families. Craddock (2000) notes that the strength of the vulnerability perspective then lies in its ability to deal with the question of why conditions pertaining to a broad area become causal factors of disease for some individuals or groups.

A number of researchers have applied the vulnerability perspective to HIV/AIDS studies. Oppong (1998) notes that while all human beings are biologically susceptible to infection by different diseases such as HIV/AIDS, certain social and economic factors place some individuals and social groups in situations of increased vulnerability. In applying the vulnerability theory to Ghana's HIV/AIDS situation, he posits that the recent political and economic history in Ghana may provide explanations for the unusual HIV/AIDS patterns. He points to the differences in HIV prevalence between the Eastern and Greater Accra region in Ghana, noting that the high prevalence in Eastern Ghana can be attributed to deteriorating economic conditions leading to increased sexual economies. Residents of Greater Accra are not as vulnerable because the area is still economically strong.

Kalipeni (2000) uses the perspective to examine the factors shaping the epidemic in southern Africa. He focuses on social and economic changes in the regions and attributes health outcomes in southern Africa in part to the structural adjustment policies (SAPS). He notes that SAPS by introducing trade liberalization and government reduction in social spending, reinforce an already existing process of marginalization of women's production; where SAPS lead to an increase in production, they stimulate production of cash crops for export often to the detriment of household consumption. Furthermore, cash crop income is largely controlled by men, and as a result women are further marginalized.

Gilbert and Walker (2002) also employ the perspective to examine the links between HIV/AIDS and social inequalities in South Africa. They find a strong link between low income levels, high unemployment, poor education and infection rates, particularly for women. Women's lack of access to resources, both financial and social, largely contributes to their vulnerability.

The vulnerability perspective has applicability for this study's objective, of investigating women's vulnerability to HIV/AIDS, for several reasons: First, the study attends to the regional political economy through an examination of the various modes of production - ACRs- and the structural and historical contingents that shape these modes of production. Second, the study focuses on women as a marginalized group and addresses institutions that regulate women's access to resources or entitlements. The aforementioned literature for instance reveals that in SSA entitlements may be largely contingent upon women's relation to men. In Kenya for instance, a woman's access to land may be dependent on her marital status. Third, the study's focus on women's social position allows for an examination of how empowerment for women may be constrained by imposition of patriarchal authority at the household level, resulting in power imbalances, which in turn elevate women's vulnerability to HIV/AIDS.

SUMMARIZING THE LINKS BETWEEN ACRS AND WOMEN'S VULNERABILITY TO HIV/AIDS

In terms of land tenure, household food security is an important link between land tenure regimes and vulnerability to HIV/AIDS. Women in food secure households are more likely to act on their knowledge of risk to prevent situations that make them vulnerable to HIV infection (Bryceson et al. 2004; Gillespie and Kadiyala 2005; Loevinsohn and Gillespie 2003). Of importance, therefore, is women's ability to access land for food production. In terms of land holding sizes, while some

studies show that in some areas households with large land holdings devote more land to cash crops reducing the amount of land available to women for food production (Davison 1988), other evidence indicates that where land is abundant, and landholdings are larger women tend to have better access to land (Zuidberg 1994). Larger land holdings are also associated with greater access to productive inputs, which contribute to improved agricultural productivity and hence household food security (Doss 2001; Maxwell and Wiebe 1999; Rohrbach 1989). Biru (1998) in his study examining the relationship between land holding sizes and household food security found that households with larger land holdings were more likely to be food secure than those with smaller land holdings.

Given that in sub-Saharan Africa tenure systems largely limit women's ownership to land, land tenure studies have focused on other indicators of women's access to land, such as input to production, and control of the produce from the plots they farm. Gwako (1997), for instance, measured tenure security as the percent of plot yield controlled by women in the previous season. Women's input into production and control of produce from the plots they farm confers an economic advantage for women. This may reduce their economic dependency on men, thus, reducing their vulnerability to HIV/AIDS.

In terms of commercialization of agriculture (traditional cash crop production versus food crop production), there is evidence indicating that women involved in cash crop production in the form of contract farming may be economically better off (Glover 1994; Spring 2000). There is overwhelming evidence, however, that indicates that cash cropping negatively impacts women: first, because income from cash crops is largely controlled by men, and secondly, because cash cropping may reduce the amount of land available for women's food crops. Cash cropping may thus reduce women's access to income, increase their economic dependency on men, and thus their vulnerability to HIV/AIDS. The literature also indicates that in regions that have a high emphasis on cash cropping, presence of agro estates, which have been cited as promoting sexual risk behavior, may increase vulnerability to HIV infection.

There is evidence that largely points to the positive effects of credit on household food security (Biru 1998; Bouis 1994; Delgado 1995; Haddad and Hoddinott 1991; Kennedy 1989; Kotwal 1985; Mbata 1991; Zhu et al. 1996). As earlier noted, women in food secure households are more likely to act on their knowledge of HIV to prevent situations that increase vulnerability to the disease.

Access to extension is important for agricultural productivity and hence household food security. Given that women in SSA have limited access to extension, studies suggest that women are more likely to benefit from extension in areas where female extension agents are used (Evans 1989; Saito 1994; Skapa 1988). Women's associations are viewed as a mechanism that enables women to ensure their own welfare and that of their families. Women's associations are thus an important household survival strategy (Bulow and Sorensen 1988; Quisumbing 1995; Staudt 1986; Thomas 1988). Membership in women's organizations may enhance women's economic independence, thereby reducing their vulnerability to HIV infection.

There is overwhelming evidence that indicates that wage employment or non-farm income diversification is associated with higher household welfare (Barrett et al. 2000; Bigsten and Ndung'u 1992; Block and Webb 2001; Canagarajah et al. 2001; Reardon 1997). Opportunities for

wage employment will reduce women's economic dependence on men, thus reducing their vulnerability to HIV infection.

EXPECTED RELATIONSHIPS

The study's general hypothesis is that agricultural contexts in Kenya create regional differences among women such that those sharing similar social positions respond differently in terms of HIV/AIDS risky behavior. The study examines three sets of attributes, individual and household, and contextual factors. With regard to individual and household factors, the study focuses mainly on two factors, women's decision- making autonomy and household food security. The contextual attributes include the various indicators of ACRs - agricultural commercialization, land tenure regimes, access to credit and cooperatives, access to extension, women's association and wage employment. ACRs may affect HIV/AIDS risky behavior directly by creating situations of risk, such as commercial trading centers, where asymmetrical relationships are more likely to take place (Bota et al. 2001; Ngwira et al. 2001), or by influencing women's access to entitlements and thus their vulnerability to HIV/AIDS.

As earlier stated, the study's objectives are: first, to understand the extent to which women's vulnerability to HIV/AIDS varies across regions in Kenya; second, to determine if women's decision-making autonomy and household food security explains variability in women's vulnerability to HIV/AIDS after controlling for individual-level factors such as age, education and occupation; third, to understand if the effects of agricultural consumption regimes explain the variability in women's vulnerability to HIV/AIDS over and above women's decision-making autonomy and household food security after controlling for individual-level factors.

To satisfy these objectives, the study seeks to answer four general questions:

1. Does women's vulnerability to HIV/AIDS vary across districts in Kenya?

In relation to this first question, I hypothesize that women's vulnerability to HIV/AIDS will not be uniform across regions. *The general hypothesis then is that women's vulnerability to HIV/AIDS varies significantly across Kenyan districts*.

2. To what extent does the non-random distribution of women's decision- making autonomy account for variation in women's vulnerability to HIV/AIDS across districts?

Power imbalances in the household may influence women's vulnerability to risk. In some cultures men dominate decision making, and this dominance may include "rights" to sexual intercourse (Lwihula 1994). Women with lower levels of decision- making power may find it difficult to act on their knowledge to prevent infection (Nzioka 1994). *I expect that women with low levels of household decision-making autonomy will be more vulnerable to HIV/AIDS risky behavior.*

3. To what extent does the non-random distribution of household food security account for variation in women's vulnerability to HIV/AIDS across districts?

Household food security may influence risk of HIV infection particularly for women who exchange sex for food and income (Bryceson 2004; Loevinsohn and Gillespie 2003; Weiser et al. 2006). *I expect that higher levels of food insecurity will be associated with women's increased vulnerability to HIV/AIDS.*

To what extent do ACRs account for the variation in women's vulnerability to HIV/AIDS across districts, over and above women's decision-making autonomy and household food security? In line with this question, the general hypothesis is that *ACRs will explain the variation in women's vulnerability to HIV/AIDS across districts, over and above women's decision-making autonomy and household food security.*

In terms of specific hypotheses related to agricultural-consumption regimes (ACRs):

a. *I expect that women living in districts characterized by larger land holding sizes will be less vulnerable to HIV/AIDS.*
b. *I expect that women's tenure security will negatively impact women's vulnerability to HIV/AIDS.*
c. *I expect that commercialization (cash crop versus food crop production) will increase women's vulnerability to HIV/AIDS.*
d. *I expect that a household's access to credit will decrease women's vulnerability to HIV/AIDS.*
e. *I expect that women's access to cooperatives will decrease women's vulnerability to HIV/AIDS.*
f. *I expect that women living in districts characterized by a high proportion of female extension agents will be less vulnerable to HIV/AIDS.*
g. *I expect that membership in organizations will decrease women's vulnerability to HIV/AIDS.*
h. *I expect that access to wage employment will decrease women's vulnerability to HIV/AIDS.*

MEASUREMENT AND SPECIFICATION

DATA

The study utilizes data at two levels: 1) combined individual and household level and 2) contextual (district) level data.

Individual level data

The individual and household level data comes from the 2003 Kenya Demographic and Health Surveys (KDHS) implemented by the Kenya Central Bureau of Statistics (CBS) in collaboration with the Kenya Ministry of Health, with technical assistance from Macro International Inc., as part of the MEASURE (Monitoring and Evaluation to Asses and Use Results) Demographic and Health Surveys Programs (MEASURE/DHS), a project sponsored by the United States Agency for International Development (USAID).

The 2003 KDHS used a representative probability sample of almost 10, 000 households. The sample utilized a two-stage sample design. The first stage involved selecting sample points (clusters) from a national master sample maintained by the CBS. A total of 400 clusters, 129 urban and 271 rural clusters were selected from the master frame. The second stage of the KDHS data

collection process involved systematic selection of all households that had been prepared from the national master sample. A total of 9,865 households were selected in the sample, of which 8,889 were occupied and therefore eligible for interviews. Of the 8,889 existing households, 8,561 were successfully interviewed. A household survey was undertaken in which information was collected, on each member of the household, including age, gender, and the person's relation to the head of household. The purpose of the household survey was to identify women between the ages of 15-49 who would be eligible for the individual interview. In the households interviewed in the survey, 8,717 eligible women were identified, and interviews were completed with 8,195 women.

