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The progressivity of health-care financing in Kenya

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Background Health-care financing should be equitable. In many developing countries such as Kenya, changes to health-care financing systems are being implemented as a means of providing equitable access to health care with the aim of attaining universal coverage. Vertical equity means that people of dissimilar ability to pay make dissimilar levels of contribution to the health-care financing system. Vertical equity can be analysed by measuring progressivity.

Objectives The aim of this study was to analyse progressivity by measuring deviations from proportionality in the relationship between sources of health-care financing and ability to pay using Kakwani indices applied to data from the Kenya Household Health Utilisation and Expenditure Survey 2007.

Methods Concentration indices and Kakwani indices were obtained for the sources of health-care financing: direct and indirect taxes, out of pocket (OOP) payments, private insurance contributions and contributions to the National Hospital Insurance Fund. The bootstrap method was used to analyse the sensitivity of the Kakwani index to changes in the equivalence scale or the use of an alternative measure of ability to pay.

Results The overall health-care financing system was regressive. Out of pocket payments were regressive with all other payments being proportional. Direct taxes, indirect taxes and private insurance premiums were sensitive to the use of income as an alternative measure of ability to pay. However, the overall finding of a regressive health-care system remained.

Conclusion Reforms to the Kenyan health-care financing system are required to reduce dependence on out of pocket payments. The bootstrap method can be used in determining the sensitivity of the Kakwani index to various assumptions made in the analysis. Further analyses are required to determine the equity of health-care utilization and the effect of proposed reforms on overall equity of the Kenyan health-care system.

Keywords Kenya, vertical equity, progressivity, health-care financing, bootstrap method

KEY MESSAGES

- Vertical equity of health-care financing measured through Kakwani index for an African country whose health system is in transition.
- The bootstrap method provides a means for analysing the sensitivity of the Kakwani index to changes in the equivalence scale of the measure of ability to pay.
- Kenya's health-care financing system is regressive mostly due to its reliance on regressive out of pocket payments.

Introduction

The importance of health to human life and flourishing means that concerns about its allotment are important to us all (Sen 2002). The means of financing health care has been identified as a barrier to access to health care and increases the likelihood of impoverishment of households (World Health Organisation 2000; World Health Organisation 2010; Ministry of Medical Services & Ministry of Public Health and Sanitation 2012). This is more so in developing countries such as Kenya where direct payments (out of pocket payments) form a greater proportion of the sources of health-care financing (World Health Organisation 2010). Fairness in financial contributions towards health care is a key component of modern day approaches to health system assessments (Murray and Evans 2003).

The notion that payments for health care be matched with ability to pay may derive from the egalitarian view that equal access to health care should be provided for those with equal need (Williams and Cookson 2000). It may also draw from the view that the post-payment status of individuals should be equalized through health payments (Wagstaff *et al*. 1999a). Each of these view points seem to justify the principles that payments for health care should not be linked to utilization and that those with different abilities to pay make different levels of payment to the health-care system (World Health Organisation 2010; Morris and Parkin 2007; Wagstaff and Van Doorslaer 1993; O'Donnell *et al*. 2008b). These principles require that those with dissimilar abilities to pay should make dissimilar contributions to financing health care (vertical equity) while those at the same level of ability to pay should make the same level of contribution to the health-care system (horizontal equity) (Wagstaff and Van Doorslaer 1993). A related view is that the burden of health-care payments should be equitably distributed (Murray and Evans 2003).

Vertical equity can be measured by investigating for progressivity (O'Donnell *et al.* 2008b). A progressive system of health-care financing means that rising income is matched with a rising fraction of income being paid to the health-care system. A regressive system implies that rising income is matched with a falling fraction of income being paid to the health-care system. A proportional system implies that a constant fraction of income is paid to the health-care system regardless of the level of income. A progressive system implies that the poor contribute a lower proportion towards health care than their share of society's income.

