International Journal of Medical Sociology and Anthropology Vol. 9 (2), pp. 001-010, February, 2019. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Author(s) retain the copyright of this article.

Review

HIV and AIDS and farm labor productivity: A review of recent evidence in Africa

Kwadwo Asenso-Okyere[1]*, Catherine Aragon[2], Paul Thangata[1], Kwaw Andam[1] and Daniel Ayalew Mekonnen[1]

[1]International Food Policy Research Institute, P. O. Box 5689, Addis Ababa, Ethiopia.

[2]International Food Policy Research Institute, 2033 K Street, Washington, D.C. 20006-1002, USA.

Accepted 25 October, 2018

Three quarters of the world's poor live in rural areas and they depend on agriculture for livelihood. Labor migration to high agricultural producing areas, funerals, traditional festivals, poverty and loose lifestyles contribute to high incidence of HIV infections in rural areas. Poor health due to AIDS brings hardships to households including debilitation, substantial monetary expenditures, loss of labor, and eventually death. The health status of adults affects the duration of labor force participation and consequently the welfare of the household. This review looks at the evidence on the effects of HIV and AIDS on farm households with respect to absenteeism due to morbidity, and eventual death; family time devoted to caring for the sick; and loss of savings, and farm assets as disease afflicts a household. The outcomes of the health condition on loss of farming knowledge, planting of less labor-intensive crops, reduction of crops planted, and fewer livestock are discussed. The ultimate impact of HIV and AIDS is a decline in household income and possible food insecurity, that is, deterioration in household livelihood.

Key words: HIV, AIDS, disease, assets, productivity.

INTRODUCTION

Agriculture provides a livelihood for most of the three-quarters of the world's poor who live in rural areas, particularly in Asia and Africa (Ravallion et al., 2007). Most of the farms are small holdings. Africa has approximately 33 million small farms (less than 2 hectares per farm), representing 80% of all farms in the region. In Asia, a majority of more than 200 million rice farmers cultivate around 2 hectares of land each, making up the bulk of the rice produced by Asian farmers. Farms of less than 2 hectares constituted 78% of the total number of farms in India. Due to the small sizes of farms and low incomes, the agricultural sector depends largely on manual labor which is invariably obtained from household members or hired from the local community. The farms are therefore vulnerable to household labor disruptions. One of the causes of the disruptions is ill-health in the household which may take labor away from the farm to treat the ailment or care for the sick person or divert money that could have been used to engage hired labor to pay for the cost of health care. Total household production is reduced and poverty is perpetuated. Health care expenditures may also affect the adoption of technology and use of inputs by poor households which negatively affects total factor productivity. One of the diseases that has had serious consequences for farm labor productivity and production, especially in Africa is AIDS.

HIV/AIDS continues to exact a heavy toll on development. Globally, the number of people living with HIV[1] continued to grow, and it is estimated at 31.1 to 35.8 million in 2008 of which 50.2% were women (UNAIDS and WHO, 2009). This is about 20% higher than the number in 2000 and about threefold higher than 1990.

*Corresponding author. E-mail: K.Asenso-Okyere@cgiar.org.

[1]These estimates include all people with HIV infection, whether or not they have developed symptoms of AIDS.

Table 1. Life expectancy with and without AIDS in selected African countries, 2000.

Country	2000			2010		
	With AIDS	Without AIDS	Years lost	With AIDS	Without AIDS	Years lost
Botswana	39.3	70.5	31.2	29.0	73.2	44.2
Ethiopia	45.2	56.1	10.9	42.1	60.0	18.0
Kenya	48.0	64.9	16.9	44.3	68.4	24.1
Nigeria	53.6	57.8	4.2	38.9	64.0	26.0
South Africa	51.1	65.7	14.6	35.5	68.3	32.8
Swaziland	40.4	57.7	17.3	29.7	61.5	31.8
Zimbabwe	37.8	69.9	32.1	32.5	72.8	40.3
Zambia	37.2	58.7	21.5	38.9	72.8	33.9

Source: U.S. bureau of the census, international data base, 2010.

There were about 2 million AIDS-related deaths in 2008 of which Sub-Saharan Africa accounted for 72%. It is also the most heavily HIV-affected region worldwide representing 67% of infections, 68% of new HIV infections among adults, and 91% of new infections among children. Women and girls continue to be disproportionately affected by HIV in the region, with women accounting for approximately 60% of all estimated HIV infections (UNAIDS, 2008; Garcia-Calleja et al., 2006).

The effects of HIV and AIDS are reflected in the changes in life expectancy. HIV infection in Sub-Saharan Africa has resulted in the substantial decrease in life expectancy (Table 1). It is disappointing that after several years of investments to control HIV and AIDS in Africa, life expectancy among people living with AIDS is expected to fall from 2000 to 2010. This is not surprising since more people in many African countries are getting infected and dying, and apparently AIDS control programs have not been adequate or effective. However, reversal of the situation is expected in later years as anti-retroviral drugs become increasingly available

For instance, the latest seroprevalence data in Mozambique indicate that one in six persons is infected with the AIDS virus. According to the Government, this means that over three million people are infected, that is over 25% of the population in some areas, with 500 new persons contracting the virus every day in certain regions (Radio ONU, Maputo; CTA, 2010). According to official 2008 data, out of the 300000 or so AIDS patients requiring urgent treatment in rural areas of Mozambique, fewer than 90000 were able to benefit from anti-retroviral drug treatment, owing to lack of information and poor access (Radio UNU, Maputo; CTA, 2010). AIDS threatens households, community, and national food security and poverty reduction efforts and so effective control measures should be put in place.

The majority of people affected by HIV work in agriculture, and agriculture continues to be one of the most important drivers of poverty reduction and a bedrock for economic growth, especially for the billions of people in developing countries (World Bank, 2007). Food production is largely undertaken by women and so with HIV/AIDS affecting more women than men then income from sale of food items and food security are greatly compromised by the disease in many African communities.