To conduct the analysis at the district level, the individual level data required further preparation. This involved linking the individual level and household level files to a geographic data file using common administrative (district level codes) available in both data files.

District level data

The data collection process for the contextual (district) level was sponsored by the International Food Policy Research Institute (IFPRI). Contextual (district) level data was based on the documented districts in Kenya (70) as of 2003 to allow for consistency with the districts used in the 2003 Kenya Demographic and Health Surveys. Data were compiled from various sources. These include: 1) the most recent district development plans and district annual reports; 2) the 2005 Kenya Integrated Budget (KIHBS) Survey conducted by the CBS; 3) the Kenyan Ministry of Gender and Social Services; and 4) the Kenyan Ministry of Agriculture.

MEASURES

Dependent Variables

Although more direct indicators of HIV risk exist, such as multiple sexual partnerships, in this analysis, I measure women's vulnerability to HIV/AIDS risk using proxy variables. The choice of proxy variables is based on the limitation of using data on self-reported sexual and other behaviors. There is evidence that women tend to underreport and men tend to exaggerate their premarital and extramarital activity (Zaba et al. 2002). Epidemiological studies have also observed weak association between self-reported risky behavior and HIV status. For example a large multi-study of factors determining HIV prevalence in four African cities revealed large numbers of HIV positive women who self-reported to be virgins or having had only one sexual partner and few episodes of sexual intercourse (Buve et al. 2001). This study thus uses proxy measures as indicators of women's vulnerability to HIV risk.

The first indicator of vulnerability to HIV/AIDS risky behavior includes a measure of *attitudes toward sex.* This measure is an attitudinal variable for which a respondent was asked to indicate if they were justified to refuse sex if she knew her partner had other sexual partners. Evidence from the literature suggests that women have fewer sexual partners than men, and women with little control over the sexual activities of their partners are vulnerable to infection. The inability of a woman to protect herself, even when she is aware of her partner's risky behavior

assesses vulnerability to risk that derives from a woman's economic dependency on men (Ingham and Holmes 1991; Reid 1999). This variable is used to assess the extent to which economic dependency may prevent or reduce the efficacy of a woman to protect herself from risky sexual behavior, thus increasing her vulnerability to HIV infection (Gupta 2005; Strickland 2004). Given that this indicator assesses risk in terms of woman's partner having other women, this outcome is limited to married women in non-polygamous relationships.

The second indicator is *perception of risk*. Studies have found a positive association between perceived risk and risky sexual behavior for both men and women. Using data from WHO/GPA survey, Cleland (1995) and Ingham and Holmes (1991) found a positive relationship between perceptions of risk and risky sexual behavior. Similarly, using data from the 1998 Kenya Demographic and Health Surveys (Akwara, Madise and Hinde 2003) found a strong association between perception of risk and sexual behavior and the association was preserved after adjusting for varying socio-demographic characteristics. The KDHS included a variable on perception of risk for which respondents were asked to indicate their chances of getting AIDS. Background characteristics reveal that the most common reasons to explain the perception of AIDS risk as low or nil is that they have just one partner or are not having sex. The most common reasons women provide to explain moderate or high perception of AIDS risk is that their partners have other partners, and having sex with more than one partner. The data also showed that condom use was generally low even for women who indicated having no or small risk. *Perception of risk* thus measures an individual's vulnerability to engage in risky sexual behavior, which may be based on a woman's own sexual behavior; or her inability to protect herself even when she is aware of her partner's risky behavior. The question included four categories of self-assessed risk: no risk, small risk, moderate risk and great risk. For this analysis, based on the distribution, respondents who indicate no risk and small risk were combined into one category, and those indicating moderate and great risk were combined into another category. A dummy variable was created with no or small risk as the reference category

Independent variables

Main Independent Variables: *Women's decision-autonomy* is measured using measures of decision-making autonomy included in the 2003 KDHS. Five questions about who makes the decisions in the household were used in the data. The questions asked in response to "Who in your family usually has the final say on the following decision?" were: 1) your own health; 2) large household purchases; 3) daily household purchases; 4) visits to family and friends; 5) What food should be cooked each day. For each of the questions the women were given the following response options: 1) respondent alone; 2) respondent and husband/ partner; 3) respondent and other; 4) husband/partner alone; 5) someone else. Since cooking is generally regarded as one of women's essential responsibilities within the household, this type of decision-making was excluded from the analysis. Two sets of dichotomous variables were created for each domain. In the first set of dichotomous variables, for each domain, the variable was coded 1 if the woman had say in the decision either alone or jointly and 0, otherwise.

In the second set of dichotomous variables, for each domain, the variable was coded 1 if the woman had final say in decision-making alone and 0 if the woman did not have final say. Using

these two sets of dichotomous outcomes, two additive scales, in which respondents were scored from 0 to 4, were created. The first scale measured decision-making autonomy in the case where woman makes decisions jointly; and the second scale measured decision making autonomy where woman makes final decisions alone. Maximum likelihood factor analysis produced a Kaiser-Meyer-Olkin (KMO) measure of 0.759, with all the variables loading into one factor. The KMO is an index that indicates if the measures are linearly related. Small values for the KMO measure tell you that factor analysis of the variables may not be a good idea. Measures above 0.6 are considered acceptable (Norusis 2008). I also used Cronbach's alpha coefficients to assess the internal reliability of the scale: the closer the value of this coefficient to 1.0, the more reliable the composite. Alpha values between 0.7 and 0.8 are considered acceptable (Norusis, 2008), while values of 0.8 and higher are considered very high (Aiken 1991). The Cronbach's alpha for measures of the four domains used to create the joint decision-making autonomy index and the final decision-making index is 0.82 and 0.78 respectively.

Household Food Security: The 2003 Kenya Demographic and Health Surveys collected data on nutrition variables, particularly on feeding practices. I use these data to construct a dietary diversity variable as a food security indicator. Dietary diversity defined as the number of different foods or food groups consumed over a given reference period, and act as an alternative indicator of food security under a variety of circumstances, including poor and middle income countries, rural and urban areas, and across seasons (Hoddinott and Yohannes 2002).

Dietary diversity is an important indicator of household food security because: it has been associated with caloric energy availability- often used as a measure of household food security- (Hoddinott and Yohannes 2002); linked to nutrient adequacy (Hatloy et al. 1998; Onyango et al. 1998; Smith et al. 1987); linked to children nutritional outcomes and anthropometric measures such as height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ) (Taren and Chen 1993; Allen et al. 1991; Onyango et al. 1998).

In this study, following Arimond and Ruel (2002), I developed a dietary diversity indicator using the data on feeding practices of children under five. The DHS data included questions on the number of times children under five living with their mother were fed certain foods, and included country specific foods. The respondents were required to indicate for example "Times given any green leafy vegetables." The question was repeated for various foods. Following Arimond and Ruel (2002), I created dichotomous variables for each food, given/ or not given in the previous 24 hours, regardless of the number of times. The table below describes the coding process. The first column indicates the variable as it was measured in the DHS. The second column presents the dichotomous variable created for each food, and the third column indicates the name assigned for the foods in each question. Also following Arimond and Ruel (2002), the dichotomous variables of the dairy foods were then combined into a single food group as follows: If milk and/or cheese and/or yogurt were coded 1 the variable *dairy* was coded 1 and 0 otherwise. The food groups were then combined into a summated scale forming the dietary diversity (food security indicator) variable.

Table 1 Formulation of the Dietary Diversity Variable

Variable Question in the DHS data	Recoded (Yes = 1 No= 0) regardless of the number of times fed	Assigned name for foods
Times given milk	Had milk yesterday/night	Milk
Times given pumpkin, carrot, red/yellow yams, red sweet potato	Ate pumpkin, carrot, red/yellow yams, red sweet potato yesterday/night	Carotene
Times given any green leafy vegetables	Ate green leafy vegetables yesterday/night	Greens
Times given mango, papaya or other vitamin rich fruits	Ate vitamin A rich fruit yesterday/night	Vitamin A Fruits
Times given food made from local grain	Ate food made with local grain yesterday/night	Grain
Times given food made from local roots/tuber	Ate food with roots/tubers yesterday/night	Tubers
Times gave child other fruits/vegetables	Ate other fruits or vegetables yesterday/night	Other Fruit/Veg. Vitamins
Times gave child meat, poultry, fish, shellfish, eggs	Ate meat poultry fish shellfish or eggs yesterday/night	Animal Proteins (ANPROT)
Times gave child legumes (lentils, beans, peanuts)	Ate legumes yesterday/night	Legumes
Times gave child cheese/yogurt	Ate cheese or yogurt	Cheese and Yogurt (CHEYOG)

Control Variables

I include several socio-demographic factors as controls since they are related to vulnerability to HIV/AIDS risky behavior. *Women's characteristics* include two continuous variables *women's age* in years and *women's education* in single years; and two categorical variables marital status, women's occupation. The *marital status* variable consists of three categories, never married, married or cohabiting, divorced/widowed/separated, and is measured using a set of dummy variables with never married as the reference category. The *women's occupation* variable initially consisted of nine categories: 1) unemployed, 2) professional technical or managerial, 3) clerical, 4) sales, 5) agricultural self-employed, 6) agricultural employee,7) household and domestic, services, 8) skilled manual, and 9) unskilled manual. For purposes of this analysis, the variable categories 5 and 6 were combined into a new category, "working in agriculture" and categories 3 and 4 were combined into a new category, "semi-professional." Few women were in skilled manual jobs so for modeling skilled manual, unskilled manual, household and domestic services were combined into a new category "manual labor." A set of dummy variables was created from these categories, with unemployed as the reference category. *Residence* (rural vs. urban) is a

dummy variable, with urban as the reference category. *Household wealth* is based on an asset index of household ownership on a number of consumer items as well as dwelling characteristics such as source of drinking water, sanitation facilities, and type of material used in flooring (ORC Macro Inc. 2003). The variable is a set of dummy variables consisting of three categories, high income, middle income and low income as the reference category. While ethnicity has been seen as an important variable due to cultural implications of risky behavior, it was not included in this analysis. The decision to exclude this variable was based on the high correlation between the ethnicity variable and the districts. This is consistent with a study by Kabubo-Mariara et al. (2006) on children's nutritional status conducted in Kenya using the 1998 and 2003 Demographic and Health Surveys (DHS), which found that ethnicity was insignificant due to the high correlation between ethnicity and the clusters used in the DHS data.

