

Assessing equity and efficiency of health financing towards universal health coverage between regions in Tanzania

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Ethical issues

Ethical approval was obtained from national and institutional ethics committees in Tanzania. The institutional ethical approval is from the Ifakara Health Institute (IHI/IRB/No: 45-2021), while the national approval is from the National Institute for Medical Research (NIMR/HQ/R.8a/Vol.IX/4099).

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Conflict of interest statement

None declared.

Author contributions

PB and JB conceived and designed the study. PB participated in the data collection, extraction and analysis. PB, MA, CP, JB participated in data interpretation. PB drafted the manuscript. All authors read and approved the final manuscript.

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Abstract (300 words)

Equity and efficiency in health financing are intermediate universal health coverage (UHC) objectives. While there is growing attention to monitoring these goals at the national level, subnational assessment is also needed to uncover potential divergences across subnational units. We assessed whether health funds were allocated or contributed equitably and spent efficiently across 26 regions in Tanzania in 2017/18 for four sources of funding. Government and donor health basket fund (HBF) expenditure data were obtained from government authorities. Households' contributions to health insurance and out-of-pocket payments were obtained from the national household budget survey. We used Kakwani index (KI) to measure regional funding equity, whereby regional GDP per capita measured regional economic status. Efficiency analysis included four financing inputs and two UHC outputs (maternal health service coverage and financial protection indices). Data envelopment analysis estimated efficiency scores. There was substantial variation in regional funding, especially in insurance contributions (TZS 525–15,007), and service coverage performance (49–86.3%). There was less variation in HBF spending (TZS 1,437–2,657) and financial protection (93.5–99.4%). Government spending (KI: -0.047 , $p=0.348$) was proportional to regional economic status; but HBF spending (KI: -0.195 , $p<0.001$) were progressive (equitably distributed), being more targeted to regions with high economic need (poor). The burden of contributing to social health insurance (NHIF) was proportional (KI: 0.058 , $p=0.613$), while the burden of paying for community-based insurance (CHF, KI: -0.152) and out-of-pocket payments (KI: -0.187) was higher among the poor (regressive). The average efficiency score across regions was 90%, indicating that 90% of financial resources were used optimally, while 10% were being wasted or underutilised. Tanzania should continue mobilising domestic resources for health towards UHC, and reduce reliance on inequitable out-of-pocket payments. Policymakers must enhance resource allocation formulas, public financial management, and sub-national resource tracking to improve equity and efficiency in resource use.

Highlights

- There is proportional government spending and progressive HBF spending among regions
- NHIF contributions were proportional, while CHF contributions and out-of-pocket payments were regressive
- The average regional efficiency score was 90% such that 10% of resources were wasted/ misallocated
- Resource allocation formulas to enhance equity and efficiency and subnational resource tracking are needed

1. Introduction (4999 words)

Health financing is an important dimension in any health system for improving performance towards universal health coverage (UHC) (Kutzin 2013; WHO 2010). The UHC Sustainable Development Goal (SDG 3.8) of ensuring all people have equitable access to quality health services without incurring financial hardship remains relevant and an important policy goal across settings. However, UHC progress is often hampered by constrained financial resources in most health systems in low and middle-income countries (LMICs) (Darzi & Evans 2016; Willcox et al. 2015). Thus, health systems need to mobilise more resources for health especially through pre-payment mechanisms, while reducing reliance on out-of-pocket payments. Mobilised resources also need to be allocated equitably and spent efficiently in a bid to improve the UHC goals of service coverage, quality and financial protection and reduce within country inequalities – indeed, equity and efficiency are identified as intermediate UHC outcomes by the WHO (Borghini et al. 2018; Kutzin 2013; WHO 2010). Equity in health financing or resource allocation refers to a situation where payments or allocation are based on people's ability to pay or economic need, respectively (Ataguba et al. 2018; Kutzin 2013). Efficiency can either be technical efficiency (minimum amount of resources used for a given level of output, or maximum amount of output produced for a given level of resources), or allocative efficiency (how resource inputs and their prices are combined to produce a mix of different outputs) (Cylus et al. 2016). Technical efficiency of health financing refers to a situation where the available financing inputs are optimally used to maximise the level of output, such as UHC outputs (Jordi et al. 2020; Jowett et al. 2016; Khalid et al. 2019). In many settings, however, health resources are inequitably allocated (Borghini et al. 2018; Brixii et al. 2013), and 20-40% of health resources are wasted annually, and more so in LMICs (WHO 2010).

While efficiency and equity are often measured at the national level (Kutzin 2013; Mills et al. 2012), there can be value in taking a subnational perspective, considering how efficiency varies across subnational units along with the distribution of contributions and funding allocations (Barasa et al. 2021; Borghini et al. 2018; Brixii et al. 2013; Khalid et al. 2019). A subnational analysis can reveal variations, inefficiencies or inequities across subnational units which are often masked in national level analyses (Armstrong et al. 2016), and help guide strategies to enhance resource use and allocation within countries, and enhance transparency and accountability in settings where resources are channelled directly to subnational units like facilities, as is the case of direct facility financing initiatives (Kapologwe et al. 2019; Khanna et al. 2021; WHO 2022). Since health financing equity and efficiency are intermediate UHC outcomes (Kutzin 2013; WHO 2010), tracking can guide assessments of progress towards health-related goals like UHC under the SDG 3.

To date, a few studies have assessed equity in financial resource allocation and contributions sub-nationally in LMICs (Borghini et al. 2018; Brixi et al. 2013). These studies found that health funding from different sources was concentrated more among wealthier districts in Malawi (Borghini et al. 2018) and among wealthier provinces in China (Brixi et al. 2013). Some studies have examined the efficiency of financing at the subnational level in relation to outputs such as Disability Adjusted Life Years in Kenya (Barasa et al. 2021), infant mortality in South Africa (Ngobeni et al. 2020), outpatient consultations in Mozambique (Anselmi et al. 2018), and under 5 mortality and service coverage in Zambia (Achoki et al. 2017). These studies show existing inefficiencies in financing health sub-nationally. To date, only one study has analysed efficiency in financing for UHC performance sub-nationally in Pakistan (Khalid et al. 2019), taking into account that efficiency is an intermediate goal of UHC. There is also a lack of studies assessing both equity and efficiency in financing for health at the sub-national level. Furthermore, the relationship between equity and efficiency and UHC is assumed and has not to date been formally tested. Yet it is important to determine the extent to which these indicators are associated with UHC outcomes and therefore serve as useful metrics for UHC progress monitoring.

This study expands the evidence base by analysing equity and efficiency in health financing at the regional level across 26 regions in mainland Tanzania. We focused on the regional rather than the district level for this analysis as the household-level data used in this analysis was not powered for district representation; as well as data on GDP per capita, government and donor expenditure were only available at the regional level. We also focused at the regional level in keeping with previous studies of health financing in Tanzania (Armstrong et al. 2016). Our analysis focused on year 2017/18 as the most recent year for which data were available for multiple financing sources. We specifically analysed equity in resource allocation and households' contributions to healthcare; and analysed efficiency in healthcare spending relative to UHC outputs (service coverage and financial protection). We also tested the association between efficiency and UHC outcomes. Our analysis tracks UHC progress sub-nationally using the intermediate UHC goals of equity and efficiency which can inform policies to address within-country inequities and inefficiencies.