This review focuses on the interaction between HIV and AIDS and agriculture, examining both direct and indirect impacts on farm labor productivity. The review is motivated by the fact that in low-income countries, work often relies more heavily on manual labor, and, therefore on good health. The labor market consequences of poor health are likely to be more serious for the poor, who are more likely to suffer from severe health problems and to be working in jobs for which strength (and therefore good health) has payoff (Strauss and Thomas, 1998). In many developing countries publicly supported social protection programs are not available and so illness can completely devastate and impoverish households.

CONCEPTUAL FRAMEWORK: LINKAGES BETWEEN AGRICULTURE AND HEALTH

Agriculture and health are linked in various ways.

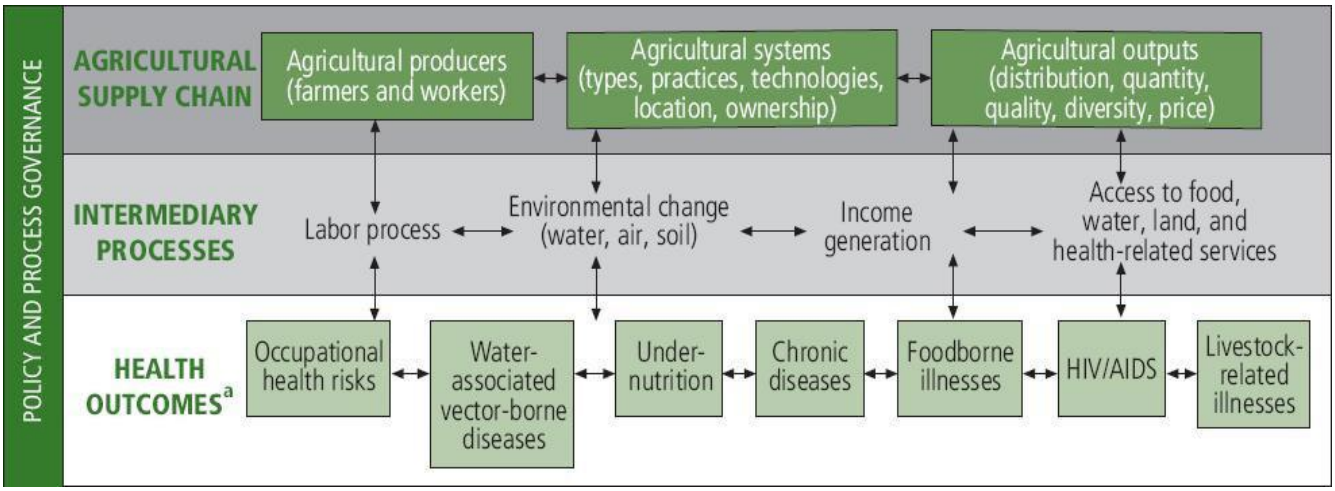


Figure 1. Framework for linkages between agriculture and health. Source: Hawkes and Ruel (2006a).

These links are bidirectional: agriculture influences health and health influences agriculture. Figure 1 presents a framework, developed by Hawkes and Ruel (2006a), for understanding the linkages between agriculture and health. In the framework, the entire agricultural supply chain—agricultural producers, agricultural systems, and agricultural outputs—has implications for health through critical intermediary processes, which are the labor process, environmental change, income generation, and access to food, water, land and health-related services. Poor agricultural households tend to be vulnerable to malnutrition and poor health; agricultural systems interact with the environment, and by so doing affect human health; and agriculture produces foods, fibers, and plants with medicinal properties essential for human life and health.