Contextual Measures

Table 2 Description and Sources of Contextual Variables

Variable	Description and Sources
Access to Credit	Proportion of households in the district that were able to access credit in past year *Kenya Central Bureau of Statistics, Kenya Integrated Household Budget Survey (KIHBS)*
Extension	Ratio of female to male extension agents in the district *Ministry of Gender and Social Services*
Title Deeds	Proportion of households in the district that own title to the land they cultivate -*CBS (KIHBS)*
Landholding Size	Average land holding size in the district
Women's Tenure Security	Measured by women's input into agricultural decision making - *CBS (KIHBS)*
Commercialization	Ratio of area under traditional cash crops to area under food crops in the district -*District Development Plans and Reports*
Cooperatives	Percent female membership in cooperatives -*Ministry of Gender and Social Services*
Women's Groups	Membership in women's groups as a percentage of district population -*Ministry of Gender and Social Services*
Wage Employment	Percent contribution of wage employment to average household income -*District Development Plans and Reports*
GDI	Gender District Development Index (measure of district gender equality)- *Ministry of Gender and Social Services*

RESEARCH DESIGN AND ANALYSIS

ANALYTICAL STRATEGY

The data described above is used to conduct a multilevel analysis of the impact of agricultural-consumption regimes on women's vulnerability to HIV/AIDS. The structure of the model allows for multilevel modeling with individual and households as the lower-level units and districts as the higher level units. The analysis in particular utilizes Hierarchical Linear Modeling (HLM). HLM takes into account that individuals are not isolated but are nested within particular social contexts, in this case districts, and while individuals from the same context differ with respect to their personal characteristics, they nevertheless share the same contextual influences. The usual method of analysis, ordinary least squares (OLS) regression, assumes independence among observations. However, when observations are clustered, in this case within districts, then observations within clusters tend to be more similar on unobserved characteristics than observations chosen at random. This violates the assumption of the independence errors, since the errors from observations within districts will be correlated. HLM models the error structure of the equation as having lower-level (individual/household) and higher-level (district) components. Failure to account for the correlated errors across individuals within districts produces biased estimates of the standard errors of the coefficients. HLM provides more robust standard errors and unbiased estimates of the relationships because a random component is added to the intercept (Raudenbush and Byrk 2002). This random component allows a separate intercept for each district, so that the fixed portion of the equation controls completely for the between-district differences in the level of the outcome. In this study, this technique will be particularly useful in identifying district ACRs that have a more pronounced impact on HIV/AIDS risky behavior.

REGRESSION DIAGNOSTICS

The outcome variables used to assess vulnerability to HIV/AIDS risky behavior, perceived risk, and attitudes toward sex are both binary outcomes. For these kinds of outcomes, the assumptions of linearity and normality are not realistic, and no transformation can be applied to satisfy these assumptions. The use of the standard HLM model (as applied in the previous chapters) would be inappropriate for a number of reasons. First, there are no restrictions on the predicted values of the level-1 outcome in the standard HLM. This means that the predicted values can take on any real value. On the contrary, the predicted value of a binary outcome Y, if viewed as the probability that Y=1 must lie in the interval (0, 1). Given the restrictions in the predicted value the level-1 random effect can take on only one of two values, and therefore cannot be normally distributed. Additionally, the level-1 random effect cannot have homogenous variance; instead the variance of this random effect depends on the predicted value (Raudenbush and Byrk 2002).

For this study, data is not tested for the assumption of independence. Based on the nesting of individual's within districts, this assumption is likely to be violated.

In order to test for multicollinearity, the diagnostic involved computation of the variance inflation factor (VIF) associated with each predictor. The rule of thumb is that a VIF which is greater than 10 indicates multicollinearity (Lynch 2003; Norusis 2008). Multicollinearity tests were conducted for the predictors of both measures of vulnerability: attitudes toward sex and perceived risk of HIV infection. For the first measure of vulnerability, attitudes toward sex, the VIF ranged from 1.08 to 1.45. For the second measure of vulnerability, perceived risk of infection, the VIF ranged from 1.1 to 1.90. These values are much less than the threshold of 10, indicating that the models have no problem of multicollinearity.

MODEL SPECIFICATION

When the outcome variable is binary, the model of choice is the hierarchical generalized linear model (HGLM). In this study, both the outcome variables are binary taking on a value of either zero or one. This kind of outcome requires the application of a special case of the HGLM known as the Bernoulli distribution.

This study uses two outcome variables for HIV vulnerability. For the first variable, attitudes toward sex, the analysis is limited to married women in non-polygynous relationships. The final sample for this outcome variable is thus reduced from the all women sample of 8,195 to 2,639 based on the 54 districts for which comprehensive data was available. For the second outcome variable, perceived risk of HIV infection, the sample consists of all women from the districts for which comprehensive data was available. For this outcome, the final sample is reduced from 8,195 women to 5,355 women.

RESULTS

SAMPLE CHARACTERISTICS

Table 3 below presents the individual-level characteristics for the sample of married women in non-polygynous relationships. The average age of the respondents is 30.64 with a standard deviation of 8.39. The average number of years of education the respondents completed is about 7 years, with a standard deviation of 3.82. About 87 percent of the population is rural. In terms of the occupation variables, 30 percent of the respondents indicated that they were not working, while 43 percent, 6 percent, 17 percent and 5 percent were working in agriculture, manual labor positions, clerical/sales/services positions, and professional/technical positions, respectively. About 39 percent of the respondents were from low income households, 21 percent from middle income households, and 40 percent from high income households. In terms of decision-making autonomy, on average, the respondents were involved in 2.1 decisions jointly with a standard deviation of 1.45, and about 1 decision independently with a standard deviation of 1.13.

The mean level of household food security for households in this sample is 3.03 out of the total 9 food groups with a standard deviation of 1.97.

Table 3 Level -1 (Individual-level) Sample Characteristics for Married Women in Non-Polygynous Relationships

Variable	Mean /Percent	Standard Deviation	Minimum Value	Maximum Value	N
Joint Decision-Making	2.10	1.45	0	4	2639
Final Decision-Making	1.10	1.13	0	4	2639
Household Food Security	3.03	1.97	0	9	1380
Age	30.64	8.39	15	49	2639
Education in years	7.17	3.82	0	26	2639
Household Socioeconomic Status					
Low income	39%	0.49	0	1	2639
Middle income	21%	0.41	0	1	2639
High income	40%	0.49	0	1	2639
Occupation					
Not employed	30%	0.46	0	1	2639
Works in Agriculture	43%	0.49	0	1	2639
Manual Labor	6%	0.23	0	1	2639
Clerical/Sales/Service	17%	0.38	0	1	2639
Professional/Technical	5%	0.23	0	1	2639
Residence					2639
Rural	87%	0.36	0	1	2639
Urban	13%	0.36	0	1	2639

Table 4 below presents the characteristics of the individual-level predictors for the full sample of women. For this sample, particular focus is on the perceived risk of infection outcome variable. The average age of the respondents is 28.13 years with a standard deviation of 9.48 years. The average number of years of education the respondents had completed is 7 years with a standard deviation of 3.79. About 83 percent of the population is rural. About 30 percent of the respondents indicated that they were never married, 60 percent were married or cohabiting and 10 percent were widowed, divorced or separated. In terms of the occupation variables, 37 percent of the respondents indicated that they were not working, while 34 percent, 8 percent, 7 percent, and 4 percent indicated that they were working in agriculture, manual labor positions, clerical/sales and services positions, and professional/technical positions, respectively. Thirty-seven percent of the respondents were from income households, 21 percent from middle income households and 42 percent from high income households. In terms of women's decision-making autonomy, on average the women were involved in 1.8 decisions (standard deviation of 1.59) jointly and 1.2 (standard

deviation of 1.39) independently. The average level of household food security for households in this sample is 2.95 with a standard deviation of 1.97.

Following Table 4, Table 5 presents the sample characteristics for the level-2 (district-level) variables.

Table 4 Full Sample Characteristics for Level-1 (individual-level) Predictors

Variable	Mean /Percent	Standard Deviation	Minimum Value	Maximum Value	N
Joint Decision-Making	1.80	1.59	0	4	5355
Final Decision-Making	1.20	1.39	0	4	5355
Household Food Security	2.95	1.97	0	9	1988
Age	28.13	9.48	15	49	5355
Education in years	7.09	3.79	0	26	5355
Marital Status					
Never married	30%	0.45	0	1	5355
Married/Cohabiting	60%	0.49	0	1	5355
Widowed/Separated/Divorced	10%	0.3	0	1	5355
Household Socioeconomic Status					5355
Low income	37%	0.48	0	1	5355
Middle income	21%	0.4	0	1	5355
High income	42%	0.49	0	1	5355
Occupation					5355
Not employed	37%	0.48	0	1	5355
Works in Agriculture	34%	0.47	0	1	5355
Manual Labor	8%	0.28	0	1	5355
Clerical/Sales/Service	17%	0.37	0	1	5355
Professional/Technical	4%	0.2	0	1	5355
Residence					5355
Rural	83%	0.38	0	1	5355
Urban	17%	0.38	0	1	5355

Table 5 Sample Characteristics for Level-2 (District) Variables

Variable	Mean /Percent	Standard Deviation	Minimum Value	Maximum Value	Nj
Proportion of households accessed credit	30.35	15.02	5.0	64	54
Proportion of households with title deeds	37.16	19.65	2.6	76.7	54
Women's tenure security	11.25	9.69	0	43.6	54
Mean landholding size	2.52	1.18	0.8	6.1	54
Ratio of cash crops to food crops	0.77	1.59	0	10.87	54
Ratio of female to male extension workers	0.40	0.25	0	1.11	54
Percent female cooperative membership	18.29	3.48	9.2	23.3	54
Membership in women's groups	38.25	16.87	16.58	88.43	54
Percent contribution of wage employment	19.98	18.4	2.0	82	54
Gender Inequality Index (GDI)	0.5	0.07	0.32	0.62	54

IMPACT ON WOMEN'S VULNERABILITY TO HIV: ATTITUDES TOWARD SEX AS THE DEPENDENT VARIABLE AND JOINT DECISION-MAKING AUTONOMY AS THE MAIN PREDICTOR VARIABLE

Table 6 below presents estimates from the nested multilevel logit models. I begin by considering the unconditional logit model of HIV vulnerability measured by a woman's willingness to have sex with her partner even if she is aware that her partner has other women. This will help with assessing the baseline variation in the log-odds of women's vulnerability to HIV/AIDS.

Model 1: Unconditional Model: To assess whether women's vulnerability to HIV varies across regions (districts), I estimate a model with no predictors at either level (individual and district level). The results indicate that the level-2 variance component is significant (τ_{00}=0.424, p<0.001), suggesting that women's vulnerability to HIV/AIDS varies significantly across regions. These results lend support to the first research hypothesis that women's vulnerability to HIV/AIDS varies significantly across districts in Kenya. This first step is important because it suggests that district-level factors may partially account for variability in women's vulnerability to HIV/AIDS.

The intercept (γ_{00}=-1.676, p<0.001) in this fully unconditional model represents that log odds of women's vulnerability to HIV/AIDS across Kenyan districts. This translates to a probability of vulnerability of 16 percent. Using the formula (γ_{00}+/-1.96*$\sqrt{\tau_{00}}$), I would expect about 95 percent of the districts to have average log odds of between -2.95 and -0.4. This translates to a probability of between 0.05 and 0.4. It appears that, with respect to the probability of women's vulnerability to HIV, some districts have a vulnerability of about 5 percent, while in others, the probability of vulnerability to HIV infection is about 40 percent.

