

**The Impact of HIV/AIDS on Labor Productivity: Akaki  
Fibre Products Factory, Akaki, Ethiopia**

**By**

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The Impact of HIV/AIDS on Labor Productivity: Akaki Fibre Products Factory, Akaki, Ethiopia

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## **LIST OF ABBREVIATIONS**

AAU	Addis Ababa University
AIDS	Acquired Immuno Deficiency Syndrome
ASO	AIDS Service Organizations
DCH	Department of Community Health
ENARP	Ethio- Netherlands AIDS Research Project
GDP	Gross Domestic Product
GNP	Gross National Product
HAART	Highly active antiretroviral therapy
HIV	Human Immuno Deficiency Virus
ILO	International Labor Organization
MOH	Ministry of Health
NGO	Non Governmental Organization
OPD	Out Patient Department
SMS	Small and Micro Enterprises
UNAIDS	Joint United national program on HIV/AIDS
WHO	World Health Organization

## **ABSTRACT**

HIV/AIDS has become a full-blown development crisis affecting all sectors of the economy. The industrial sector is one of the severely hit sectors in Africa. AIDS-related illnesses and deaths of employees affect an enterprise by both decreasing production (e.g., absenteeism, decrease of production while at work) and increasing expenditures (e.g., health care costs, burial fees and training and recruitment of replacement employees).

This is a report of a study that attempted to estimate the changes in worker's output and attendance associated with advancing HIV infection, and to determine direct costs incurred by a fibre products factory due to illness and death related to HIV/AIDS.

The study subjects were factory workers enrolled in a cohort study of HIV incidence and progression in Akaki since February 1997. Laboratory data (HIV serological status, CD<sub>4</sub>, viral load) at enrolment were matched with factory records on individual worker's productivity (as measured by incentive payments) and sick leaves taken during the study period.

Among a total of 797 workers in job category with incentive payment, 676 participants were included for the study. Of these, 86 (12.7%) were HIV infected with a mean age of 36 years. The mean incentive earnings have no significant difference between HIV positives and negatives at baseline (in 1997). However, in the following years (1998,1999 and 2000) the incentive earnings of HIV positives were significantly lower than the incentive earnings of HIV negatives.

In 2000 HIV infected workers earned significantly less incentive (mean = 51.77 Eth. Birr) than those who are not infected (mean =79.77 Eth. Birr). In addition the mean sick leave days per year were significantly greater in HIV positives than HIV negatives both at baseline and after four years. HIV positives were given 64% and

81% more sick leaves than HIV negatives in 1997 and 2000 respectively. In conclusion, this study has shown that there is a direct negative impact of HIV infection on the productivity of factory workers.

## **INTRODUCTION**

Acquired Immunodeficiency Syndrome (AIDS) has now been recognized for two decades. During this time it has claimed the lives of millions of people and has caused tremendous suffering for millions of others. HIV/AIDS is one of the major global concerns of our time. According to UNAIDS report of 2000 the HIV/AIDS epidemic has been spreading at a rate of about 16,000 infections per day, the most rapid increase being observed in southern and central Africa and in south Asia. UNAIDS also estimated that at the end of 2000, 36.1 million people in the world were living with HIV/AIDS of which 67% were in sub Saharan Africa. Three million of these cases were estimated to be in Ethiopia (1). In Addis Ababa, the capital of Ethiopia, HIV prevalence figure ranges 10 % to 23 % in adults of the general population and 45% to 74 % in sex workers confirming the severity of the epidemic (2).

Nearly 10 million deaths are expected by 2005. The disease kills both old and young, but mainly strikes people in their prime productive years. Over 80 % of AIDS deaths have been within the age group of 20 to 49 years. Since the start of the epidemic, 18.8 million children and adults have fallen sick and died and almost twice that number are now living with HIV, with some 5.4 million newly infected people joining their ranks in 1999. So far the epidemic has left behind 13.2 million orphans. Consequently it profoundly disrupts the economic and social bases of families and threatens to disintegrate the institutional framework of countries (2,3).

Therefore, AIDS has become a full-blown development crisis. Its social and economic consequences are felt widely not only in health but in education, industry, agriculture, transport, human resource and the economy in general.

It was at the end of the 1980s that the economic impact of the disease started to become an issue in countries where the prevalence of HIV was worrying. The problem soon took on a wider perspective, in light of the threat posed by the epidemic on the functioning and production of firms (industries). Since most of the people at the work place are young and sexually active, they are at risk of HIV/AIDS.

Studies on socioeconomic impact in different African countries show that enterprises are being affected severely by decreased productivity, increased costs in training and health care and loss of human life due to the AIDS pandemic (3).

Novel approaches to these problems must be actively sought and systematically evaluated. One such avenue is the occupational setting where infrastructure and medical care already exists in many countries in sub Saharan Africa. Most of the available studies are based on indirect or extrapolation of information and no study has directly linked HIV status and labor productivity. Therefore, additional studies are needed to define the impact of HIV/AIDS in sub Saharan Africa.

This study was, therefore, undertaken to assess the economic impact of HIV infection in a cohort of factory workers in Ethiopia from the perspective of industrial productivity. The results of the study were aimed at filling the information gap in this area by assessing the real impact of HIV/AIDS on labor productivity and on the cost of business in factory setting.

## **LITERATURE REVIEW**

### **Magnitude of the problem**

Worldwide approximately one in every 100 adults aged 15-49 is HIV infected. In sub-Saharan Africa, about 8.6% of all adults in this age group are HIV infected. This figure exceeds 10% in 16 African countries including Ethiopia (3).

For Africa, HIV/AIDS is perhaps the single most important obstacle to social and economic progress. At least two-thirds of the world's HIV/AIDS population lives in this sub-region. Countries like Botswana, Namibia, Swaziland, and Zimbabwe have been among the hardest hit nations. Between 20 and 26 percent of people aged 15 to 49 in these countries are living with HIV/AIDS (4).

Because HIV/AIDS cuts into the size and quality of the workforce it is of fundamental concern to businesses and economic policy makers. It is estimated for example, that in South Africa's mining sector as many as one out of five workers is HIV positive. Data collected by the ILO in May 1999 on the labor force in Rwanda, United Republic Tanzania, Zambia and Uganda revealed that 80 per cent of the persons infected in those countries were between 20 and 49 years old. In other words, AIDS is affecting and ultimately killing, the most productive labor forces within the formal sector. Many are experienced and skilled workers in both blue-collar and white-collar jobs. In Zambia for instance 96.8 percent of all deaths in 18 firms studied occurred among workers aged 15 to 40 years. Between 1984 and 1992, mortality has risen fivefold with AIDS related illness accounting for 56 per cent of the death among general workers, 71 percent among lower level workers, 57 percent among middle level workers, and 62 per cent among the top level managerial workers (5).

The problem posed by HIV/AIDS on the functioning of economic structures is highly alarming in Africa. In order to put the problem under study more clearly into context, a brief historical review is called for. Five years after the discovery of the agent responsible for AIDS, the question of constraints in the workplace was first perceived by the international community as a judicial and ethical problem concerning discrimination towards HIV infected employees. As early as 1988, the World Health Organization (WHO) and the International Labor Organization (ILO) issued a common declaration of an ethical and moral nature, the aim of which was to protect the rights of AIDS sufferers in the workplace and also inform people as to the absence of risk of contamination in the practice of the majority of occupations. However, these considerations are based essentially on a problem, which is appropriate to industrialized countries concerned with occupational safety and health. Moreover, the HIV/AIDS epidemics in Europe and the USA have never attained a level likely to alarm the authorities about the possible consequences of the illness in the economic sphere, apart from that of health and medical research expenditure (6).

The interest of research in Africa, besides the medical and biological aspects, concerns the socioeconomic consequences of infection by HIV. The socioeconomic impact of the epidemic has been the object of two different though complementary approaches; one concerns the study of firms or economic sectors based on the observation of a sample (companies, farmers, households, etc.); the other suggests a more global view based on macroeconomic aggregates. The first approach gives illustration to the second.

## **Macroeconomic Impact of HIV/AIDS**

The macroeconomic impact of AIDS is difficult to assess. Most studies have found that estimates of the macroeconomic impacts are sensitive to assumptions about how AIDS affects savings and investment rates and whether AIDS affects the best-educated employees more than others. Few studies have been able to incorporate the impacts at the household and firm level in macroeconomic projections. Some studies have found that the impacts may be small, especially if there is a plentiful supply of excess labor and worker benefits are small. Other studies have found significant macroeconomic impacts. Studies in Tanzania, Cameroon, Zambia, Swaziland, Kenya and other sub Saharan African countries have found that the rate of economic growth could be reduced by as much as 25 percent over a 20-year period.