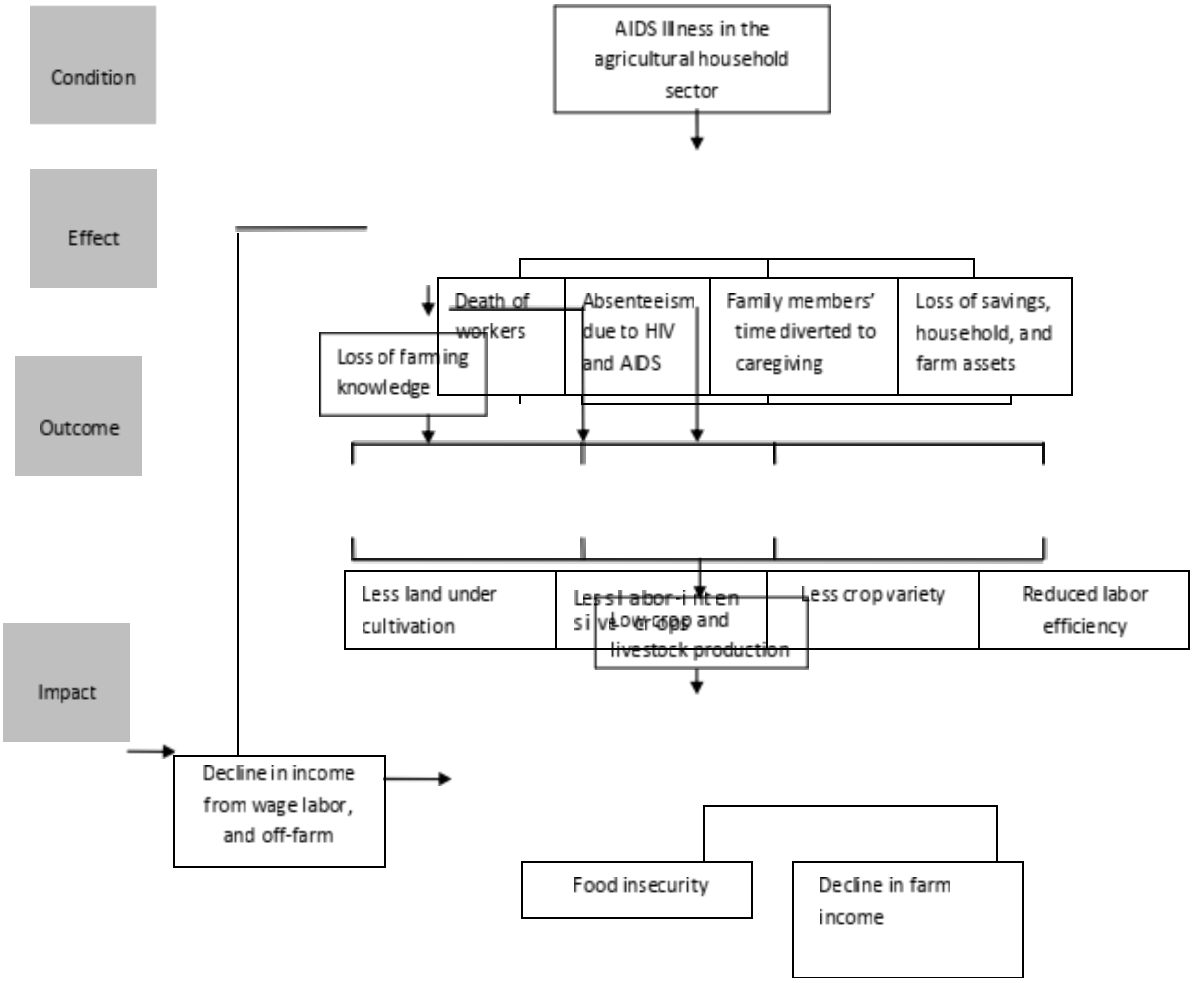
Agricultural production is a determinant of health, primarily through the consumption of food produced and through intermediary processes related to income and labor. In addition to providing some or all of the household's food needs, agriculture provides income for farmers and farm laborers. Income enables them to purchase and gain access to food, water, land, information and education and health-related services which in turn determine their overall nutritional and health status. On the other hand, agricultural labor, which is relatively intensively utilized, can affect nutritional status due to high energy expenditure and by usurping time that could be otherwise spent on child care, food preparation, and other nutrition-related activities. Farm labor, particularly when inefficiently utilized, can also detract from time that could be productively spent on income-generating activities, educational, or other endeavors. Labor exposes producers to a range of occupational health hazards, such as accidents, diseases, and poisoning from pesticides.

Agricultural income generation in terms of the amount and type of agricultural activities of producers influences migration and the search for alternative income sources, which has implications for the spread of and exposure to diseases such as HIV. In the other direction linking health to production, poor health and malnutrition of agricultural producers reduce their work performance, thereby reducing productivity and income and bringing about even more ill health (Hawkes and Ruel, 2006a; Hawkes and Ruel, 2006b).

Agricultural systems affect human health via the intermediary process of environmental changes in water, soil and air. For instance, characteristics of agricultural production systems, such as crop rotation, the presence of livestock, and the proximity of villages to fields and water sources, create conditions for contracting water-borne vector diseases (World Bank, 2007).

Conversely, poor health also affects agricultural systems. Poor health reduces the farmer's ability to innovate, experiment, and operationalize changes in agricultural systems. Experimentation on technology adoption and improved practices would be too costly for a farm household that is spending a lot of money on healthcare and is losing labor to illness.

Agricultural output also affects health through availability of quality food. Quality and diversity of food produced influence access to micronutrients and dietary diversity. Agricultural outputs are also linked to health through medicinal plants which help treat diseases, thus increasing access to health-related products. Medical treatment for HIV and AIDs-related illnesses have tended to focus on pharmaceuticals and supplements rather than make use of the vast network of traditional healer's plant-based medicines for the alleviation of opportunistic infections and diseases (Kaboru et al., 2006; Wright, 2008). Because of the high treatment costs and difficulties with access, only a small percentage of households with people living with HIV or AIDS are



currently using pharmaceuticals and supplements and instead depend on local capacities and resources, including plant-based medicine sourced from the forest (Willumsen and Kettaneh, 2005; FAO, 2003). WHO estimates that about two-thirds of the world's population, and 80% of Africa's population, sometimes use herbal or traditional medicine. Therefore, medicinal plants constitute a fundamental component of traditional healthcare systems in rural communities throughout Africa. For example, the bark from *Prunus africana* trees is used in a treatment for prostrate disorders; *Artemisia annua* (sweet wormwood) is used to treat malaria; and the African tree *Melaleuca alternifolia* (tea tree) contains an antifungal substance that combats *Candida albicans*, the bacteria responsible for fungal skin problems and mycosis (a condition that commonly affects the eyes of AIDS patients).

Health also affects agricultural output, particularly its demand. Malnutrition and disease patterns influence market demand for food quantity, quality, diversity, and the price people are able or willing to pay.

CONCEPTUAL FRAMEWORK FOR THE IMPACT OF HIV AND AIDS ON AGRICULTURE THROUGH FARM LABOR PRODUCTIVITY

To examine the impacts of the disease aspect of health on agriculture, this paper adapts the conceptual framework used by Negin (2005) in the study on the impact of HIV and AIDS on agriculture and adapted by Asenso-Okyere et al. (2009) for use on the linkages between malaria and agriculture (Figure 2). Microeconomic explanation of individual and household poverty revolves around the understanding that an individual's labor (health and energy), human capital (education and skills), and physical and social assets (such as land and access to a social network) determine the individual's ability to generate income both today and in the future (Von Braun et al., 2009) . A study exploring welfare dynamics in rural Kenya and Madagascar found that every poor household interviewed could ultimately trace its poverty to an unexpected loss of assets or health (Barrett et al., 2006). Similarly, in 74% of the households

that had fallen into poverty in the Indian state of Andhra Pradesh, serious illness was discovered to be one of the causes (Krishna, 2004).

