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Investigating sustainability challenges for the National Health Insurance Fund in Tanzania: a modelling approach

Brianna Osetinsky [iD] ,[1,2] Günther Fink,[1,2] August Kuwawenaruwa [iD] ,[3] Fabrizio Tediosi [iD] [1,2]

[1]Epidemiology and Public Health, University of Basel, Basel, Switzerland
[2]Household Economics and Health Systems Research Unit, Swiss Tropical and Public Health Institute, Basel, Switzerland
[3]Health Systems, Impact Evaluation and Policy, Ifakara Health Institute, Ifakara, Tanzania

Correspondence to
Dr Brianna Osetinsky;
bosetinsky@gmail.com

ABSTRACT

Objective This study aimed to model the long-term cost associated with expanding public health insurance coverage in Tanzania.

Design, setting and participants We analysed the 2016 claims of 2 923 524 beneficiaries of the National Health Insurance Fund in Tanzania. The analysis focused on determining the average cost per beneficiary across 5-year age groups separated by gender, and grouped by broad health condition categories. We then modelled three different insurance coverage scenarios from 2020 to 2050 and we estimated the associated costs.

Outcome measures Average cost per beneficiary and the projected financing requirements, projected from 2020 to 2050.

Results The analysis revealed that the average per beneficiary cost for insurance claims was $38.58. Among males over 75 years, the average insurance claims costs were highest, amounting to $125. The total estimated annual cost of claims in 2020 was $151 million. Under the status quo coverage scenario, total claims were projected to increase to $415 million by 2050. Increasing coverage from 7% to 50% would result in an additional financing requirement of $2.27 billion. If coverage would increase by 10% annually, reaching 56% of the population by 2050, the additional financing need would amount to $2.84 billion.

Conclusion This study highlights the critical importance of assessing the long-term financial viability of health insurance schemes aimed to cover large segments of the population in low-income countries. The findings demonstrate that even without expansion of coverage, financing requirements for insurance will more than triple by 2050. Furthermore, increasing coverage is likely to substantially escalate the cost of claims, potentially requiring significant government or external contributions to finance these additional costs. Policymakers and stakeholders should carefully evaluate the sustainability of insurance schemes to ensure adequate financial support for expanding coverage and improving healthcare access in low-income settings.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The utilisation of insurance claims data for this analysis provides a rich comprehensive and detailed record of the care provided and associated costs through the National Health Insurance Fund (NHIF) for the entire country.

⇒ The modelled projections take into account dynamic demographic changes and are informed by policy-relevant coverage growth scenarios that are currently being discussed by stakeholders from NHIF and the Ministry of Health.

⇒ The available data are restricted to the information contained within the claims and beneficiary data sets, which do not include diagnosis records, and have limited beneficiary covariates. This limits the depth of analysis that could be performed.

⇒ The study relied on only 1 year of claims data, which restricts the ability to evaluate changes and trends over time. Longer term data would have provided a more comprehensive understanding of the evolving patterns.

⇒ The projections presented in the study are conservative estimations due to certain factors that could not be incorporated into the model. These factors include the potential changes in age-specific burden of disease, increases in costs of care due to the introduction of new technologies and specific cost-sharing policies.

INTRODUCTION

Access to quality healthcare without risk of financial hardship is at the centre of the global push for universal health coverage (UHC). Pursuing the goal of UHC in low and middle-income countries (LMIC) requires a multifaceted effort to expand the availability and quality of essential health services while containing out-of-pocket (OOP) payments that can impoverish households. To this end, in sub-Saharan Africa (SSA) several countries are employing social health protection schemes such as national-based or community-based health insurance.[1 2]

In most of these countries, financing health insurance schemes poses a major challenge. In theory, health insurance schemes work if all households would pay a premium contribution into a national pool. However, in practice in LMICs, automatic payments or deductions are only possible for the generally

small proportion of the population with formal employment, and targeting this sector only implies limited potential revenue, smaller risk pools and, most importantly, major inequity in enrolment.[3 4]

Like many other countries in SSA, Tanzania has been aiming to increase enrolment into the national health insurance scheme over nearly two decades. To date, the total programme costs are covered by premium contributions. The health financing strategy aims to increase insurance coverage and work towards a single national health insurance.[5] However, it remains unclear how such a unified national scheme would look in practice, and how it could be financed in light of an ageing population and an increase in chronic care needed, as the prevalence of non-communicable diseases (NCDs) rises.[6] Benefit packages are designed to be comprehensive in order to be attractive for the population; however, this poses a major challenge to the financial sustainability of these programmes.[7 8]

In this manuscript, we analyse the beneficiary and claims data from the Tanzanian National Health Insurance Fund (NHIF) to compute insurance cost by age, gender and disease. We then use these estimates to predict future financing needs under a range of insurance expansion scenarios.