There are several mechanisms by which AIDS affects macroeconomic performance. AIDS deaths lead directly to a reduction in the number of workers available. These deaths occur to workers in their most productive years. As younger, less experienced workers replace these experienced workers, worker productivity is reduced. Moreover, a shortage of workers leads to higher wages, which leads to higher domestic production costs. Higher production costs lead to a loss of international competitiveness, which can cause foreign exchange shortages. Lower government revenues and reduced private savings (because of greater health care expenditures and loss of worker income) can cause a significant drop in savings and capital accumulation. This leads to slower employment creation in the formal sector, which is particularly capital intensive. And also reduced worker productivity and

investment leads to fewer jobs in the formal sector. As a result some workers will be pushed from high paying jobs in the formal sector to lower paying jobs in the informal sector (7).

The overall impact of AIDS on the macro economy is small at first, but it increases significantly over time. The economic burden is rising significantly because the number of cases is increasing, the people infected are living longer, and new therapies are more expensive. According to a study by the Canada National HIV/AIDS Economic Research Institute (8) the total cost to date amounts to some US\$ 35 billion or about US\$ 1,200 per Canadian citizen. The new and emerging HIV episode is longer and total direct costs of care and treatment in this new episode are much higher between 1997 and 2001 and financial savings in the order of 4 billion are available in moving from the status quo to more effective epidemic control. More importantly, if the epidemic shifts from the status quo to becoming uncontrolled, the cost increases are estimated to be some US\$ 7.5 billion over a five-year period. The new highly active antiretroviral therapy (HAART) permits people living with HIV to return to normal patterns and thus decreasing the economic burden in terms of lost productivity and participation in society. If HAART treatment increases the period of productive life for those people living with HIV/AIDS by 15 percent, the savings in indirect costs will cover the increased costs of treatment since indirect costs of HIV/AIDS far outweigh the costs of prevention and treatment.

There is strong economic incentive for investment in HIV prevention and education. Canada invested over 80 million in HIV prevention and education in 1996. Invested by the provinces, territories and municipalities, roughly 29 percent was transferred to

community-based AIDS service organizations (ASOs). At the federal level, Health Canada invested roughly 52 percent of its total HIV prevention and education funds at the community-based level. Another study predicted that by the year 2000, the cost to Asian economics from AIDS would have been US\$ 38-52 billion (8,9).

By directly ruining the human capital, HIV threatens the socioeconomic equilibrium of high-prevalence countries. It therefore appears necessary to account for this economic impact on a nationwide scale, as do the authors of macroeconomic models. They attempt, for example to test certain hypotheses by comparing the evolution of gross national product (GNP) in an HIV epidemic situation with a supposedly non-epidemic growth situation. By using a Solow model, Cuddington made it possible to set out the problems; loss of economic growth, and disastrous consequences on employment and savings due to increase in public and private health expenditure (10). Over suggests the weighting of the epidemic's impact according to the qualification level of the human capital. The use of macro tools applied to the identification and analysis of the processes of malfunctioning that the epidemic inevitably imposes on the organization and structure of the companies. A microeconomic approach facilitates understanding of the different stages, which made it possible to explain more clearly the reasons for the effects present in the macroeconomic models, notably by examination of the behaviour of the actors involved. On the basis of the reactions, either prevailing or potential, of the actors of the industrial sector to the disruptions caused by the epidemic, it is possible to thoroughly examine the impact of HIV/AIDS on firms (11).

The epidemic is already mature in some parts of Africa and its impact on national

productivity is telling. Several studies have found that these effects could be large in some African countries. According to a study by World Bank in 30 sub-Saharan African countries, there will be a reduction of the annual growth rate of GDP of 0.8 to 1.4 percentage points per year and a 0.3 percentage point reduction in the annual growth rate of GDP per capita (11). A simulation model of the economy of Cameroon concluded that the annual growth rate of GDP could have been reduced by as much as 2 percentage points during the 1987-1991 period because of AIDS (12). Other studies in Zambia and Tanzania found that by 2000 and 2010 the GDP would be 5 to 10 percent and 15 to 25 percent lower because of AIDS than it would be if there were no AIDS affecting the population (13,14). Yet another study assessing the impact of AIDS on the economy of Kenya projected that GDP will be 14 percent lower in 2005 than it would have been without AIDS (15).

Kelo assessed the economics and health care system impact of HIV/AIDS in five hospitals in Ethiopia. The study calculated direct and indirect HIV/AIDS related costs by taking the lowest and highest figures as low and high cost scenarios, respectively. In terms of per capita patient cost the low scenario gives US\$ 12.03 outpatient cost and US\$ 24.64 inpatient cost. The high cost scenario per capita outpatient visit costs is US\$ 41.30 and the per capita in patient costs are US\$ 197.00. The total real cost of preventive services will amount to US\$ 56 million in the next ten years. Indirect costs in terms of income loss due to premature deaths over the ten-year period (1997-2006) stood from US\$ 1496 to US\$ 2719 million (16).

### **Microeconomic and Sector-based studies**

The consequences of the epidemic were studied in rural areas, on farming systems and cattle breeding in Tanzania and Zambia. These results have allowed links to be established between the illness, the question of food processing safety and the impoverishment of certain families. Another study on the Kenyan commercial sector has allowed assessment of the categories of costs identified as those induced by medical absenteeism, deaths and recruitment of new employees (17). These costs vary according to the companies and their social policies. For example, it is known that the involvement and participation of firms towards the health of employees varies, a fact, which implies important variations in the cost of HIV/AIDS coverage by employers.

The actual distribution of these costs has been calculated as part of various USAID-funded studies of the private sector impact of AIDS. One study examining several firms in Botswana and Kenya showed that the most significant factors in increased labor costs were absenteeism due to HIV or AIDS and increased burial costs (18). Another study in Zimbabwe found that the major expense was health care costs. The transport company in this study has a large staff of 11,500 workers. Since the company offers significant health benefits to its employees, the cost of AIDS is even higher than for other companies that do not provide such benefits. The study estimated that there are currently more than 3,400 workers who are infected with HIV and 64 who died from AIDS in 1996. The total costs of AIDS to the company in 1996 were estimated at Z\$ 39 million, equal to about 20 percent of the company's profits. More than half of this amount resulted from increased health care costs. By 2005 the cost of AIDS to the company could reach Z\$ 108 million. There may be indirect costs as well. The report speculates that HIV/AIDS will worsen employee

morale and create greater labor-management tensions and cause a labor shortage among skilled positions (18).

Various studies have also examined the total annual cost of AIDS to different companies, as well as the annual cost of AIDS per employee. These studies found that the annual cost of AIDS per employee varied from US\$ 17 to US\$ 300 (18,19).

Increased labor costs can reduce the profits necessary for expansion. This impact on profits can be considerable as seen in Indeni Petroleum Refinery in Zambia that spent US\$ 26,400 on AIDS-related costs in 1994, more than its declared profits of US\$ 25,514 in that year. Another study in South Africa examined the expected impact of AIDS on employee benefits, and thus on corporate profits. It found that at current levels of benefits per employee, the total costs of benefits would rise from 7 percent of salaries in 1995 to 19 percent by 2005. Since these additional costs will have to be paid at the same time that productivity is declining, due to AIDS, the net impact on profits could be significant (18).

Other costs associated with AIDS that firms face include increased insurance premium and cost associated with high labor turn over. Medical aid companies in Zimbabwe have estimated that meeting all the claims of just one percent of HIV-infected members could result in a 31 percent increase in insurance rates. Most of this increase would have to be paid by employers. The Uganda Railway Corporation has been hard hit by AIDS among its employees, experiencing a labor turnover rate of 15 percent per year in recent years (20).

For some smaller firms the loss of one or more key employees could be catastrophic, leading to the collapse of the firm. In others, the impact may be small. Firms in some key sectors, such as transportation and mining, are likely to suffer larger impacts than firms in other sectors. In poorly managed situations the HIV-related costs to companies can be high. However, with proactive management these costs can be mitigated through effective prevention and management strategies.

Assessment of the impact of HIV/AIDS on the economic performance of firms was done in Rwanda, Tanzania, Uganda and Zambia. In the enterprises that cover medical care costs for employees, the costs has increased substantially since 1989. The general finding in all four countries is that reductions in labor output may be imminent. It might have become a serious problem currently as sick leaves and deaths have increased. At the time of the study (1994) the majority of the firms (institutions) covered in the study felt that labor productivity had not yet been affected by AIDS (21).

