# HIV/AIDS and Labour Productivity in Kenyan Manufacturing

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**Abstract**

The article investigates labour productivity effects of workers' concerns about HIV/AIDS on firm revenues and wages. Using cross-sectional data from Kenyan manufacturing firms, the article demonstrates that firm expenditures on medical care improve the mental health of workers, as proxied by concerns about HIV/AIDS, and in turn, a reduction in concerns is associated with increased labour productivity. Policy implications of the study findings are highlighted.

**Keywords**: health concerns; HIV/AIDS; labour productivity, firm performance
JEL Classification: I10, J24, L25.

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## 1.0 Introduction

It is widely known that HIV/AIDS imposes a significant psychological, emotional and behavioural burden on both the infected and the affected (Chipimo and Fylkesnes, 2009). Individuals infected with HIV often suffer from depression and anxiety as they adjust to the impact of the diagnosis of a positive status. Similarly, those who live and work with HIV/AIDS infected individuals experience some form of mental distress due to fear of being infected or of too much workload due to slowdown of the infected co-workers. Furthermore, there is evidence showing that HIV/AIDS infection is associated with high risk of suicide or attempted suicide (Byrne and Petrak, 2006, World Health Organisation, 2008). Thus workers' concerns about HIV/AIDS (a rough proxy for mental health) should have adverse effects on labour productivity.

Despite its potential adverse consequences, little is known in Kenya (and Africa generally), about the economic consequences of health concerns of workers. Previous research in this area provides but informal evidence on workers' worries about diseases (Chipimo and Fylkesnes, 2009 for HIV/AIDS, Goulia *et al.*, 2010 for Swine flu, Noel-Miller, 2003 for HIV/AIDS, Schnur *et al.*, 2006 for prostate cancer). The contention of this article is that despite the subjective nature of diseases worries, they can be reasonably measured, and their economic consequences rigorously assessed.

This study is the first of its kind to explore the effects of disease worries on economic outcomes in Kenya. Although the empirical analysis in the article is based on Kenyan data, the article adds value to the wider economics literature in several respects. First, it complements previous studies, e.g., Weehuizen (2008) who finds that mental health is an important factor of production. Second, the article shows how existing econometric techniques can be used to deal with common problems of endogeneity and heterogeneity in the estimation of causal effects (Thomas and Strauss, 1997).

The rest of the article is organised as follows. Section II presents the measurement framework. Section III describes the data, and Section VI presents the results along with their discussion, while section V concludes.

## 2.0 Empirical model

### 2.1 Effect of disease worries on sales

Health worries are endogenous to productivity and therefore cannot be related directly to sales. To deal with this problem, medical expenditure per capita is used as an instrument for workers' concerns about HIV/AIDS. The basic equating equation is:

$$S = \gamma_0 + \gamma_1 A + \gamma_2 X_2 + \gamma_3 D + \gamma_4 X_4 + \varepsilon_2 \quad (1)$$

Where $S$ is the firm's sales revenue, normalised by the number of employees; $A$ is a set of worker characteristics; $X_2$ is a dummy for health concerns; $D$ is a vector of firm

characteristics; $X_4$ are the control function regressors; $\varepsilon_2$ is the error term, and $\gamma_0, \gamma_1, \gamma_2, \gamma_3$ are coefficients to be estimated.

### 2.2 The effect of disease worries on wages

We follow previous literature and assume that labour markets are efficient and that workers in manufacturing firms are paid, approximately, according to their productivity (Dearden *et al.*, 2006, Serneels, 2005). Equation 2 measures effects on the productivity of health concerns using the standard log wage function. Again, following the literature (see e.g., Thomas and Strauss, 1997), the structural wage equation can be written as:

$$LnW = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_5 X_5 + \mu \quad (2)$$

Where $LnW$ is the log of worker's hourly wage; $X_1$ is a vector of worker or firm characteristics; $X_2$ is the endogenous regressor (worker's concern about HIV/AIDS); $X_3$ is a vector of location dummies; $X_5$ is a vector of control function regressors; $\mu$ is the error term; and $\alpha_0, \alpha_1, \alpha_2, \alpha_3$ and $\alpha_5$ are coefficients to be estimated.