Illness results in morbidity and sometimes mortality. These reduce labor availability through absenteeism or death of agricultural producers/workers (Figure 2). Through morbidity the quantity and quality of labor to the household is also affected because the sick may abstain completely or partially from work during the period of illness. Labor availability is also indirectly affected when labor of productive members of the household is diverted from the farm to caring for the sick. When sick persons die, the knowledge that they acquired through learning and experience is no longer available for others to use and considerable agricultural knowledge is lost. However, it must be pointed out that although chronic illness results in a net decrease in household labor (the ill and the caretaker), the death of a chronically ill person who had a full-time caretaker can result in increased household labor when the caretaker returns to the workforce.

The cost of healthcare for sick persons and of funerals drive many households into debt, and they resort to using their savings and remittances they receive or even sell household and farm assets to defray the costs. For instance, due to costs of treatment and other expenses as well as lower incomes from loss of labor, AIDS affected households usually draw on assets. After the onset of AIDS, savings and financial assets are usually the first to be depleted. Then, non-productive assets, such as furniture, cooking utensils and clothes follow. Finally households may have to sell off productive assets such as tools, draught animals, and land (Slater and Wiggins, 2005). The outcomes of these effects include reduction of farm sizes, cultivation of less-intensive crops, reduction in variety of crops planted, and reduction in livestock numbers. These outcomes affect livelihoods in terms of reduction in farm outputs and income, decline in income from wage labor and off-farm activities, and food insecurity.

LINKAGES BETWEEN HIV AND AIDS AND FARM LABOR PRODUCTIVITY

Impacts on farm labor

Several studies have estimated labor time lost as a result of illness and death. Here we focus on studies looking at the impacts of HIV and AIDS on agricultural productivity. A Tanzanian study on AIDS found that males with AIDS lost an average of 297 days of productive work over an 18months period and women with AIDS lost 429 days over the same period due to morbidity of the disease (Rugalema, 1998). The gender difference may be due to severity of the disease to females versus males. A study in Rwanda revealed that for people who died of AIDS, the average period of illness before death was 23 months during which care had to be provided (Donovan et al., 2003).

Loss of labor also occurs as a result of time reallocated to care for an ill household member, including children. A household impact study of HIV and AIDS on families in the free state province of South Africa found that household members spend 7.5 h per day taking care of the ill (Booysen and Bachman, 2002). In rural Zimbabwe, the average time spent in taking care of bed-bound AIDS patients is 38.5 h per week, which nearly represent full-time employment (Woelk, 1996).

Hence, as quantity and quality of labor are affected during the duration of an illness, capacity to produce agricultural output often is reduced, resulting in lower labor productivity. For example, a study in western Kenya that examined the impact of HIV and AIDS on labor productivity found that HIV-positive workers plucked 4 to 8 kg/day less tea in the last year and a half before they died compared to HIV-negative workers (Fox et al., 2004).

As suggested by theoretical literature, household farm production will decline (and shift to less labor-intensive crops) because of loss of productive labor due to illness. While numerous studies have focused more on estimating the economic burden of illnesses (direct and indirect[2] costs), the available empirical literature[3] evaluating effect of morbidity on agricultural production has shown varying results. Sometimes when people are sick they still go to the farm and they are counted fully as being part of the farm labor force. However, their contribution to farm productivity may be lower because of reduced effort. This situation occurs often during the incubation stages of HIV until full blown AIDS when the person becomes bed-ridden.

A study in Rwanda indicated that reduced labor time as a result of HIV related illness among women and increased time women devote to care- giving to members living with AIDS resulted in a decline in production of beer bananas (a cash crop), a source of income for women. While beer banana production decreased, sweet potato (food crop) production increased because it allowed a more flexible labor schedule (Donovan and Bailey, 2006). A survey in Zambia found that heads of HIV-affected households reduced their cultivated land area by 53%, resulting in reduced crop production (ILO, 2000).

When illness of a productive household member results in death, this leads to a permanent loss of one source of labor in the farm household. A household death further affects labor availability as healthy individuals divert their

[2]Direct costs refer to household expenditure linked with seeking treatment, including non -medical expenses such as transport or special foods. Indirect costs refer to the loss of household productive labor time for patients and caregivers valued using the going wage rate.

[3]For literature on HIV, impacts for the illness period have been rarely evaluated (Donovan and Bailey, 2006). Studies on HIV focused more on the impact of adult death. Production impacts during the illness period as compared to those in the postdeath period have received little attention. HIV studies that examined the impact of adult death on agricultural production are mentioned in the next section.

time and energy from the farm to mourn and attend to the funeral and related matters. All these have an impact on agricultural production. Due to the permanent labor loss, area cultivated and crop variety may decline. Cropping patterns may also change from more labor-intensive systems to less intensive ones.

A study in Uganda found that reductions in labor supply due to AIDS death resulted in reduced variety of crops planted by households (Asingwire, 1996). Most of the reduction was more common in female-headed households (77.3%), particularly where the woman was widowed. Such households experienced a reduction in the production of food and cash crops. Similarly, in Rwanda households with a recently deceased adult male from AIDS suffered a decline in the production of cash crops; while production increased for cassava and sweet potato, which are less -labor intensive crops, there was a decline in these crops if the female died (Donovan et al., 2003). These findings are consistent with the fact that, in Africa, men are more involved in cash crop production while women are more involved in food crop production.

In Thailand, 35% of households with an AIDS death felt a serious impact on agricultural production, leading to a 48% reduction in family income (Pitayanon et al., 1997). In Zimbabwe, a study conducted by the Zimbabwe farmers union showed that death of a household head due to AIDS will lead to a reduction in maize production in the small-scale farming sector and communal areas of 61% where family labor is mostly used.