A study to assess the projected financial impact on businesses of HIV/AIDS, and determine the costs and benefits of HIV/AIDS prevention for businesses was conducted at 2 large factories (one with skilled and the other with predominantly unskilled workers) in Thailand. The results revealed that the financial impact of HIV/AIDS on businesses was found to be very similar for the 2 factories that were analyzed. Each factory was incurring additional expenditures and lost revenues of approximately US\$ 18,000 per year. The factory with predominantly unskilled workers was estimated to incur costs mostly for health care, while the factory with

more highly skilled workers predominantly incurred lost revenues in retraining replacement employees (22).

Aventin and et al studied the cost of AIDS to three manufacturing firms in Cot d'Ivoire to assess the economic consequences of HIV/AIDS. The results showed that the companies are not all affected by HIV/AIDS in the same manner. For example, one firm does not participate in its employees' health costs, whereas for another firm it is the most important cost, that is to say, 25% of the total cost. Thus the cost structure differs from one firm to another. Whether it is medical care for firm 1, productivity loss for firm 2 or sick leave for firm 3, these costs correspond more with the morbidity phase than that of mortality. Consequently, it is the illness and not death, which is ultimately more expensive for the three firms (23).

Yet another study in 3 districts of Kenya in 1999 tried to reflect some of the observed effects of HIV/AIDS on small and micro enterprises (SMEs). The business mortality rate was approximately 64 percent. Twenty percent of household income is paid for medical care and an additional 20 per cent was spent on funeral expenses of which 79 percent were likely to be AIDS related deaths. Moreover, many of the SMEs are completely managed by the individual owners, other family members having little or no knowledge of management of the business. Therefore the loss of the business owners resulted in the enterprises being taken over by inexperienced family members. There was a significant time loss in the care of the sick, when entrepreneurs themselves fell sick and when funeral arrangements had to be made (24).

Bersufekad (1994) assessed the socioeconomic impact of HIV/AIDS on industrial labor forces in 3 industries and 66 establishments in Ethiopia. Among 1297 workers covered 232 were cases of HIV/AIDS. There was a correlation between HIV/AIDS and length of sick leave and nearly 53% of all OPD attendance was HIV/AIDS related. The other finding was that most of the affected workers were those in unskilled and semiskilled positions and therefore in this case it is easy to replace the AIDS related attrition (25).

The impacts on enterprises or firms discussed so far have become serious concerns of employers but many fear that addressing AIDS in the workplace would be too costly, while others are concerned that they do not know how best to approach the issue. Surveys reveal that few companies have established comprehensive prevention, care and support interventions in their workplace. A study of Kenyan companies done by UNAIDS showed that while most managers believed HIV/AIDS would have some effect on their business, only one half of them provided HIV/AIDS education (26). In the early years of the AIDS pandemic little thought was given to the role that businesses might play in HIV prevention, and the workplace was not seen as a major venue for interventions. Since then much has been learned about the pandemic and how it should be fought and in particular that AIDS Prevention and Care are complex issues requiring a multisectoral approach. The business sector and its work places can play a key role in preventing the transmission of HIV, and in caring for and supporting those affected. As the impact of HIV/AIDS on business becomes more visible, business leaders are increasingly seeing the advantages of creating HIV/AIDS programmes for their work places and beyond the work place, for their surrounding communities. HIV/AIDS raises the costs of doing

business, therefore it makes sense to invest in prevention, care and support programmes to stem declining business productivity and profitability (26).

In some countries of Africa and Asia the AIDS impact on its labor force and productivity has made the industry to respond positively to HIV/AIDS through its commitment to the direct need to control the spread of AIDS and remove discrimination against HIV infected people. The major commitments are the establishments of an HIV/AIDS personnel policy, conducting HIV/AIDS campaigns through information and education, condom provision and collaboration with institutions/organizations involved in anti-AIDS campaigns.

### **Measures of productivity**

Productivity is the relationship between the products or services produced and the resources used in their production. Expressed in technical terms, productivity is output per input i.e. it is the ratio of the “outputs” (products produced or services), divided by the “inputs” (the resources used). Productivity is often expressed in terms of specific inputs, e.g. productivity of labor, of capital, of materials, of energy or a combination of various elements.

Due to the various possible combinations of outputs and inputs, there are a variety of productivity definitions and measures that throw light on different aspects of productivity. There is no “right” or “best” productivity measure. Instead, a set or “family” of many productivity measures is needed to reflect the various factors and influences on productivity. The following are examples of productivity measures (27).

A. *Partial productivity* ratios measure output per unit of one type of input,

Examples: - Labor productivity - Output of some kind divided by employees input.

Material productivity- Output divided by unit of material input.

B. *Multifactor productivity* is a measure of output per unit of labor input plus units of one or more type of inputs:

Example: -Capital and labor productivity – Output per unit of labor input plus unit of capital input

C. *Total factor productivity* relates output to the weighted total of all inputs.

Therefore, an organization with a comprehensive productivity improvement effort would probably track a number of the productivity measures and develop its own family of productivity measures that highlight areas of interest to the organization.

Accordingly, the organization's incentive system could also make use of a number of the productivity measures listed above and base bonus payments on measures such as some of partial and multifactor productivity measures.

Of the family of productivity measures partial productivity measure is the most widely used one. When productivity is expressed as output per one type of input, such as output per labor, the measure is referred to as a "partial productivity" measure. The most important is labor, because everything is made for and by people. Therefore the most widely applied partial productivity measure is "labor productivity", that is output per labor. Labor is typically expressed in person-hours or person-days or person-years (28).

Even though “labor productivity” is defined as output per labor input, it does not measure the specific contribution of labor alone, but expresses the joint effect of a number of influences on the utilization of labor in the production or distribution process. Such influences include changes in technology, substitution of one factor of production for another (e.g. capital for labor), utilization of physical capital and lay out, as well as the efforts of the labor force including managers. In other words, “labor productivity” shows how workers produce per hour with all the resources available.

### **Gain sharing**

The proxy indicator of productivity that is used in the present study is incentive or gain sharing. Gain sharing refers to a category of incentive systems that involves a group of employees in the productivity improvement efforts and shares the resulting gains with the group based on its overall performance improvement. Better use of inputs such as labor, capital, materials and energy can create productivity and profitability gains. Gain sharing plans share these gains with employees according to a predetermined formula that reflects the productivity or profitability improvement over historical levels. Nowadays many actual gain sharing plans have evolved to be hybrids of the Scanlon, Rucker, Improshare, and Profit sharing basic plans. Often custom-tailored plans are simply referred to as gain sharing plans, because they are too different and cannot be identified as any particular basic plan. Ultimately, the “correct” gain-sharing plan is the one that labor and management feel is fair, fosters a sense of identity with the organization, and improves productivity and profitability of the organizations. The basic elements of a gain-sharing plan include a system for employee participation in productivity improvement or a group financial bonus payment according to a predetermined formula. Experience indicates that having

elements of both these systems creates an optimal synergy to bring about the greatest improvement. It is possible to have a successful incentive system that only has an employee participation system. The non-financial reward in that case is being a sense of belonging, higher sense of accomplishment and appreciation of worth that management fosters amongst employees. Similarly, paying employees a financial bonus without an employee participation system can also improve performance.

Occasionally the definition of productivity is debated with respect to gain sharing. As discussed earlier it is acceptable to define productivity as output over input in financial (as opposed to physical) terms if the figures are deflated. Also, comparisons of changes in value added over input (deflated) are equally valid measures of productivity improvement. Productivity purists may note that the Scanlon and Rucker bonus measurements are input over output and therefore are technically the inverse of productivity. However, what is important to note is that these plans, therefore, are generally referred to as productivity sharing plans, because they are based on real relationships between output and input (29).

Studies so far done evaluated the aggregate impact of HIV/AIDS at micro and macro level; to my knowledge no study has assessed the effect of HIV infection on labor productivity. The present study has assessed the effect of advancing HIV infection on workers productivity in factory.

## **OBJECTIVES**

### **GENERAL OBJECTIVE**

To assess the economic impact of HIV infection in a cohort of factory workers from the perspective of industrial productivity.

### **SPECIFIC OBJECTIVES**

1. To assess different measures of performance and productivity (sick leave, individual monthly/annual output) and compare with the individual worker's HIV status.
2. To assess the changes in workers output and attendance associated with advancing HIV infection.
3. To determine costs incurred by the factory due to illness and death related to HIV/AIDS.