## 3.0 Data

Firm-level data from the 2002/3 Regional Program on Enterprise Development (RPED) Survey conducted by the World Bank is used for estimations. The existing RPED panel data sets (1993-1995) available for most sub-Saharan African countries, including Kenya, do not have health data and therefore, cannot be used. The Kenyan 2002/2003 RPED dataset is a viable alternative, despite its limitations in other dimensions, e.g., limited geographic coverage and a relatively small sample of formal firms. The RPED 2002/03 survey of 282 formal manufacturing firms and workers covered seven sub-sectors in five urban areas, namely, Nairobi, Mombasa, Eldoret, Kisumu and Nakuru (see Annex Table1).

The firm's sales revenue is easily computed from the reported information on number of employees and value of goods sold. Wage is defined as the hourly earnings, excluding the fringe benefits received by a worker. This information is reported for each worker in the survey. Wage as a proxy measure of productivity has been used or implied in various studies (Dearden *et al.*, 2006, Serneels, 2005). The main explanatory variable in equations 1 and 2 is the health concern i.e., workers' concern about HIV/AIDS. The variable 'concern' is synonymous with 'worry' (Keeler *et al.*, 1987, Noel-Miller, 2003) and is measured as a dummy variable which takes a value '1' if a worker is concerned about HIV/AIDS and a value of '0' otherwise.

## 4.0 Results and discussions

The coefficients on medical care expenditure in each equation show the impact of this variable on sales and wages, respectively, lumped together with the effects of all the variables with which the medical expenditure is correlated. In column (1), the coefficient

shows that a 1% increase in medical care expenditure per worker is associated with .94% increase in the value of firm sales per worker. Similarly, the coefficient in column (2) indicates that a 1% increase in medical care expenditure per worker is associated with .08% increase in the hourly wage, the preferred measure of labour productivity.

**Table 1: The effects of medical care expenditure on sales and wages, reduced form OLS estimates**

| *Variable* | *Log of sales per worker (1)* | *Log of hourly wage (2)* |
|---|---|---|
| Log of medical care expenditure per worker | .9409 (16.41) | .0787 (11.15) |
| Years of worker experience in the firm | -.0015 (0.44) | .0047 (0.78) |
| Years of worker experience in the firm squared | .0001 (0.50) | .0001 (1.04) |
| Female | .0061 (0.21) | -.0278 (0.94) |
| Constant | 0.174 (7.41) | 3.448 (58.37) |
| Adjusted R-squared | .1480 | .0833 |
| F-Statistic [p-value] | 68.68 [.000] | 35.54 [.000] |
| No. of observations | 1556 | 1556 |

*Note*: Absolute *t* statistics in parentheses.

There are two assumptions on the coefficients of medical care expenditure reported in the Table. The first is that the estimated effect is driven by the health status of workers specifically, the workers' mental health that is correlated with medical care expenditure. The second assumption is that medical care expenditure has no direct, independent effect on sales and wages. That is, the expenditure affects sales and wages only through its effect on the health concerns of workers. Thus, medical care expenditure is can be used as an instrument for health concerns.

Table 2 presents results for OLS regressions for workers' concerns about HIV/AIDS. The results show that a 1% increase in medical care expenditure is associated with a 6.74% reduction in the proportion of workers with health concerns at the workplace.

**Table 2: Determinants of workers' concerns about HIV/AIDS**

| *Variables* | *OLS estimates (first stage)* |
|---|---|
| Years of experience in this firm | .0041 (2.09) |
| Years of experience squared | -.0001 (1.95) |
| Female | .0218 (1.27) |
| Log of medical expenditures per worker | -.0674 (2.03) |
| Constant | .9131 (67.40) |
| F statistic [p-value] | 2.40 [.0483] |
| Adjusted R-squared | 0.0036 |
| No. of observations | 1556 |

*Note*: Absolute *t* statistics in parentheses.

The results in Table 3 show that health concerns have a statistically significant and economically important effect on the performance of firms. The estimates indicate that for a 1% reduction in the proportion of workers concerned about HIV/AIDS, the revenue of the firm increases by 1.38%. Similarly, a 1% increase in the proportion of concerned workers reduces sales revenue, by 1.38%. A similarly large negative effect of HIV related illnesses has previously been reported on a tea plantation in Kenya (Larson *et al.*, 2009).

It should be noted that the coefficient on the predicted value of the residual of the health concerns variable in **Error! Reference source not found.** is statistically significant, indicating that the concerns variable is endogenous to the sales revenue, and thus the 2SLS estimation procedure is quite appropriate.