In contrast, some studies found that household agriculture production did not significantly change after incurring AIDS-related death. A study in the Kagera district of Tanzania found only short-term and temporary effects of AIDS-related deaths on household's agricultural activities (Beegle, 2005). There was little or no impact on labor devoted to agricultural activities because households brought extended family members to the farm, a finding highlighted in other empirical studies (Ainsworth et al., 1995; Menon et al., 1998; Mather et al., 2004; Jayne et al., 2004).

Another important effect of HIV and AIDS is the drain on household labor availability which starts as soon as any one member falls sick and women and girls have to be taken away from their livelihood activities to care for them. The increased workload of women for care giving can greatly reduce their time to participate in farming activities, leading to a decline in farm production in areas where women are major farmers. In Northern Zambia, AIDS-affected households, particularly those headed by women, reduced the total area under cultivation due to labor shortages (FAO, 2003). In Tanzania, women spent 60% less time on farming activities taking care of their husbands suffering from AIDS (Rugalema, 1998). In southern Zambia, women were forced to abandon harvesting as their time became entirely taken up with the care of sick household members. In Ethiopia, women were found to spend about 100 h a week nursing AIDS-affected household members, largely at the expense of their children and their farms (ILO, 2000). This care giving burden can also affect technology adoption, largely because of lack of labor for farm activities. In the Tigray region of Ethiopia, the opportunity costs of caring for sick family members significantly affect adoption of productivity-enhancing technologies (Ersado et al., 2003).

Attempts have been made to estimate the extent of rural labor loss due to AIDS mortality. The U.S. department of agriculture has estimated that the reduction in numbers of agricultural laborers in Southern Africa will reduce agricultural labor productivity by 12% per year, which will result in a 3.3% loss in grain output.[4] Moreover, FAO (2004), using epidemiological data, projected that by 2020 the nine most severely hit Sub-Saharan African countries would lose from 13 to 26% of their agricultural labor force to HIV and AIDS (Figure 3). Botswana, Mozambique, Namibia, South Africa, and Zimbabwe are expected to lose between a fifth and a quarter of their agricultural labor in less than a generation. Unfortunately the return of caretakers to the household labor force after the death of a person living with AIDS has not been featured into computation of labor loss in AIDS-afflicted households. Since a lot of time is spent on caring for people living with AIDS, the death of the patient may add on to household labor through the return of the caretaker to the labor force. This happens because the disease led to the withdrawal of the labor of two persons (the sick person and the caretaker) but with the death of the person living with AIDS the caretaker returns to the household labor force and adds on to household production and income.

Note: Figures must be interpreted with caution as projections were estimated prior to the stabilization and decline of HIV epidemic and the increasing availability of antiretroviral drugs (ARVs) in these countries.

Impacts on agricultural knowledge and innovation

The available literature indicates that farm-specific knowledge is lost due to death of agricultural producers, especially when these deaths occur as a result of HIV (van Liere, 2001; Gillespie et al., 2001; United Nations, 2004). Agricultural knowledge is obtained from indigenous sources, experience, scientific research, and technical experts and extension workers. The knowledge is normally not written down because of oral traditions and low literacy rates in developing countries. Although extension workers can play a major role in knowledge transfer from research to farmers, a lot of information is shared within families and among farmers through social networks such as farmer or community-based organizations and solidarity groups. Adults pass on traditional knowledge to their children and grandchildren through conversations, demonstration, and working together. In many African societies it was customarily for

[4] As cited by ILO (2004)

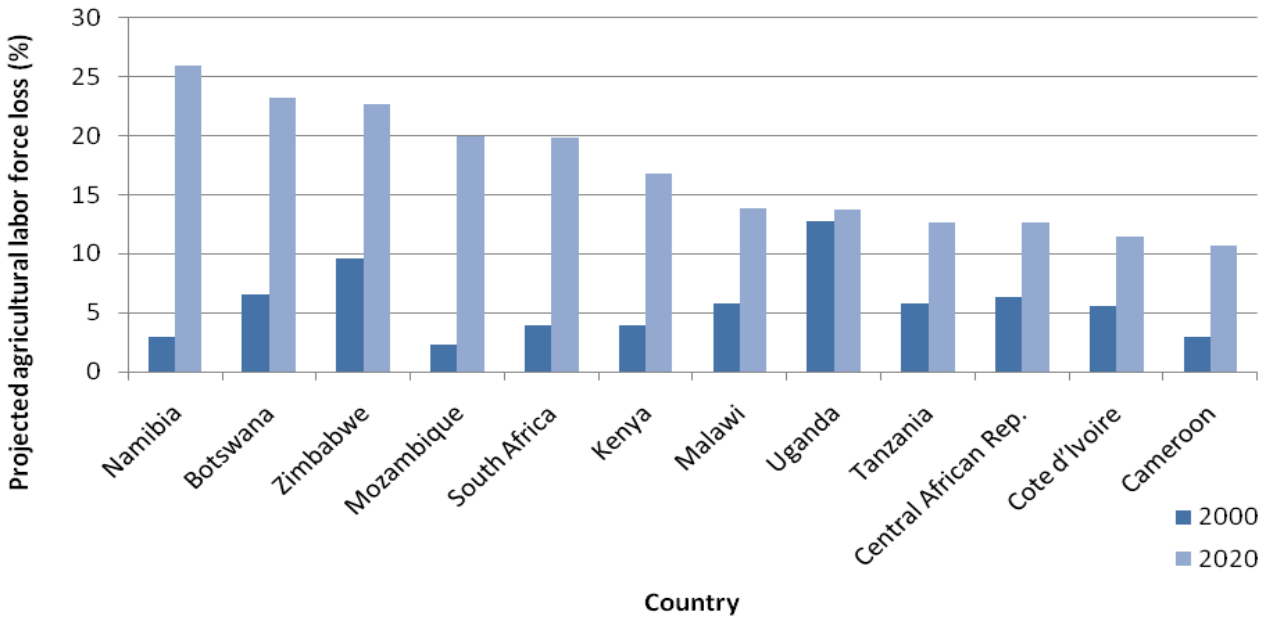


Figure 2. Projected agricultural labor force loss due to HIV and AIDS in the most affected countries of Africa, 2000 and 2020. Source: FAO (2004).

grandmothers to tell stories to their grandchildren before they go to bed. Some of these stories may cover experiences in farming through which the children may learn improved practices and better ways of doing farming. Therefore, when a farmer dies of disease, the knowledge may be completely lost to the detriment of labor productivity of succeeding generations.