METHODS
Study setting
Tanzania is a lower middle-income country with relatively high economic growth, averaging 6% annually since 2010 (see online supplemental table S1 for Tanzanian economic and health financing indicators).[9] The population is 59.7 million, and the median age is 18 years, with 43% under the age of 14.[10] Life expectancy at birth has increased from 56 to 64 years from 2007 to 2016.[11]

The leading causes of death in Tanzania are maternal and neonatal diseases, respiratory infections and tuberculosis, HIV, neglected tropical diseases and malaria.[12] However, the burden of NCDs such as cardiovascular diseases and diabetes is growing, and the age-adjusted disability-adjusted life years rate due to NCDs is now almost the same as all communicable, maternal, neonatal and nutritional diseases, which have been declining since 2005.[13]

In Tanzania, only 32% of the population had health insurance as of 2018.[14] The NHIF is the most comprehensive health insurance programme in Tanzania and covers 7% of the population based on the number of beneficiaries reported in the NHIF Annual Report from 2020/2021.[15] The community health insurance (Improved Community Health Fund) provides insurance primarily in the informal sector, though coverage has been decreasing since 2018, and as of July 2021 only 5% of the population was actively insured. The remaining 1% is covered by other private insurance schemes.[16 17] The majority of the population does not have health insurance, and OOP costs account for 23% of all health expenditures.[18]

The NHIF was established in 2001 as a compulsory national health insurance for civil servants, but has expanded to include mandatory enrolment for all public sector employees. Additionally, now some private companies in the formal sector, associations and nongovernmental organisations have agreements with the NHIF and provide mandatory NHIF enrolment for all of their employees. The newest coverage group is voluntary membership, and it is now available for private individuals, people working in the informal sector, students and retirees.[19] In addition to the enrolled policyholder, the beneficiaries include a spouse, and up to four dependents that can be parents of either spouse, or minor children. As a result of many people including parents as beneficiaries due to high OOP cost for care of older people, and the subsidised cost of healthcare for children, many contributing members choose to set parents as dependents. Compared with the general population of Tanzania, NHIF beneficiaries are older, and children under 18 years are disproportionately underenrolled. The beneficiaries are also more likely to have higher education and socioeconomic status compared with the total population.[10]

The NHIF reimburses providers on a fee-for-service basis and provides extensive benefits, including inpatient and outpatient care services, physiotherapy and rehabilitation care, optical services, dental and oral services, retirees' health benefits, orthopaedics, medical appliances and prescription medicines. The reimbursement is based on tariffs agreed on by the NHIF and the healthcare providers. NHIF members can receive care from both public and private facilities within the network of 7390 accredited NHIF facilities, accounting for 79% of all health facilities in Tanzania.[15]

Data and empirical strategy
This analysis used the complete NHIF claims and beneficiary databases for 2016. There were 36 092 414 claims for 7 862 934 treatment episodes in the claims database. This includes the date of service, cost of claim, type of claim, that is, consultation, medications, diagnostic examinations, inpatient charges, procedural charges, other charges, and finally service details such as information on the names of medications dispensed, which consumables were charged and details on consultations and procedures. The claim cost is the monetary value reported by the health facilities to the NHIF as per the NHIF tariff list. The beneficiary database covers all registered beneficiaries during 2016 including the principal policyholder and any of their registered dependents. The beneficiary database included anonymised identification numbers, birthdate, gender and member category for 2 927 114 beneficiaries. We linked the beneficiary information and claims by identification number, date of birth and gender. Data cleaning identified duplicate reports and OpenRefine software was used in order to clean non-numerical variables to unify naming and spelling conventions of medications and

treatments. Those beneficiaries without claims for 2016 were included in the linked data set with their claim number zero and claim cost zero. When linked, this data set included 37 601 313 observations. We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines including the REporting of studies Conducted using Observational Routinely-collected Data (RECORD) statement for the reporting of our findings.[20]

Claims and definitions

Within the NHIF system, each component of a visit to a healthcare facility is filed as a separate claim. Each treatment episode may have multiple claims, including for registration costs, consultation fees, specific medicines each recorded separately, and consumable supplies claimed, procedures, laboratory tests and surgical and inpatient costs. Within the claims database all inpatient charges for a single treatment episode are billed on 1 day, so we also aggregated a beneficiary's claims within a single day, as a treatment service episode.