Model 2a: Conditional at Level-1: The second column of Table 6 reports the pattern of association between individual-level predictors and women's vulnerability to HIV. The results reveal that in terms of the control variables, the expected odds of HIV vulnerability for a woman who works in agriculture, manual labor, and a professional or technical position are 37 percent, 46 percent and 46 percent, respectively, lower than the odds of vulnerability for a woman who is not employed. This indicates that these forms of employment decrease the odds of a woman's vulnerability to HIV/AIDS. The findings also reveal that the expected odds of HIV vulnerability for a woman in a high income household are 37 percent lower than the odds of a woman living in a low income household.

Model 2b: Conditional at Level-1 with Joint Decision-Making Autonomy: In this model, in addition to the control variables, I include the first individual-level variables of interest, joint decision-making autonomy. I hypothesize that women's joint-decision making autonomy will be associated with lower levels of vulnerability to HIV/AIDS, even after controlling for individual-level predictors. The third column of Table 6 reports the pattern of association between joint decision-making autonomy and women's vulnerability to HIV after controlling for other individual-level factors. The analysis suggests that joint decision-making autonomy has no significant impact on women's vulnerability to HIV/AIDS. The effects of the occupation variables maintain significance and continue to exert a negative effect on women's vulnerability to HIV/AIDS. Similarly, the magnitude and effect of a woman being from a high income household compared to a low income household on HIV vulnerability is also maintained, even after taking into account joint decision-making autonomy.

Model 3a: Fully Conditional Model: In this fully conditional model, regional level (contextual) variables are included in the analysis. With this inclusion, this model now has three sets of variables: control variables, individual-level variables of interest and contextual variables. The fourth column of Table 6 reports the results of this fully conditional model. This model presents estimates to address one of the key research questions of this study, the extent to which agricultural-consumption regimes account for district-level variation in women's vulnerability to HIV/AIDS net of individual-level characteristics.

In terms of the contextual effects, access to credit, surprisingly, increases the expected odds of HIV vulnerability by 2.2 percent (Table 6). This effect is not in the expected direction. Women's land tenure security and membership in organizations significantly decreases the expected odds of women's vulnerability to HIV/AIDS by about 2 percent each. These effects are in the expected direction. Similar to the effects of access to credit, the data suggests that wage employment increases the expected odds of women's vulnerability to HIV infection by about 1.7 percent. This effect is not in the expected direction. In general, this model indicates that district-level variables

remain significant in predicting HIV vulnerability even after taking into account individual-level covariates. This lends support for my hypothesis that agricultural-consumption regimes explain variation in HIV vulnerability, over and above individual-level predictors.

In this model, the occupation variables, except working in professional or technical position, maintain statistical significance and continue to exert the effect of decreasing the expected odds of women's vulnerability to HIV/AIDS, after controlling for contextual effects. With the inclusion of contextual variables, the effect of working in professional or technical position is rendered statistically insignificant. This suggests that the context mediates the effects of working in professional or technical positions.

Model 3b: Fully Conditional Model with Gender Inequality Index (GDI): The fifth column of Table 6 reports the results of the model that includes all individual-level and contextual-level variables in the previous models and adding the gender inequality index (GDI) contextual-level predictor. The GDI variable does not significantly impact on women's vulnerability to HIV/AIDS.

Table 6 Random Intercept Logit Models of the Attitudes Toward Sex Measure of HIV Vulnerability and Joint Decision-Making as the Level-1 Predictor of Interest

Variable	Model 1	Model 2a	Model 2b	Model 3a	Model 3b
Intercept γ_{00}	-1.68*** [a]	-1.32***[a]	-1.30*** [a]	-1.48*** [a]	-1.49*** [a]
Level 2 variance τ_{00}	0.424***				
Level-1 Variables					
Joint decision-making			1.03	1.05	1.05
Age		0.99	0.99	0.99	0.99
Education in years		0.97	0.96	0.96*	0.96*
Household SES					
Middle income		1.03	1.03	1.03	1.03
High income		0.63**	0.63**	0.61**	0.61**
Occupation					
Works in agriculture		0.63**	0.63**	0.61**	0.61**
Manual labor		0.54*	0.53*	0.52*	0.52*
Clerical/sales/service		0.74	0.73*	0.71*	0.72*
Professional/technical		0.54*	0.53*	0.54	0.54
Residence					
Rural		1.09	1.08	1.15	1.15
Level-2 (Contextual Variables)					
Access to credit				1.02**	1.02**
Title deeds				1.01	1.01
Women's tenure security				0.98*	0.98**
Landholding Size				0.94	0.94
Commercialization				0.94	0.94
Extension (female to male)				0.53	0.54
Cooperative membership (females)				1.01	1.02
Organization membership (females)				0.98**	0.98**
Wage employment				1.02**	1.02**
Gender inequality index					1.01
N	2639	2639	2639	2639	2639
Nj	54	54	54	54	54
[a] log odds coefficient	*p<0.05		**p<0.01		***p<0.001

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Table 7 below presents the estimates from the nested regression models.

Model 1: Unconditional Model: Since we are dealing with the same outcome variable, attitudes toward sex, the baseline or unconditional model is similar to the one displayed in the first column of Table 6

Model 2a: Conditional at Level-1: This model includes only the individual-level predictors, without the main independent variable. The results are similar to Model 2a in Table 6.

Model 2b: Conditional at Level-1 with Main Independent Predictor (Final Decision-Making Autonomy): In this model in addition to the control variables I include the second individual-level variable of interest, final decision-making autonomy. I hypothesize that women's final decision-making autonomy will be associated with lower levels of vulnerability to HIV/AIDS after controlling for individual-level predictors. The third column of Table 7 reports the pattern of association between final decision-making autonomy and women's vulnerability to HIV/AIDS.

In this model, contrary to expectations, final decision-making autonomy has no significant impact on women's vulnerability to HIV/AIDS. The expected odds of vulnerability for a woman working in agriculture are 0.65 times the odds of vulnerability of a woman who is not employed. In other words, working in agriculture decreases the odds of HIV vulnerability by 35 percent. In this model, when the final decision-making variable is introduced; the other occupation variables, while maintaining their direction (that is decreases the expected odds of vulnerability), lose significance. Bivariate analysis between final decision-making autonomy and the occupation variables revealed that women working in other occupations, apart from agriculture, were more likely to make decisions independently. This finding may suggest that the effects of these other occupation variables (working in manual labor, clerical or sales, or professional and technical positions) on women's vulnerability to HIV are mediated by final decision-making autonomy. Similar to the model that includes joint decision-making autonomy, the findings also reveal that the expected odds of HIV vulnerability for a woman in a high- income household are 37 percent lower than the odds of a woman living in a low income household.

Model 3a: Fully Conditional: At the contextual level, similar to the model with joint decision-making autonomy access to credit increases the expected odds of women's vulnerability to HIV/AIDS by about 2.2 percent. As noted, this effect is not in the expected direction. Women's land tenure security and women's membership in organizations decreases the expected odds of HIV vulnerability by 2 percent and 2.2 percent, respectively. Commercialization (cash crop production versus food crop production) decreases the expected odds of HIV vulnerability by 6 percent. This effect is not in the expected direction. Wage employment increases the expected odds of HIV vulnerability by 1.7 percent. This effect is intriguingly not in the expected direction. In this model, after controlling for contextual effect, the education variable which was not previously significant gains significance. This may suggest that when you partial out the effects of final decision-making autonomy, depending on the context, education decreases the expected odds of HIV vulnerability by about 1.9 percent.

Model 3b: Fully Conditional with Gender Inequality Index (GDI): The GDI variable is not significantly related to women's vulnerability to HIV/AIDS.

Table 7 Random Intercept Logit Models of the Attitudes Toward Sex Measure of HIV Vulnerability and Final Decision-Making as the Level-1 Predictor of Interest

Variable	Model 1	Model 2a	Model 2b	Model 3a	Model 3b
Intercept γ_{00}	-1.68*** [a]	-1.32*** [a]	-1.34*** [a]	-1.53*** [a]	-1.53*** [a]
Level 2 variance τ_{00}	0.424***				
Level-1 Variables					
Final decision-making			0.93	0.93	0.93
Age		0.99	0.99	0.99	0.99
Education in years		0.97	0.96	0.96*	0.96*
Household SES					
Middle income		1.03	1.04	1.03	1.03
High income		0.63**	0.63*	0.61**	0.61**
Occupation					
Works in agriculture		0.63**	0.65**	0.64**	0.64**
Manual labor		0.54*	0.55	0.54	0.54
Clerical/sales/service		0.74	0.78	0.77	0.77
Professional/technical		0.54*	0.57	0.58	0.58
Residence					
Rural		1.09	1.08	1.15	1.15
Level-2 (Contextual Variables)					
Access to credit				1.02**	1.02**
Title deeds				1.01	1.01
Women's tenure security				0.98*	0.98*
Landholding Size				0.95	0.94
Commercialization				0.94*	0.94*
Extension (female to male)				0.53	0.54
Cooperative membership (females)				1.07	1.01
Organization membership (females)				0.98**	0.97**
Wage employment				1.02**	1.02**
Gender inequality index					0.74
N	2639	2639	2639	2639	2639
Nj	54	54	54	54	54

[a] log odds coefficient *p<0.05 **p<0.01 ***p<0.001

IMPACT ON WOMEN'S VULNERABILITY TO HIV: ATTITUDES TOWARD SEX AS THE DEPENDENT VARIABLE AND HOUSEHOLD FOOD SECURITY AS THE MAIN PREDICTOR VARIABLE

Table 8 below presents estimates from the nested regression models.

Model 1: Unconditional Model: Since we are dealing with the same outcome variable, attitudes toward sex, the baseline or unconditional model is similar to the one displayed in the first column of Table 6

Model 2a: Conditional at Level-1: This model includes only the individual-level predictors, without the main independent variable, and is similar to Model 2a in Table 6.

Model 2b: Conditional at Level-1: This model, in addition to the control variables, includes household food security as the main predictor. The third column of Table 8 reports the pattern of association between household food security and women's vulnerability to HIV/AIDS, using the outcome variable attitudes toward sex. Contrary to expectations, the food security variable does not exert a significant effect on vulnerability to HIV/AIDS. In this model, however, education decreases the expected odds of vulnerability of HIV/AIDS by about 6 percent. The findings also reveal that the expected odds of HIV vulnerability for a woman in a high income household are 37 percent lower than the expected odds for a woman in a low income household, holding constant all other predictors.

The food security variable while not significant when included in the model, renders all the occupation variables insignificant. These variables however maintain their direction, and this may suggest that the effects of these occupation variables on HIV vulnerability may be suppressed by household food security.