2. Study setting

Tanzania is a lower-middle income country in East Africa. In 2019/20, the Government expenditure on health out of total government spending was 8.1% below the Abuja declaration target of 15%, and spending as a share of GDP on health was 1.8% below the recommended threshold of 5% for achieving UHC. The per capita spending on health was USD 40.3, close to the USD 44 target recommended by WHO for provision of essential health services, but far from USD 86 recommended for UHC. The Tanzanian health system is funded through multiple sources, including the government through general taxation (22%), donor support (34%), out-of-pocket payments (32%), and health insurance contributions (12%) (MOH 2022b). However, health insurance coverage is very low at 14%, and the share of out-of-pocket payments to total health expenditure is 32% (which is well above the recommended threshold of 15% for financial protection) (WHO 2005).

<Table 1 >

This study focused on mainland Tanzania which is decentralised with 26 administrative regions and 184 district councils. Regional and district health managers oversee health care in their respective areas, develop annual plans and prepare budgets in consultation with healthcare providers and communities. Since the decentralisation policy in 1990s (Frumence et al. 2013),

health sector funds in Tanzania are disbursed from the Ministry of Finance and Planning to each district council as block grants (made up from government revenue and external funds provided as general budget support) to cover district level health activities and operational costs across public facilities (Boex et al. 2015). The health sector is also funded through health basket funds (HBF), which are donor funds earmarked for the health sector, and cover most operational costs at the facility level. Since 2017/18, the central government disburses the HBF directly to public health facilities through a direct health facility financing (DHFF) mechanism, with the aim of promoting provider autonomy and responsiveness to patient needs (Kapologwe et al. 2019; MoHCDGEC 2017). The allocation of government funds for health (block grant) and HBF to councils and/or facilities uses an allocation formula which accounts for various adjusters (URT 2020). Note that funds allocated to district councils are different from funds allocated to facilities. In particular, government funds and HBF to district councils are adjusted for population (60%), poverty (10%), under-five mortality for burden of diseases (10%) and capped land factor (20%); while government funds and HBF allocated to health facilities are adjusted for catchment population (40%), distance from facility to council's headquarter (10%), service utilisation on six indicators from DHIS2 (40%) and performance on two indicators of modern family planning use and availability of 10 tracer medicines (10%) (URT 2020).

Households also contribute to health care through health insurance contributions and user fees/out-of-pocket payments. Tanzania has multiple health insurance schemes including: (i) the National Health Insurance Fund (NHIF) for public formal sector employees, who contributes through mandatory payroll deductions (shared between employee 3% and employer 3%); (ii) the Community Health Fund (CHF) as a voluntary scheme for informal sector workers with a harmonized premium of Tanzanian Shillings (TZS) 30,000/- (USD 13) per household of six members (if a household has more than 6 members, they need two groups not exceeding six members to enrol). CHF uses the same premium in all regions with the exception of households in Dar es Salaam region who pay a higher premium of TZS 150 000/- (USD 65) per household of six members due to the higher socioeconomic status of residents (Binyaruka et al. 2023); (iii) the social health insurance benefit (SHIB) under the National Social Security Fund (NSSF), and (iii) multiple private health insurance schemes.

3. Methods

3.1 Conceptual framework

This study was guided by the WHO UHC health financing framework (Kutzin 2013). The framework includes three steps towards UHC (Figure 1), which can be monitored: (i) health financing arrangements (revenue collection, pooling and purchasing), (ii) UHC intermediate objectives (equity in resource allocation, efficiency, transparency and accountability), and (iii) UHC goals (healthcare utilisation relative to need, quality of health services, and universal financial protection). This study focused on describing four financing inputs in Tanzania (government funding, donor funding, health insurance contributions and out-of-pocket payments) to assesses equity and efficiency of health financing across all 26 regions.

<Figure 1 >

3.2 Data sources

We used annual regional level data for health expenditure (inputs) and UHC performance (outputs) for the financial year 2017/18 (Table 2). Government and external health basket fund

(HBF) expenditure data were obtained from the Ministry of Health and Presidents' Office - Regional Administration and Local Government (PO-RALG), respectively. However, government health expenditure includes donor budget support. Government health expenditure and HBF expenditure includes aggregated expenditure across all facilities and districts in a particular region, since some funds are allocated at district level and some at facility level directly.

<Table 2 >

Household Budget Survey (HBS) data 2017/18 from 9463 households, provided regional level data on households' contributions to health insurance and out-of-pocket payments. The HBS 2017/18 did not capture households' contributions to health insurance, instead it captured whether an individual is covered by any health insurance and included household payments for all health services including maternal care through out-of-pocket spending. We estimated contributions to health insurance based on two main schemes in Tanzania (NHIF and CHF), which covered 8% and 6% of the entire population in 2020/21, respectively (MOH 2022a). In the absence of income data or actual household payments, consumption expenditure is used to estimate household contributions to health insurance and tax payments, in keeping with previous studies (Borghi et al. 2009; Mills et al. 2012; Mtei et al. 2012). We therefore estimated household contributions to NHIF by using the premium of 3% share of total household consumption expenditure (a proxy of household income) among those who were covered by NHIF; and estimated contributions to CHF based on premiums for their place of residence among those who were covered by CHF. The estimated annual household contributions to health insurance and out-of-pocket payments from the HBS were used to generate regional level average annual household contributions to health insurance and average annual household out-of-pocket payments. This was done by aggregating all households' contributions and payments per region and dividing by the total number of households within a region. We further divided the regional level average annual household contributions and payments by regional level average household size to obtain per capita estimates per region. Data on UHC outputs (financial protection and service coverage) for efficiency analysis were obtained from different sources. The out-of-pocket payments from the HBS were used to calculate measures of regional financial risk protection for UHC (% of households not incurring catastrophic and impoverishing health expenditure). We also extracted data on regional level service coverage for maternal health services for the calendar year 2018 from the district health information system version 2 (DHIS2), and regional GDP and population size for 2017 from the National Bureau of Statistics (NBS).

3.3 Data analysis

This study used region as a unit of analysis. Regional level health financing expenditures were adjusted by population size to get per capita estimates. This involved dividing government and external HBF expenditures by corresponding regional population size, and dividing household contributions to health insurance and out-of-pocket payments by regional average household size.

To describe the level of health financing and the relative share of each source of financing out of total per capita funding for each region, we generated bar charts and heat maps. All health financing data for year 2017/18 were in TZS (1 USD=2277 TZS as an average exchange rate in 2018). We also described UHC outputs (service coverage and financial risk protection indices) across regions using a bar chart and line graph, respectively.

To assess equity in health funding allocations and contributions across 26 regions, we compared funds allocated to regions from government and HBF, and households' contributions for health by regions (in per capita units) in relation to regional economic need (GDP per capita). We computed a Kakwani index (KI) (Kakwani 1977; O'Donnell et al. 2008) by funding source to quantify the degree of inequity in health financing across regions. Since KI measures the degree of resource distribution according to need or household contributions according to ability to pay, it reflects the difference between the concentration index (a measure of the distribution of funds/ contributions) and the Gini index (a measure of income distribution/ economic need/ ability to pay) across 26 regions. The concentration index (CI) quantified the degree of inequality in the distribution of funding across regions, and measured as twice the area between a concentration curve and a line of equality. The CI ranges between [-1 and +1], whereby zero indicates equality between economic subgroups (regions), while negative and positive values indicate that funds are concentrated more in poorest regions and concentrated more in non-poor regions, respectively. The KI of a financing source j at region i was computed as follows (Kakwani 1977):

$$KI_{ji} = C_{ji} - G_x ,$$

where C_{ji} is the concentration index of a health financing source j at region i ; and G_x is the Gini index of the regional GDP per capita (measure of regional economic status). The KI ranges from -2 to 1. Progressive allocation of funds from government and donors happens if $KI < 0$, meaning that poor regions receive higher shares of government/ donor subsidies in relation to their economic status than least poor regions (i.e., prioritisation of poor regions). $KI > 0$ indicates a regressive allocation of funds in favour of least poor regions. In contrast, households' contributions to health insurance and out-of-pocket payments are progressive if the $KI > 0$, meaning that households in least poor regions contribute a relatively larger share of their resources for health care than households in poor regions. We confirmed whether the CIs and KIs were significantly different from zero using t-tests.