We then used identifying information from the claims, primarily medications and procedures to classify the treatment episodes according to general health condition categories. Conditions were classified broadly by category as cardiometabolic NCDs, cancers, mental health and neurological disorders, communicable diseases, dental care, maternal care and childbirth, and injury/surgery. If there was no clearly modal category, the treatment episodes were deemed non-attributable and included in the residual category 'Other treatment'. Example conditions included in the broad categories are given in online supplemental table S2, and examples of service details are included in online supplemental table S3. Costs of all claims within the treatment episode were attributed to the condition category.

All claims costs were converted from Tanzanian shillings (TZS) to US$ using the average 2016 currency exchange rate of TZS2177 to US$1 from the World Bank official annual average based on monthly averages. All results are presented in real 2016 US$.[21]

Analysis of claims

We divided all patients into 5-year age groups as well as a residual 85 years and older group using age at the end of the claims period (31 December 2016). We quantified the per cent of all treatment events within the gender-separated 5-year age group in each disease category. We also calculated the claims cost from each treatment episode. To generate the per person claims cost for each category and group, we divided the total claims by the number of registered patients in each gender and age category regardless of if they had a claim in the last year.

Predictions of the long-term NHIF claims costs

To predict the NHIF costs up to 2050 we considered the following three enrolment scenarios.

Scenario A: stable coverage per cent in population

The current coverage of the NHIF is 7% of the total population using population estimates from the United Nations (UN) Population Projections for Tanzania and the number of beneficiaries, but the distribution of this coverage is not uniform across the population groups (see online supplemental figure S1). We assumed that enrolment increased proportionally to population growth in each age group and we then kept group-specific coverage proportion constant over time to project to 2050.

Scenario B: target of 50% NHIF coverage by 2025

In Tanzania, the government set a goal of increasing NHIF coverage to 50% of the total population by 2025.[22] To model this 50% coverage target scenario, we increased coverage over the 2020–2025 period across all groups in equal steps to reach 50% coverage in 2025, and then kept coverage constant at this level until 2050.

Scenario C: continued 10% annual increase in NHIF coverage

Given that scaling up insurance coverage so rapidly may not be feasible in practice, we also considered a more moderate scenario with a gradual increase in enrolment of 10% annual growth in coverage. To operationalise this scenario we increased the coverage by 10% as both a share of the current enrollees within each gender-specific group and accounting for the growing and ageing population. Once any group reached full coverage, the increased enrolment to continue a 10% total growth was split between the remaining groups.

All three scenarios drew on the population projections from the 2019 UN World Population Prospects.[11] We used the medium estimates as our main scenario, and high and low projections to generate upper and lower bounds. Population projections for Tanzania indicate a significant growth in size, reaching an estimated 129.4 million by the year 2050. Alongside this growth, the country is also experiencing an ageing population due to the decline in the crude birth rate and an increase in life expectancy. This demographic shift plays a crucial role in shaping the changing prevalence of diseases, as reflected in the Global Burden of Disease estimates.[13]

Due to the uncertainty surrounding the effect sizes and trends of other factors contributing to the rise in the burden of NCDs, we have taken a conservative approach in our modelling. We have assumed that the average burden of diseases across different age groups will remain unchanged throughout the entire duration of our model period. For all three scenarios we modelled the total and category-specific costs for each gender-separated 5-year age group based on the number of beneficiaries and the costs per beneficiary as calculated above, and projected the total annual claims cost from 2020 to 2050.

As all public sector employees are currently enrolled in the NHIF through the mandatory scheme, the increased enrolment will be from voluntary individual enrolment or mandatory private sector employee programmes. To achieve the ambitious growth scenario targets, significant

