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The Dynamics of Health Inequality in Kagera Region in Tanzania, 1991-2010

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Abstract

This paper investigates issues related to the dynamics of health inequality and its relation to income in Kagera region in Tanzania. Specifically, it investigates the size of health inequality and examines the extent of income-related health inequality and income in the region. The study uses the Kagera Health and Development Survey (KHDS) panel data, and a measure of income-related health inequality and health-related income inequality as proposed by Allanson et al. *(2010) to measure the extent of income-related health inequality and health-related income inequality. The findings show that there is a relationship between relative health changes and individuals' initial level of income, which implies income plays a vital role in reducing inequalities in health. Furthermore, health-related income mobility is found to be positive, signifying that the current health status was more strongly related to the current income than lagged income. The key findings imply that income-related policy interventions for improving health status of the poor is inevitable.*

Keywords: *health, poverty, Kagera, inequality, dynamics*

1. Introduction

Globally, issues of health inequality between the poor and the non-poor have attracted the attention of researchers and international organizations for a while now. For instance, the World Health Organization (WHO) has issued a number of statements that strongly emphasize the reduction of differences in health status between countries, and between socioeconomic groups within countries. The emphasized perceived gap was mainly on health outcomes and health care access; and these globally follow the Alma-Ata declaration of 1978, which recognized unacceptable health conditions found among hundreds of millions of the world's poor, and insisted using primary health care as a potential to close the gap between the haves and the have-nots—i.e., to lessen health inequalities (Gwatkin, 2000).

There is an empirical evidence worldwide on the existence of big inequalities between the poor and better-off in the health sector (Wagstaff et al., 2001). These inequalities are manifested in health outcomes, the utilization of health services and in the benefits received from public expenditures on health services (ibid.). However, the nature of the relationship between health and income is still ill-defined (Jones & Wildman, 2005). It is widely accepted that income poverty is a

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risk factor for premature mortality and increased morbidity (Subramanian & Kawachi, 2004). This fact makes individual income an important element in determining individual health, and thus efforts have been made to establish the role of income inequality to health outcomes (see, e.g., Allanson et al., 2010). Theoretically, the relation between individual income and health status is said to be concave, such that each additional expenditure of income raises individual health by a decreasing amount. This theoretical underpinning raises empirical concerns, especially in developing countries like Tanzania, where reduction strategies of income poverty are at the centre stage of poverty reduction.

Studies linking income inequality and health inequality have also given contradicting results in terms of income distribution and health inequalities. For instance, studies by Wagstaff et al. (2003) found that rising incomes causes an increase in relative inequality in malnutrition; while in a study on how income inequalities drive health disparities, Sahn and Younger (2005) found that changes in income inequality have no effect on health status. In addition, Hauck and Rice (2004) analysed long-term health inequalities between socioeconomic groups in terms of mobility in mental health through calculating the contribution of the permanent component to total variability, and by estimating the coefficient of the lagged health status variable in a dynamic Ordinary Least Square (OLS) model to determine whether persons in the two lowest income quintiles showed greater mental illness, as well as greater persistence in having this condition in comparison to their counterparts in the two highest income quintiles. Kawachi et al., (1997) found strong cross-sectional associations between indicators of social capital and mortality rates in the United States, and suggested that a high level of income inequality erodes 'social capital' which is the stock of investments, resources and networks that produce social cohesion, trust and willingness to engage in community activities, hence good health. The relation between health status, health inequality, income inequality and social process are also evidenced in Pradhan et al. (2001).

In a test of 42 countries, Gwatkin et al. (2000)—as summarized in Wagstaff (2002)—found little evidence in support of the hypothesis that income inequality is associated with health inequality. However, they found a strong positive relationship between health inequality and average income. Moreover, there is widespread evidence showing that health inequalities may be more articulated than income inequalities, in developing countries. In their index, Jones and Lopez-Nicolas (2004) shows that whenever there are systematic differences in health among individuals whose income change over-time, long-run income-related health inequality will differ from short-time span measurements, or over a sequence of independent snapshots, which do not capture individual dynamics in income and health. Jones and Lopez-Nicolas' (ibid.) conclusion implies that if the income direction between healthy individuals and unhealthy individuals differs, income-related health inequality would tend to increase (decrease) as time passes. It has not yet been established whether their findings are plausible in Tanzania's setting.