The traditional sources of health-care financing are taxation, private insurance, Out of pocket (OOP) payments (direct payments) and social insurance. Out of pocket payments are charged at the point of health-care delivery. Private and social insurance reduce the barrier to access and spread the risk of ill health away from the household (Morris and Parkin 2007). For the purpose of progressivity analysis, taxation is split into indirect and direct taxes (O'Donnell *et al.* 2008b; Wagstaff *et al.* 1992; Wagstaff *et al*. 1999b). Each of these sources can be analysed for their adherence to the principle that payments should be based on the ability to pay.

Equity analysis of this nature has been performed in many parts of the world and has generally taken the form of cross-country comparisons such as those for the OECD countries (Wagstaff *et al.* 1992; Wagstaff *et al.* 1999b) and more recently in Asia (O'Donnell *et al*. 2008a; Yu 2008). Single country analyses have been performed in the Middle East (Hajizadeh and Connelly 2010; Shmueli *et al*. 2008) and South America (Cavagnero and Bilger 2010). Africa is seeing an explosion in research in the area in recent times (Mills *et al.* 2012; Cisse *et al.* 2007; Akazili *et al.* 2011).

Kenya's health-care system

Kenya is a low-income country on the east coast of Africa. The under-five mortality rate is 52 per 1000 live births and the maternal mortality ratio is 488 per 100 000 in 2008 (Kenya National Bureau of Statistics (KNBS) & ICF Macro 2010). The Kenya Health Policy 2012–30 notes that Kenya may not achieve any of the health related Millennium Development Goals (Ministry of Medical Services & Ministry of Public Health and Sanitation 2012).

Health care in Kenya is provided through public, private-for-profit and private not-for-profit facilities. Health-care services are arranged in tiers running from level 1 (dispensary, the lowest level of care) to level 6 (referral hospitals, the highest level of care). Public health facilities are to be found in the lower levels of care while private-for-profit facilities are concentrated in the higher levels of care (Ministry of Health *et al.* 2005). A recent study on health benefits concluded that use of health-care services is inequitable, with a predominance of pro-rich use of hospital services (Chuma *et al.* 2012).

Health-care financing in Kenya

In the years after independence in 1963, an overarching policy 'Sessional Paper No. 10 on African Socialism and its Application to Planning in Kenya' guided Kenya (Chuma and Okungu 2011; Wamai 2009a). This policy provided for free health care for all. Subsequent decades were characterized by significant changes in health-care financing with the introduction (then withdrawal, then re-introduction, then reduction) of user fees, decentralization of health-care management and encouragement of private-sector involvement in health (Chuma *et al.* 2009; Mwabu *et al.* 1995; Mbugua *et al.* 1995). It is believed that user fees may have contributed to an increase in out of pocket expenditure, and accompanying fall in service use (Mwabu *et al.* 1995).

Currently, health care in Kenya is financed from three main sources: out of pocket expenditure (households), government expenditure and donors. In 2005–06, OOP payments were 29.1% of total health expenditure (Ministry of Medical Services & Ministry of Public Health and Sanitation 2009a). Out of pocket payments are a barrier to access to health care in Kenya. A survey performed in 2007 showed that 38% of persons who were ill cited lack of money as a barrier to seeking health care (Ministry of Medical Services & Ministry of Public Health and Sanitation 2009b). By 2009–10 out of pocket payments still made up nearly a quarter of total health expenditure (Ministry of Medical Services & Ministry of Public Health and Sanitation 2010) and even this small decline was likely a nominal change as it represents a transfer

in financing towards donors and away from households and the government. The impact of user fees on health-care utilization is demonstrated in that the recent move to eliminate user fees charged for maternity and at dispensaries and health centres (Leftie 2013) has resulted in a massive influx of patients seeking health care (Maina 2013).