Table 1 NHIF 2016 claims and beneficiary data

NHIF claims	n/mean	(%/SD)
Total claims	33 847 649	
Total cost of all claims	$104 279 229	
Mean cost of claims	US$3.10	(US$25.8)
Total treatment events	6 372 724	
Mean cost of treatment event	US$17.54	(US$75.63)
Number of treatment events by principal condition		
Cardiometabolic NCD	890 114	14.0%
Cancer	22 153	0.3%
Mental and neurological disorders	89 782	1.4%
Communicable disease	3 865 175	60.7%
Injury/surgery	107 851	1.7%
Dental work	65 893	1.0%
Maternal care and childbirth	44 277	0.7%
Other	1 287 479	20.2%
Concurrent treatment for NCD and communicable disease	273 506	4.3%
NHIF beneficiary demographics	**n/mean**	**(%/SD)**
Enrolled beneficiaries	2 923 524	
Age	30	(20)
Female	1 552 119	53%
Enrollees with zero claim in 2016	1 484 952	51%
Per beneficiary mean treatment events	2.2	(4.2)
Per beneficiary mean treatment events if claims >0	4.4	(5.1)

NCD, non-communicable disease; NHIF, National Health Insurance Fund.

endeavours will be necessary to improve uptake of individual enrolment or private sector employer enrolment, as the present low coverage of the NHIF indicates.

Patient and public involvement
Public representatives proposed scenario B for our growth modelling and projections. We have worked with stakeholders from the NHIF, the Ministry of Health, and the President's Office, Regional Administration and Local Government in dissemination plans.

RESULTS
We analysed 33 847 649 claims across 6 372 724 treatment events and 2 923 524 enrolled beneficiaries. As shown in table 1, the average number of claims for each beneficiary was 2.2, though 51% of beneficiaries had zero claims recorded in 2016. Of beneficiaries with at least one claim, the average number of claims was 4.4. The average cost per episode was $17.54 (SD $75.63). Claims that were primarily attributed to communicable disease treatments made up 60% of all claims, 14% were for cardiometabolic NCDs. Mental health and neurological disorders, injury/surgery, dental work, and maternal care and childbirth made up 1%–2% of claims each, and cancers were less than 1% of all claims. Treatment episodes that were attributed primarily to NCD and communicable disease categories, but included concurrent NCD and communicable disease treatments, made up 4.3% of all claims.

The share of NCD claims, which include cardiometabolic NCDs, cancer, and mental health and neurological disorders, increases with age for both males and females, while the share of communicable diseases decreases (figure 1).

Annual per beneficiary total claims costs in 2016 rose with age for both males and females to a high of $125 (95% CI 114–135) for males aged 75–79 years, and $103 (95% CI 92–113) for females aged 70–74 years (figure 2). While the claims costs for communicable diseases vary somewhat across the age groups and between males and females, the age-associated increase in total claims costs is primarily driven by growing costs in the NCD categories of cardiometabolic NCDs and cancer, with additional growth stemming from increased other costs.

At the model baseline in 2020, there were 3.9 million beneficiaries with an average claims cost of $39.00 per beneficiary and a total annual cost of $150.7 million for the insurance scheme (table 2).