To assess technical efficiency in health financing with respect to UHC outputs, a non-parametric Data Envelopment Analysis (DEA) was used to generate regional efficiency scores. In our case, an efficiency score shows how well a region converts a set of financing inputs into a set of UHC outputs. We used four financing inputs (regional level government and donor funding, health insurance contributions and out-of-pocket payments) and two UHC outputs (regional level service coverage and financial protection indices). Since outputs are a function of multiple inputs, we used all four financing inputs as opposed to each input separately. Since out-of-pocket payments are a source of revenue as a financing input, but also negatively affect financial protection and service coverage, unlike the other financing inputs, we conducted a robustness check by generating efficiency scores using three inputs excluding out-of-pocket payments. Although the chosen service coverage outputs (see below) are officially exempt from user payments, this is weakly enforced with evidence of associated out-of-pocket payments in Tanzania (Binyaruka & Borghi 2022; Kruk et al. 2008). We chose outputs related to UHC as opposed to health outcomes (e.g., life expectancy and mortality) in analysing efficiency of financing inputs, because efficiency is an intermediate goal for UHC (Jordi et al. 2020; Jowett et al. 2016). The service coverage outputs included regional level coverage of three maternal health services (antenatal care 4+ visits, skilled delivery assistance, and postnatal care in 48 hours after childbirth). We obtained regional level coverage data for each service, from DHIS2 and then created an unweighted average maternal health service coverage for each region by adding the coverage of three services and divide by three. The financial protection output was measured as the absence of catastrophic and impoverishing health expenditure. We computed the shares of households that did not incur catastrophic spending and shares of households not pushed into poverty due to health spending. We used a 10%

threshold for catastrophic health spending in line with SDG UHC indicator 3.8.2 (United Nations 2016); while impoverishing health expenditure refers to household spending on health that pushes households into poverty or below the poverty line (WHO 2020b). Impoverishment is not an official SDG indicator but supplements the catastrophic payment indicator by highlighting the poverty implications of out-of-pocket spending (Wagstaff et al. 2018). We used the poverty line of TZS 49,320 per adult equivalent per month reported in the HBS 2017/18 to assess the incidence of impoverishment.

Efficiency scores generated through DEA range from 0 (completely inefficient) to 1 (efficient). We considered an output-oriented approach assuming that a fixed level of funding may lead to various levels of UHC outputs (i.e., possible to maximize outputs with similar levels of inputs). We used DEA as opposed to parametric Stochastic Frontier Analysis (SFA) because DEA accommodates multiple inputs (e.g., financing sources) and multiple outputs (e.g., UHC dimensions), and DEA is a data-driven approach without any assumptions on the form of the production function or the distribution of the error term (Hollingsworth & Parkin 2003; Jacobs 2001).

To test the association between the intermediate objective of efficiency and UHC final goals suggested in the WHO UHC framework (Kutzin 2013), we conducted a pairwise correlation analysis. We generated correlation coefficients showing the strength and direction of the association between efficiency scores and UHC outputs (service coverage and financial protection). All the analyses were performed using STATA version 16.

Ethical issues

Ethical approval was obtained from national and institutional ethics committees in Tanzania. The institutional ethical approval is from the Ifakara Health Institute (IHI/IRB/No: 45-2021), while the national approval is from the National Institute for Medical Research (NIMR/HQ/R.8a/Vol.IX/4099).

4. Results

4.1 Regional health expenditure and performance

Total per capita health expenditure varied significantly between regions (Figure 2a). The total per capita funding ranged from TZS 21,555 (Shinyanga) to TZS 87,272 (Dar es Salaam), a funding gap of almost four times between regions with lowest and highest funding. The greatest funding gap was on per capita insurance contributions ranging between TZS 525 (Rukwa) and TZS 15,007 (Dar es Salaam), while the allocation of HBF had the lowest funding gap, ranging between TZS 1,437 (Dar es Salaam) and TZS 2,657 (Katavi).

On average, the largest sources of regional health funding were government (49%) and out-of-pocket payments (39%), with insurance contributions (7%) and donor HBF (5%) representing the lowest shares of funding (Figure 2b). However, the relative shares of regional funding between sources of financing varied across regions. Regions with the highest share of government funding were Mbeya (71%), Lindi (71%) and Pwani (66%), while Manyara (32%), Simiyu (26%), and Kigoma (21%) had the lowest shares of government funding. Regions with the highest government fundings had lowest shares of out-of-pocket payments and vice versa (Figure 2b). The shares of out-of-pocket payments ranged between 18% (Mbeya) and 73%

(Kigoma); donor HBF between 2% (Dar es Salaam) and 10% (Katavi); and health insurance contributions between 2% (Rukwa and Simiyu) and 17% (Dar es Salaam).

The average performance on service coverage across three maternal health services was 67.8%, but varied across regions, ranging from 49% in Simiyu (lowest) to 86.3% in Kilimanjaro (highest) (Figure 3). Average performance on financial risk protection across regions was 98.1%, with little variation from 93.5% (Kigoma) to 99.4% (Mara and Shinyanga). Four regions (Mara, Shinyanga, Dodoma, and Pwani) had financial protection score greater than 99%, indicating that less than only one percent of households in these regions faced either catastrophic health spending or being pushed into poverty by their health expenditures.

Figure 4 shows regions like Rukwa, Kilimanjaro, and Mtwara had lowest or average total health expenditure but performed relatively better on service coverage (>80%). Similarly, Mara and Shinyanga regions had the lowest total health expenditure but performed better on financial protection (>98.8%).

4.2 Equity in health financing

The government expenditure was significantly pro-rich, concentrated more in least poor regions than poor regions (CI: 0.131, $p < 0.001$), but KI indicated proportional spending relative to regional economic status (not statistically different from zero) (KI: -0.047 , $p = 0.348$) (Table 3). The CI for HBF spending was negative but not statistically significant (CI: -0.017 , $p = 0.269$), with significant progressivity in spending (poorer regions receiving more funding relative to their share of income) (KI: -0.195 , $p < 0.001$). Thus, external HBF spending were significantly progressive, while government health expenditure was proportional to regional economic status (neither progressive nor regressive).

In terms of household contributions to health insurance (NHIF and CHF combined), the least poor households and regions contributed significantly more than their counterparts (CI: 0.240, $p < 0.005$), but KI indicated proportional contributions relative to ability to pay (not statistically different from zero) (KI: 0.062, $p = 0.576$) (Table 3). NHIF contributions were proportional because KI was not statistically different from zero (KI: 0.058, $p = 0.613$), but CHF contributions were significantly regressive (KI: -0.152 , $p < 0.005$) (poor households and regions contributed significantly more than their counterparts). Out-of-pocket payments were significantly regressive relative to ability to pay (KI: -0.187 , $p < 0.001$) (Table 3).