A study on the likely impact of HIV/AIDS on knowledge and information flows, and on the retention of traditional knowledge around seed management in southern Mozambique found that HIV/AIDS is just one of several factors that can result in the loss of traditional crops and varieties and erosion of knowledge around seed (Dominguez et al., 2005). The authors noted that it was difficult to separate the effect of HIV/AIDS from other factors and safely assumed that the loss of agriculturally active adults and the increased number of orphans in the study sites will deprive children of learning opportunities from family members. Another study in Mozambique (Waterhouse et al., 2004), examined the likely impact of HIV/AIDS on farmer's knowledge of seed using female-headed households, households caring for the sick and households caring for orphans as proxies to HIV/AIDS affected households. The study found that HIV/AIDS affected households especially those households caring for orphans experienced constraints in access to seed and seed information. These households had smaller acreages of cultivated land under irrigation; none of them used purchased chemicals to preserve seed; and they were also less exposed to modern sources of information dissemination. The study also pointed out the methodological difficulties in isolating the effects of HIV/AIDS on local agricultural practice and associated changes in knowledge. High medical expenses further undermine the household ability to purchase, maintain, and replace essential farm inputs as well as to adopt technologies requiring such. A study in Uganda found that it was difficult for HIV- affected households to adopt recommended agronomic practices that boost the production and quality of produce because they had limited funds to invest in farm inputs and implements (NAADS, 2003).

The study concluded that under current conditions wherein local knowledge around seed is being eroded and that various obstacles exist to learning and acquiring new information around seed, HIV/AIDS is even more likely to accelerate loss of traditional knowledge and increase the barriers to learning. It is noteworthy that due to the methodological constraints, limited studies have adequately assessed the nature and degree of loss of knowledge in smallholder agriculture. Little is actually known about the extent to which the death of one or both parents affects the transfer of agricultural knowledge to younger generations.

Impacts on household savings and assets

The direct costs people incur due to illness may impose a great financial burden on resource-poor farmers, thereby affecting sustainability of their farm. A review of studies on the economic burden of illness for households in developing countries focusing on malaria, TB, and HIV found that in resource-poor settings, illness imposed

regressive cost burdens on patients and their families, particularly for TB, HIV, and AIDS which were more than 10% of income (Russell, 2004) . In Côte d'Ivoire, healthcare costs specific to the person with AIDS accounted for almost 80% of the household healthcare budget (Bechu, 1998) . In the Rungwe district of Tanzania, rising medical expenses significantly increased the probability of a household's falling below the poverty line (Mwakalobo, 2003). Due to the high cost of managing the condition, HIV and AIDS have an indirect effect on labor productivity by depleting savings and household and farm assets of farmers. Studies from various parts of Sub-Saharan Africa indicate that HIV and AIDS, through loss of income and loss of productive asset sales, cause a process of household impoverishment. Research in Zimbabwe reports that more than 60% of households have borrowed money to cover the direct costs of the disease; about one-third have reduced expenditure on basic needs; and between 20 to 30% have sold assets (Russell, 2004). A study by the Southern Africa partnership program provided the example of livestock sales of chickens, goats, or cattle as coping strategies that households employ in Sub-Saharan Africa (Southern Africa partnership programme, 2005). In Kenya, cattle and productive farm equipment are sold in response to severe cash requirements after incurring a male AIDS-related death in the family (Yamano and Jayne, 2004) . Sale of livestock does not only affect the livestock subsector but also has implications for the crop production subsector due to reduced availability of draught power and manure, which has implications for a household's future production.

Several studies in Africa also found that some HIV-affected households sold their land to cope with the impact of the condition (Drimie, 2003; Mbaya, 2002; Rehmtulla, 1999; Rugalema et. al., 1999). In Thailand, HIV-affected households used household savings, borrowed money, and sold assets, most often land (Pitayanon, 1997). The sale of land to combat disease is a serious phenomenon since for most poor people, the most important production factors they have are land and their labor and so the absence of one or both of them implies their inability to produce for home consumption and for sale to earn income for other purchases.

Impacts on nutrition

Good nutrition is recommended for delaying opportunistic infections and prolonging the life of people living with AIDS. However, households who have AIDS patients and are burdened with high costs of managing the condition adopt reduction of consumption of basic needs, including food as coping mechanism (Pitayanon et al., 1997).This eventually would lead to worsening nutrition status of adults that in turn affects the duration of labor force participation and consequently the welfare of the household including the development of children. A survey in Côte d'Ivoire found that per capita consumption of AIDS-afflicted households to be half that of other households (Bechu, 1998). In two districts of Zimbabwe, it was found that less than a quarter of households acutely affected with HIV/AIDS had three meals per day, compared with more than half of households coping with the impacts of AIDS. Similarly, the former households had less diversity in their diets (Food security network of Zimbabwe, 2007). In Malawi, HIV-affected households had to reduce their food consumption by 30% because of making allowance for taking care of household members living with AIDS (Thangata et al., 2007).