With constant enrolment (scenario A), annual total insurance claims cost increases to US$415 million by 2050 as the population ages and grows in size, with the
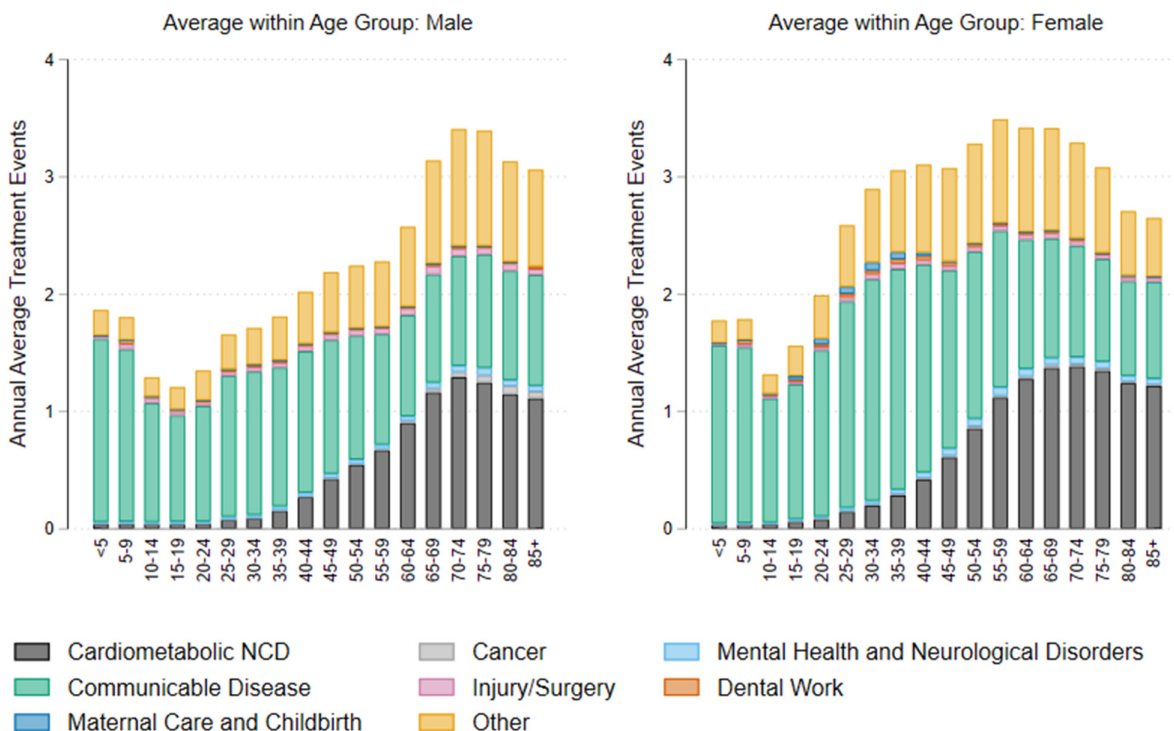
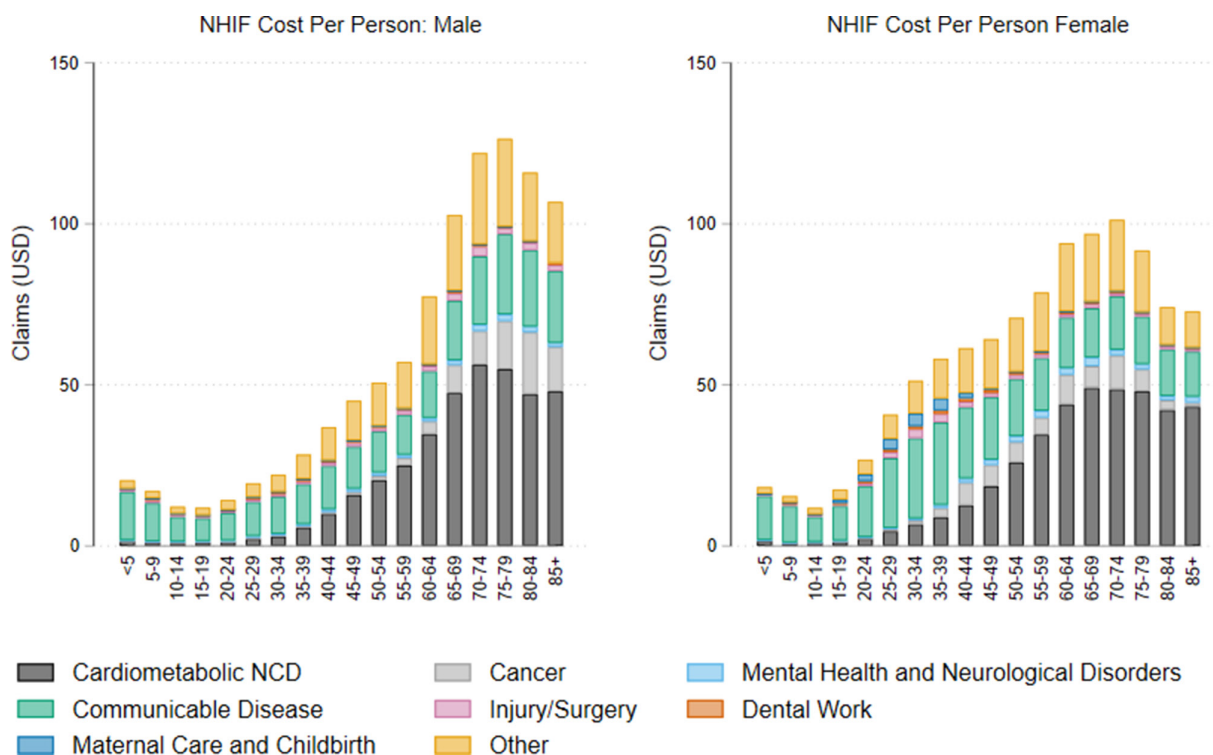**Figure 1** The number of treatment events per National Health Insurance Fund (NHIF) enrollee in 5-year age groups for males and females, by broad treatment category, from the 2016 NHIF claims and beneficiary databases. NCD, non-communicable disease.

annual per beneficiary cost increasing to $44.48. The growth in cost of claims is highest in the categories with higher burden in older age groups, as cardiometabolic NCD claims and cancer claims costs increase 3.1 times

from baseline, compared with an increase of 2.5 times for communicable diseases (figure 3). In scenario B, where the increased enrolment across the whole population results in a higher share of younger beneficiaries,

Figure 2 The cost of claims per National Health Insurance Fund (NHIF) enrollee in 5-year age groups for males and females, by broad treatment category, from the 2016 NHIF claims and beneficiary databases. NCD, non-communicable disease.