4.3 Efficiency in health financing

The average efficiency score of four financing inputs combined relative to UHC performance was 90% (SD=0.11) (Table 4). Overall, 90% of funding from four financing inputs were optimally used on average to achieve UHC outputs, but 10% of resources were either wasted, underutilised or misallocated and regions could improve UHC outputs by 10% using similar levels of funding. A robustness test of DEA result by using each UHC output separately revealed that the average efficiency score of four financing inputs in improving service coverage was slightly lower 83% (SD=0.14) than for improving financial protection 88% (SD=0.11). This shows that regions are better able to convert spending into financial protection gains than service coverage gains. Ten regions (39%) out of 26 regions were efficient or best performing with 100% efficiency score, these included regions with higher overall per capita total spending like Dar es Salaam (TZS 87,272), and regions with lower per capita total spending like Shinyanga (TZS 21,555). Three regions with the lowest efficiency scores include Lindi (74%), Morogoro (72%) and Ruvuma (69%) (Figure 5). Another robustness test for the

efficiency analysis involved excluding out-of-pocket payments as a financing input. When doing so the efficiency score of the remaining three financing inputs relative to UHC performance were 89% (SD=0.11) (Appendix Table 1) which is similar to what was observed with all four financing inputs. The level of inputs, outputs and efficiency scores of all 26 regions are presented in Appendix Table 2.

4.4 Efficiency and UHC goals

We found no evidence of a significant association between efficiency scores (intermediate objective of UHC) and the UHC index (aggregate of UHC goals) ($p=0.785$) (Table 5). Similarly, there were no significant association between efficiency scores and the service coverage index ($p=0.856$) or the financial protection index ($p=0.436$).

5. Discussion

This study assessed equity and efficiency in health financing across sub-national units (regions) in Tanzania for financial year 2017/18. We found substantial variation in regional per capita total spending, with largest variation in insurance contributions and less variation in HBF spending. The largest sources of regional health funding were government and out-of-pocket payments, with little contributions from health insurance and donor HBF. Regional performance on service coverage varied across regions than financial protection performance. Government spending was proportional to regional economic status; but HBF spending was progressive (equitably distributed), being more targeted to regions with high economic need (poor). The burden of contributing to NHIF was proportional, while the burden of paying for CHF and out-of-pocket payments was higher among the poor (regressive). The average efficiency score across regions was 90%, indicating that 90% of financial resources were used optimally to achieve UHC outputs, while 10% were being wasted or underutilised. We also found no evidence of a significant association between efficiency scores (intermediate objective of UHC) and the UHC index (aggregate of UHC goals).

This study expands on the existing evidence base in four ways: first, we analysed both equity and efficiency of financing across subnational units, as opposed to other studies analysing equity or efficiency separately. It is important to account for equity and efficiency in tracking progress towards UHC, since they are intermediate objectives of UHC (Kutzin 2013). Second, we examined equity and efficiency across a larger number financing inputs (government, donor, health insurance and out-of-pocket) than previous studies (Jordi et al. 2020; Khalid et al. 2019) (Borghini et al. 2018; Brixii et al. 2013). Third, we relied on expenditure data instead of budget data (often used to proxy expenditure), which offers the most reliable estimate of funding received by regions (Borghini et al. 2018). Expenditure data are preferred as they reflect actual spending than budget data, due to low rate of disbursing budgeted funds especially in low-income setting. Fourth, we expanded the method of analysing equity through the use of Kakwani Index as opposed to using concentration indices alone. Kakwani index is preferred in assessed equity as it takes into account the distribution of resources (through a concentration index) and distribution of economic need or ability to pay (through a Gini index).

We found government expenditure was significantly concentrated more among least poor regions (pro-rich) in Tanzania. This finding is similar to other studies that found that government funding was concentrated more among wealthier districts in Malawi (Borghini et al. 2018) and among wealthier provinces in China (Brixii et al. 2013). Donor spending was neither pro-poor nor pro-rich in Tanzania, which is different from pro-rich allocation in Malawi (Borghini et al. 2018). However, the assessment of funds concentration reported in Malawi

(Borghi et al. 2018) and China (Brixi et al. 2013) did not account for distribution of economic needs as being measured through a progressivity analysis.

The progressivity analysis in Tanzania revealed proportional government health spending and progressive spending of donor HBF across regions, which is encouraging in relation to the intermediate UHC objective of enhancing equity. This is because regions received proportional amount of government funding (subsidies) relative to their economic status; and poor regions with higher economic need received a higher share of donor funds (subsidies) in relation to their economic status than in least poor regions. Proportional government spending and progressivity in donor HBF spending in Tanzania is likely due to the resource allocation formula used to allocate these funds sub-nationally (Nyamhanga et al. 2013; URT 2020). For instance, district allocation accounted for poverty, disease burden and under 5 mortality and capped land factor for rural location. Like other countries in sub-Saharan Africa (Anselmi et al. 2015; McGuire et al. 2020; McIntyre et al. 2007; Nyamhanga et al. 2013), needs based adjusters that promote equity were included in the allocation formula for both funding sources (in terms of remoteness) in Tanzania. However, the allocation formula for government funds to district councils also adjusted for other measures of need including: poverty (10%), under-five mortality (10%) and capped land factor (20%). Nevertheless, evidence from Tanzania have shown that needs-based resource allocation formula reduced inequalities in allocating government funds and HBF between rural and urban districts (Nyamhanga et al. 2013; Semali & Minja 2005).

Our study revealed that the regional contributions to a social health insurance (NHIF) were proportional, which differs from progressivity contributions reported previous using household level data in Tanzania and elsewhere (Asante et al. 2016; Mtei et al. 2012). Nevertheless, proportional and progressivity in NHIF contributions are largely driven by the fact that NHIF members are mostly from higher socioeconomic groups, working in the formal sector, and they contribute three percent through payroll deductions which takes into account peoples' ability to pay (Macha et al. 2012; Mtei et al. 2012). In contrast, the regional contributions to CHF scheme were regressive due to the concentration of membership among poorer or rural groups and the flat rate premium which translates into a relatively larger share of household resource coming from poorest compared to least poor households (Binyaruka et al. 2023; Kalolo et al. 2018; Macha et al. 2012; MoHCDCGEC 2018; Mtei et al. 2012). The regressivity of out-of-pocket payments is similar to previous findings in Tanzania (Mtei et al. 2012), and a systematic review by Asante et al. (2016) which revealed out-of-pocket payments in most settings were regressive and inequitable means of financing in absence of pooling, with the exception of Uganda (Kwesiga et al. 2015), Nigeria (Ichoku et al. 2010) and some countries in Asia-Pacific region (Asante et al. 2016; O'Donnell et al. 2008) showing progressivity in out-of-pocket payments.

This study revealed that 90% of financial resources for health were on average spent efficiently to achieve UHC outputs, a similar efficiency level to that reported across divisions in Pakistan for pooled funding (Khalid et al. 2019) and in a study across 172 countries (Jordi et al. 2020). Remaining resources are possibly wasted, underutilised or allocated into activities that do not contribute to UHC improvement. Moreover, on average, regions in Tanzania were better able to convert spending into financial protection gains than service coverage gains. This is possibly due to the additional demand side factors that constrain access beyond financing (Jacobs et al. 2012), since the average service coverage index was 68% while the financial protection index was 98%. One way to further enhance efficiency is through resource allocation adjusters that target population and health service workload (Anselmi et al. 2015), and both HBF and

government funding included such adjusters, with HBF also including a performance element (URT 2020).