Income poverty and inequality varies from region to region in Tanzania. Over time, Kagera region has not fared well in poverty ranking although it has had a favourable inequality ranking. According to Mkenda et al. (2004), Kagera ranked 10th out of 20 regions of Tanzania (Mainland) in terms of income poverty (calculated basing on adult equivalent scale and per capita expenditure scale). The region also ranked 13th and 14th in poverty gap basing on calculated adult equivalent scale and per capita expenditure scale, respectively. The region poorly performed in terms of poverty severity ranking by being the 15th and 16th in ranking out of 20 regions in both adult equivalent scale and per capita expenditure scales, respectively. The region has also faced a number of shocks over time that has affected most households' income and health. The region had both high and early HIV prevalence, with prevalence rates in the late 1980s as high as 24% (Beegle et al., 2006), which is believed to have affected the income status and production capacity of most families, particularly those whose household members suffered from the disease; and increased the existence of orphans in respective families: all of which led to the decimation of the number of the economically active age group.[1] Other shocks mainly associated with the disease, to mention a few, include neglected homesteads and banana and coffee farms, which resulted in reduced household health status and income.

Despite the prevalence of poverty in the region and the nature of income inequality, the link between socioeconomic status and income inequality on health inequality, to the best of our knowledge, has not been examined in Kagera and Tanzania in general. According to Deaton (2003) the positive link of income, particularly on health, can be challenged on account of the nature of a country, type of data, econometric approach used and the variables considered in the estimation process. This stands to be the vital argument among those that have motivated this study.

To this end, this paper addresses the following questions: How severe are health inequalities in Kagera region? Are these inequalities widening or narrowing? Are there gender differences in health and income-related inequalities? To what extent does age profile account for the inequalities? What is the extent of income-related health inequality and health-related income inequality given the income trend between the poor and non-poor? In responding to these questions, this paper—using the Kagera Health and Development Survey (KHDS) panel data and a measure of income-related health inequality and health-related income inequality as proposed by Allanson et al. (2010)—found that in most cases the income-related health inequality is progressive; and that gender and age differences matters in explaining the health-income dynamics of Kagera region.

The rest of this paper is organized as follows. In section two we introduce the methodology of the study; section three provides the estimated results and a discussion of the findings, before finally concluding in section four.

[1]However, Kagera has witnessed a decline in the prevalence HIV/AIDS during the past two decades (Frumence et al., 2014); decreasing from 100% in 1983 to 24% in 1987, and to 4.8% in 2009.

2. Methodology

2.1 Approach

This paper explores income-related health inequality and health-related income inequality in Kagera region for the period 1991 to 2010. In analysing the income-health inequality, the study follows the work of Allanson et al. (2010), which extends Jones and Lopez Nicolas (2004) index (JLN index) of 'health-related income mobility' by first clarifying the nature JLN index of health-related income mobility, and secondly by developing a complementary approach to the analysis of longitudinal data that brings out other policy-relevant aspects of the evolution of health-related inequalities over time.

The health and income status of people in rural Tanzania has been very dynamic. As mentioned earlier, Kagera region—from where we collected the data—has been adversely hit by the HIV/AIDS problem and its related shocks. This disease and other shocks have for a time affected the income status and production capacity of most of the families whose household members suffers from the disease. With these effects, the health status of some families may have changed to a worse status depending on how a family manages to cope with the problem.

The index by Allanson et al. (2010) is called 'income-related health mobility', based on a decomposition of the change in the short-run concentration index (CI) over time, which measures whether the pattern of relative health changes between two periods is biased in favour of those with initially low or high incomes.

In trying to explain the Jones and Lopez Nicolas (2004) index, Allanson et al., (2010) decomposes Equation 1, which is the measure of 'health-related income mobility' into two sub-components:

$$M = \frac{\sum_i w_t CI^t - CI^T}{\sum_i w_t CI^t} = \frac{\left((2/NT\bar{\bar{h}}^t)\sum_i \sum_i (h_{it} - \bar{\bar{h}}^T)(R_i^t - R_i^T)\right)}{\sum_i w_t CI^t} \qquad (1)$$

where M is defined as the difference between the weighted average short-run and long-run concentration indices;$CI^t$and $CI^T$are short-run and long-run concentration indices respectively obtained from income and health data averaged over all Tperiods;$h_{it}$is a cardinal measure of health for individual $i(1,2,\dots,N)$in period $t, \bar{\bar{h}}^t$ is the average health of the population over all T periods, $R_i^t$is the individual's relative rank in the period t income distribution and $R_i^t$is the individual's relative rank in the distribution of total income over all T periods. $w_i = N\bar{h}^t/NT\bar{h}^T$ which is equal the share of the total health of all N individuals in time period t relative to the total health of all individuals in all T periods combined and $\bar{h}^t$ is the average health of the population in period t.