Both private and public facilities charge user fees. Private facilities are used predominantly by the wealthier in society (Ministry of Medical Services & Ministry of Public Health and Sanitation 2009b). Public facilities that charge user fees are allowed to keep 75% of the collected sum for approved expenditure (Chuma *et al.* 2009). The application of user fees at public facilities is characterized by the inconsistent application of exemptions to groups such as children under the age of 5 years (Chuma *et al.* 2009). This is bound to change after the abolition of user fees for all classes of patients at dispensaries and health centres and of user fees for maternity services at all public facilities on 1 June 2013 (Leftie 2013). Public facilities are also directly funded through government revenue. For example, 6% of the government's budget was allocated to health in 2005–06 (Ministry of Medical Services 2009). Public health facilities may also obtain funding through other sources such as income generating activities, direct facility funding and collaborations with development partners and related agencies (Wamai 2009b).

Government expenditure on health care as a proportion of total government expenditure has fallen from 8% in 2001–02 to 4.6% in 2009–10 (Ministry of Medical Services & Ministry of Public Health and Sanitation 2010). This is in spite of the government's commitment to increase this proportion to 15% as part of the Bamako initiative (Wamai 2009b). Taxation is the main source of government revenue in Kenya (Kenya National Bureau of Statistics 2009). The Kenya Revenue Authority is the principal tax-collecting agency. In 2007, the government drew its income from taxable (93%) and non-taxable income (7%) (Kenya National Bureau of Statistics 2009). Income tax is the main form of direct tax and it is charged on a progressive scale. Indirect taxes include value added tax (VAT), fuel levy, and excise duty. There is no government revenue earmarked for health care.

In 2005–06, the health insurance market in Kenya handled 9.1% of health-care funds in and covered 10% of the population (Ministry of Medical Services & Ministry of Public Health and Sanitation 2009a). Four years later, the situation was largely unchanged (Ministry of Medical Services & Ministry of Public Health and Sanitation 2010). Private insurers control about 60% of the market while the National Hospital Insurance Fund (NHIF) manages the rest. Established in 1966, the NHIF is Kenya's equivalent of a social health insurance fund. All employees in formal employment who earn greater than Kenya Shillings 1000 make contributions to the fund (National Hospital Insurance Fund 2011). Coverage now extends to volunteer members in formal and informal employment. The fund has expanded its benefit package from only inpatient services to include outpatient services. Recent health-care financing reforms have been characterized by a move away from OOP payments towards universal access to health care with financing through the National Health Insurance Fund (Chuma and Okungu 2011; Wamai 2009b). The phased expansion of the NHIF has met with opposition due, in particular, to a perceived lack of good governance and lack of capacity among other reasons (Munguti 2010). Three years on, progress towards universal access to health care through the expansion of the NHIF still faces significant challenges (Nation 2013).

Donor funding provides general budgetary support and also supports specific programmes such as HIV/AIDS programmes (Ministry of Medical Services & Ministry of Public Health and Sanitation 2009a). For example, 85% of funding for HIV/AIDS activities in the country was derived from donor funds in 2005–06. The contribution of donor funding to total health expenditure has grown from 16% in 2001–02 to 35% in 2009–10 (Ministry of Medical Services & Ministry of Public Health and Sanitation 2010). It is thought that the increase in donor funding has resulted in a reduction in OOP payments as the main source of health-care financing.

Kenya Vision 2030, the national strategic plan, states that 'Kenya's vision for health is to provide equitable and affordable health care' (Kenya Vision 2030 Secretariat 2007). The recently enacted Constitution of Kenya guarantees the right to the 'highest attainable standard of health which includes the right to health care service' (Republic of Kenya 2010). The Kenya Health Policy 2012–30 identified free access to specific forms of health care as one of its priority policy strategies (Ministry of Medical Services & Ministry of Public Health and Sanitation 2012). Although none of these policy documents explicitly states that health-care payments should be matched with ability to pay this may be implied by their commitment to equity in the distribution of health services and the reduction of the burden of health-care financing on the most vulnerable groups.