We found no evidence of an association between efficiency and UHC outputs using data across regions in Tanzania; and therefore, our data do not support the relationship posited in the health financing framework for UHC (Figure 1) (Kutzin 2013). The correlation coefficient was negative, but not statistically significant, indicating that regions with higher efficiency score had lower UHC outputs. However, our sample size of 26 regions is small, and more research is needed to explore whether there is an association between equity and efficiency and UHC in other settings.

There are some limitations to this study. First, we relied on estimates of out-of-pocket and insurance contributions from household survey data that is regionally representative, but this may not reflect the actual contributions across all households in the region. Second, we only examined one channel of external financing (the HBF), and were unable to examine other channels of external funding (e.g., off-budget support, aid through projects) at regional level as these data were unavailable. However, HBF remains one of the main sources to finance operational expenses at facility level (e.g., drugs and outreach). Third, we analysed government health expenditure across regions which includes both government funds and donor budget support, but we were unable to disentangle the two aspects. Fourth, we were unable to identify drivers of (in)efficiency through a regression analysis because of the limited sample size of 26 sub-national units. Fifth, we were unable to test the relationship between equity and UHC, as our equity assessment produced national equity measures. Sixth, we estimated the NHIF contribution based on 3% of household consumption expenditure instead of 3% deduction from gross income. We believe this is the most practical/ feasible approach to generate the best possible results in the absence of income data.

Our findings have important implications for research and policy. Our equity findings, such as considerable regional financing disparities, and inequitable contributions to community-based health insurance and out-of-pocket payments, highlight the need for regular sub-national resource allocation tracking and equity monitoring in household health care payments to inform progress towards UHC. Our findings further underscore that average funding and performance can mask important substantial variations which need to be addressed. Establishing and monitoring annual country-specific targets for equitable resource allocation is essential. Policy makers need to incorporate a mix of adjusters into the allocation formula to account for the multiple policy objectives of equity and efficiency. With the increasing focus on direct health facility financing (WHO 2022), countries should establish robust allocation formulas considering health facility characteristics such as: economic status of the catchment population and performance. Policymakers should also ensure efficient resource spending to achieve goals, guarantee value for money, and minimize misallocation or misuse by strengthening or implementing public financial management systems.

Addressing supply- and demand-side barriers to healthcare access or use is vital to improving UHC service coverage. This may involve interventions to increase the affordability of care for poorer groups (e.g., strengthening health insurance coverage and exemptions), expanding benefit packages to cover additional costs (Binyaruka & Borghi 2022), and improving the quality of service delivery (e.g., ensuring drug availability and outreach services) to attract demand. To enhance equity in household contributions, policy makers should redesign and strengthen pre-payment mechanisms like mandatory health insurance to enable broader risk pooling instead of relying on inequitable and catastrophic out-of-pocket payments. Further

research using primary data and qualitative research are needed to understand drivers of inequities and inefficiencies across regions in order to inform policy makers and reforms towards UHC. Despite the need to continue tracking country’s progress towards UHC, we also highlight the need for more empirical evidence to validate the associations proposed in the health financing framework for UHC (Figure 1), including the relationships between efficiency and equity, and UHC outputs; and establish appropriate indicators to track UHC progress at all levels of the health system.

List of Tables

Table 1: Selected health financing indicators in Tanzania

Indicators	2019/20	Target
Government health expenditure as a % of total government spending	8.1%	15% Abuja declaration target
Government health expenditure as a % of GDP	1.8%	5% for UHC (WHO 2020a)
THE per capita (USD)	40.3	44 USD for essential services by WHO (86 USD for UHC)(Jowett et al. 2016)
THE as % of GDP	3.9%	
Breakdown of THE		
<i>External/ donor expenditure</i>	34%	
<i>Government health expenditure</i>	22%	
<i>Health insurance</i>	12%	
<i>Out-of-pocket expenditure</i>	32%	15% threshold for financial protection (WHO 2005).
Health insurance coverage	14%	

Source: National Health Accounts (NHA) data 2019/20 (MOH 2022b).

Table 2: Data type and sources

Data types	Regional level data	Source (2017/18)
Health financing (inputs)	Government health expenditure	MTEF, NHA
	External health expenditure –using a proxy of Health Basket Fund (HBF)	PORALG
	Health insurance contributions	HBS
	Out-of-pocket payments	HBS
UHC performance (outputs)	Financial risk protection – using catastrophic and impoverishing health expenditure *	HBS
	Service coverage –using three maternal health services	DHIS2

Notes: *This was calculated based on out-of-pocket payment data from the HBS; MTEF -Medium-Term Expenditure Framework; NHA - National Health Account; HBS - Household Budget Survey; NBS- National Bureau of Statistics; DHIS2 –District Health Information System version 2.

Table 3: Equity in resource allocation and households’ contributions across regions

Financing mechanism (inputs)	Concentration index (p-value)	Kakwani index (p-value)
Government Health Expenditure (GHE)	0.131 (0.004) ***	-0.047 (0.348)
Health Basket Funds (HBF)	-0.017 (0.269)	-0.195 (0.000) ***
Households’ contributions to insurance	0.240 (0.016) **	0.062 (0.576)
NHIF	0.236 (0.019) **	0.058 (0.613)
CHF	0.025 (0.700)	-0.152 (0.012) **
Household out-of-pocket payments	-0.010 (0.899)	-0.187 (0.005) ***

Notes: GINI index=0.178 (p<0.001); *** denotes significance at 1%, ** at 5%, and * at 10% level.

Table 4: Efficiency scores

Efficiency scores (four financing inputs) *	Mean [SD]	Range (min – max)
UHC output	0.90 [0.11]	0.69 – 1.00
Service coverage output only	0.83 [0.14]	0.53 – 1.00
Financial protection output only	0.88 [0.11]	0.69 – 1.00

Notes: SD=Standard Deviation; *Four financing inputs (government funding, donor funding, insurance contributions, out-of-pocket payments) in per capita estimates; two UHC outputs (service coverage index of 3 maternal health services, and financial protection index using two indicators of catastrophic and impoverishing spending).

Table 5: Association between efficiency scores and UHC goals

UHC final goals	Efficiency score ^ (P-value)
UHC index combined	-0.056 (p=0.785)
Service coverage index	-0.038 (p=0.856)
Financial protection index	-0.159 (p=0.436)

Notes: ^Efficiency score based on 4 financing inputs vs. 2 UHC outputs (service coverage and financial protection indices); *** denotes significance at 1%, ** at 5%, and * at 10% level

Appendix Table 1: Efficiency scores using two scenarios of financing inputs

(1) Efficiency scores (four financing inputs) *	Mean [SD]	Range (min – max)
UHC output	0.90 [0.11]	0.69 – 1.00
Service coverage output only	0.83 [0.14]	0.53 – 1.00
Financial protection output only	0.88 [0.11]	0.69 – 1.00
(2) Efficiency scores (three financing inputs) ^		
UHC output	0.89 [0.11]	0.69 – 1.00
Service coverage output only	0.83 [0.15]	0.53 – 1.00
Financial protection output only	0.86 [0.11]	0.68 – 1.00

Notes: SD=Standard Deviation; *Four financing inputs (government funding, donor funding, insurance contributions, out-of-pocket payments) in per capita estimates; two UHC outputs (service coverage index of 3 maternal health services, and financial protection index using two indicators of catastrophic and impoverishing spending); ^efficiency scores based on three financing inputs (excluding out-of-pocket).