Note that M will differ from zero as a result of a systematic association between changes in the income rank of an individual, and differences in health. The larger

the difference between the short-run weighted average and the long-run inequality measures, the larger the value of *M*. If there is no difference between the short-run and long-run inequality measures, then *M* equals zero.

The two sub-components of *M* result from the variation in the health of each individual over time and the variation in average health between individuals:

$$\left(h_{it} - \bar{\bar{h}}^T\right) = (h_{it} - h_i^T) + (h_i^T - \bar{\bar{h}}^T) \qquad (2)$$

where h_i^T is the average health of individual i over the T periods.

Thus,M can be written as the sum of contributions due to health variation 'within' and 'between' individuals:

$$M = M^w + M^B = \sum_i v_i M^i + M^b \qquad (3)$$

In their extension, Allanson et al. (2010) based on the observation that any change in income-related health inequality over time must arise from some combination of changes in health outcomes (i.e. 'health mobility') and changes in individuals' positions in the income distribution (i.e. 'income (rank) mobility'). By decomposing the change in the concentration index between two periods, they provide an index of income-related health mobility that captures the effect on cross-sectional income-related health inequality of the relationship between relative health changes and individuals' initial level of income. In essence, the index addresses the question of whether the pattern of health changes favours those with initially low or high incomes, providing a natural counterpart to measures of income-related health inequality that address the issue of whether those with better health tend to be the poor or rich. They also obtain an index of health-related income mobility, which in this case captures the effect of the reshuffling of individuals within the income distribution on cross-sectional socioeconomic inequalities in health. In doing so they decompose the change in the short-run CI between any initial or start period, and any final period f into two parts:

$$\begin{aligned} CI^f - CI^s &= \frac{2}{\bar{h}^f}\mathrm{cov}(h_{if}, R_{if}) - \frac{2}{\bar{h}^s}\mathrm{cov}(h_{is}, R_{is}); f = 1, \dots, T; s \le f \qquad (4) \\ &= \frac{2}{\bar{h}^f}\mathrm{cov}(h_{if}, R_{if}) - \frac{2}{\bar{h}^f}\mathrm{cov}(h_{if}, R_{is}) + \frac{2}{\bar{h}^f}\mathrm{cov}(h_{if}, R_{is}) - \frac{2}{\bar{h}^s}\mathrm{cov}(h_{is}, R_{is}) \\ &= (CI^f - CI^{fs}) + (CI^{fs} - CI^s) \\ &= M^R - M^H \end{aligned}$$

where $CI^s$and$CI^f$are the CI's in periods s and f respectively, and $CI^{fs}$is theCI obtained when health outcomes in the final period are ranked by income in the initial period.

The index above, $MH = CI^f - CI^s$, provides a measure of income-related health mobility, which captures the effect of the relationship between relative health changes and individuals' initial level of income. MH is positive (negative) if health changes are progressive (regressive) in the sense that the poorest individuals either enjoy a larger (smaller) share of total health gains or suffer a smaller (larger) share of total health losses compared to their initial share of health; and equals zero if relative health changes are independent of income, or there are no health changes. MH in turn depends on the progressivity and scale of health changes:

$$M^H = (CI^s - CI^{fs}) = \left(\frac{2}{\bar{h}^s}\text{cov}(h_{is}, R_{is}) - \frac{2}{\bar{h}^f}\text{cov}(h_{if}, R_{is})\right) \quad (5)$$

$$= \left(\frac{2}{\bar{h}^s}\text{cov}(h_{is}, R_{is}) - \frac{2}{\Delta h}\text{cov}(h_{if} - h_{is}, R_{is})\right)\left(\frac{\overline{\Delta h}}{\bar{h}^f}\right)$$

$$= (CI^s - CI^{\Delta s})\left(\frac{\overline{\Delta h}}{\bar{h}^f}\right) = Pq$$

where $CI^{\Delta s}$ is the concentration coefficient of health changes ranked by initial period income, and $\overline{\Delta h} - \bar{h}^f - \bar{h}^s$ is the average health change between the two periods. $(CI^s - CI^{\Delta s})$ captures progressivity. For any given P, the gross impact on final period income-related health inequalities is proportional to the scale of health changes, $q = \left(\frac{\overline{\Delta h}}{\bar{h}^f}\right)$ is measured as the ratio of average health changes to the average final period health. Note that if the average health change is negative, then P will be negative (positive) if health depreciation is progressive (regressive), such that relative health losses tend to be larger (smaller) for rich individuals than poor ones.