## **SUBJECTS AND METHODS**

### *Description of the study area and subjects*

The study was conducted at Akaki, a suburb of Addis Ababa. The source population is employees of Akaki Fibre Products Factory. The study population mainly includes operators of the factory machinery and their assistants. The factory has 1572 workers, 1276 of whom are permanent employees. Among the permanent employees of the factory those who were younger than 45 years old and willing to participate were included in the cohort study of ENARP. The factory produces different types of sacks for grain, coffee, flour etc. It was not profitable during most times of the previous regime when it was under National Textile Corporation. In 1992, the administration was restructured and started to be administered by board. Since 1997, it became profitable probably reflecting the impact of the new organizational structure and the free market economy. The factory was losing more than 3 million Birr yearly from 1991 to 1996 except one year (1994) when it lost 1.8 million Birr. It profited more than 3 million Birr in 1997 and 1998. The profit declined in 1999 (1.5 million Birr) and 2000 (600,000 Birr) due to shortage of raw materials and Ethio-Eritrean conflict.

The study population is cohort of workers participating in a study to determine the progression of HIV-1 infection by ENARP since February 1997. As an incentive to participate factory workers and their families are offered free medical care in ENARP project clinic.

During the planning stage of the study the factory management were asked

permission to conduct the study. A team from ILO, ENARP and Addis Ababa University visited the factory and saw the whole production process. At the time of the visit, permission was obtained to collect data on all variables that measure productivity.

### *Design and sampling*

The study is a retrospective cohort. Secondary data on the variables were collected from the factory and ENARP records over a period of 4 years (January 1997 – December 2000).

Among the cohort participants those workers in job category with incentive were eligible for the study. Among the total of 797 workers in the ENARP cohort, 695 have incentive payment. Incentive is calculated based on individual output or effort or the average output of a section. A study number is given sequentially to the study subjects after all subjects are arranged in alphabetical order of job categories. All workers in the factory have their own identification number i.e. factory number. We retrieved the factory number of all the 695 study subjects and linked with the study number for identification of the subject in the financial and personnel records. Complete records were retrieved for 676 workers.

The collected data was checked for completeness, clarity and consistency by the principal investigator. Any error or ambiguity was corrected and clarified promptly. For subjects who have died or left the factory or recently employed workers, record extraction formats are filled up to the month the worker is in the factory out of the 48 months, the study period.

### *Data collection tools*

The factory keeps financial and personnel records in the respective departments. Data on the amount of incentive pay can be obtained from the monthly payroll in the Finance Department. A leaf of payroll contains list of 20 workers. The data collectors identified each study subject from all the factory workers in the payroll and record the amount of incentive earned in each month during the study period. Data on absenteeism was obtained from the Personnel Department. Each worker has time controlling card which serves for 12 months. The cards are filled by timekeepers daily whether the worker is on work, sick leave, annual leave, mourning leave, cooperation leave, maternity leave or absent. Therefore information on absenteeism was obtained from the cards for the 4-year period. Data on sociodemographic variables and HIV status is obtained from the ENARP records. Five data collectors for the financial department and four for the personnel department extracted the data. The principal investigator coordinated and supervised the data collection process.

Data was collected using a Record Extraction Form (REF) prepared based on the variables the study is interested in. The form consists of different variables such as absenteeism (number of days out of work), burial cost, death benefits and individual productivity measures (amount of incentive an individual gets).

The factory has expected range of performance level in each section from the workers. Those that produce more receive higher monetary incentive. Therefore, for measure of productivity the presence or amount of incentive retrieved from the

financial records will be used. Level of performance of each worker is measured and recorded by the section boss. The measurement is on the weight of raw material processed, the number of thin and thick thread bobbins produced and the number of sacks sewn in the respective sections of the production process. This is converted into monetary incentive based on a scale in the different sections.

*Variables for the study*

*Dependent variables*

- Absenteeism- is the number of days out of work in a year due to sick leave or absence of terminally sick patient.
- Productivity- is measured in terms of the amount of monthly incentive earned by a worker.
- Burial costs – the amount of money the factory has paid for burial arrangement.
- Death benefits – the amount of money the factory has paid to the family of a deceased worker.
- Funeral attendance cost – the number of workdays lost due to funeral attendance when a factory worker died.

### *Independent variables*

- HIV serological status
- CD<sub>4</sub> counts
- Viral load
- Clinical stage of HIV infection
- Sociodemographic variables

### *Data entry, processing and analysis*

Data entry is done by the principal investigator and data entry clerks. The principal investigator has processed and analyzed the data using statistical soft wares that include SPSS and STATA.

### **ETHICAL CLEARANCE**

Ethical clearance had already been obtained for the ongoing cohort study on the natural history of HIV-1 infection by ENARP from the national ethical clearance committee. This research was conducted after getting approval from the ethical clearance committee of Addis Ababa University Medical Faculty. All information will be kept strictly confidential, and a code number is used to preserve the anonymity of the Record Extraction Format.

## RESULTS

### **Sociodemographic characteristics of the study subjects**

A total of 676 individuals working in Akaki Fiber Products Factory in Addis Ababa were enrolled in the study. The sociodemographic characteristics of the study subjects are summarized in table 1. Accordingly, the ages of the study subjects ranged between 20 and 46 (mean,  $35.7 \pm 6.01$ ) and 75% of them are in the age group 20 – 40 years. Majority of the study participants had little education (67.5% were grade 6 or less), are married (79.6%), and (86.4%) had at least one child. Slightly more than half, 351(51.9%), of the participants were males and 325(48.1%) were females with male to female ratio 1.08.

The majority of the study participants identified themselves with Oromo and Amhara ethnic group. The great majority were residents of Akaki area (96.3%). Majority of study participants had household sizes ranging between 2 and 7 (84.4 %). Monthly income of the majority of the study participants (68%) is less or equal to 300 Eth. Birr.

Table 1: Distribution of study participants by sociodemographic characteristics in Akaki

Fiber Products Factory, Akaki, 2001

Variable	n	%
<b>Age (years)</b>		
Less than 35	304	45.0
Above 35	372	55.0
<b>Sex</b>		
Male	351	51.9
Female	325	48.1
<b>Educational status</b>		
Below secondary	456	67.5
Secondary and above	220	32.5
<b>Marital status</b>		
Married	534	79.0
Unmarried	142	21.0
<b>Monthly income</b>		
≤ 300	461	68.2
>300	215	31.8
<b>Family size</b>		
1 – 4	277	41.0
5 – 12	399	59.0
<b>Experience (years)</b>		
<10	178	26.3
10+	498	73.7
<b>Alcohol drinking habit</b>		
No	329	46.7
Yes	347	53.3
<b>Chat chewing habit</b>		
No	601	88.9
Yes	75	11.1
<b>Cigarette smoking habit</b>		
No	359	53.1
Yes	317	46.9
<b>Residence</b>		
Akaki	651	93.3
Outside Akaki	25	3.7

### HIV prevalence and related factors

HIV serological test result was obtained for all studied subjects at enrollment. The

association between HIV infection and sociodemographic characteristic among the factory workers is depicted in table 2.

The prevalence at the beginning of the cohort study was 12.7%. It was 16.8% and 9.4% respectively in the age group below 35 and above 35 respectively. This difference is statistically significant (OR=1.94; 95% CI =1.22,3.07). However, this association was not significant in the multivariate analysis (OR=1.22, 95% CI= 0.68, 2.19). HIV prevalence tended to decrease with age ( $p < 0.005$ ; test for trend).

Females have slightly higher prevalence than males. Prevalence in females was 13.8% while it was 11.7 % in males even though the difference is not statistically significant. The prevalence of HIV among the widowed was 40.7% as compared to 9.7% in the married ones. Being widowed is associated with HIV infection as compared to the married ones (OR = 6.43, 95% CI =2.65, 15.61) in bivariate analysis, but this association disappeared in multivariate analysis.

HIV seroprevalence was also high among workers who were single and separated, 20.3% and 21.3 % respectively as compared to those who were married (9.7%). Being unmarried was associated with HIV infection as compared to being married (OR = 2.38, 95% CI= 1.43, 3.97) in multivariate analysis.

Household size was also associated with HIV infection in multivariate analysis, i.e. workers with smaller family size were at increased risk of HIV infection (OR =2.48, 95% CI= 1.56, 3.94). The number of years working (experience) in the factory is

associated with low prevalence of HIV infection in multivariate analysis (OR=0.52, 95% CI=0.29, 0.95).

Monthly income, educational status and alcohol drinking habit were not associated with HIV infection. The factors independently associated with HIV infection in multivariate analysis are shown in table 2.