This article analyses the progressivity of the main sources of health-care financing in Kenya and also of the health-care financing system as a whole. The rest of the article is organized as follows. The next section explains the methodology employed. The third section presents the results and is followed by a discussion section. The fifth and final section draws the conclusions.

Methods

Sources of data

The sources of data and their characteristics are described in Table S1 of the supplementary data.

Household-level data

Data were obtained from the Kenya National Health Accounts (KNHA) Study conducted in 2007 (Ministry of Medical Services 2009). The study comprised two surveys: the KNHA of 2005–06 and the Kenya Household Expenditure and Utilisation Survey (KHHEUS) conducted in 2007 (Ministry of Medical Services & Ministry of Public Health and Sanitation 2009b). The households surveyed were randomly selected from the all of Kenya's provinces and districts as existed before the new constitution was promulgated in 2010. Data were collected on household health-care utilization,

health-care expenditure, consumption, income and NHIF premium payments.

Data on income tax rates and taxable household consumption were obtained from the Kenya Revenue Authority (Kenya Revenue Authority 2007a, 2007b). Data on other payments for health care (out of pocket and private insurance) were obtained from survey responses.

In developing countries where employment is mainly in the informal sector, incomes tend to be irregular. In addition, reporting of incomes may be faced with reporting bias since state agents conducted the KHHEUS survey. Therefore, we use food and non-food expenditure gross of taxes and contributions to the NHIF as a measure of consumption and hence as measure of ability to pay. Adjustments were made for household composition using equivalence scales (Deaton and Zaidi 2002). The scale used was:

$$\mathrm{AE} = (A + \alpha K)^{\theta}$$

where A is the number of adults, K is the number of children, α is the cost of a child relative to that of an adult and θ reflects the degree of economies of scale. As per the convention, children were defined as those aged less than 15 years. Since the cost of children in developing countries is thought to be lower than that in developed countries and the economies of scale are also lower, the values of α and θ used were 0.3 and 1.

Since income was collected as part of the KHHEUS, we utilized the data reported to perform sensitivity analysis on the results we obtained by using consumption as a measure of ability to pay.

The treatment for each of the variables used for the analysis is summarized in Table S1 of the supplementary data.

Macro-level data

The Kenya National Health Accounts 2005–06 provided data on government health expenditure, aggregate household-level expenditure and aggregate OOP payments. The NHIF and private insurance shares of total health expenditure were calculated from the same data. Statistical abstracts provided data on government revenues from direct and indirect taxes.

Analysis

Measuring progressivity

Vertical equity in health-care financing is measured by analysing the progressivity most commonly using the Kakwani Index of progressivity (Segura and Braun 2004). The Kakwani index is defined as twice the area between a payment concentration curve and the Lorenz curve for income (see text box) (O'Donnell *et al*. 2008b; Segura and Braun 2004). The index, k, is calculated as

$$k = C - G$$

where C is the concentration index for the health-care payment and G is the Gini coefficient for the measure of ability to pay. The value of the index ranges from −2 to 1.

Glossary:

Concentration curve: A graphical representation of the distribution of a variable of interest throughout the population with the population ranked by cumulative proportions from poorest to richest based on a living standard. If the particular variable is distributed proportionately through all the population, then the concentration curve is a diagonal line running at 45° from the origin (line of perfect equality).

Lorenz curve: A special application of the concentration curve where the variable of interest is income. Unlike the concentration curve, however, the Lorenz curve cannot lie above the line of equality.

Concentration index: Defined as twice the area between the concentration curve and the line of perfect equality. The index's value lies between −1 and 1. A negative value suggests the variable is concentrated in the poor, while a positive value suggests that the value is concentrated in the rich.

Gini coefficient: The summary measure associated with the Lorenz curve. Its value is twice the area between the Lorenz curve and the line of perfect equality. It has a value between 0 and 1 with zero indicating perfect equality. It is a commonly used measure of inequality in income distribution.