However, according to Allanson et al. (2010), the income-related health mobility index M^H will not generally equal the change in income-related health inequality because it does not allow for the effect of changes in the ranking of individuals in the income distribution between the initial and final periods. This effect is captured by the health-related income mobility index $M^R = CI^f - CI^{fs}$. M^R will be equal to zero if the final period health is uncorrelated with changes in income rank, irrespective of the degree of reshuffling of individuals in the income distribution, or if there are no changes in the income rank. Therefore, we use the Allanson et al. (2010) approach to examine these issues.

2.2 Data

We use the Kagera Health and Development Survey (KHDS), a panel data that traces out households over a decade. The data has 6 waves: the first four were collected between 1991 and 1994, the fifth wave (wave 5) was collected in 2004, and the last one (wave 6) was done in 2010. In this study we use the first four waves and the sixth wave. The fifth wave is not used on account of difficulties in reconciling the health indicator dataset with the rest of the waves.

The KHDS sampling procedure involved two stages. The first stage involved selection of the sample, where 550 primary sampling units (PSUs) were classified according to eight strata defined over four agronomic zones. Enumeration areas of households were drawn randomly from the PSUs in each stratum, with a probability of selection proportional to the size of a PSU.

The second stage involved household selection, where households were selected from the enumeration areas using stratified random sampling. During this procedure, households that were expected to experience an adult death were over-sampled. To stratify the population, an enumeration of all households was undertaken. For the first waves a total of 29,602 households were enumerated in 51 areas. The dataset is rich in information, and is appropriate with attrition rates better comparable to most of the panel datasets.

In this paper we compiled a balanced panel dataset of individuals who could be traced in all the waves. The consumption aggregates—as compiled by the KHDS team and measured as per capita consumption—was used as proxies for the income measures used in this study. In the study we use the first wave as the initial period, and wave 6 as the final period. In establishing the health measure, we use the Body Mass Index (BMI), which is universally expressed in kg/m^2. The BMI measure provides a simple numeric measure of a person's thickness or thinness; hence allowing people to discuss weight and health problems. The Allanson et al.'s (2010) measure is a cardinal measure; hence the BMI provides us with a health measure that fits the used approach.

3. Results

This section reports and discusses results of the decomposition of changes in income-related health inequality in Kagera Region for the period 1991 to 2010. The decomposition provides a platform to understand the dynamics of health inequality in the region between different socioeconomic groups. According to Christian and Dillon (2016), early life under-nutrition links with adverse adult wealth outcomes, among other effects; an evidence that has prompted us to separately decompose the concentration index by first pooling together all individuals in our datasets regardless of the age, and later by considering only those individuals in the dataset who were aged 16 years and above during the respective wave.

Also, a number of literatures have shown the relationship between wealth and health, although few distinguish the effects accrued to males as opposed to females. For instance, one of the key findings of the study done by Wu (2003) shows that there are gender differences in health effects to household's wealth. On account of gendered health and wealth differences, this paper presents separately the results for female and male individuals.

Table 1 provides different Body Mass Indices as our measure of health status. The Body Mass Index (BMI) presented in Table 1 is computed as a function of body mass and body height, and shows the ranges that define underweight, normal weight, overweight and obese among individuals.

Table 1: Body Mass Index

Body Mass Index (BMI)	Interpretation
BMI<18.5	Underweight
BMI between 18.5-24.9	Normal Weight
BMI between 25-29.9	Overweight
BMI>30	Obese

Source: Blackburn and Jacobs, 2014

As discussed in the methodology, we use the approach by Allanson et al. (2010) to decompose the income-related health inequality for the region. Tables 2, 3, 4 and 5 present the results for the different categories.