Table 2: Association of socio demographic characteristics and HIV serological status in Akaki Fiber Products Factory, Akaki, 2001

Variable	HIV serological status				Crude OR (95% CI)	Adjusted OR (95% CI)
	+ve		-ve			
	n	%	n	%		

<b>Age (years)</b>						
35+	35	9.4	337	90.6	1	
<35	51	16.8	246	83.2	1.94(1.22, 3.07)*	1.22 (0.68, 2.19)
<b>Sex</b>						
Male	41	11.7	310	88.3	1	
Female	45	13.8	280	86.2	1.21 (.77, 1.91)	1.70 (0.73, 4.13)
<b>Marital status</b>						
Married	52	9.8	482	90.2	1	
Unmarried	34	23.9	108	76.1	2.92 (1.81,4.72)*	2.38 (1.43, 3.97)*
<b>Family size</b>						
5 - 12	34	8.5	365	91.5	1	
1 - 4	52	18.8	225	81.2	2.48 (1.56,3.94)*	1.81 (1.10, 2.98)*
<b>Educational status</b>						
Sec. and above	27	12.3	193	87.7	1	
Below secondary	59	12.9	397	87.1	1.06 (0.65, 1.72)	.63 (0.35, 1.15)
<b>Monthly income (Eth. Birr)</b>						
≤300	55	11.9	406	88.1	1	
>300	31	14.4	184	85.6	1.24 (0.78, 1.99)	1.75 (0.94, 3.25)
<b>Experience</b>						
10+	49	9.8	449	90.2	1	
<10	37	20.8	141	79.2	2.40 (1.50, 3.83)*	1.91 (1.05, 3.47)*
<b>Alcohol drinking habit</b>						
No	42	12.8	287	87.2	1	
Yes	44	12.7	303	87.3	0.99 (0.63, 1.56)	1.49 (0.72, 3.12)
<b>Chat chewing habit</b>						
No	75	12.48	526	87.52	1	
Yes	11	14.7	64	85.3	1.20 (0.61, 2.38)	1.05 (0.51, 2.20)
<b>Cigarette smoking habit</b>						
No	41	11.4	318	88.6	1	
Yes	45	14.2	272	85.8	1.28 (0.82, 2.01)	1.18 (0.71, 1.99)

\*Significant at  $p < 0.05$

### Productivity and related factors

Incentive payment is used as a proxy indicator of productivity. Table 3 shows the mean incentive earnings for the 676 study subjects at baseline (in 1997) and four years later (in 2000).

At base line the mean incentive earnings ( $\pm$  standard error) of workers aged 35 years and above were more than those less than 35 years with values  $239 \pm 15$  Eth. Birr and  $188 \pm 5$  Eth. Birr respectively. This difference is statistically significant in bivariate analysis.

The mean incentive earned by males is greater ( $242 \pm 16$  Eth. Birr) than that of females ( $189 \pm 5$  Eth. Birr) and the difference is statistically significant in bivariate analysis. Workers with experience of 10 years and above earn more incentive (mean =  $235 \pm 12$  Eth. Birr) than those with lower work experience (mean =  $164 \pm 5$  Eth. Birr). This difference is also statistically significant in bivariate analysis.

Those who drink alcohol get comparably more incentive (mean =  $237 \pm 16$  Eth. Birr) than non-drinkers (mean =  $195 \pm 5$  Eth. Birr) and the difference is statistically significant in bivariate analysis but not in multivariate analysis.

The aggregate mean incentive of HIV positive workers ( $173 \pm 9$  Eth. Birr) is less than that of HIV negative workers ( $223 \pm 10$  Eth. Birr). However, the difference is not statistically significant. No association was found between incentive earning and factors such as marital status, monthly income, chat chewing and cigarette smoking. On the other hand, four years later HIV positives earn 57% ( $51 \pm 7.48$  Eth. Birr) less incentive than HIV negatives ( $80 \pm 3.50$  Eth. Birr) and the difference is statistically significant.

Table 3 also demonstrates the mean incentive earnings for 753 study subjects four years later in 2000. The mean incentive payment in 2000 is higher for workers 35

years and older ( $90.18 \pm 4.79$  Eth. Birr) as compared with that paid for the younger ones ( $59.92 \pm 3.99$  Eth. Birr), which is statistically significant in bivariate analysis ( $p = 0.000$ , 95% CI = 18.03, 42.48).

Workers who attained secondary and above educational level get less incentive (mean=  $57.33 \pm 5.23$ ) than the others (mean=  $86.00 \pm 4.02$ ), which is statistically significant ( $p = 0.000$ , 95% CI of the mean difference (MD) = 15.71, 41.64). Employees with work experience of 10 years and above earn more incentive (mean =  $86.34 \pm 4.03$ ) than those with less experience (mean =  $48.80 \pm 4.19$ ). This difference is also statistically significant ( $p = 0.000$ , 95% CI of MD = 26.12,48.95).

Those who earn monthly salary of 300 Eth. Birr and below get higher incentive than those with higher salary. This difference is also statistically significant ( $p = 0.000$ , 95% CI of the mean difference =20.98,44.95). Those with positive HIV serology get significantly less incentive earning (mean =  $51 \pm 7.48$  Eth. Birr) than seronegative subjects (mean =  $80 \pm 3.50$  Eth. Birr).

The mean incentive earning is higher in subjects with lower education, lower income, higher family size and more work experience. This difference is statistically significant in bivariate analysis.

Table 3: The association between incentive earnings in Birr (mean) in 1997 and 2000 with HIV serological status and other selected variables in Akaki Fiber Products Factory, Akaki, 2001

Variable	Mean incentive in 1997 n=676	95% CI of the mean difference	Mean incentive in 00 (n=653**)	95% CI of the mean difference
<b>Age (years)</b>				
35+	239.48	17.32, 85.90*	90.18	18.03, 42.48*
<35	187.87		59.92	
<b>Sex</b>				
Male	241.70	18.77, 87.02*	78.53	-8.97, 16.38
Female	188.81		74.82	
<b>Marital status</b>				
Married	220.74	-20.83, 63.41	76.00	-19.73, 12.30
Unmarried	199.46		79.72	
<b>Family size</b>				
5 –12	229.39	-2.81, 66.84	82.29	1.50, 26.48*
1 – 4	197.38		68.30	
<b>Educational status</b>				
Below sec.	224.94	-9.97, 63.21	86.00	15.71, 41.64*
Sec. and above	198.32		57.33	
<b>Monthly income (Eth. Birr)</b>				
≤300	208.40	-61.57, 12.06	87.19	20.98, 44.95*
> 300	233.16		54.22	
<b>Experience</b>				
10+	234.91	45.88, 95.70*	86.34	26.12, 48.95*
<10	164.13		48.80	
<b>Alcohol drinking habit</b>				
Yes	236.81	8.70, 75.70*	78.74	-8.59, 16.79
No	194.61		74.64	
<b>Chat chewing habit</b>				
Yes	222.91	-47.20, 62.13	70.89	-26.71, 13.52
No	215.44		77.49	
<b>Cigarette smoking habit</b>				
Yes	217.86	-29.74, 35.71	70.76	-23.84, 1.60
No	214.87		81.88	
<b>HIV status</b>				
Negative	222.62	-1.51, 101.26	79.77	12.29, 45.07*
Positive	172.74		51.09	

\* Significant at p< 0.05

\*\* 23 subjects has died or left the factory

Table 4 demonstrates results of multivariate analysis for predictors of incentive earnings in the four-year period (1997 to 2000). Among the predictors of incentive earnings in 1997, only illness (sick leave) and gender were found to be significant. That is to say as one goes from male (1) to female (2) controlling the effect of all the other covariates in the model there will be reduction in incentive earnings by about 54.00 Birr. In another example, a worker who was on sick leave for 10 days earned 21.00 Birr less incentive due to his/her absence only controlling the effect of all the other covariates in the model. All the other variables included in the model showed no significance. But in the following years (1998, 1999 and 2000) HIV status and work experience consistently became significant predictors of productivity. Since those workers who were HIV positive were found to earn significantly less incentive and experienced workers earned significantly more incentive. Sick leave also continued to be significant predictor of productivity.