Kakwani index (also Kakwani Progressivity Index): Defined as twice the area between the concentration curve for a payment (for taxes or health care etc.) and the concentration curve for income (or other measure of ability to pay). The index's value lies between −2 and 1. A negative index suggests regressivity (a lower proportion of income is paid out towards the payment as income increases) and a positive index suggests progressivity (a higher proportion of income is paid out towards the payment as income increases).

The overall progressivity of the health-care financing system can be determined by weighting the Kakwani index of each health-care payment identified at the household level based on the proportion that each payment makes up of total health-care expenditure at national level (Wagstaff and Van Doorslaer 1993; O'Donnell *et al*. 2008b; Wagstaff *et al*. 1992; Wagstaff *et al*. 1999b; Yu 2008). In the analysis, we assumed that all public revenue is pooled and then allocated towards health care.

Because it is not possible to trace each source of financing at national level directly to the payments made by households, three assumption scenarios were used in a manner similar to Yu *et al.* (2008). First, we assumed that the taxes that could be traced directly to households (income tax from individuals and taxes from VAT on domestic and imported goods and services) were the basis on which all other revenue was then allocated to health care. The proportions of contributions to health care were then inflated. In the second scenario, income tax from corporations was aggregated with income tax from individuals, and revenue from taxes on other goods and services was aggregated with revenue from VAT. After this, all other sources of revenue were allocated as a weighted

average of these new shares. In our last scenario, all sources of financing for health care were ventilated. This means that the sources of revenue that could not be directly traced to household are distributed based on the proportion that all sources of financing for health care contribute to total health-care expenditure. A more detailed explanation of the specific steps and the weights obtained by the three methods are shown in Tables S2 and S3 in the supplementary data.

Using bootstrap method for sensitivity analysis

Assumptions are made when calculating progressivity indices (and other welfare indices) (O'Donnell *et al.* 2008b; Deaton and Zaidi 2002). The key assumptions involve the measure of ability to pay and the use of equivalence scales. Equivalence scales disaggregate household consumption to individual level. No agreed method of applying equivalence scales exists. The use of different equivalence scales has an effect on the measurement of progressivity (O'Donnell *et al.* 2008b). We use the bootstrap method to test whether any observed differences resulting from the use of different scales were statistically significant. The null hypothesis was that the change in Kakwani index when moving from one equivalence scale to another was zero. The alternative equivalence scales used were:

$$\mathrm{AE} = (A + \alpha K)^{\theta} \text{ with } \alpha \text{ set at 0.5 and } \theta \text{ at 0.95,}$$

and

$$\mathrm{AE} = \sqrt{(A + K)}.$$

Consumption is used as an alternative measure of ability to pay in developing countries owing to the informal nature of labour markets among other reasons (Deaton and Zaidi 2002). Reported income (gross of taxes and contributions to NHIF) collected during the KHHEUS was used as an alternative measure of ability to pay in the sensitivity analysis. The null hypothesis was one of no difference in progressivity indices when moving from measure of ability to pay to another.

Results

There were a total of 8844 households surveyed with about 49% of the respondents being male. The background characteristics of the respondents by consumption decile are summarized in Table S4. The descriptive results suggest that there was little difference in background characteristics between consumption deciles for sex and self-reported health status. There seems to be a higher concentration of persons with higher levels of education in the wealthier deciles.

The concentration indices for ability to pay and payments for health care are summarized in Tables S4 and S5 of the supplementary data. The concentration index for ability to pay is 0.65, which implies that ability to pay is concentrated in the wealthy. All the health-care payments have concentration indices that are positive which implies that they are concentrated in the wealthy. The highest value is that for private insurance while the lowest is that for direct taxes.

The Kakwani indices for the sources of health-care payments are summarized in Table 1.