Table 2: Decomposition of Changes in Income-Related Health Inequality (All KHDS Individuals)**

	KDHS Waves	1	2	3	4	6
Average Health	$\bar{h}^t$	18.140	18.027	18.245	19.130	22.134
Health Concentration Index	CI^t	0.0176 *	0.0177 *	0.0172*	0.0331 *	0.0229 *
Average Health Change	$\overline{\Delta h}$		-0.1130	0.1047	0.9894	3.9939
Concentration Index of Health Changes based on Initial Income Ranks	$CI^{\Delta s}$		0.5047	-0.5924	0.5428	-0.0284
Concentration Index of Health Changes based on Final Income Ranks	$CI^{\Delta f}$		1.1273 *	- 1.1180*	-0.3427	0.1216 *
Changes in Inequality	$CI^f - CI^s$		0.0001	-0.0004	0.0155	0.0053
Change Decomposition Analysis						
Income-related Health Mobility	M^H		0.0025	0.0029	-0.0228	0.0093
Progressivity Index	P		-0.4871	0.6096	-0.5097	0.0513
Scale Factor	q		-0.0051	0.0047	0.0447	0.1804
Health-related Income Mobility	M^R		0.0033	0.0030	-0.0116	0.0137
Alternative Change Decomposition Analysis						
Income-related Health Mobility	$M_{\#}^H$		0.0069	0.0066	0.0205	-0.0217
Progressivity Index	$P_{\#}$		-1.1097	1.1351	0.3757	-0.0987
Scale Factor	$q_{\#}$		-0.0062	0.0058	0.0545	0.2202
Health-related Income Mobility	$M_{\#}^R$		-0.0239	-0.0224	-0.0499	-0.0002

Note: * Statistically significant at 1 percent
** Including Children aged below 16 years

Table 2 presents results for all KHDS individuals regardless of their age profile and gender. This approach gives a picture of the status and dynamics of health-related income inequality in the region as a whole. The results in Table 2 show that there are improvements in average health changes when the health and wealth outcomes are compared with wave 1. However, the results show that if you exclude the individuals under age 16 there is no problem of underweight in the first three waves for all categories presented in Table 3 through Table 5.

Table 3: Decomposition of Changes in Income-Related Health Inequality (All KHDS Adults Individuals)**

	KDHS Waves	1	2	3	4	6
Average Health	$\bar{h}^t$	21.146	21.133	21.113	21.198	22.137
Health Concentration Index	CI^t	0.0122	0.0137	0.0180	0.0169	0.0228
Average Health Change	$\overline{\Delta h}$		-0.0135	-0.0330	0.0514	0.9909
Concentration Index of Health Changes based on Initial Income Ranks	$CI^{\Delta s}$		0.5070	-0.5916	0.5431	-0.0289
Concentration Index of Health Changes based on Final Income Ranks	$CI^{\Delta f}$		1.1305	-1.1205	-0.3431	0.1212
Changes in Inequality	$CI^f - CI^s$		0.0015	0.0057	0.0047	0.0105
Change Decomposition Analysis						
Income-related Health Mobility	M^H		0.0003	-0.0009	-0.0012	0.0021
Progressivity Index	P		-0.4948	0.6054	-0.5251	0.0458
Scale Factor	q		-0.0006	-0.0015	0.0023	0.0448
Health-related Income Mobility	M^R		-0.0006	0.0039	-0.0278	0.0137
Alternative Change Decomposition Analysis						
Income-related Health Mobility	$M_{\#}^H$		0.0007	-0.0018	0.0009	-0.0049
Progressivity Index	$P_{\#}$		-1.1182	1.1342	0.3611	-0.1043
Scale Factor	$q_{\#}$		-0.0006	-0.0016	0.0024	0.0469
Health-related Income Mobility	$M_{\#}^R$		-0.0200	-0.0232	-0.0338	-0.0002

Note: * Statistically significant at 1 percent

**Excluding Children aged below 16 years

However, if we do not consider age differences and include all individuals as for Table 2, and for males in Table 4, the first three waves show that the average health is reflecting underweight individuals. These results show that, for adult individuals in the study area, changes in health status is not a serious problem; and this partly explains the improvement in the average health that is observed in Table 2 through Table 5. This is attributed by the fact that as time goes on, ages grow towards being adults and the same people are traced out throughout the study period.