Appendix Table 2: Level of inputs, outputs and efficiency scores

REGION	Financing inputs (per capita TZS)				UHC outputs (%)		Efficiency scores (by output type)		
	Government Health Expenditure	Health Basket Fund	Health Insurance contributions	Out-of-pocket payments	Service coverage index	Financial protection index	UHC	Service coverage	Financial protection
Arusha	35,003	1,814	4,466	14,852	59.3	98.5	0.83	0.64	0.83
Dar Es Salaam	26,481	1,294	13,519	37,329	73.0	97.6	1.00	1.00	1.00
Dodoma	23,133	1,836	5,725	12,304	62.3	99.2	0.83	0.70	0.83
Geita	9,783	1,629	1,882	9,688	65.7	98.5	1.00	0.99	1.00
Iringa	31,658	1,945	3,043	15,556	72.0	97.7	0.77	0.74	0.77
Kagera	16,281	1,814	2,053	12,539	75.3	97.6	0.92	0.92	0.86
Katavi	8,553	2,394	1,362	10,699	56.0	97.8	1.00	0.91	1.00
Kigoma	10,411	1,776	1,307	35,667	72.7	93.5	1.00	1.00	0.86
Kilimanjaro	29,398	1,580	6,140	16,579	86.3	98.5	1.00	1.00	0.93
Lindi	45,165	2,185	3,776	12,573	76.0	98.0	0.74	0.74	0.70
Manyara	23,001	1,959	3,401	44,349	49.3	97.9	0.77	0.53	0.77
Mara	11,796	1,652	3,093	12,610	58.7	99.4	0.97	0.82	0.97
Mbeya	43,139	1,829	4,355	11,073	68.7	98.8	0.84	0.79	0.84
Morogoro	26,235	2,079	2,218	20,365	71.3	97.4	0.72	0.72	0.72
Mtwara	23,521	1,749	2,085	20,932	78.7	98.4	0.92	0.92	0.86
Mwanza	20,432	1,515	1,541	9,851	73.7	98.5	1.00	1.00	1.00
Njombe	24,521	2,060	6,641	19,146	74.7	98.2	0.76	0.76	0.73
Pwani	39,666	2,049	2,085	16,451	79.0	99.1	0.79	0.79	0.74
Rukwa	10,686	2,000	473	13,320	76.7	97.7	1.00	1.00	1.00
Ruvuma	24,167	2,227	5,109	12,875	71.0	98.5	0.69	0.68	0.69
Shinyanga	10,876	1,619	1,397	5,528	69.3	99.4	1.00	1.00	1.00
Simiyu	8,332	1,606	801	21,798	49.0	97.1	1.00	0.82	1.00
Singida	18,107	2,026	1,108	9,943	62.3	98.6	0.90	0.77	0.90
Songwe	13,522	1,744	862	14,770	65.0	98.6	1.00	0.90	1.00
Tabora	9,670	1,977	2,437	12,473	65.3	97.6	0.99	0.94	0.94
Tanga	29,082	1,735	5,173	14,243	51.7	98.6	0.86	0.58	0.86