CONCLUSION

This paper has reviewed some of the current evidence about the various ways in which health in general and HIV and AIDS in particular affect farm labor productivity, and how agriculture affects the health of people. The paper used a conceptual framework to discuss the impact of health and or HIV and AIDS on agricultural productivity (through its impact on labor productivity), and then looked at the effects and outcomes of illness and how households adjust to these shocks. This review has shown that the household's vulnerability or ability to cope with a shock is based on its asset portfolio, which includes human, physical, and financial assets, and intangible social resources. Health is treated as both an investment and consumption asset, as is agriculture. A situation by which these investments and consumption activities erode the asset base of agriculture and leave farmers without a means of livelihood should be avoided. When both health and agriculture thrive, a reinforcing cycle of health can result, but when either suffers, the cycle becomes one of lowered agricultural productivity and lowered health status.

ACKNOWLEDGEMENT

We are grateful to the Bill and Melinda Gates Foundation for providing funding for the research that led to the publication of this paper.

REFERENCES

Ainsworth M, Ghosh S, Semali I (1995). The impact of adult deaths on household composition in Kagera Region, Tanzania. Policy Research Department, World Bank, Washington, D.C. Unpublished manuscript.

Asenso-Okyere K, Asante FA, Tarekegn J, Andam KS (2009). The linkage between agriculture and health. International Food Policy Research Institute Discussion Paper 00861. Washington, D.C.: International Food Policy Research Institute.

Asingwire N (1996). AIDS and agricultural production: Its impact and implications for community support in ACORD Programme Areas, Mbarara District. A consultancy report.