The average health indicators can be confirmed by NCD-RISC (2017) on worldwide comparison of BMI that revealed that the lowest mean child and adolescent BMIs in 2016 for instance was between 16.9 and 17.9 kg/m² for girls and boys in East Africa. On health improvements, the trend is not surprising since most studies on the relationship between income and health have found that whenever there are improvements in income measure, so will be the health measure.

For instance, Rowlingson (2011) concluded that there is some evidence that income inequality has negative health effects. Lynch, et al. (2004) show that evidence has converged on the conclusion that socioeconomic disadvantage precedes poor health; and the reverse is also true—i.e., poor health may also affect earnings. Also, Lynch et al. (2001) found links between income inequality and child health outcomes (infant mortality, low birth weight, etc.).

Table 4: Decomposition of Changes in Income-Related Health Inequality
(All KHDS Males including and Excluding Children aged below 16 years)

KDHS Waves		1		2		3		4		6	
		Male All	Male Adult	Male All	Male Adult	Male All	Male Adult	Male All	Male Adult	Male All	Male Adult
Average Health	$\bar{h}^t$	17.761	20.595	17.408	20.350	17.668	20.456	19.285	20.363	21.344	21.349
Health Concentration Index	CI^t	0.0194	0.0126	0.0184	0.0114	0.0168	0.0155	0.0535	0.0150	0.0204	0.0202
Average Health Change	$\overline{\Delta h}$			-0.3531	-0.2443	-0.0928	-0.1389	1.5241	-0.2321	3.5828	0.7544
Concentration Index of Health Changes based on Initial Income Ranks	$CI^{\Delta s}$			0.3758	0.3768	1.6314	1.6051	0.7151	0.7157	-0.0576	-0.0587
Concentration Index of Health Changes based on Final Income Ranks	$CI^{\Delta f}$			0.7399	0.7415	3.2707	3.2307	-0.5596	-0.5612	0.0977	0.0969
Changes in Inequality	$CI^f - CI^s$			-0.0010	-0.0012	-0.0026	0.0029	0.0341	0.0024	0.0010	0.0076
Change Decomposition Analysis											
Income-related Health Mobility	M^H			0.0059	0.0042	0.0070	0.0103	-0.0472	0.0076	0.0131	0.0028
Progressivity Index	P			-0.3574	-0.3654	-1.6146	-1.5896	-0.6617	-0.7007	0.0779	0.0789
Scale Factor	q			-0.0165	-0.0114	-0.0043	-0.0065	0.0714	-0.0109	0.1679	0.0353
Health-related Income Mobility	M^R			0.0068	-0.0001	0.0058	0.0045	-0.0216	-0.0601	0.0143	0.0144
Alternative Change Decomposition Analysis											
Income-related Health Mobility	$M_{\#}^H$			0.0143	0.0087	0.0170	0.0217	0.0526	-0.0065	-0.0156	-0.0028
Progressivity Index	$P_{\#}$			-0.7215	-0.7301	-3.2539	-3.2152	0.6131	0.5762	-0.0773	-0.0767
Scale Factor	$q_{\#}$			-0.0199	-0.0119	-0.0052	-0.0067	0.0858	-0.0113	0.2017	0.0366
Health-related Income Mobility	$M_{\#}^R$			-0.0292	-0.0223	-0.0285	-0.0273	-0.0947	-0.0564	-0.0004	-0.0004

Table 5: Decomposition of Changes in Income-Related Health Inequality (All KHDS Females including and Excluding Children aged Below 16 years)