Table 4: Multivariate linear regression analysis of predictors of incentive earnings in Birr (labor productivity) over four-year period in Akaki Fibre Products Factory, Akaki, 2001

Variable	1997		1998		1999		2000	
	$\beta$	t-ratio	$\beta$	t-ratio	$\beta$	t-ratio	$\beta$	t-ratio
Constant	303.61		209.08		232.30		107.48	
Sex	-54.41*	-2.26	-28.03*	-3.50	-38.73*	-3.83	-12.70	-1.48
Educational status	-13.77	-1.52	-12.49*	-4.16	-19.90*	-5.23	-13.60*	-4.34
Experience	2.23	1.92	0.861*	2.24	1.09*	2.23	1.40*	3.40
Family size	1.77	0.41	-1.02	-0.71	-0.68	-0.37	1.42	0.92
Alcohol drinking	0.21	0.03	-3.87	-1.48	-4.24	-1.28	-2.36	-0.84
HIV status	-28.48	-1.07	-30.27*	-3.46	-50.48*	-4.54	-28.67*	-3.03
Sick leave	-2.10*	-2.88	-0.68*	-3.43	-0.28	-1.16	-0.47*	-2.10

\* Significant at  $p < 0.05$

As shown in table 5 only minimal differences were seen in the mean sick leaves given to the study subjects between the categories of the sociodemographic variables at baseline (1997) and four years later (2000). HIV positives were given 64% more sick leaves than those HIV negatives in 1997, which is statistically significant ( $p=0.018$ , 95% CI of the mean difference = -9.01, -0.65). In 2000 HIV positive subjects were given 81% more sick leaves than HIV negatives, which is statistically significant ( $p=0.012$ , 95% CI of the mean difference = -11.84, -1.28).

Table 5: The association between sick leaves given (mean) in 1997 and 2000 with

HIV serological status and other selected variables in Akaki Fiber  
Products Factory, Akaki, 2001

Variable	Mean sick leave 1997 (n=676)	95% CI of the mean difference	Mean sick leave 2000 (n=653**)	95% CI of the mean difference
<b>Age (years)</b>				
35+	7.67	-2.97, .66	8.38	-3.26, .97
<35	8.83		9.52	
<b>Sex</b>				
Male	7.90	-2.41, 1.21	8.12	-3.71, .51
Female	8.50		9.72	
<b>Marital status</b>				
Married	8.19	-2.25, 2.20	8.98	-2.19, 2.99
Unmarried	8.21		8.58	
<b>Family size</b>				
5 – 12	8.10	-2.07, 1.61	9.67	-.25, 4.03
1 – 4	8.33		7.78	
<b>Educational status</b>				
Below sec.	8.22	-1.84, 2.02	9.39	-.72, 3.78
Sec. and above	8.13		7.86	
<b>Monthly income (Eth. Birr)</b>				
≤300	8.30	-1.62, 2.27	8.88	-2.31, 2.22
>300	7.97		8.93	
<b>Experience</b>				
10+	8.44	-1.12, 2.99	8.92	-2.28, 2.51
<10	7.50		8.81	
<b>Alcohol drinking habit</b>				
Yes	8.00	-2.21, 1.41	8.08	-3.78, .43
No	8.40		9.75	
<b>Chat chewing habit</b>				
Yes	7.75	-1.62, 2.27	9.29	-2.91, 3.81
No	8.25		8.84	
<b>Cigarette smoking habit</b>				
Yes	7.63	-2.87, .76	8.88	-2.13, 2.10
No	8.69		8.90	
<b>HIV status</b>				
Negative	7.58	-9.01, -0.65*	8.06	-11.84, -1.28*
Positive	12.41		14.62	

\* Significant at  $p < 0.05$

\*\* 23 subjects has died or left the factory

As shown in Table 6 HIV status was also the only significant predictor of illness (sick leaves given) both in 1997 and 2000. One also notes the fact that the magnitude of

the coefficient is higher in 2000 than in 1997.

Table 6: Multivariate linear regression analysis of predictors of Illness (sick leave) at baseline and 4 years later in Akaki Fibre Products Factory, Akaki, 2001

Variable	1997		2000	
	$\beta$	t-ratio	$\beta$	t-ratio
Constant	12.176		11.05	
Age	-0.06	-0.72	-0.10	-1.04
Sex	-0.57	-0.43	1.03	0.66
Educational status	0.01	0.02	-0.24	-0.41
Alcohol drinking	-0.17	-0.39	0.07	0.14
Cigarette smoking	-0.21	-1.65	-0.04	0.79
Chat chewing	-0.45	-0.51	-0.28	-0.27
HIV status	4.85*	3.51	6.35*	3.95

\* Significant at  $p < 0.05$

To see the effect of advancing HIV infection on labor productivity and number of days on sick leave test for trend was done among different categories signifying the level of HIV infection as depicted in tables 7, 8, and 9. Table 7 shows that there is significant reduction in incentive earning and significant increase in days on sick leave as CD<sub>4</sub> count declines ( $p < 0.01$ ; test for trend).

Table 7: The association between CD<sub>4</sub> count per ml and the median incentive earnings (labor productivity) in the first year after enrolment (1997) in the cohort in Akaki Fibre Products Factory, Akaki, 2001

Category	n	Median incentive	Z-ratio for trend	Median sick leave	Z-ratio for trend
HIV-	596	172.99		5.0	
HIV+ with CD <sub>4</sub> > 500	16	159.3	-2.75 ( $p=0.01$ )	6.5	3.01 ( $p= 0.01$ )
HIV+ with CD <sub>4</sub> 200-499	46	145.22		10.5	
HIV+ with CD <sub>4</sub> <200	18	142.10		8.5	

Table 8 demonstrates that there is significant reduction in incentive earning and significant increase in days on sick leave as the viral load in the serum increases ( $p < 0.00$  and  $p < 0.01$  respectively; test for trend).

Table 8: The association between viral load in log copies per  $\mu\text{l}$  and median incentive earning in the first year after enrollment (1997) in Akaki Fibre Products Factory, Akaki, 2001

Category	n	Median incentive	Z- ratio for trend	Median sick leave	Z- ratio for trend
HIV -	596	172		5	
HIV+ load <1.99	6	199.44	-3.15 (P=0.00)	4	2.58 (P=0.01)
HIV+ load 2 – 3.99	35	146.46		8	
HIV+ load 4 - 4.99	30	142.93		6.5	
HIV+ load >5	13	139.04		7	

Table 9 shows that incentive earning tends to decline and days on sick leave tend to increase with advancing clinical stage of HIV infection ( $P < 0.00$  and  $p < 0.03$  respectively; test for trend).

Table 9: The association between clinical stage of HIV infection and median incentive earning in the first year after enrollment (1997) in Akaki Fibre Products Factory, Akaki, 2001

Category	n	Median incentive	Z- ratio for trend	Median sick leave	Z- ratio for trend
HIV -	596	172.99		5	
Stage 1	52	145.54	-3.22 (p=0.00)	8	2.19 (p=0.03)
Stage 2	18	143.92		8.5	
Stage 3	13	151.78		6	
Stage 4	0				

### **Assessment of HIV/ AIDS related Costs**

The study participants have the privilege of getting services both from the ENARP and factory clinics. The former provides medical services in the morning hours of Monday to Friday while the latter works seven days a week. Therefore a worker goes to either of the two clinics depending on his/her preference, urgency and convenience. The total medical cost of the factory over the four-year period is 253,230.00 Eth.Birr and the profit the factory has made during the same period is 8,884,748.00 Eth. Birr. On the basis of the number of cases of HIV infection and the records obtained from the factory, the costs incurred due to HIV infection over the four-year period was estimated.

The result of this estimate is presented in Table 10. Among the various functional impairments and problems that HIV/AIDS has caused in the factory, the costs were estimated for some of them. The total cost incurred due to HIV/AIDS to the factory over the four-year period was Eth. Birr 244,960, which is 2.76% of the factory profits during this time. This is the estimate of the cost of medical care, sick leave, absenteeism, attendance at funeral, lost productivity and funeral costs. The lion's share is taken by lost productivity cost (42.7%), followed by medical care cost (25.7%) and sick leave cost (21.7%). The factory's HIV/AIDS related medical cost (63,305.00) is 25% of the total medical expenditure of the factory for all its employees (253,230.50 Eth. Birr).

Table 10: Financial expenditure by Akaki Fibre Products Factory attributable to HIV over four year period (1997 – 2000), Akaki, 2001

<b>Category</b>	<b>Costs in Eth.Birr</b>	<b>Percentage</b>
Medical care	63,308	25.8
Sick leave	53,042	21.7
Absenteeism (terminal phase)	8279	3.4
Attendance at funeral	3114	1.3
Lost productivity (overtime)	104,617	42.7
Funeral costs	12,600	5.1
<b>Total</b>	<b>244,960</b>	<b>100.00</b>

## **DISCUSSION**

The HIV/AIDS epidemic has had consequences at all levels of society in sub-Saharan Africa (11). The economic impact of HIV/AIDS has primarily been studied at three levels, the macroeconomic, the household and at the sector or industry level. At the macroeconomic level the impact has been estimated in Tanzania, Cameroon and Ethiopia among others (10,12,16). These studies have postulated that HIV/AIDS will likely have a deleterious economic consequence within the next 20 years but its current impact is largely unknown. The impact of HIV on individual households has been also estimated in Cote d'Ivoire, Uganda, and South Africa (30,31,32). At this level it has been shown that up to 67% decrease in average income can be expected with one HIV infected household member. The consequences and impact of HIV on the industrial sector have been estimated in countries such as Tanzania, Zimbabwe, Zambia and Kenya, (7,17, 18).