Model 3a: Fully Conditional Model: At the contextual-level access to credit increases the expected odds of women's vulnerability to HIV/AIDS by about 2.4 percent. This finding is very similar to the previous model reported above. In this model, the effect of a household having a title deed increases women's vulnerability to HIV infection by about 2percent. Women's tenure security, which was significant in the models that included joint and final decision-making autonomy, is not significant in this model. When I exclude the title deeds variable from the model, women's tenure security significantly reduces the expected odds of women's vulnerability to HIV. This finding suggests that when effects of household food security are partialed out, women's tenure security decreases the expected odds of HIV vulnerability. However, this effect is largely dependent on whether a household has a title deed.

Model 3b: Fully Conditional Model with Gender Inequality Index (GDI): The GDI variable is not significantly related to women's vulnerability to HIV/AIDS.

Table 8 Random Intercept Logit Models of the Attitudes Toward Sex Measure of HIV Vulnerability and Household Food Security as the Level-1 Predictor of Interest

Variable	Model 1	Model 2a	Model 2b	Model 3a	Model 3b
Intercept γ_{00}	1.68***[a]	-1.32*** [a]	-1.62*** [a]	-1.86*** [a]	-1.86*** [a]
Level 2 variance τ_{00}	0.424***				
Level-1 Variables					
Household food security			1.01	1.02	1.02
Age		0.99	0.99	0.99	0.99
Education in years		0.97	0.94*	0.94*	0.94*
Household SES					
Middle income		1.03	1.11	1.11	1.11
High income		0.63**	0.61*	0.56*	0.58*
Occupation					
Works in agriculture		0.63**	0.89	0.86	0.86
Manual labor		0.54*	0.82	0.80	0.80
Clerical/sales/service		0.74	1.17	1.09	1.09
Professional/technical		0.54*	1.33	1.42	1.43
Residence					
Rural		1.09	1.17	1.23	1.26
Level-2 (Contextual Variables)					
Access to credit				1.02*	1.02*
Title deeds				1.01**	1.02**
Women's tenure security				0.98	0.98
Landholding Size				0.97	0.96
Commercialization				1.00	1.00
Extension (female to male)				0.49	0.48
Cooperative membership(female)				1.02	1.02
Organization membership (female)				0.98**	0.98**
Wage employment				1.02*	1.02*
Gender inequality index					1.41
N	2639	2639	2639	2639	2639
Nj	54	54	54	54	54
[a] log odds coefficient	*p<0.05		**p<0.01		***p<0.001

IMPACT ON WOMEN'S VULNERABILITY TO HIV: PERCEIVED RISK OF HIV AS THE DEPENDENT VARIABLE AND JOINT DECISION-MAKING AUTONOMY AS THE MAIN PREDICTOR VARIABLE

Table 9 below presents estimates from the nested multilevel logit models. I begin by considering the unconditional logit model of HIV vulnerability measured by *perceived risk of HIV infection*. This will help in assessing the baseline variation in the log odds of women's vulnerability to HIV/AIDS.

Model 1: Unconditional Model: To gauge the magnitude of variation between districts in women's HIV vulnerability, measured using perceived risk of HIV infection, I estimate a model with no predictors at either level. The estimated results indicate that the level-2 variance is significant (τ_{00}=0.328, p<0.001) suggesting that women's vulnerability to HIV/AIDS using the measure, perceived risk of HIV infection, varies significantly across regions. These results lend support for the first research hypothesis that women's vulnerability to HIV/AIDS varies significantly across districts in Kenya. This first step is important because it suggests that district-level factors may partially account for the observed district variation in women's vulnerability to HIV/AIDS. The intercept (γ_{00}=-1.18, p<0.001) in the fully unconditional model represents the average log odds of women's vulnerability to HIV/AIDS across Kenyan districts. This translates to a probability of vulnerability of 24 percent. Using the formula (γ_{00}+/-1.96*$\sqrt{\tau_{00}}$), I would expect about 95 percent of the districts to have average log odds of between -2.3 and -0.06. This translates to a probability of between 0.09 and 0.49. It appears that, with respect to the probability of women's vulnerability to HIV, some districts have a vulnerability of about 9 percent, while in others, the probability of vulnerability to HIV infection is roughly 50 percent.

Model 2a: Conditional at Level-1: In this model, only the individual-level predictors are included. In terms of the control variables, age increases the expected odds of perceived HIV vulnerability by about 2 percent. Working in a manual labor position and working clerical or service positions also increases the odds of HIV vulnerability by about 47 percent and 41 percent, respectively. This means that compared to women who are not employed, women who are working in manual labor and clerical and service position were more likely to perceive themselves as being vulnerable to HIV infection. Married women and widowed and separated are more likely than never married women to perceive themselves as vulnerable to HIV infection. The expected odds of a vulnerability of a married woman are 2.77 times and the expected odds of a widowed/separated/divorced woman are 1.75 times that of a never married woman.

Model 2b: Conditional at Level-1 with Joint Decision-Making Autonomy: In this model, age continues to increase the expected odds of HIV vulnerability. Similarly, the effects of the occupation variables (working manual labor and clerical positions) and the marital status variables (being married, widowed/divorced/separated) are maintained. The joint decision-making variable does not significantly impact HIV vulnerability in terms of perceived risk.

Model 3a: Fully Conditional: At the contextual level, land holding size and commercialization (cash crops to food crops) have significant impacts on perceived vulnerability. Land holding size and commercialization decrease the expected perceived odds of vulnerability by

about 20 percent and 13 percent, respectively. The effect of commercialization while significant is not in the expected direction. After controlling for contextual effects, all the effects of age, marital status, occupation (manual labor and clerical/services positions) maintain their direction and significance.

These findings support the hypothesis that the effects of agricultural-consumption regimes on HIV vulnerability persist even after taking into account women's individual level factors.

Model 3b: Fully Conditional with Gender Inequality Index (GDI): The gender inequality index is not significantly related to women's perceived vulnerability of HIV/AIDS.

Table 9 Random Intercept Logit Models of the Perceived Risk of HIV Measure of HIV Vulnerability and Joint Decision-Making as the Level-1 Predictor of Interest

Variable	Model 1	Model 2a	Model 2b	Model 3a	Model 3b
Intercept γ_{00}	-1.18*** [a]	-2.10***[a]	-2.06*** [a]	-2.13***[a]	-2.13*** [a]
Level 2 variance τ_{00}	0.328***				
Level-1 Variables					
Joint decision-making			1.01	1.01	1.01
Age		1.02***	1.01***	1.02***	1.02***
Education in years		1.02	1.01	1.01	1.01
Marital Status					
Married/cohabiting		2.77***	2.79***	2.81***	2.80***
Widowed/divorced/separated		1.75**	1.76**	1.76**	1.76**
Household SES					
Middle income		0.98	0.98	0.99	0.99
High income		0.96	0.95	0.95	0.95
Occupation					
Works in agriculture		1.02	0.99	0.98	0.98
Manual labor		1.47**	1.36*	1.35*	1.35*
Clerical/sales/service		1.41**	1.37**	1.36**	1.36**
Professional/technical		1.20	1.17	1.17	1.17
Residence					
Rural		1.09	1.06	1.07	1.07
Level-2 (Contextual Variables)					
Access to credit				1.01	1.01
Title deeds				0.99	0.99
Women's tenure security				0.98	0.98
Landholding size				0.80**	0.80**
Commercialization				0.87*	0.87
Extension (female to male)				1.02	1.09
Cooperative membership (female)				1.02	1.03
Organization membership (female)				0.98	1.03
Wage employment				1.00	0.99
Gender inequality index					0.40
N	5355	5355	5355	5355	5355
Nj	54	54	54	54	54

[a] log odds coefficient *p<0.05 **p<0.01 ***p<0.001

IMPACT ON WOMEN'S VULNERABILITY TO HIV: PERCEIVED RISK OF HIV AS THE DEPENDENT VARIABLE AND FINAL DECISION-MAKING AUTONOMY AS THE MAIN PREDICTOR VARIABLE

Table 10 below presents estimates from the nested regression models.

Model 1: Unconditional Model: Since we are dealing with the same outcome variable, attitudes toward sex, the baseline or unconditional model is similar to the one displayed in the first column of Table 9

Model 2a: Conditional at Level-1: This model includes only the individual-level predictors, without the main independent variable, and is similar to Model 2a in Table 9.

Model 2b: Conditional at Level with Final Decision-Making Autonomy: In this model, I include the control variables and final decision-making autonomy as an individual-level variable of interest. Contrary to expectations, final decision-making autonomy increases the expected odds of HIV vulnerability by about17 percent. In this model, age continues to increase the expected odds of HIV vulnerability by about 2 percent even after taking into account final decision-making autonomy. When this variable is included in the model, the effect of being widowed or separated loses significance. A possible explanation of this finding is that women who are widowed/separated or divorced are more likely to have final decision-making autonomy. The final decision-making variable also reduces the effect of working in manual labor to non-significance, however, working in clerical or services position continues have significant impacts and increases the expected odds of HIV perceived vulnerability by 25 percent. After controlling for final decision-making autonomy, the expected odds of perceived HIV vulnerability of married women is 2.83 times the expected odds of HIV vulnerability for never married women.

Model 3a: Fully Conditional: Similar to the previous model, the effects of final decision-making autonomy age, working in clerical position and being married continue to exert a significant positive impact on HIV vulnerability.

At the contextual level, similar to the findings for the model that includes joint decision-making autonomy, land holding size and commercialization reduce the odds of HIV vulnerability. Land holding size and commercialization decrease the expected odds of HIV vulnerability by 20 percent and 13 percent respectively. The effects of commercialization while significant are not in the expected direction. These findings lend support to the hypothesis that the impact of agricultural-consumption regimes on HIV vulnerability persist even after taking into account individual-level factors.

Model 3b: Fully Conditional with Gender Inequality Index (GDI): Like the previous models the gender inequality index (GDI) is not significantly related to women's vulnerability to HIV/AIDS.