KDHS Waves		1		2		3		4		6	
		Female All	Female Adult	Female All	Female Adult	Female All	Female Adult	Female All	Female Adult	Female All	Female Adult
Average Health	$\overline{h^t}$	18.473	21.521	18.568	21.666	18.745	21.561	18.995	21.779	22.817	22.817
Health Concentration Index	CI^t	0.0160	0.0125	0.0171	0.0170	0.0177	0.0208	0.0145	0.0203	0.0282	0.0282
Average Health Change	$\overline{\Delta h}$			0.0954	0.1450	0.2728	0.0395	0.5222	0.2579	4.3445	1.2956
Concentration Index of Health Changes based on Initial Income Ranks	$CI^{\Delta s}$			0.0031	-0.0551	0.0019	0.0019	-0.0002	-0.0002	-0.0093	-0.0093
Concentration Index of Health Changes based on Final Income Ranks	$CI^{\Delta f}$			-0.0629	-0.0629	0.1653	0.1653	0.1161	0.1161	0.1481	0.1481
Changes in Inequality	$CI^f - CI^s$			0.0011	0.0046	0.0017	0.0083	-0.0015	0.0078	0.0122	0.0158
Change Decomposition Analysis											
Income-related Health Mobility	M^H			0.0001	0.0005	0.0002	0.0000	0.0003	0.0002	0.0072	0.0021
Progressivity Index	P			0.0140	0.0721	0.0158	0.0189	0.0147	0.0204	0.0376	0.0376
Scale Factor	q			0.0042	0.0064	0.0120	0.0017	0.0229	0.0113	0.1904	0.0568
Health-related Income Mobility	M^R			0.0020	0.0020	0.0025	0.0056	-0.0005	0.0053	0.0176	0.0176
Alternative Change Decomposition Analysis											
Income-related Health Mobility	$M_{\#}^H$			0.0004	0.0005	-0.0022	-0.0003	-0.0029	-0.0011	-0.0282	-0.0072
Progressivity Index	$P_{\#}$			0.0800	0.0800	-0.1476	-0.1445	-0.1016	-0.0958	-0.1199	-0.1199
Scale Factor	$q_{\#}$			0.0052	0.0067	0.0148	0.0018	0.0283	0.0120	0.2352	0.0602
Health-related Income Mobility	$M_{\#}^R$			-0.0177	-0.0177	-0.0158	-0.0189	-0.0118	-0.0176	-0.0004	-0.0004

Further, there are no clear patterns in changes in health inequality between wave 1 and the other waves, especially when looking at the trend of income-related health inequality. In Table 2 through Table 5 the index of Income-related Health Inequality is positive in almost all waves except for wave 4; implying that the relationship between relative health changes and an individual's initial level of income had the effects of reducing inequalities in health. Thus, poorest individuals enjoyed a larger share of total health gains; hence income-related interventions targeting the improvement of the health of the poor will be very useful in the region. As provided in the previous sections, in late 1980s and early 1990s Kagera region was highly hit by the HIV/AIDS disease, which eroded the manpower and time available for household production. Over time the negative HIV/AIDS health effects have been declining, partly explaining the equilibrating effects observed through the trend of the income-related health inequality.

Tables 2 and 3, which provide results that are not disaggregating individuals by gender, the progressivity index does not provide a clear picture on who benefited much in terms of health gains since the results are balancing by showing progressivity and regressivity across waves. Thus, in some cases the rich were, in general, healthier than the poor and vice versa. In waves with negative value of the progressivity index (P), the result implies that health depreciation is progressive and the concentration of health losses in those waves among the better-off was greater than the concentration of their initial health losses. Mills et al. (2012) found that overall distribution of health service benefits in Ghana, Tanzania and South Africa favoured richer people, and that the burden of illness was greater for lower income groups. However, the nature of progressivity changes when the data are disaggregated by gender; almost all waves show a progressive trend for both adult and all males (Table 4), and vice versa for female individuals (Table 5).

The health-related income mobility is positive in almost all waves in Table 2, signifying that the current health status was more strongly related to contemporaneous income than lagged income. This trend shows that those who moved up the income ranking tended to be healthier in the final period, compared to those who moved down. However, the above observation is not always the case, especially when males are considered as an independent group since in most cases health-related income inequality is negative; hence their health was more correlated with lagged income. For men, who in the African setting are bread-winners, this is not surprising because those who are initially poor do suffer more health losses than those who are rich; hence increased inequality. This case holds especially when analysis focuses from the dynamic perspective.

Results on the lower panel relating to alternative decomposition show that the income-related health mobility is not very different when individuals are not disaggregated by gender. After considering gender disaggregation, the income-related health mobility become regressive towards the last waves, indicating that poorest individuals enjoy a smaller share of total post-and ante-health gains. The negative progressivity index for almost all waves in Tables4 and 5 show that male

and female individuals who were poor in final period experienced smaller relative health losses compared to the rich, and vice versa when individuals are not disaggregated.