There exists very little quantitative assessment of impact at the level of the work place, at least in published literature. The few studies available in this setting evaluate the impact in terms of factory expenditures, but do not address economic issues or quantify workplace impact on labor productivity and absenteeism (23). The present study has tried to address this issue. It has analyzed the socio demographic characteristics and other factors associated with HIV infection and labor productivity and absenteeism among factory workers. The findings indicate an overall high seroprevalence of 12.7% (11.7% for men and 13.8% for women) among a population of mostly married factory workers in a suburb of Addis Ababa. This indicates an alarming progression of the infection since the HIV prevalence rates were 6.0% and 6.9% for men and women respectively in a community based sero

prevalence study conducted in Addis Ababa in 1995 (1).

In the present study, HIV prevalence was higher among workers younger than 35 years (16.8%) whereas in the age group 35 years and above the prevalence was lower (9.4%). Even though the difference was not statistically significant in multivariate analysis, it was significant in bivariate analysis. This might be related to their low risk sexual behaviour, as most could be married as well as faithful to their partner as age increases. Higher HIV prevalence was observed among the widowed (40.7%) and separated (21.3%) workers, compared to married ones (9.7%). This association was statistically significant in bivariate but not in multivariate analysis. Being unmarried was associated with HIV infection as compared to being married in multivariate analysis. This might be related to risky sexual behaviour (having multiple sexual partners) in separated and single groups as compared to married ones. The highest prevalence in the widowed might reflect the magnitude of AIDS deaths in the population. The loss of significance in multivariate analysis is due to the small number of widowed and separated workers in the sample. Workers with smaller family size (1-4) have significantly higher HIV prevalence than those with larger family size (5-12) in multivariate analysis. This might be related to the higher rate of risky previous sexual behaviour in single and recently married ones (smaller family size) than those with larger family size.

The primary objective of this study was to quantify differences in productivity and absenteeism between HIV positive and HIV negative workers over the study period (1997 – 2000) and see the effect of advancing HIV infection. For this purpose incentive earning is used as a proxy indicator of productivity. Analysis of the

baseline data (1997) showed no association between HIV seropositivity and incentive earning. The mean incentive earnings were 173 Eth. Birr and 223 Eth. Birr for HIV positives and negatives respectively. The only significant predictors of productivity in bivariate analysis were work experience, age, gender and alcohol drinking habit. This could be due to the higher proportion of HIV infected workers were in early phase of the spectrum of HIV infection (asymptomatic carriers) at baseline (1997). More incentive earned in alcohol drinkers might be explained by the confounding effect of gender due to the fact that the great majority of alcohol drinkers (90%) are males who are found to earn significantly more incentive than females. This association disappeared for all covariates except sick leave and gender when entered to a multivariate model.

Then as of 1998 the incentive earnings of HIV positive workers were found to be significantly less (e.g. mean 2000 =51.99 Eth Birr) than those of HIV negative (e.g. mean 2000 =79.77 Eth. Birr) in multivariate analysis. This may be explained by progression of the HIV infection causing negative effect on the productivity of the affected worker since sick and worried workers are less productive than happy, healthy workers (14). In 2000 the days on sick leave of HIV positive subjects were also significantly higher than that of HIV negatives (81% more). The mean number of days on sick leave was 14.62 and 8.06 for HIV positives and negatives respectively.

Decline in CD<sub>4</sub> count, increase in viral load and progression of clinical stage significantly reduce incentive earnings and increase the number of days on sick leave. This finding demonstrates the impact of advancing HIV infection on labor

productivity and illness episodes a person gets.

The costs incurred by HIV positive workers are predominantly divided between productivity losses (42.7%), medical care costs (25.8%) and sick leave costs (21.7). The findings are comparable to a study in Cote d'Ivoire in three firms where medical care cost was the most important in one firm and productivity loss or sick leave costs in the others depending on whether the firm participates in its employees' health costs (23). The medical expenditure is not prominent in this study because all the study participants and their families utilize the free medical service of ENARP project clinic at Akaki that provides better service than the factory clinic. As in other studies (23,) the predominant costs in this study correspond more with the morbidity phase than the mortality. Consequently it is the illness and not death that is more expensive for the factory.

## **STRENGTH AND LIMITATIONS OF THE STUDY**

As one of possibly few studies relating HIV status and productivity it gives a clue about the association between these factors. The study has objectively assessed the impact of HIV on labor productivity and absenteeism. Comparison of measures

of productivity was made at two points (1997 and 2000) between HIV positives and negatives and different levels of HIV infection to see the effect of advancing disease. Costs incurred by the factory due to HIV/AIDS are calculated directly using the costs the factory has incurred on all HIV/AIDS cases and deaths rather than using average costs and some assumptions of prevalence and natural history of HIV. Multivariate analysis using multiple linear regression model was performed to control for possible confounding effect of all other variables.

The use of incentive instead of actual output might have affected the measurement of labor productivity. Another limitations of this study is the cost calculated here account only those accrued to the factory currently and do not take into considerations future pension fund losses. This future impact on pension funds and insurance schemes could further increase the costs of the enterprise. The provision of free medical service at ENARP clinic has definitely underestimated the strain HIV/AIDS is causing on the medical care budget of the factory.

## **CONCLUSION AND RECOMMENDATIONS**

In the multivariate analysis the factors independently predicting labor productivity are work experience and HIV status. That is to say HIV positive workers earn significantly less incentive payments than HIV positive workers and those workers with more work experience earn significantly better incentive earnings than those

with less experience. The advancement of HIV infection tends to reduce incentive earnings significantly and increases illness episodes manifested by more sick leave days. Generally the study concludes that HIV infection had direct impact on worker's productivity and absenteeism.

Based on these finding the following recommendations are drawn.

1. Workplace HIV/AIDS policy that addresses issues related to HIV positive workers (Fight discrimination against HIV infected workers, right to work, right to get extended leaves in time illnesses etc.) should be instituted in no time.
2. Antiretroviral drugs should be imported tax free and provided to enterprises to improve quality of life and survival of HIV infected workers thereby increasing labor productivity.
3. Defensive strategy should be adopted by enterprises to mitigate the impact of HIV/AIDS on their operation e.g., by reorganizing the work process, increasing functional flexibility, or adapting their social policy.
4. Further prospective studies about the impact of HIV/AIDS on enterprises, the workers, and their families are recommended.

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## **ANNEX 1**

### **OPERATIONAL DEFINITIONS**

*Medical care cost:* This represents the cost of the medical expenditure incurred by the factory

*Sick leave:* This is a measure of the absences of employees due to illness and is justified by sick leave. The cost is calculated by the number of work hours paid and not those actually worked.

*Absenteeism (terminal phase):* In the terminal phase, a few months before death, there is the possibility of regular absence by sick employees and without the usual compliance with sick leave formalities, a situation that makes precise assessment absenteeism somewhat difficult.

*Funeral attendance:* During funerals of deceased employees, personnel representatives or trade union officials, along with other employees, attend and participate on behalf of the company. The company meets the delegation's traveling expenses.

*Lost productivity:* Productivity loss corresponds to the reduction in work capacity of sick employees. Replacing the sick or absent HIV positive workers other colleagues do the job by being paid overtime. The overtime paid to the worker, replacing the sick employee estimates the lost productivity. It is estimated by calculating the number of days missed, and then multiply their daily wage by 1.25 to account for overtime for all subjects. Overtime is paid depending on the shift the overtime is worked (by 1.25 on day shift, by 1.5 on night shift, by 1.75 on Sundays and by 2 on holydays.

*Funeral costs:* This concerns company financial participation in the funeral of late

employees, notably a cash donation to the family of the deceased, purchase of a coffin, payment of expenses for transporting the body to the village, etc.

*Incentive:* the amount of money paid to a worker when he/she produces more than the expected level of performance per day, which is measured as the amount of raw material processed or weaving material produced by each operator working on a machine.

*Cigarette smoking:* - one is considered a smoker if he/she smokes 1 or more cigarettes per day.

*Alcohol drinking habit:* - a study participant is taken to be alcohol drinker if he/she drinks any beverage containing alcohol three times per week.

*Chat chewing habit:* - one is considered to have chat chewing habit if he/she chews chat at least once per week.