Table 2 Baseline and 2050 projections for NHIF enrollees and claims costs under three growth scenarios using mean projected population growth (95% CI)

	Baseline (2020)	Scenario A (2050)	Scenario B (2050)	Scenario C (2050)
Enrollees (million)	3.9	9.4 (8.9–9.8)	64.7 (59.4–65.7)	72.1 (70.9–73.2)
Claims total cost (million US$)	150.7	415 (414–424)	2270 (2170–2380)	2840 (2810–2860)
Total annual claims cost per beneficiary (US$)	39.0	44.4 (42.99–45.57)	35.15 (33.95–36.53)	39.39 (39.13–39.64)
Total annual cost of communicable disease claims (million US%)	56.5	140.4 (134.5–146.3)	897 (836–961)	1020 (1010–1040)
Total annual cost for cardiometabolic NCD claims (million US$)	41.2	127.5 (126.4–128.7)	571 (561–580)	765 (762–767)
Total annual cost of cancer claims (million US$)	7.4	23.1 (22.9–23.3)	101 (101–102)	137 (136–137)
Total annual cost of maternal care and childbirth claims (million US$)	3.2	7.2 (7.0–7.6)	41.1 (39.4–42.9)	55.0 (54.1–57.3)
Total annual cost of injury/surgery claims (million US$)	4.4	11.2 (10.9–11.6)	67.1 (63.5–70.9)	79.7 (78.6–80.6)
Total annual cost of mental health and neurological disorder claims (million US$)	3.0	8.3 (8.2–8.4)	44.3 (42.6–46.0)	56.3 (54.5–57.4)
Total annual cost of dental work claims (million US$)	2.5	6.2 (5.9–6.4)	38.7 (36.4–41.0)	44.9 (44.3–45.5)
Total annual cost of other claims (million US$)	32.5	91.5 (89.7–92.4)	470.9 (457.1–486.2)	600.2 (588.5–597.2)
Claims total as share of public health expenditures* (%)	6.84	7.94	42.50	53.18
Coverage (% of total Tanzanian population)†	7	7	50	56

*Assuming 3% annual growth in annual health expenditures reflecting the average growth in expenditures from 2010 to 2018.
†The United Nations (UN) World Population Projections for Tanzania estimate the total Tanzanian population was 59.7 million in 2020 and will be 129.4 million in 2050.
NCD, non-communicable disease; NHIF, National Health Insurance Fund.

the total annual cost of the scheme increases to US$2.3 billion in 2050. The cost of claims for communicable diseases increases by 16 times compared with cardiometabolic NCDs and cancer claims, which both increase by 14 times. In scenario C, where enrolment grows 10.3% annually, 72.1 million enrollees are anticipated by 2050, with an annual cost per enrollee of US$39.35 and a total cost of US$2.8 billion.

As current health expenditures in Tanzania are US$2.3 billion as of 2018 with an estimated average growth of 3% annually,[23] scenario A implies an increase in the total financing needs from 7% of total health expenditures in 2020 to 8% in 2050. Scenario B would require an increase to 42% of health expenditures, and scenario C would require an increase to 53% of health expenditures by 2050 (table 2).

DISCUSSION

This study shows that health insurance schemes aimed to cover a large part of the population in LMICs should be carefully assessed for their long-term financial viability.