Barrett C, Marenya P, McPeak J, Minten B, Murithi F, Oluoch-Kosura

W, Place F, Randrianarisoa JC, Rasambainarivo J, Wangila J (2006). Welfare dynamics in rural Kenya and Madagascar. J. Dev. Stud. 42(2): 248-277.
Bechu N (1998). The impact of AIDS on the economy of families in Côte d'Ivoire: Changes in consumption among AIDS-affected households. In *Confronting* AIDS: Evidence from the developing world*,* ed. M. Ainsworth, L. Fransen, and M. Over. Brussels: European Commission. 8(1): 2-3
Beegle K (2005). Labor effects of adult mortality in Tanzanian households. Econ. Dev. Cult. Change, 53 (3): 655-683.
Booysen F, Bachmann M (2002). HIV/AIDS, poverty, and growth: Evidence from a household impact study conducted in the Free State Province, South Africa. Presented at the Annual Conference of the Center for Study of African Economies. St. Catherine's College, March 18-19, Oxford.
CTA (2010). Fertilizer: Bringing down the price. Spore 146 (April 2010). Dominguez, C.O., R.B. Jones, and R. Waterhouse. 2005, The impact of HIV/AIDS on seed security in southern Mozambique. International Conference on HIV/AIDS and Food and Nutrition Security, Durban, 14-16 April.
Donovan C, Bailey LA (2006). Understanding Rwandan agricultural households' strategies to deal with prime-age illness and death. In *AIDS,* poverty, and hunger: challenges and responses, ed. S. Gillespie. Washington, D.C.: International Food Policy Research Institute, April 14-16.
Donovan C, Bailey L, Mpyisi E, Weber M (2003). Prime-age adult mortality and mortality in rural Rwanda: Which households are affected and what are their strategies for adjustment. Paper presented at the 25th International Conference of Agricultural Economists, August 16-23, Durban, South Africa.
Drimie S (2003). HIV/AIDS and Land: Case Studies from Kenya, Lesotho, and South Africa. Development Southern Africa, 20(5): 647-658.
Ersado L, Amacher G, Alwang J (2003). Productivity and land enhancing technologies in Northern Ethiopia: Health, public investment and sequential adoption. EPTD Discussion Paper 102. Washington, D.C.: International Food Policy Research Institute.
Food and Agricultural Organization (FAO). 2003. HIV/AIDS and Agriculture: Case Studies from Namibia, Uganda and Zambia, Rome. 2004. Impact of HIV/AIDS on the agricultural sector and FAO's response. FAO contribution to HIV/AIDS and work: global estimates, impact and response. Rome: FAO, Population and Development Service (SDWP) (March).
Food Security Network of Zimbabwe (2007). Impact, of HIV and AIDS on rural agricultural production and food security in Chivi and Makoni Districts. Harare, Zimbabwe: Food Security Network of Zimbabwe.
Fox M, Rosen S, MacLeod W, Wasunna M, Bii M, Fogliam G. Simon G. (2004). The impact of HIV/AIDS on labour productivity in Kenya. Trop Med Int. Health, 9(3): 318-324.
Garcia-Calleja JM, Gouws E, Ghys PD (2006). National population based HIV prevalence surveys in Sub-Saharan Africa: Results and implications for HIV and AIDS estimates. Sexually Transmitted Infections, 82 (Supp. 3): iii64-iii70.
Gillespie S, Haddad L, Jackson R (2001). HIV/AIDS, Food and nutrition security: Impacts and actions. In Nutrition and HIV/AIDS. Nutrition Policy Paper no. 20. Administrative Committee on Coordination/Subcommittee on Nutrition. Geneva: United Nations.
Hawkes C, Ruel MT (2006a). The links between agriculture and health: An intersectoral opportunity to improve the health and livelihoods of the poor. Bull. World Health Organ., 84 (12): 985-991.---. (2006b). Overview. 2020 Vision Focus No. 13, Brief. In Understanding the links between agriculture and healt*h*, eds. C. Hawkes and M.T. Ruel. Washington, D.C.: International Food Policy Research Institute. Hempel J. and J. Najera (1996). The burden of malaria. Geneva: World Health Organization.
International Labor Organization (ILO) (2000). *M*odeling the impact of HIV/AIDS on social security. Geneva: International Labor Organization.
ILO (2004). HIV/AIDS and work: Global estimates, impact and response Geneva: International Labor Organization.
Jayne TS, Villareal M, Pingali P, Hemrich G (2004). *Interactions* between the agricultural sector and the AIDS pandemic: Implications for agricultural policy. ESA Working Paper No. 4. Rome: FAO.
Kaboru BB, Falkenberg T, Ndubani P (2006). Can biomedical and traditional health care providers work together? Zambian practitioners' experiences and attitudes towards collaboration in relation to STIs and HIV/AIDS care: A cross-sectoral study. Hum. Resour. Health, 4: 16.
Krishna A (2004). Escaping poverty and becoming poor: who gains, who loses, and why. World Dev., 32(1): 121-136.
Mather D, Donovan C, Jayne TS, Weber M, Mazhangara E, Bailey L, Yoo K, Yamano T, Mghenyi E (2004). A cross-country analysis of household responses to adult mortality in rural Sub-Saharan Africa: Implications for HIV/AIDS mitigation and rural development policies. International Development Working Paper 82. Department of Agricultural Economics. East Lansing: Michigan State University.
Mbaya S (2002). HIV/AIDS and its impact on land issues in Malawi. Paper presented at the FAO/SARPN Workshop on HIV/AIDS and Land, June 24-25, Pretoria, South Africa.
Menon R, Wawer MJ, Konde-Lule JK, Sewanlambo NK, Li C (1998). The economic impact of adult mortality on households in Rakai district, Uganda. In Confronting AIDS: Evidence from the developing world, ed. M. Ainsworth, L. Fransen, M. Over. Brussels: European Commission, 12(2): S47-S55.
Mwakalobo A (2003). Implications of HIV/AIDS on rural livelihoods in Tanzania: The case of Rungwe district*.* Unpublished Manuscript.
National Agricultural Advisory Services (NAADS) (2003). The impact of HIV/AIDS on the agricultural sector and rural livelihoods in Uganda. Baseline Report.
Negin, J (2005). Assessing the impact of HIV/AIDS on economic growth and rural agriculture in Africa. J. Int. Affairs, 58(2): 267-281.
Pitayanon S, Kongsin S, Janjaroen W (1997). The economic impact of HIV/AIDS mortality on households in Thailand. In The economics of HIV and AIDS: The case of South and South East Asia, ed. D. Bloom, and P. Goodwin. Delhi: Oxford University Press.
Ravallion M, Chen S, Sangraula P (2007). New Evidence on the Urbanization of Global Poverty. Policy Research Working Paper No. 4199. Washington, D.C.: World Bank. http://econ.worldbank.org/docsearch
Rehmtulla S (1999). Initiatives to help widows in the struggle for property and inheritance rights in Tanzania. Paper presented at a conference on AIDS, Livelihood and Social Change in Africa, April, Wageningen, The Netherlands.
Rugalema G (1998). It is not only the loss of labour: HIV/AIDS, loss of household assets and household livelihoods in Bukoba District, Tanzania. Paper presented at the East and Southern Africa Regional Conference on responding to HIV/AIDS, June 8−12, Harare.---. (1999). Consequences of loss of labour due to HIV/AIDS in smallholder households in a Buhaya Village, Bukoba District, Tanzania. In *AIDS* and African smallholder agriculture, ed. G. Mutangadura, H. Jackson and D. Mukurazita. Harare: SAFAIDS.
Russell S (2004). The economic burden of illness for household in developing countries: A review of studies focusing on malaria, tuberculosis, and human immunodeficiency virus/acquired immunodeficiency syndrome. Am. J. Trop. Med. Hyg., 71 (Suppl 2): 147-155.
Slater R, Wiggins S (2005). Responding to HIV/AIDS in agriculture and related activities. Natural Resource Perspectives 98. March 2005. Overseas Development Institute, London.
Strauss J, Thomas D (1998). Health, nutrition, and economic development. J. Econ. Literature, XXXVI: 766-817.
Thangata PH, Hildebrand PE, Kwesiga F (2007). Predicted impact of HIV/AIDS on agroforestry adoption and household food security in Malawi. Sustain. Dev., 15 (4): 205-215.
United Nations (2004). *Impact of AIDS*. Department of Economic and Social Affairs. Population Division. New York: --- 2008. *Report on the global AIDS epidemic.* Geneva, UNAIDS.
UNAIDS and World Health Organization (WHO). 2009. AIDS epidemic update December 2009. Geneva: UNAIDS.
Van Liere MJ (2001). HIV/AIDS and food security in Sub-Saharan Africa. 7th Annual ECOWAS Nutrition Forum, Sept 2-6, Banjul, Gambia.
Von Braun J, Hill RV, Pandya-Lorch R (2009). The poorest and hungry: a synthesis of analyses and actions. In von Braun J, Hill RV, Pandya-

Lorch R (eds.). The Poorest and Hungry: Assessments, Analyses and Actions, Washington, D.C.: International Food Policy Research Institute, pp. 421–438.
Waterhouse R, Jones R, Dominguez C (2004): The Impact of HIV/AIDS on farmer's knowledge of seed: Case study of Chokwe District, Gaza Province, Mozambique.
Willumsen J, Kettaneh A (2005). Nutrition, HIV and AIDS. HIV and AIDS key issues guide. Health and Development Information Team. DFID Health Resources Centre, London.
Woelk (1996). From D. Topouzis. Measuring the impact of HIV/AIDS on the agricultural sector in Africa. Paper presented at the African Development Forum. (Addis Ababa: December 3-7 2000).
World Bank (2007). World Development Report 2008: Agriculture for Development. Washington, D.C: World Bank.
Wright J (2008). Organic agriculture and HIV/AIDS: The Nutritional Response. Presented at the 16th IFOAM Organic World Congress, Modena, Italy, June 16-20, 2008.
Yamano T, Jayne TS (2004). Measuring the impact of working-age adult mortality on small-scale farm households in Kenya. World Dev., 32 (1): 91-119.