Table 10 Random Intercept Logit Models of the Perceived Risk of HIV Measure of HIV Vulnerability and Final Decision-Making as the Level-1 Predictor of Interest

Variable	Model 1	Model 2a	Model 2b	Model 3a	Model 3b
Intercept γ_{00}	-1.18***[a]	-2.10*** [a]	-2.04*** [a]	-2.10*** [a]	-2.10*** [a]
Level 2 variance τ_{00}	0.328***				
Level-1 Variables					
Final decision-making			1.17***	1.18***	1.18***
Age		1.02***	1.01**	1.01**	1.01**
Education in years		1.02	1.01	1.00	1.00
Marital Status					
Married/cohabiting		2.77***	2.83***	2.85***	2.85***
Widowed/divorced/separated		1.75**	1.39	1.39	1.39
Household SES					
Middle income		0.98	0.98	0.98	0.98
High income		0.96	0.95	0.96	0.96
Occupation					
Works in agriculture		1.02	0.94	0.93	0.93
Manual labor		1.47**	1.28	1.27	1.27
Clerical/sales/service		1.41**	1.25*	1.24*	1.24*
Professional/technical		1.20	1.06	1.08	1.07
Residence					
Rural		1.09	1.09	1.10	1.10
Level-2 (Contextual Variables)					
Access to credit				1.01	1.01
Title deeds				1.00	1.00
Women's tenure security				0.98	0.98
Landholding size				0.80**	0.80**
Commercialization				0.87*	0.87*
Extension (female to male)				1.01	1.07
Cooperative membership (females)				1.02	1.03
Organization membership (females)				0.99	0.99
Wage employment				1.00	1.00
Gender inequality index					0.39
N	5355	5355	5355	5355	5355
Nj	54	54	54	54	54

[a] log odds coefficient *p<0.05 **p<0.01 ***p<0.001

IMPACT ON WOMEN'S VULNERABILITY TO HIV: PERCEIVED RISK OF HIV AS THE DEPENDENT VARIABLE AND HOUSEHOLD FOOD SECURITY AS THE MAIN PREDICTOR VARIABLE

Table 11 below presents estimates from the nested regression models.

Model 1: Unconditional Model: Since we are dealing with the same outcome variable, perceived risk of HIV infection, the baseline or unconditional model is similar to the model in the first column of Table 9

Model 2a: Conditional at Level-1: This model includes only the individual-level predictors, without the main independent variable, and is similar to Model 2a in Table 9.

Model 2b: Conditional at Level-1 with Household Food Security as the Main Predictor: In this model, contrary to my expectations, the food security variable has no significant impact on women's perceived HIV vulnerability (Table 11). After controlling for household food security and other individual-level predictors, age increases the expected odds of HIV vulnerability by about 3 percent. After holding constant the effects of household food security, the effects of the other variables, except age, are no longer significant. This may suggest that household food security mediates the effects of the occupation, marital status and household income variables.

Model 3a: Fully Conditional: At the contextual level, after taking into account the effects of household food security and other individual-level predictors, access to credit increases the expected odds of HIV vulnerability (perceived risk of infection) by about 1.4 percent. Land holding size and commercialization (cash crops/versus food crops) decrease the odds HIV vulnerability by 21 percent and 13 percent, respectively. These findings further lend support to the hypothesis that the effects of agricultural-consumption regimes impact women's vulnerability to HIV/AIDS over and above women's individual-level factors, although the directions of these findings do not follow my hypotheses.

Model 3b: Fully Conditional with Gender Inequality Index (GDI): The GDI variable does not have a significant effect on women's vulnerability to HIV/AIDS. Inclusion of this variable however reduces to non-significance the effects of access to credit at the contextual level. This may suggest that after taking into account the effects of household food security and other individual-level predictors, the effects of access to credit on women's vulnerability to HIV/AIDS (perceived risk of infection) are mediated by gender inequality at the contextual level.

Table 11 Random Intercept Logit Models of the Perceived Risk of HIV Measure of HIV Vulnerability and Household Food Security as the Level-1 Predictor of Interest

Variable	Model 1	Model 2a	Model 2b	Model 3a	Model 3b
Intercept γ_{00}	1.18***[a]	-2.10*** [a]	-0.81* [a]	-0.88* [a]	-0.87* [a]
Level 2 variance τ_{00}	0.328***				
Level-1 Variables					
Household food security			0.99	0.99	0.99
Age		1.02***	1.02**	1.03**	1.03**
Education in years		1.02	1.03	1.02	1.02
Marital Status					
Married/cohabiting		2.77***	0.97	0.97	0.97
Widowed/divorced/separated		1.75**	0.7	0.69	0.69
Household SES					
Middle income		0.98	0.92	0.95	0.95
High income		0.96	1.01	1.05	1.05
Occupation					
Works in agriculture		1.02	1.01	0.98	0.97
Manual labor		1.47**	1.01	0.99	0.98
Clerical/sales/service		1.41**	1.3	1.26	1.25
Professional/technical		1.20	0.91	0.94	0.92
Residence					
Rural		1.09	0.90	0.91	0.92
Level-2 (Contextual Variables)					
Access to credit				1.01*	1.01
Title deeds				1.00	1.00
Women's tenure security				0.98	0.99
Landholding size				0.79**	0.79**
Commercialization				0.87*	0.87*
Extension (female to male)				0.74	0.84
Cooperative membership (female)				0.99	1.01
Organization membership female)				0.98	0.98
Wage employment				1.00	1.00
Gender inequality index					0.15
N	5355	5355	5355	5355	5355
Nj	54	54	54	54	54
[a] log odds coefficient	*p<0.05		**p<0.01		***p<0.001

DISCUSSION AND CONCLUSION

The goal of this study is: to assess whether women's vulnerability to HIV/AIDS varies across districts in Kenya, and to estimate whether the independent effects of district-level agricultural-consumption regimes (ACRs) explain women's vulnerability to HIV/AIDS over and above women's decision-making autonomy on one hand and household food security on the other. In line with this goal, it was hypothesized that: women's vulnerability to HIV/AIDS varies significantly across districts in Kenya, and further that women's decision-making autonomy and household food security would explain some of the variation in women's vulnerability to HIV/AIDS. It was also hypothesized that the effects of district-level ACRs would explain the variation in women's vulnerability to HIV/AIDS over and above women's decision-making autonomy and household food security as well as other individual-level control factors.

The study employed two indicators of vulnerability to HIV/AIDS. The first indicator, attitudes toward sex, measured the likelihood of a woman to refuse sex if she knew her partner had other women. The inability of a woman to protect herself, even when she is aware of her partner's risky behavior derives largely from a woman's economic dependency on men (Ingham and Holmes 1991; Reid 1999). Adoption of this indicator was based on the assumption that economic dependency may prevent or reduce the efficacy of a woman to protect herself from risky sexual behavior, thus increasing her vulnerability to HIV infection. The analysis focusing on this measure was limited to women in non-polygynous partnerships for whom comprehensive district-level ACR data was available.

The second indicator of vulnerability was perception of risk of infection. The choice of this indicator was based on evidence of the positive association between perceived risk and risky sexual behavior (Akwara et al. 2003; Cleland 1995; Ingham and Holmes 1991). Perceived risk of infection may be based on a person's own behavior or that of her partner. This indicator thus makes the assumption that a woman's vulnerability to HIV/AIDS may derive from her own risky behavior. Women may also find that the economic consequences of leaving a relationship that they perceive to be risky are far worse than the health risks of staying in the relationship (Gupta 2002). This measure is applied to the full sample of women for whom comprehensive district-level ACR data was available.

In general, the results suggest that for both measures, attitudes toward sex and perception of risk of infection, women's vulnerability to HIV/AIDS varies significantly across districts in Kenya. The results also reveal that ACRs explain women's vulnerability to HIV/AIDS controlling for women's decision-making autonomy, household food security and individual-level control factors.

Specifically, focusing on the attitudes toward sex (likelihood of a woman to refuse sex if she knows her partner has other women) as a measure of vulnerability, the study found that in terms of the control variables, women's work status variables were associated with lower odds of HIV vulnerability. This finding of a negative association between women's occupation and vulnerability to risky behavior is consistent with findings from a study by Kirigia and Muthuri (1999) which found that in South Africa, increased income from women's employment was protective for married women. My study also found that living in a high-income household was associated with decreased

risk of vulnerability to HIV. This finding is consistent with other studies that have found a negative association between income and vulnerability to HIV/AIDS (Akwar et al. 2003; Lopman et al. 2007). Akwara et al. (2003) found that in Kenya, compared to women from low income households, women from high-income households were less likely to engage in risky sexual behavior. Similarly, Lopman et al. (2007) found that in Zimbabwe, better-off women were less likely to engage in transactional sex.

An important contribution of this study is to investigate whether the non-random distribution of women's decision-making autonomy across regions explains variation in women's vulnerability to HIV/AIDS. The study uses two measures of decision-making autonomy, joint decision-making autonomy and final decision-making autonomy. Still focusing on attitudes toward sex as the measure of vulnerability, both of these measures of decision-making autonomy were not significantly associated with women's vulnerability to HIV/AIDS. A possible explanation of the insignificance of these variables is the low level of involvement in both joint and final decision-making autonomy for women in this sample. The sample's descriptive characteristics indicate that married women in non-polygamous relationships on average are involved in one and two decisions independently or jointly, respectively. It is possible then that the domains in which married women make decision jointly or independently do not confer an advantage in terms of increasing the ability of women to negotiate safer sex with their partners. Hindin (2000) suggests that household decision-making power is multi-dimensional and not all domains may be equally important for all outcomes. In particular, joint household decision-making may not translate to women's control over sexual decisions. According to Lwihula (1994) in sub-Saharan Africa, men particularly dominate sexual decision-making, making it nearly impossible for a woman to refuse sex from her husband even when she suspects that he is engaging in risky sexual behavior.

The effects of final decision-making autonomy while not significant mediate some of the effects of the occupation variables except working in agriculture. These findings suggest that the protective effects of a married woman working outside agriculture against HIV risk depend largely on the household decision-making process, in particular whether a woman has final decision-making autonomy.

Another significant contribution of this study is to show that district-level agricultural-consumption regimes (ACRs) influence women's vulnerability to HIV/AIDS independently of women's decision-making autonomy, net other individual-level covariates. To test the independent effects of ACRs, two models, one that included joint decision-making autonomy and the other that included final decision-making autonomy, were estimated. Continuing the discussion on attitudes toward sex as a measure of HIV vulnerability, the study found that even after taking into account joint decision-making autonomy and final decision-making autonomy in districts where households had higher access to credit, women were more vulnerable to HIV infection. These findings are not in the hypothesized direction and the explanation may be two-fold. First, this finding may relate to the literature on wealth and HIV, which tends to be mixed with some studies finding positive correlations between economic resources and HIV infection. In sub-Saharan Africa, a household's access to credit depends on the availability of other resources, such as land, that can be used for collateral. Household's that have access to credit may therefore be better-off than those with limited access. This finding, then, would be consistent with studies that

have found a positive association between wealth and HIV (Mishra et al. 2007; Wojcicki 2005). Second, related to the gender and development literature, the access to credit variable measured the proportion of households that were able to access credit in the district. This finding may thus be explained by the fact that women in SSA have limited access to credit; a household's access to credit may not necessarily reflect women's access. According to Saito (1994), male members of the household are more likely to access credit than women. Agricultural credit allocated to farming households therefore, may not benefit all of its productive members. According to FAO (1998), access to credit by male household members may result in credit being diverted to male-dominated production systems at the expense of women's production activities. A household's access credit may thus affect women's access to resources such as land, impacting their economic independence and their ability to protect themselves from HIV infection. Substantiation of this finding, however would require gender disaggregated data on access to credit.