Even with the conservative assumptions of maintaining rather low coverage and no changes in either the prevalence of NCDs or the costs of medical technologies, the results presented here suggest that the growing and ageing population will require a doubling of available resources. In our simulations, the increase in the per beneficiary treatment episodes and cost of claims is driven by cardiometabolic NCDs and cancer treatments in older age groups (see online supplemental figure S2). The long-term chronic treatment needs for cardiometabolic NCDs and the expense of cancer care make these types of claims particularly costly.[24] The role of ageing and NCDs in driving increases in healthcare costs is an ongoing concern across different settings, illustrated by projections of health expenditures in China which show similar growth driven by NCD risk factors.[25]

The higher cost per beneficiary in the older age groups is predicted to lead to an increase in claims costs of 176% by 2050, even if the percentage of the population covered by the NHIF would not increase. Our simulations predict that in Tanzania, an increase to 50% coverage by 2025
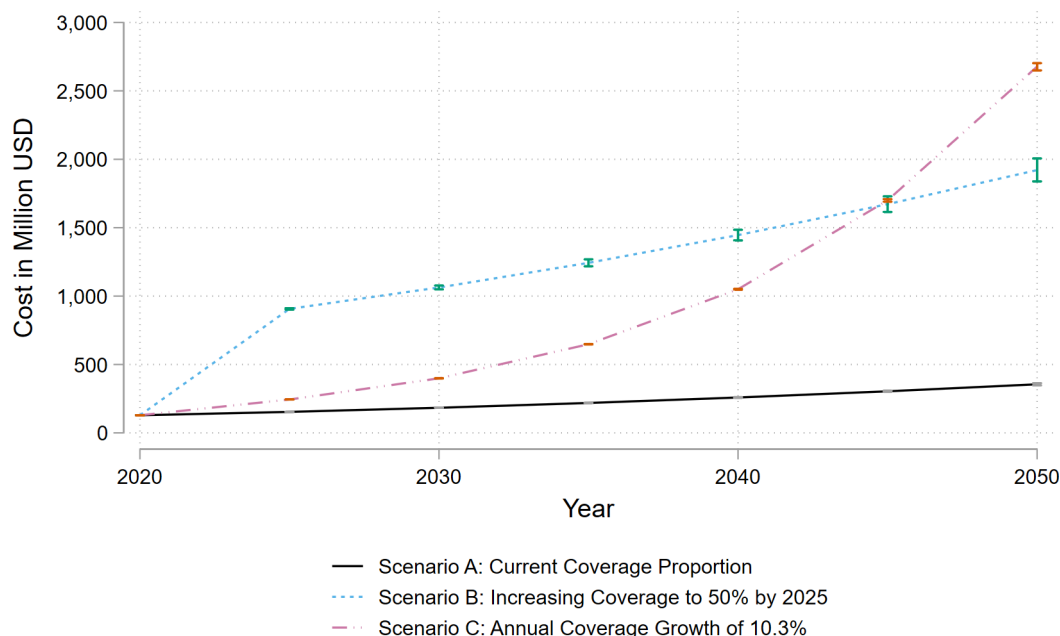
Figure 3 Total annual cost of National Health Insurance Fund (NHIF) claims under the three modelled scenarios from 2020 to 2050.

as in scenario B, or a more gradual annual increase of 10% as in scenario C, will result in a fivefold and sixfold increase in cost of claims, respectively, compared with the unexpanded coverage of scenario A by 2050.

However, since attaining 50% and 56% coverage would mean increasing enrolment among younger individuals to reach the coverage levels (see online supplemental figure S3), scenarios B and C exhibit a significantly lower per beneficiary cost. As all public sector employees are currently enrolled in the NHIF through the mandatory scheme, the increased enrolment will be from voluntary individual or private sector employee programmes. To achieve the ambitious growth scenario targets, significant endeavours will be necessary to improve uptake of individual enrolment or private sector employee enrolment, as the present low coverage of the NHIF indicates.

Prioritising extensive enrolment across all age groups, including younger employees and students, becomes crucial in realising the NHIF's goal of expanding membership coverage and moving towards UHC. This approach will also aid in mitigating adverse selection issues observed among older adults within the existing programme.[26]

Increasing coverage to the levels proposed by NHIF officials also requires enrolling many more people in the formal private and even the informal sector through voluntary enrolment who may be unable to pay a high premium cost. Rising gross domestic product and increased household income might translate to increased voluntary enrolment. However, it is unclear how much the uncovered population would be willing to pay for premiums or coinsurance. While the premium costs for mandatory enrolment for public sector employees and private formal sector workers employed at a participating employer are set at 6% of the contributing member's income, voluntary packages aimed at increasing enrolment have more flexibility in setting the cost of the premium. The voluntary NHIF insurance packages for 2023 include three levels of coverage and associated difference in premium contribution.[27] The higher contribution packages include provisions for longer length of inpatient care, higher number of tests covered and higher number of surgeries covered compared with the lowest level coverage, but all include similar medical consultation coverage, pharmaceutical access and imaging availability. Within the packages, premium contribution size varies by number of dependents included, and age category of the primary beneficiary, with those 18–35 years paying the least and those over 60 years contributing the highest amount.