Figure 1: UHC health financing framework

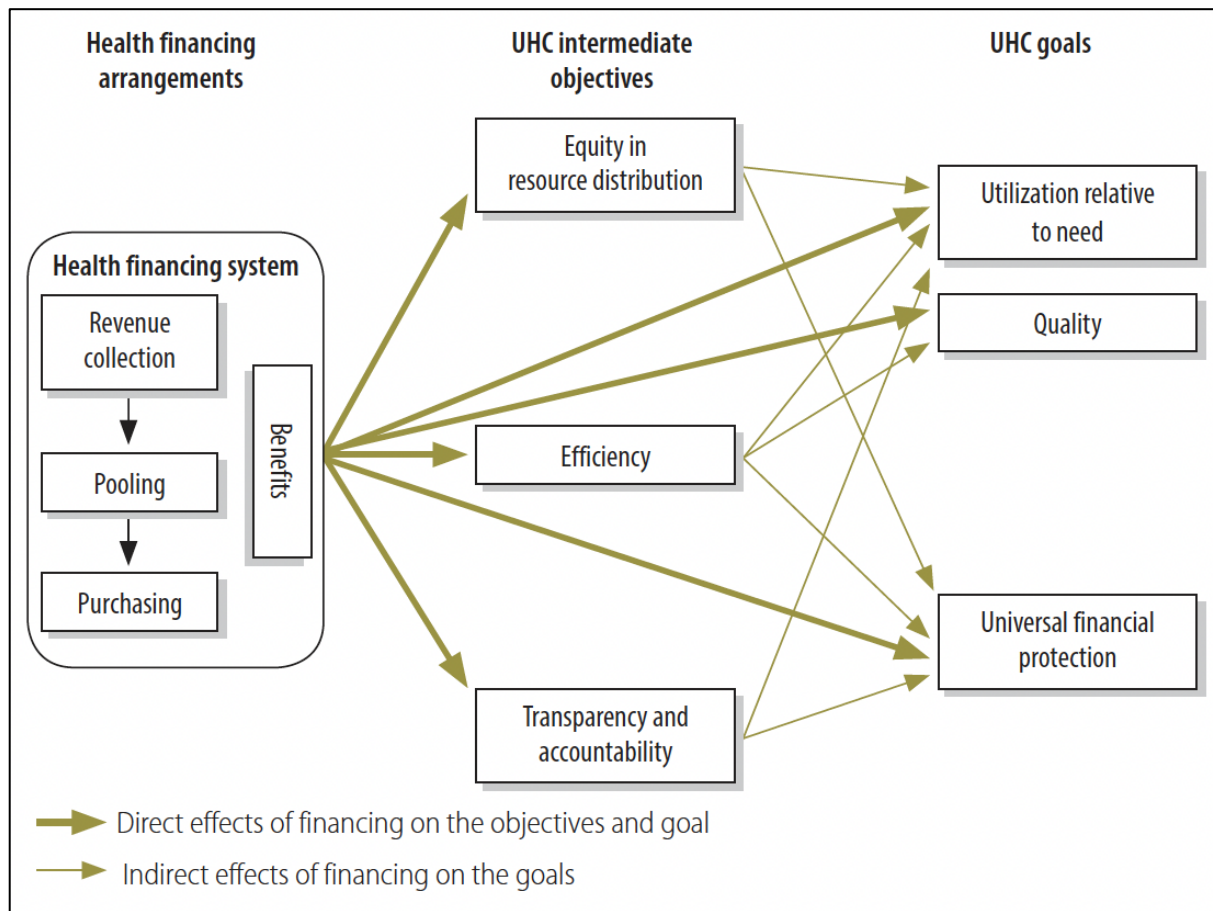


Figure 2: Regional health expenditure per capita

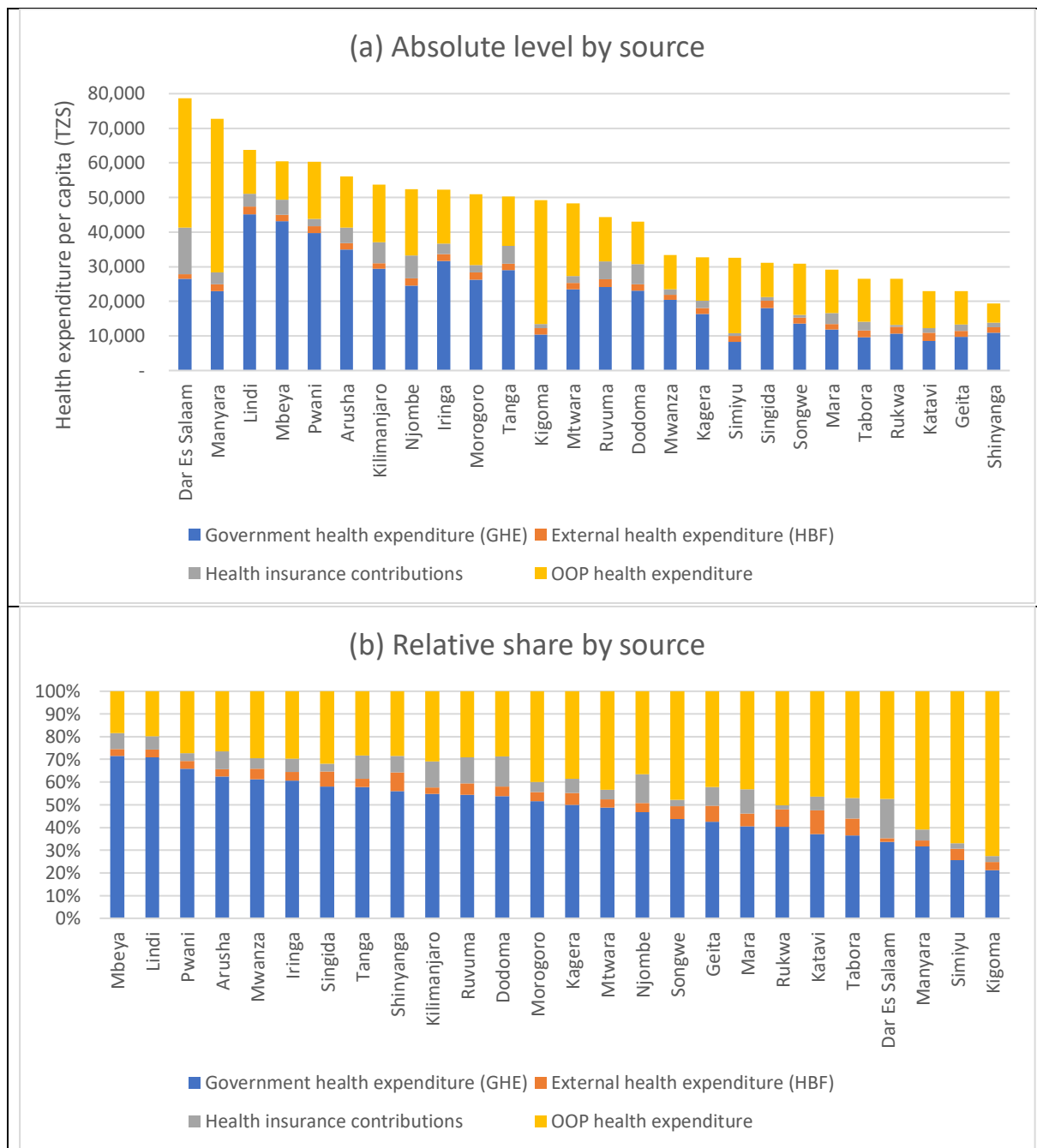


Figure 3: Regional performance

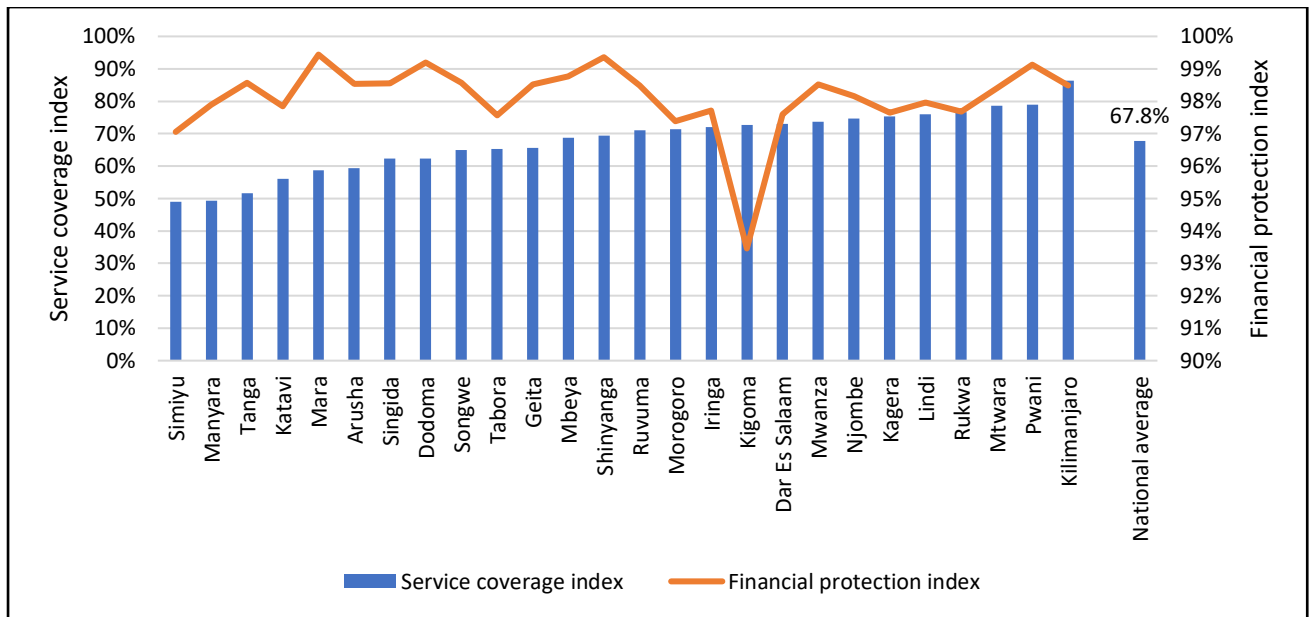
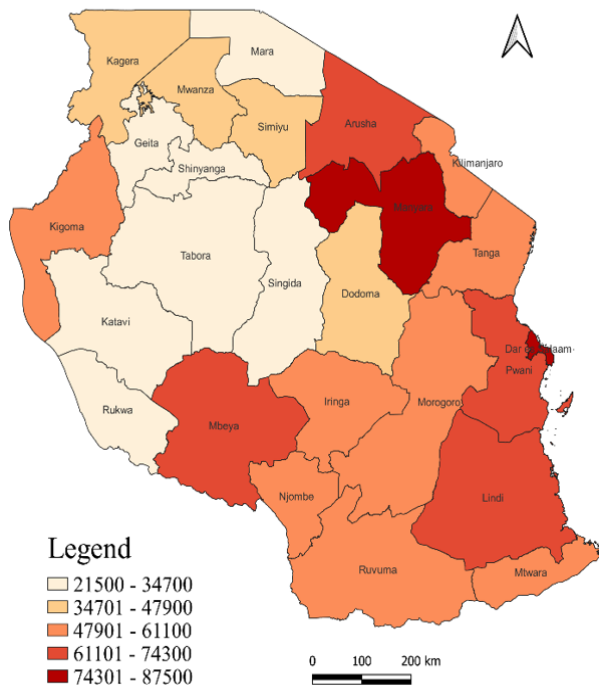
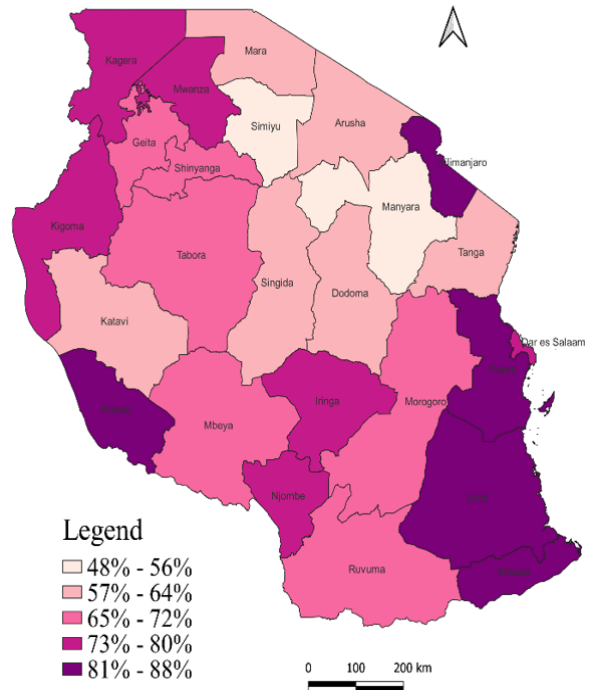