As expected, women living in districts that are characterized by women's tenure security are less vulnerable to HIV infection, and these effects persist even after taking into account joint and final decision-making autonomy. These findings may suggest that tenure security increases married women's economic independence, which may translate to greater sexual negotiating power. These findings may also suggest that household gender relations in districts where women have secure tenure differ from the relations in districts where women do not have secure tenure. Prior analysis examining the determinants of women's decision-making autonomy revealed that in districts characterized by secure tenure, married women had higher levels of joint decision-making autonomy. Studies have also found that in regions characterized by gender equality, women have increased access to resources (Hamilton 2000; Roos and Gladwin 2000). Hamilton (2000) also found that in regions where gender equality prevailed, households were characterized by collaborative intra-household decision-making. In this study, however, I can only imply the relationship between women's tenure security and household gender relations; more work remains to be done to concretely establish this relationship. What is clear from this study is that women's tenure security confers an advantage that decreases women's vulnerability to HIV/AIDS.

As expected, in districts with more access to women's organizations, women are less vulnerable to HIV/AIDS. These findings are consistent with other studies that have found that membership in women's groups has positive implications for women's reproductive and sexual health outcomes. Gregson et al. (2003) found that in Zimbabwe, participation in community groups is associated with safe sexual behavior and successful avoidance of HIV. Koenig et al (2005) also found that in Bangladesh, women's membership in groups is associated with lower risk of domestic violence, while Gage (1995) found that in Togo, women who were members of women's groups were more likely to have used modern contraceptives.

With regard to contextual outcomes, the study also finds that women living in districts characterized by a high contribution of wage employment to average household income were more likely to be vulnerable to HIV infection (attitudes toward sex). These positive effects of wage employment on women's vulnerability to HIV though not in the hypothesized direction are consistent with Chapoto and Jayne's (2006) study that showed that non-poor women with business income were more likely to die from HIV than those without business income. Another possible explanation of the finding is that that district-level data on wage employment is not gender

disaggregated. Prior analysis examining the impact of ACRs on women's decision-making autonomy showed that contribution of wage employment to household income did not show significance for married women's decision-making autonomy. This may suggest that for married women, contribution of wage employment to average household income may be through income earned by male members of the household, which may not translate to an economic advantage for women. If we assume that the contribution of wage employment to household income is through male household members, and a household is largely dependent on wage income for economic survival, wage employment may thus increase women's economic dependency and reduce a woman's efficacy to protect herself from HIV infection, even if she was aware that her husband was engaging in risky behavior. In terms of the awareness of a partner's engagement in risky behavior, Rugalema (1999) notes that in rural areas, agro-estates account for about 30 percent of the formal wage labor. Agro-estates have high seasonal demands for labor and these types of arrangements draw male farmers from their families for extended periods. This separation largely creates situations of dependency of these male farmers on occasional or commercial sex (Masanjala 2007; Ngwira et al. 2001; Rugalema 1999). The finding of a positive association between wage employment and women's vulnerability to HIV infection may suggest that women's economic dependency, coupled with increased opportunities for males to engage in risky behavior, potentially created by wage employment, increases women's vulnerability to HIV infection. The use of gender disaggregated district-level data on wage employment, however, would help to further substantiate the effects of wage employment on women's vulnerability to HIV/AIDS.

At the contextual level, the analysis also reveals that when you account for final decision-making autonomy, cash crop production is advantageous for women and reduces their vulnerability to HIV/AIDS. These findings may suggest that households where women make at least one decision independently are also characterized by more egalitarian intra-household resource dynamics that translate to greater involvement of women in cash crop production. These findings may thus be consistent with the argument that the effects of commercialization on women's well being may depend on the prevailing gender relations (Hamilton 2000; Roos and Gladwin 2000; Stone and Stone 2000). Roos and Gladwin (2000), in a study comparing two regions in Cameroon, found that in the region characterized by gender equality, women benefitted from agricultural commercialization. These findings were echoed for women in the Ecuadorean Andes (Hamilton 2000) and Kofyar women in Nigeria (Stone and Stone 2000). The finding of a negative association between commercialization (cash crop versus food crop production) and women's vulnerability to HIV/AIDS suggests that where gender equality prevails, married women derive economic benefit from cash crop production, reducing their economic dependency on men and thus their vulnerability to HIV infection.

Another important hypothesis proposed in this study is that the non-random distribution of household food security across regions explains the variation in women's vulnerability to HIV/AIDS across districts, net of individual-level control variables. Still focusing on women's attitudes toward sex as the measure of HIV vulnerability, the findings reveal that household food security does not significantly explain women's vulnerability to HIV/AIDS, and hence do not provide support for this hypothesis. Despite the non-significance of the household food security variable, with the inclusion of this variable in the model all the occupation variables(previously significant in the model that

consisted only of the individual-level control variables) became non-significant, suggesting possible moderation effects. This suggests that the effects of a woman's work status on HIV vulnerability depend on the level of household food security. The findings may thus imply that in food insecure households, a woman's occupation matters more for her ability to act in way that reduces her vulnerability to HIV infection than in households that are food secure.

At the contextual level, after taking into account household food security, the effect of land titles is associated with women's increased vulnerability to HIV infection. Interestingly, women's tenure security, previously significant in the models that included the decision-making autonomy variables, is no longer significant. With the exclusion of the land titles variable, women's tenure security regains significance and is associated with women's decreased vulnerability to HIV infection. These findings suggest that regardless of the level of household food security, women's tenure security decreases women's vulnerability to HIV infection; however, the effect of tenure security depends on whether a household has title to land. A possible explanation of this finding is that in SSA few women have land titled in their names (Davison 1988; Gray and Kevane 1999; Gwako 1997; Shipton 1988), and land registration may affect women's access to land. Shipton (1988) argues that "land registration has effected a hardening of men's land rights into absolute legal ownership to the point of exclusion of women and children" (1988:119). Nzioka (2005) indicates that registered land titles in individual male names imply that a man has the legal right to dispose of the land without consulting other members of the family, particularly women. This may suggest then that in districts characterized by high proportion of households with titled land, women's tenure security and thus their economic independence may be threatened resulting in women's increased vulnerability to HIV/AIDS.

Shifting the focus to the other indicator of women's vulnerability to HIV/AIDS, perceived risk of infection, as earlier noted, may be based on a person's own risky behavior or on a woman's inability to protect herself, even when she is aware of her partner's risky behavior. In terms of the control variables, the study finds that age increases the expected odds of HIV vulnerability. This is consistent with other studies that have found a positive association between age and risk of HIV infection (Caraèl 1995; Quigley et al. 1997). Working in manual labor and working in clerical positions was also found to have a positive association with HIV vulnerability. There is evidence that indicates that certain occupations put women at increased risk of HIV infection. Akeroyd (2004) notes that some occupations may present settings in which sexual services are presumed to be an offer or to be negotiable. She gives the example of occupations in the tourist and leisure industry. Some occupations may also subject incumbents to situations where they have to submit to demands of sexual favor in order to retain a job, gain advancement, and acquire economic favors. While the occupation variables in this study do not detail the specific industry occupation, the finding may suggest that certain characteristics of these occupations increase women's vulnerability to HIV. The findings also reveal that married women and widowed, divorced, or separated women are more likely to perceive themselves as vulnerable to HIV infection. In the case of married women, these findings are consistent with other studies that have found that married women are more vulnerable to HIV/AIDS compared to never married women. The studies noted that married women may face extra challenges in their ability to negotiate safer sex because of the fear of being suspected of promiscuity by their spouses (Blanc et al. 1996; Cleland 1995). For

widowed, divorced, or separated women, the findings are consistent with studies that have shown that freedom away from marital obligations that comes with marriage dissolution may increase a woman's risk of engaging in risky behavior (Akwara et al. 2003; Fapohunda and Rutenberg 1999). Moreover, widowed, divorced or separated women may also face economic challenges that increase their likelihood of engaging in risky behavior.

Contrary to expectations, there is no significant association between joint decision-making autonomy and women's vulnerability to HIV/AIDS using this measure. An earlier explanation focusing on the insignificance of joint decision-making autonomy for HIV vulnerability (attitudes toward sex) may also apply to this finding. The idea that women are involved in few decisions jointly and further that the domains in which women make decisions jointly may not confer an advantage in terms of increasing women's self-efficacy to negotiate safer sex.

Final decision-making autonomy, unexpectedly, is associated with increased vulnerability to HIV/AIDS. When this variable is added to the model, the effect of being widowed, separated, or divorced, and the effect of working a manual position became non-significant. An analysis examining the individual-level determinants of women's final decision-making autonomy showed that widowed, separated and divorced women were more likely to have final (independent) decision-making autonomy. The finding of the positive effect of final decision-making on HIV vulnerability may reflect the disadvantaged position of divorced, separated or divorced women, or in general female- headed households. Female-headed households have limited access to livelihood assets, and are less able to cope with economic shocks and seasonality. Elabor-Idemudia (1991) for instance notes that rural female-headed households are the first to suffer when a macroeconomic downturn hits and the last to recover from it. Since most female-headed households are resource constrained, they may, therefore be forced by hardship and marginalization into making sub-optimal choices (Masanjala 2007).

At the contextual level, after taking into account joint decision-making autonomy and final decision-making autonomy, land holding size is associated with women's decreased vulnerability to HIV/AIDS. A possible explanation of this finding is that this sample includes widowed, separated or divorced women. Land holding sizes may be particularly important for widowed, divorced or separated women. For this category of women, access to land largely depends on availability of land. In situations of land scarcity, the land widows' hold may be reduced or the widow may be deprived of any land that she previously farmed (FAO/IFAD 1998; Sebina-Zziwa 1998; Walker 2002). It is, therefore, likely that in districts characterized by small land holdings widowed, divorced or separated women may be forced to turn to risky sexual behavior, such as transactional sex, to ensure their own survival and that of their families. Rugalema (2004) in his study of agro-estates in Kenya probed into the factors that led to widows settling in commercial settlements rather than their rural homes. It emerged that once a husband has died, the widow and her children become social and economically vulnerable. Unable to provide for herself and her children, and unable to marshal social and economic support from the extended family, a widow decides to migrate to a commercial settlement, sites that are characterized by a high prevalence of commercial sex.

Another possible explanation of this finding is that in areas where agricultural resources, such as land are limited both males and females may be pushed into cyclical migration. Although

migration reduces the likelihood of livelihood collapse by allowing family members to earn wage income, it may also promote breakdown of social structures and create opportunities by which HIV spreads. This is particularly the case for males who leave home to find work, become infected and return home to infect women left behind (Bloom et al 2003; Collins and Rau 2000; Kane et al. 1993; Masanjala 2007). The situation of male migration is especially risky for married women. Kane et al. (1993:1261-1265) for instance found that in Senegal, 27 percent of the men who had previously traveled to other African countries, and 11.3 percent of spouses of men who had migrated were infected with HIV/AIDS. In districts characterized by large landholdings, agriculture may provide a livelihood reducing the likelihood of households to engage in migrant labor, and thus reduce women's vulnerability to HIV/AIDS. The above discussion, stipulating the possible explanation of the effects landholding sizes, potentially applies to the finding of a negative effect of commercialization on HIV/AIDS. Viability of small-scale cash crop production, for instance, may imply a lower likelihood of household members engaging in migrant labor. While the gender and development literature largely indicates that women have limited access to cash crop production; women may feel less vulnerable to HIV if cash crop production reduces the likelihood of male involvement in migrant labor or other income earning opportunities that exhibit a high correlation with HIV risk.