The NHIF reliance on premium contributions as its primary source of funding poses challenges for long-term financing. Evaluations of the NHIF income statements indicate that expenditures are projected to surpass total income by 2025 under the current premium pricing, and the financial reserves will be depleted by 2029, even with the current coverage levels.[28] One solution to tackle the escalating costs is to raise premiums; however, implementing higher premiums without subsidies for lower income members would hinder efforts to expand coverage.[29] The lower premium contribution options for voluntary enrolment may motivate individuals to purchase health insurance especially if OOP costs rise, especially as it could reduce catastrophic health expenditures.[30] NHIF has also proposed developing a maximum premium cost for voluntary enrolment to increase marketability of private enrolment, suggesting that increases in primary contribution to address rising cost of care would face major resistance and limit new enrolment.[15]

Mobilising additional public funding to supplement the NHIF finances could alleviate the rising claims

costs without negatively impacting coverage. Increasing the share of health expenditures from public sources to the NHIF to cover that deficit could be possible as coverage increases, thereby redirecting public health service costs. Increased tax funding beyond insurance contributions has been shown in other LMICs to improve financial protection, especially when extending national health insurance outside of the formal sector.[29] The projected cost of all claims would rise to around 43% of all health expenditures under scenario B for 50% coverage, and 53% of health expenditures under scenario C as coverage increases to 56% of the population by 2050. Additionally, as coverage increases, the share of all NHIF expenditures that goes towards administration costs may decrease as economies of scale are maximised, continuing a trend that has already begun as enrolment has grown since 2012.[28] Furthermore, the NHIF's priorities, as highlighted in the 2020/2021 annual report, encompass strengthening fraud prevention measures and optimising care delivery and operational efficiency.[15] These initiatives have the potential to generate additional savings and enhance the sustainability of the programme. Mobilising public funding to strengthen the coverage of the NHIF would be a strong step towards the goal of UHC.[31]

The results presented in this study should be interpreted in light of some important limitations. First, although insurance claims provide rich data on specifics of care and costs, the data used did not include diagnoses. We therefore had to use medications and procedures to classify the treatment episodes according to general health condition categories. Furthermore, we had relatively limited information about beneficiaries to identify more specific differences between sample and total population, and how that could influence future projections. We were also limited to the use of data from a single year, so changing cost profiles over time could not be directly measured outside of the projections we modelled. The cost indicated in the claim value was based on the official tariff lists of the NHIF that might not reflect the real costs of services. For some interventions, the actual costs that healthcare providers incur for service provision might be higher than the tariff reimbursed by the NHIF. The scenarios modelled are very simplified and include several conservative assumptions. Studies have also shown an increase in NCD prevalence across younger age groups as economic development increases the prevalence of risk factors in LMICs.[32 33] The long-term estimates should therefore be considered as lower bound predictions anticipating a direction of the results rather than precise size of the effects observed.

Despite these limitations, this study demonstrates the value of data that capture the use of health services routinely collected for the administration of the health insurance programmes, but that are seldom used in the evaluation of the programmes or modelling the long-term costs.[2 4 8 28 34] Additionally, the results of this study clearly indicate the need to mobilise substantial public funding to scale up the coverage of health insurance schemes in LMICs.

Our projections suggest that the demographic and epidemiological transition will result in an increased funding demand for the NHIF of 2.75 times; a potential coverage expansion to 56% would amplify this need by a staggering 2000% compared with the costs in 2020. However, the positive impact of enrolling younger members through expanded coverage is that it helps moderate the per beneficiary costs, making them more reasonable and sustainable.

Strategies that can bring together the beneficial structures developed for national health insurance and the public funding needed to increase coverage across age and income level will be crucial to move to UHC. The demographic and epidemiological transitions are underway throughout LMICs, and the rising costs of claims modelled here underscore the sustainability risk to traditional insurance. Extending coverage to over 50% of the population both provides a reasonable avenue to leverage public financing to supplement the insurance premiums if it improves access to healthcare for so much of the population, and is a substantial step towards UHC.

ORCID iDs
Brianna Osetinsky http://orcid.org/0000-0002-9871-3062
August Kuwawenaruwa http://orcid.org/0000-0001-8459-443X
Fabrizio Tediosi http://orcid.org/0000-0001-8671-9400

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