The Kakwani index for OOP payments was −0.31 ($P = 0.016$) indicating that they are regressive. The Kakwani index for direct taxes is positive (0.21) suggesting progressivity but there is inconclusive evidence that the index differs from zero ($P = 0.094$) and proportionality cannot be rejected. The high concentration index (0.88) implies that direct taxes fall mainly on the wealthy but this effect is probably offset by the concentration of ability to pay in the wealthy resulting in proportional distribution of the impact of health-care payments. Indirect taxes, NHIF payments and private insurance were also proportional.

Overall, the Kenyan health-care financing system is regressive with a negative Kakwani index regardless of assumption scenario used (Table 2).

The most negative index was obtained with the use of the third scenario (Kakwani index −0.15). It is likely that the regressive nature of OOP payments is the chief contributor to this since all other payments are proportional. Wealthy Kenyans may have alternative sources of financing their health care and this may mean they do not have to resort to OOP payments as often as the poor. The concentration indices for private insurance (0.92) and reported NHIF premium payments (0.58) suggest that this is a distinct possibility.

Table 2 Kakwani indices for the overall financing system under various assumption scenarios

Finance source	Kakwani index for source	Macroweights		
		Scenario 1	Scenario 2	Scenario 3
Direct tax	0.21	0.17	0.18	0.10
Indirect tax	−0.05	0.22	0.22	0.13
NHIF	−0.09	0.06	0.06	0.07
OOP payments	−0.31	0.47	0.47	0.59
Private insurance	0.25	0.08	0.08	0.11
Kakwani Index for health-care financing system		−0.10	−0.10	−0.15

Table 1 Kakwani indices for the sources of health-care financing

	Direct taxes	Indirect taxes	OOP	NHIF	Private insurance
Kakwani index	0.21	−0.05	−0.31	−0.09	0.25
(robust standard error)	0.1235	0.0383	0.1289	0.0745	0.1990
P value	0.094	0.238	0.016	0.226	0.203
95% confidence interval	−0.04 to 0.45	−0.12 to 0.03	−0.56 to −0.06	−0.24 to 0.06	−0.14 to 0.64

Sensitivity analysis

Bootstrap Kakwani indices were obtained using each one of the alternative equivalence scales (scale 1, 2 and 3 described in the Methods section) and measures of ability to pay (consumption and income) for each one of the health-care payments (Table S6 of the supplementary data). We then obtained bootstrap confidence intervals to test if there was evidence of a change in the Kakwani indices (Table S7 of the supplementary data). There was no evidence of a difference for all of the sources of financing when moving from equivalence scale 1 to 2. A similar conclusion is reached with regard to using equivalence scale 3 instead of scale 1. When considering income as a measure of ability to pay, direct tax ($P < 0.001$), indirect tax ($P < 0.001$) and private insurance ($P = 0.04$) all showed significant differences from those obtained when using consumption as a measure of ability to pay. However, there is inconclusive evidence of a difference between the Kakwani indices for out of pocket and NHIF payments ($P = 0.396$ and 0.678, respectively).

We examined the sensitivity of our results for the overall health-care financing system to changes in the measure of ability to pay by using different equivalence scales and by using income as a measure of ability to pay. Overall, the health-care financing remained regressive even when different measures of ability to pay were used (Table 3).

A Kakwani index of −0.23 was the most negative and was obtained by applying assumption scenario 3 and income as a measure of ability to pay.

We tested the effect that different allocation scenarios would have on the Kakwani index for the overall health-care financing system. All three indices are negative suggesting that the overall health-care financing system is regressive even under various assumptions for the allocation of revenues towards health care.

Discussion

The Kenyan health-care financing system is regressive. It is likely that the regressive nature of OOP payments is the chief contributor to this since all other payments are proportional. The irregular application of waivers for the poor may also worsen the poor's burden of payments (Chuma and Okungu 2011; Chuma *et al*. 2009). This has important implications following the recent waiver of fees for maternity fees and charges at dispensaries and health centres. Although the move is celebrated, it must also be viewed with caution since it may not adequately address the regressive nature of health-care payments if the waivers are irregularly applied. Recent research shows health-care services in Kenya tend to be pro-rich at hospital level. Equity considerations for policy-makers must also include matters of horizontal equity, which though not addressed by our article are well described by other authors (Chuma *et al*. 2012).