Similar to the findings for attitudes toward sex as an indicator of vulnerability and contrary to expectations, household food security did not exhibit a significant impact on women's vulnerability to HIV/AIDS, with perceived risk as the outcome measure. Despite the insignificance of this variable, the findings suggested that household food security may moderate the effects of occupation, marital status and household income on women's vulnerability to HIV/AIDS. Weiser et al. (2007) suggest that while food insufficiency is influenced by income, it is a different entity with different causes and consequences. They note that in sub-Saharan Africa, there is heterogeneity of food insecurity within socioeconomic strata. For example studies have shown that women within households in various parts of sub-Saharan Africa may be less food secure than men as a result of unequal food allocation. This finding may thus suggest that the effect of a woman's occupation, marital status, and household income may depend on whether the household is food secure or not. In terms of vulnerability to HIV, the finding may imply that for food secure households these variables confer a protective effect.

At the contextual level, consistent with the findings for attitudes toward sex as an indicator of vulnerability, access to credit is associated with women's increased vulnerability to HIV/AIDS. Taking into account contextual gender inequality, however, reduces the effect of access to credit to non-significance. Recall the earlier suggested two-fold explanation of the positive effect of access to credit on HIV vulnerability. In particular this finding suggests the possibility that in regions with gender equality, that credit may be beneficial to the household in general and may not negatively impact women's access to production resources such as land.

While there is support for one of the central hypothesis of this study, that agricultural-consumption regimes explain women's vulnerability to HIV/AIDS over and above women's decision-making autonomy and household food security, there are some important limitations. First, considering the secondary nature of the individual-level data set used in this study, it is

difficult estimate any potential bias that might have been introduced in the course of data collection.

Second, the study was limited in the use of direct measures of HIV/AIDS vulnerability. There is evidence that women in SSA tend to underreport risky sexual behavior. Furthermore, epidemiological studies have observed a weak association between self-reported risky behavior and HIV status. In this dataset in terms of direct measures, AIDS-related risk behavior was considered as sex with multiple partners and lack of condom use during sex with multiple partners. These measures are consistent with biomedical models that generally attribute disease to individual behavior. These variables do not take into account that it is possible that some women may be at risk of HIV infection by virtue of the fact that their partners are themselves engaging in risky behavior. For this reason, the study employed proxy variables to capture women's vulnerability to HIV/AIDS. This limitation points to the need to go beyond measures that attribute risky behavior to individual volition, and incorporate measures that take into account the social context of sexual risky behavior.

Third, there is lack of gender disaggregated access to credit data. This limits the ability to understand if the study's hypothesis, that a household's access to credit will lower the odds of a woman's vulnerability to HIV/AIDS, would have been supported if data on the proportion of women able to access credit at the district level was available. Studies on the impact of credit on women would also benefit from comprehensive data on informal sources of credit. The issue of gender disaggregated data also applies to wage employment. Wage employment, measured as the contribution of wage employment to average household income, does not tell us which member of the household is earning the income. It is difficult then to fully explore whether the effects of wage employment depend on the household member earning the income.

Fourth, evidence indicates that dietary diversity is an important indicator of household food security; however, the use of dietary diversity may be limited in that the variable does not establish a clear cutoff point that would allow the identification of households that were food secure and those that were food insecure. Ruel (2002) notes that cutoff points to define varying levels of diversity have to be defined in the context where they are used, and they must take into account local food systems and dietary patterns. Future data collection efforts should thus incorporate regional specific measures of dietary diversity and establish context specific cutoffs that can be used to determine whether a household should be considered food secure or food insecure. Additionally, future data collection efforts should emphasize experiential measures of household food security, for instance changes in eating patterns in response to food shortages. Regarding household food security, another limitation is that it is difficult to infer causal direction of the associations between food insecurity and risky sexual behavior from a cross-sectional study design.

Fifth, the commercialization data (cash crop versus food crop production) is limited in that it does not explicitly capture the prevalence of agro-estates or large scale commercial agriculture. This kind of data would be important to further substantiate and explain the observed effects of cash crop production on women's vulnerability to HIV/AIDS. Agro-estates are characterized by a high prevalence of HIV/AIDS (Masanjala 2007; Rugalema, 1999, 2004). Comprehensive data that details the prevalence of agro-estates in each district would thus be useful in determining if the

effects of cash crop production on women's vulnerability to HIV/AIDS would differ in regions characterized by a high presence of agro-estates.

Despite the limitations, overall the study makes the following important contributions. First, the study extends the women and agriculture literature to the investigation of women's health outcomes, in particular HIV/AIDS. The findings establish that the challenges women meet as agricultural producers may contribute significantly to their vulnerability to HIV/AIDS. Specifically in terms of the agricultural structure literature, the study extends the cash crop/food crop debate to the study of HIV vulnerability. The findings suggest that contrary to the overwhelming notion that cash crop production may adversely impact women's well-being; the negative effect of cash cropping on women's vulnerability to HIV/AIDS may be an indication that some women draw benefits from cash crop production with potentially positive implications for lowering their vulnerability to HIV. The agricultural literature focusing on the cash crop-food crop debate has tended to focus mainly on the challenges women face as a result of cash crop production, such as reduced access to plots for food production, increased labor burden and limited access to income from cash crop production. This study suggests, however, that failing to extend the cash crop/food crop debate to a broader range of women's outcomes, such as HIV risk, may ignore potential benefits of cash crop production for women's well-being. This study for instance suggests that a possible explanation of the negative effect of cash cropping on women's vulnerability to HIV/AIDS is that viable cash crop production may reduce the need for family members, particularly husbands, to migrate in search of wage labor, thus reducing the risk of HIV infection. More empirical work, however, remains to be done to establish the mechanisms that drive the negative effect between cash crop production and women's vulnerability to HIV/AIDS.

Second and related to the previous point, the study extends the literature examining the contextual influences on health by allowing a focus on agricultural contexts. The findings that agricultural-consumption regimes explain women's vulnerability to HIV/AIDS over and above individual-level factors underscores the importance of studying health outcomes in Africa as enmeshed within the social, political and economic context. In particular, given the dependence of livelihoods in sub-Saharan Africa on agriculture, the findings suggest that when examining well-being outcomes; we cannot ignore the potential effects of the agricultural context.

Third, theoretically the study also gives empirical support to arguments extended by the vulnerability perspective. The finding that agricultural-consumption regimes explain women's vulnerability to HIV/AIDS over and above women's individual-level characteristics reflects the vulnerability perspective's understanding of HIV/AIDS as resulting from forces that effectively constrain the opportunities and choices available to individuals, potentially creating situations of vulnerability for certain groups of people. Methodologically, the ability to disentangle individual-level factors, such as women's decision-making autonomy and household food security, influencing HIV vulnerability from contextual factors, suggests the value of multilevel analysis for the vulnerability perspective.

SUMMARY AND POLICY IMPLICATIONS

This study assessed the extent to which agricultural-consumption regimes (ACRs) influence women's vulnerability to HIV/AIDS, net of individual-level characteristics, such as women's decision-making autonomy and household food security. The study used two proxy measures of HIV vulnerability.

The first measure, attitudes towards sex (likelihood of woman to refuse sex if she knows her partner has other women), is based on the assumption that economic dependency on men may reduce the efficacy of a woman to protect herself, thereby increasing her vulnerability to HIV/AIDS. For this measure, the sample was limited to women in non-polygynous relationships. The study finds that after taking into account women's decision-making autonomy, women living in districts characterized by women's land tenure security, cash crop production, and higher level of membership in women's organizations are less vulnerable to HIV/AIDS. On the other hand, women living in districts characterized by a high contribution of wage employment to average household income are more likely to be vulnerable to HIV/AIDS. The study also finds that after taking into account household food security, land titling, possibly through its effects on women's land tenure security, increases women's vulnerability to HIV.

The other measure of HIV vulnerability, perceived risk of infection, assumes that a woman's vulnerability may derive from her own risky behavior, or her economic dependence on her partner. For this outcome, the study finds that after taking into women's decision-making autonomy, land holdings size is associated with lower odds of vulnerability to HIV infection. The study also finds that after taking into account household food security, access to credit associated with higher odds of women's vulnerability to HIV.

These findings suggest that in terms of policy, efforts to safeguard women's rights to land, through tenure policy innovation, may be an important component of not only poverty alleviation, but also HIV/AIDS mitigation strategies. In particular, the policy efforts need to protect the rights of widows who are likely to lose their productive assets after the death of their husbands. Increased government commitment to ensure women's, particularly widows, access to productive assets may potentially reduce poverty-related risky behavior. Additionally, policymakers need to consider other sub-groups, for example divorced and separated women, have distinct experiences relating to access to productive resources.

The finding that in districts characterized by larger land holdings and cash crop production, women are less vulnerable to HIV/AIDS has important policy implications. This finding suggests that where agriculture is viable, women are less likely to be vulnerable to HIV/AIDS. This finding is consistent with literature that indicates that when agriculture fails to provide a livelihood, women may be an increased risk of HIV infection. In terms of policy, the study suggests the need for policymakers to realize that one of the critical factors in enhancing HIV/AIDS mitigation strategies is to ensure that the agricultural sector remains an effective source of livelihoods.

This study also indicates that in districts with higher levels of membership in women's organizations, women were more likely to have decision-making autonomy. This finding reinforces the importance of civic organizations for women's well-being, and suggests the need to design policies that increase support for local initiatives and strengthen women's groups and associations.

The finding that access to credit increases women's vulnerability to HIV/AIDS has important policy implications. First, the lack of gender disaggregated limits the ability to understand if this variable would have a different effect if data on the amount of credit accessed by women were available. Governments and donors, thus, need to emphasize strategies that enhance collection of gender disaggregated agricultural data. The negative effect of credit on HIV vulnerability suggests that a generalized approach to credit delivery to households does not guarantee women access to credit. Policymakers, thus, need to emphasize strategies that enhance women's access to credit and control over credit.

In summary, most HIV prevention interventions to date focus on the proximate causes of HIV and target changing people's attitude, knowledge and behaviors. Less attention is given to the underlying circumstances that may foster behaviors and attitudes that facilitate HIV/AIDS transmission. The findings in this study underscore the importance of structural interventions. In particular, the study attests to the importance of economic interventions that help reduce women's economic dependency on male partners

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