## ANNEX 2

### Data collection form

/ HIV Cohort Study	Enrollment Questionnaire (Akaki)	ENR
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**Starting time of the interview:** \_\_\_\_\_

1. Participant's Code Number:
2. Date of visit:        dd-mm-yy day, month, year (Gregorian calendar)
3. Interviewer's name:
4. Factory :            01. Fibre  
                              02. Metal  
                              03.
5. Weight                \_\_\_ kg  
                              99. unknown
6. Height                \_\_\_ cm  
                              999. unknown

*Explain the purpose of the questionnaire:*

- . *evaluation of the individual health status*
- . *evaluation of the risk of HIV/AIDS epidemic for the community by assessing individuals' behaviours*

**STRESS THAT ALL INFORMATION IS KEPT STRICTLY CONFIDENTIAL, AND THAT A CODE NUMBER IS USED TO PRESERVE ANONYMITY OF THE QUESTIONNAIRE**

### DEMOGRAPHICS

7. Gender                1. male  
                              2. female  
                              9. unknown
8. What is your current residence ?
  1. Akaki
  2. Kaliti
  3. Addis Ababa
  4. Other
  9. unknown

9. To which occupational category do you belong ?

- 01. field worker
- 02. administrative/office
- 03. factory worker
- 04. maintenance/garage
- 05. medical
- 06. housewife
- 07. students
- 08. supportive personnel (driver, cleaner...)
- 88. other
- 99. unknown

10. How old are you ?

- \_\_\_ years
- 77. refuses to answer
- 99. unknown

11. What is your ethnic group?

- 01. Amhara
- 02. Oromo
- 03. Tigray
- 04. Gurage
- 05. other
- 06. mixed
- 77. refuses to answer
- 99. unknown

13. Which level of education did you achieve ?

- 1. less than grade 1
- 2. grade 1-6
- 3. grade 7-12
- 4. grade 12 completed, without further education
- 5. education after grade 12
- 7. refuses to answer
- 9. unknown

14. How many people live permanently in your house ?

- \_\_\_ number of people
- 99. unknown

15a. What is your monthly personal income?

1. < 100 Birr
2. 100 - 199 Birr
3. 200 - 299 Birr
4. 300 - 399 Birr
5. 400 - 999 Birr
6. > 1000 Birr
7. refuses to answer
9. unknown

15b. What is your other household income?

1. < 100 Birr
2. 100 - 199 Birr
3. 200 - 299 Birr
4. 300 - 399 Birr
5. 400 - 999 Birr
6. > 1000 Birr
7. refuses to answer
9. unknown

## **RISK BEHAVIOUR AND HEALTH STATUS**

*Remind the study subject that the following information will be kept strictly confidential*

16. What is your current marital status?

1. single, never married
2. married and living together
3. married, but temporarily not living together
4. married, but separated or divorced
5. widowed
9. unknown

17. What is the occupation of your spouse ?

01. field worker
02. administrative/office
03. Production worker
04. maintenance/garage
05. medical
06. housewife
07. student
08. supportive personnel (driver, cleaner...)
09. Other
10. Unemployed
88. not applicable (single never married)
99. unknown

18. How old is your spouse (If married and living together) ? Or how old would be your spouse (if married not living together, divorce or widowed) ?

\_\_ years

88. not applicable (single never married)

99. unknown

19. What educational level does he/she have ?

1. less than grade 1

2. grade 1-6

3. grade 7-12

4. grade 12 completed, without further education

5. education after grade 12

7. refuses to answer

8. not applicable

9. unknown

20. What ethnic group does he/she belong to ?

01. Amhara

02. Oromo

03. Tigray

04. Gurage

05. other

06. mixed

77. refuses to answer

88. not applicable

99. unknown

21. At what age did you first marry?

\_\_ years

88. not applicable (single never married)

99. unknown

22. For your only or most recent marriage, for how many years have you been married?

\_\_ years

88. not applicable (single never married)

99. unknown

23. How many wives do you have now?

\_ number of wives

7. refuses to answer

8. not applicable (woman or man single never married)

9. unknown

24. How many children do you have now?

\_ number of children

- 7. 7 or more
- 8. not applicable
- 9. unknown

25. How many cigarettes do you smoke on average per day in the past 12 months?

- 0. Never
- 1. less than one
- 2. 1 to 4 per day
- 3. 5 to 9
- 4. 10 to 19
- 5. 20 or more
- 7. Refused to answer
- 9. unknown

26. How often did you drink alcohol on average during the past 12 months ?

- 1. never
- 2. once less than once per month
- 3. more than once per month, less than once per week
- 4. more than once per week, less than once per day
- 5. every day
- 7. refuses to answer
- 8. temporarily stopped
- 9. unknown

27. How often did you chew chat on average during the past 12 months ?

- 1. never
- 2. once less than once per month
- 3. more than once per month, less than once per week
- 4. more than once per week, less than once per day
- 5. every day
- 7. refuses to answer
- 9. unknown

28. How many health events required going to the health facilities in the past 12 months?

- \_\_\_ number of times
- 99. unknown



**ANNEX 3**

**Study No.:** \_\_\_\_\_

**RECORD EXTRACTION FORM ON ECONOMIC IMPACT OF HIV/AIDS IN ETHIOPIA FIBRE PRODUCTS  
FACTORY**

**I. Personnel Record Extraction Form**

1. Name of the participant: \_\_\_\_\_ Factory No. \_\_\_\_\_
2. Date of data collection: \_\_\_\_\_
3. Year starting to work in factory   /  /  /  /  /
4. Current working position (job category) \_\_\_\_\_
5. When did he/she start to work in the current working position (month, year)   /  /  /  /  /

If change of job category since the recent (new) assignment in 1995, provide months and year of change and new category (if reason known, please provide):

*New position:* \_\_\_\_\_ (month, year)   /  /  /  /  /   *Reason:* \_\_\_\_\_

*New position:* \_\_\_\_\_ (month, year)   /  /  /  /  /   *Reason:* \_\_\_\_\_

*New position:* \_\_\_\_\_ (month, year)   /  /  /  /  /   *Reason:* \_\_\_\_\_

*If person deceased: (month year) \_\_\_\_\_, \_\_\_\_\_*

6. How much money was spent for burial arrangement by the factory?  
\_\_\_\_\_ Birr

7. How much compensation (death benefit) was given to the family of the deceased?  
\_\_\_\_\_ Birr

8. Number of days out of work (absenteeism) to be filled in the following tables

**Reasons for absenteeism**

- |                                   |                      |
|-----------------------------------|----------------------|
| 1. Annual leave                   | 5. Maternity leave   |
| 2. Sick leave                     | 6. Cooperation leave |
| 3. Mourning leave                 | 7. Marriage leave    |
| 4. Leave without pay (Free leave) | 8. Absent            |

	1997								1998							
	Annual Leave	Sick Leave	Mourning L.	Free Leave	Maternity L.	Cooperation L.	Marriage L.	Absent	Annual Leave	Sick Leave	Mourning L.	Free Leave	Maternity L.	Cooperation L.	Marriage L.	Absent
January																
February																
March																
April																
May																
June																
July																
August																
September																
October																
November																
December																

	1999								2000							
	Annual Leave	Sick Leave	Mourning L.	Free Leave	Maternity L.	Cooperation L.	Marriage L.	Absent	Annual Leave	Sick Leave	Mourning L.	Free Leave	Maternity L.	Cooperation L.	Marriage L.	Absent
January																
February																
March																
April																
May																
June																
July																
August																
September																
October																
November																
December																

**Study No.** \_\_\_\_\_

**II. FINANCIAL RECORD EXTRACTION FORM**

1. Name of the participant: \_\_\_\_\_
2. Date of Data collection \_\_\_\_\_
3. Data collector's name \_\_\_\_\_
4. Current basic salary \_\_\_\_\_

**Factory No.** \_\_\_\_\_

5. Amount of monthly incentive and overtime payment to be filled in the following table

	1997		1998		1999		2000	
	Amount of additional payment in Birr		Amount of additional payment in Birr		Amount of additional payment in Birr		Amount of additional payment in Birr	
	Incentive	Overtime	Incentive	Overtime	Incentive	Overtime	Incentive	Overtime
January								
February								
March								
April								
May								
June								
July								
August								
September								
October								
November								
December								

## DECLARATION

I, the undersigned, declared that this is my original work, has not been presented for a degree in this or any other university, and that all sources of materials used for the thesis have been fully acknowledged.

Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Place: \_\_\_\_\_

Date of submission: \_\_\_\_\_

This thesis has been submitted for examination with my approval as university advisor

**Name:** \_\_\_\_\_

**Signature:** \_\_\_\_\_