4. Conclusions

This paper decomposed health measures into income-related health mobility and health-related income mobility using the Kagera Health and Development Survey (KHDS) for the period 1991 to 2010. Efforts were made to present the results disaggregated by gender, with a view to find out whether there are gender differences in health inequality. Conclusively, the findings indicate that there is no clear pattern in changes in health inequality between wave 1 and the other waves using the trend of income-related health inequality. Also, the findings show that there is a relationship between relative health changes and individuals' initial level of income, which implies income plays a vital role in reducing inequalities in health status. This is supported by some cases where the rich were shown to be healthier than the poor. Furthermore, health-related income mobility is found to be positive, signifying that current health status was more strongly related to the current income than lagged income. This implies that those who moved up the income ranking are healthier compared to those who moved down. In general, the key findings indicate that the need for interventions by the government and other stakeholders to focus on income-related policy to improve the health status of the poor; and over time this will reduce health inequality in the country.

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5. Reference

Allanson, P., U-G. Gerdtham & D. Petrie. 2010. Longitudinal Analysis of Income-Related Health Inequality. *Journal of Health Economics*, 29: 78–86

Beegle, K., J. De Weerdt & S. Dercon. 2006. Kagera Health and Development Survey 2004-Basic Information Document. The World Bank.

Dressler, W.W. 1996. Culture and Blood Pressure: Using Consensus Analysis to Create A Measurement. *Cultural Anthropology Methods*, 8: 6–8.

Dressler, W.W., M.C. Balierio & J.E. Dos Santos. 1999. Culture, Skin Color & Arterial Blood Pressure in Brazil. *American Journal of Human Biology*, 11: 4959.

Frumence, G., M. Emmelin, M. Eriksson, G. Kwesigabo, J. Kilewo, S. Moyo & L. Nystrom. 2014. Access to Social Capital and Risk of HIV Infection in Bukoba Urban District, Kagera Region, Tanzania. *Archive of Public Health*, 72(38): 1–11.

Hauck, K. & N. Rice. 2004. A Longitudinal Analysis of Mental Health Mobility in Britain. *Health Economics*, 13: 981–1001.

Https://www.jrf.org.uk/sites/default/files/jrf/migrated/files/inequality-income-social-problems-full.pdf.

Jones, A.M., A. López Nicolás. 2004. Measurement and Explanation of Socioeconomic Inequality in Health with Longitudinal Data. *Health Economics*, 13: 1015–1030.

Kawachi, I., B.P. Kennedy, K. Lochner & D. Prothow-Stith. 1997. Social Capital, Income Inequality & Mortality. *American Journal of Public Health*, 87: 1491–1498.

Lynch, J., G. Davey Smith, S. Harper, M. Hillemeier, N. Ross, G. Kaplan & M. Wolfson. 2004. Is Income Inequality a Determinant of Population Health? Part 1: A Systematic Review. *Millbank Quarterly*, 82(1): 5–99.

Lynch, J., G. Davey Smith, M. Hillemeier, M. Shaw, T. Raghunthan & G. Kaplan. 2001. Income Inequality, the Psychosocial Environment & Health: Comparisons of Wealthy Nations. *Lancet*, 358: 194–200.

NCD RISC. 2017. Worldwide Trends in Body-Mass Index, Underweight, Overweight & Obesity From 1975 to 2016: A Pooled Analysis of 2416 Population-Based Measurement Studies in 128·9 Million Children, Adolescents & Adults. *Lancet Articles*

Rowlingson, K. 2011. Does Income Inequality Cause Health and Social Problems. Joseph Rowntree Foundation, September, 2011. Available at: http://www.jrf.org.uk/sites/default/files/jrf/migrated/files/inequality-income-social-problems-full.pdf.

Sahn, D.E. & S.D. Younger. 2005. Improvements in Child Health: Does Inequality Matter? *Journal of Economic Inequality*, 3(1): 125–43.

Subramanian, S. V. & I. Kawachi. 2004. Income Inequality and Health: What Have We Learned So Far? *Epidemiologic Reviews*, 26: 78–91.

Tibaijuka, A. 1997. AIDS and Economic Welfare in Peasant Agriculture: Case Studies from Kagabiro Village, Kagera Region, Tanzania. *World Development,* 25(6): 963–975.

Wagstaff, A., E. Von Doorslaer & N. Watanabe. 2003. On Decomposition the Cases of Health Sector Inequalities with an Application to Malnutrition Inequalities in Vietnam. *Journal of Econometrics*, 112(1): 207–23.

World Bank. 2017. *World Development Indicators*. Washington, DC: World Bank.

World Economic Forum (WEF). 2016. *The Global Competitiveness Report 2016–2017*. Geneva: World Economic Forum.

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