Table 3 Overall Kakwani indices using different measures of ability to pay for sources of health-care financing

Measures of ability to pay	Kakwani Index (based on different macroweights)		
	Case 1	Case 2	Case 3
$AE = (A + 0.3K)^1$	−0.10	−0.10	−0.15
$AE = \sqrt{(A + K)}$	−0.10	−0.09	−0.15
$AE = (A + 0.5K)^{0.95}$	−0.11	−0.11	−0.15
Income	−0.17	−0.17	−0.23

AE = adult equivalents; A = persons aged 18 years and over in household; K = persons aged under 15 years.

National Hospital Insurance Fund (NHIF) premium payments are proportional. This is not in keeping with findings in other works where social health contributions are often regressive. We propose that our findings are a result of two counter influences. The first is the limit on contribution levels which would ordinarily make the payment regressive (Wagstaff *et al*. 1992), while the second is the progressive nature of the contribution scale, which would ordinarily make the payment progressive. Our findings have significant implications on proposals to restructure the NHIF. If the NHIF is to be the main vehicle for health-care financing in Kenya, then steps must be taken to ensure that it is a progressive form of health-care financing. Our results suggest that the current cap on premium payments may contribute towards making NHIF payments proportional and not progressive.

Private insurance in Kenya seems to be concentrated in the wealthy as suggested by the concentration index of 0.91. In systems where private insurance is purchased by the wealthy to 'top-up' health coverage, the payments tend to be progressive (Wagstaff *et al.* 1999b). In health systems where private insurance is the main source of health-care financing, the system tends to be regressive. In Kenya the insurance market is small and employers pay some of private insurance premiums for their employees (Ministry of Medical Services & Ministry of Public Health and Sanitation 2009a). It could be that premium payments, while concentrated in the wealthy, are charged at proportional rates on employees as a result.

Direct taxes had a Kakwani index that did not differ significantly from zero implying proportionality. This suggests that the direct tax regime needs realignment to increase its progressivity. However, using income as a measure of ability to pay produced a progressive index. This illustrates the importance of using alternative measures of ability to pay whenever they are available to assess the sensitivity of the results. In our analyses, the overall Kakwani index for Kenya's health-care financing system remained negative even when income was used as a measure of ability to pay.

Indirect taxes tend to be regressive but were found to be proportional. This may have been as a result of using consumption as a measure of ability to pay. Using income as an alternative measure of ability to pay resulted in a significant change in the Kakwani index for indirect taxes towards being regressive. However, this did not alter the overall conclusion of the regressive nature of the health-care financing system. The regressive nature of indirect taxes when income is used as a measure of ability to pay suggests that indirect taxes are an unsuitable source of health-care financing. This is against the background of proposals for earmarked funding for health care through a tax on mobile phone airtime (Gathura 2012).

A key assumption in our analysis is the full fungibility of the funds available for health-care financing; for example, that all

income tax is available to fund health care. From our review of literature on Kenyan public financing and health-care financing, there is no evidence to suggest that this assumption is incorrect with reference to income tax or to VAT through which we derived direct taxes and indirect taxes. However, this assumption may not hold for other forms of indirect tax such as fuel levy which is often earmarked for road construction and maintenance. Our three allocation assumptions attempt to take into account the various ways in which these other monies may be allocated in calculating the overall progressivity index for health-care financing in Kenya. However, the values presented for the individual sources of health-care financing do not take the possibility of the absence of full fungibility into account.