**Table 3: The effects of health concerns on firm's revenue**

| *Variables* | *2SLS estimates* |
|---|---|
| Are Workers concerned about HIV/AIDS? (1=yes) | -.1376 (11.93) |
| Predicted residual for concerns about HIV/AIDS | .1368 (11.80) |
| Years of experience in the firm | .0549 (10.35) |
| Years of experience squared | -.0015 (10.86) |
| Female | .3059 (7.68) |
| Constant | .1273 (12.21) |
| R-squared | 0.1463 |
| F statistic [p-value] | 30.90 [0.000] |
| Durbin-Wu-Hausman [p-value] | 219.73 (0.000) |
| Number of observations | 1556 |

*Note:* Absolute *t* statistics in parentheses.

Table 4 presents estimates of effects of workers' concerns about their health on hourly wages. In particular, a 1% increase in the proportion of workers with HIV/AIDS concerns reduces the hourly wage by 1.09%. As can be observed, all the coefficients have expected signs. The coefficient on predicted residual for health concerns, interacted with concerns about HIV/AIDS is highly significant. This provides some evidence of the need to account for heterogeneity of wages when estimating wage effects of health concerns. Another finding of interest is that women in manufacturing firms earn significantly less than men. Moreover, the firm location coefficients show that firms located in Nairobi pay significantly more than firms located elsewhere.

**Table 4: The effects of health concerns on wages**

| *Explanatory variables* | *2SLS estimates* |
|---|---|
| Are workers are concerned about HIV/AIDS?, (1=yes) | -.1088 (5.95) |
| Predicted residual for health concerns | .2439 (6.50) |
| Predicted residual * health concerns | -.3374 (7.18) |
| Square of predicted residual | .1269 (4.89) |
| Years of experience in the firm | .0005 (0.10) |
| Years of experience squared | .0003 (2.51) |
| Female | -.7746 (7.05) |
| Nairobi | .0069 (4.54) |
| Mombasa | .0020 (1.39) |
| Nakuru | -.0013 (0.93) |
| Eldoret | -.0035 (2.55) |
| Constant | 15.094 (8.17) |
| F-statistics [p-value] | 20.65 (0.00) |
| R-squared | 0.1247 |
| Durbin-Wu-Hausman [p-value] | 189.96 (0.00) |
| Number of observations | 1556 |

*Note:* Absolute *t* statistics in parentheses.

## 5.0 Conclusion

This article has examined the impact of mental health (proxied by concerns about HIV/AIDS) on sales revenue and wages in Kenyan manufacturing. The results show that revenue and wages are highly responsive to health concerns of workers. The results reported are largely consistent with the theoretical models of the economic importance of improving mental health of workers proposed by Weehuizen (2008). The study suggests that firms can reduce worries about HIV/AIDS at the workplace and thus increase productivity by investing in health care.

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## Appendix Table A: Summary statistics

| Variable | Observations | Mean | Standard deviation |
|---|---|---|---|
| Age of workers (in years) | 1556 | 36.25 | 9.53 |
| Years of education | 1556 | 11.14 | 4.24 |
| Years of experience in this firm | 1556 | 9.09 | 8.11 |
| Years of experience in this firm squared | 1556 | 1498.47 | 276.60 |
| Female (=1 if female, 0 otherwise) | 1556 | 0.18 | 0.38 |
| Is worker concerned about HIV/AIDS? (=1 if concerned, 0 otherwise) | 1556 | 0.93 | 0.26 |
| Log of total firm expenditures on medical per worker | 1556 | 0.14 | 0.19 |
| Workers concerned about HIV/AIDS (=1 if small concerned, 0 otherwise) | 1556 | 0.03 | 0.16 |
| Workers concerned about HIV/AIDS (=1 if moderate concerned, 0 otherwise) | 1556 | 0.06 | 0.24 |
| Workers concerned about HIV/AIDS (=1 if big concern, 0 otherwise) | 1556 | 0.33 | 0.47 |
| Workers concerned about HIV/AIDS (=1 if very big concern, 0 otherwise) | 1556 | 0.51 | 0.50 |
| Log of value of sales per worker | 1556 | 0.30 | 0.48 |
| Log of wages per hour | 1556 | 3.96 | 1.03 |
| Nairobi=1, if firm located in Nairobi, 0 otherwise | 1556 | 0.59 | 0.49 |
| Mombasa=1, if firm located in Mombasa, 0 otherwise | 1556 | 0.15 | 0.36 |
| Nakuru=1, if firm located in Nakuru, 0 otherwise | 1556 | 0.13 | 0.33 |
| Eldoret=1, if firm located in Eldoret, 0 otherwise | 1556 | 0.08 | 0.28 |
| Kisumu=1, if firm located in Kisumu, 0 otherwise | 1556 | 0.05 | 0.23 |