Figure 4: Heat maps on regional funding and performance

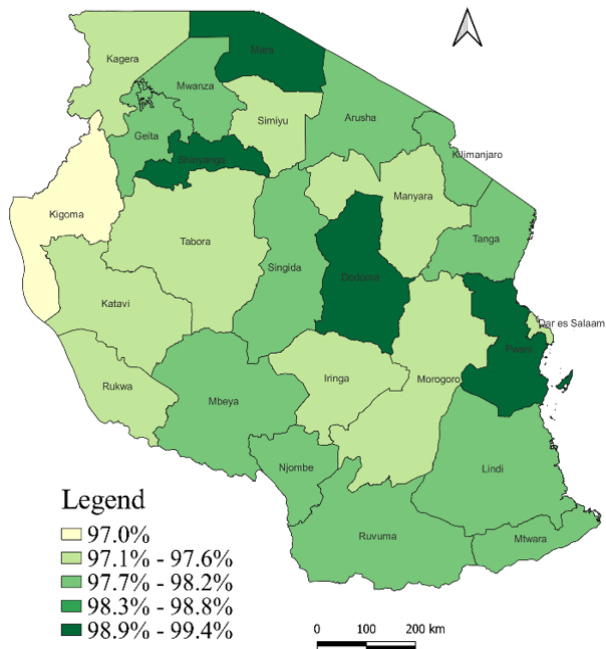
Total health expenditure (per capita)



Service coverage index



Financial protection index



Efficiency scores

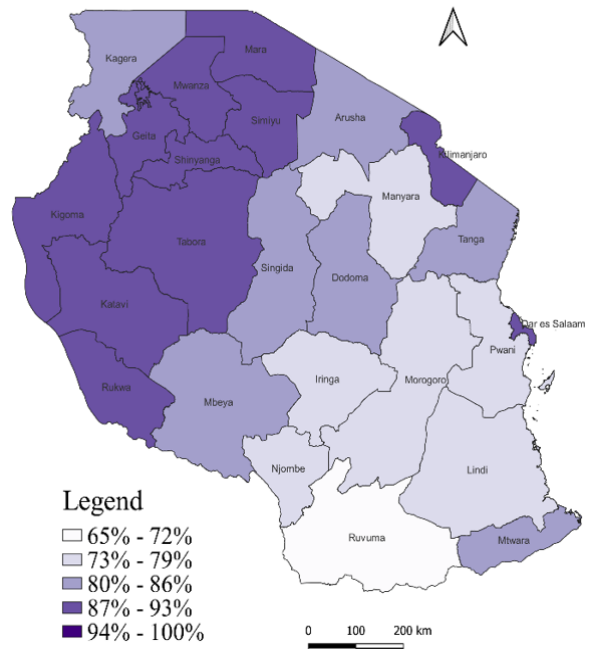
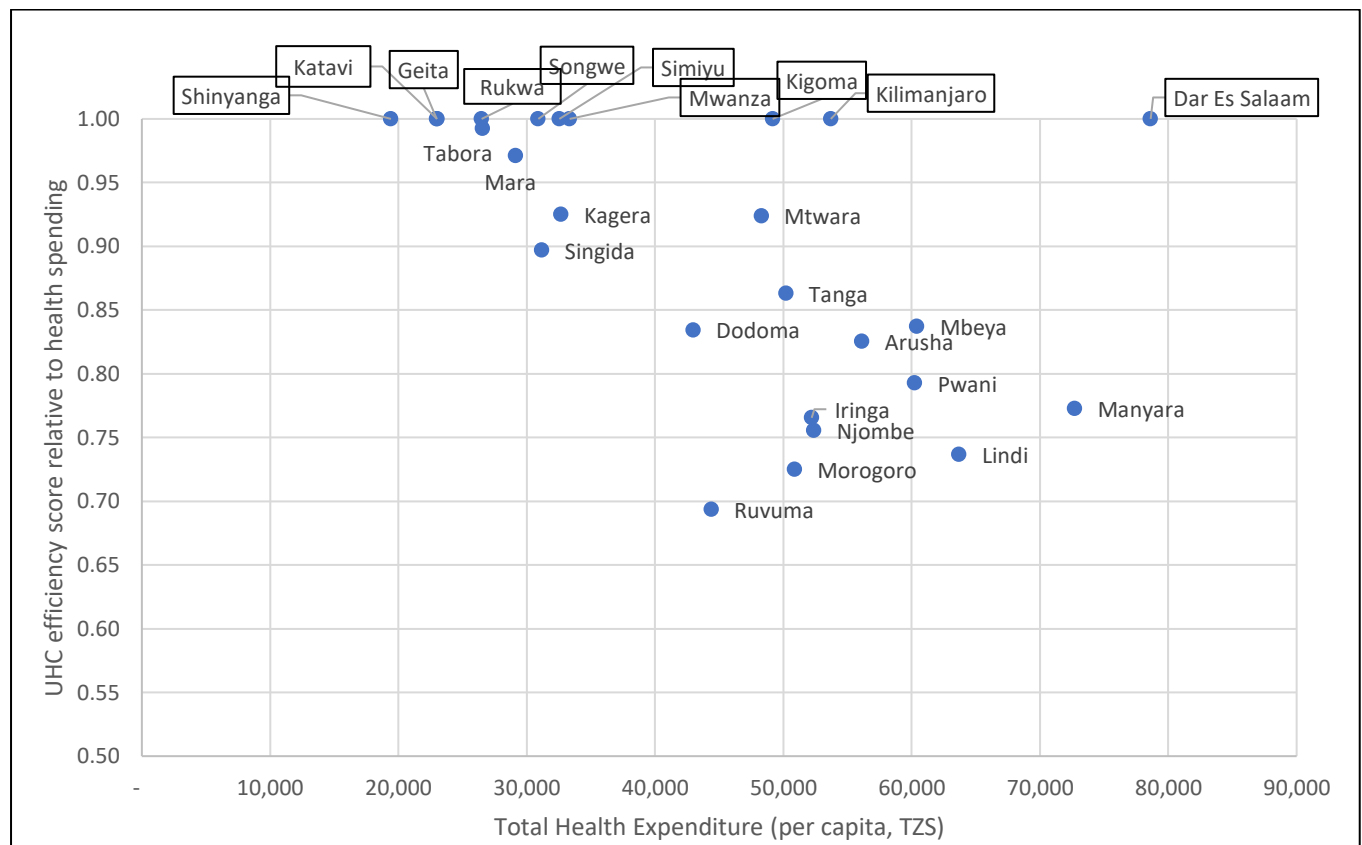


Figure 5: UHC performance relative to per capita total health spending in 26 regions



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