Another assumption in our analysis relates to the contribution of all deciles of the population to each of the sources of health-care financing. Given that only a small proportion of the Kenyan work force is in formal employment, the progressivity index for NHIF contributions may not adequately describe the actual distribution of burden of payment for the financing of health care in Kenya. This caveat also holds for private insurance contributions since these are drawn from wealthy individuals or from corporate bodies for their employees. This therefore affects conclusions reached on the overall progressivity of the health-care financing system in Kenya.

The sensitivity analysis performed demonstrates that using different measures of ability to pay may result in changes in the Kakwani index. The use of the bootstrap method allows for an easy and intuitive way to statistically test for this change. In our analysis, this change was observed when comparing equivalence scale 1 (consumption based) to income. This suggests that where data for different measures of ability to pay exist, testing should be carried out for the sensitivity of the results.

Our article is the first, to our knowledge, to quantify the regressive nature of the health-care financing system in Kenya using the Kakwani index. It also quantifies the Kakwani indices for all sources of health-care financing. We add to the growing body of evidence that indicates that there exist inequalities in access in the Kenyan health-care system (Chuma *et al*. 2012; Chuma and Okungu 2011). There is evidence that this inequality is in both vertical and horizontal planes. This is important for policy makers as they try to address these inequalities as movement is made towards universal coverage. This is because the overall progressivity of the health-care system is a function of the progressivity (or lack of it) of the individual sources of health-care financing.

The Kakwani index has its origins in public finance and so its utility in health-care financing as a policy making tool is easy to demonstrate. For example, if the NHIF is to become the predominant source of health-care financing, then it implies that the contribution scale may need adjustment to make it more progressive. Applying the same techniques to generate a Kakwani index for NHIF payments following changes to the contribution scale can then test any movement towards progressivity. The same methods can also be used to assess the impact of other health-care financing decisions on the overall system. In addition to this kind of comparison, cross-country comparisons can be made for stakeholders in international health who may want to prioritize areas of health system support. Finally, Kakwani indices provide an easy to understand summary measure that may be easier to communicate to key decision makers such as politicians, especially in the context of the Kenyan health-care system in which political backing for policy decisions is critical (Wamai 2009b).

Another strength of our analysis is the use of bootstrap methods to test whether moving from one measure of ability to pay results in any difference in the estimate of the Kakwani index. This has implications for future progressivity analysis in that different measures of ability to pay should be used whenever information on them is available.

Our analysis had its limitations. First it relied on data obtained from a national survey, which is subject to reporting bias among other problems. The conduct of these surveys has improved over the years. Also, household surveys are the most commonly used of data source in this kind of analysis. For national-level data, we used aggregate data reported in government publications. This may have limited the value of these data since they could not be counterchecked.

We were not able to trace all expenditure on health care directly to households. We addressed this problem by applying three different scenarios in tracing these funds to households. We found that our results were robust to the allocation scenario used.

A significant limitation of our analysis is that we did not explore the redistributive effect of payments for health care and equity in the utilization of health care, which are complementary methods of analysing vertical and horizontal equity respectively. As noted in the introduction to this article, there are concerns that access to health care is inhibited by having to pay for health care (Ministry of Medical Services & Ministry of Public Health and Sanitation 2009b). There is also evidence to suggest that access to some services in Kenya is pro-rich (Chuma *et al*. 2012). Taken together, our results and those published by others point to an inequitable health-care system. It is important that any conclusions on equity in health-care financing in Kenya take into account these other aspects.

Conclusion

Payments for health care as measured by the Kakwani index are regressive in Kenya. The regressive nature of OOP payments outweighs the proportional nature of all other sources of payment. Policy towards correcting this inequitable state of affairs needs to concentrate on the reduction of dependence of OOP payments and increasing the dependence on more progressive forms of health-care payments.

Supplementary data

Supplementary data are available at *Health Policy and Planning* online.

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Ethical approval

The study did not involve human subject research and so no ethical approval was required. The data used for the study was provided on written request from the Ministry of Medical Services Kenya.

Conflict of interest

None declared.

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