Towards Universal Health Coverage:

The Case of Improved Community Health Fund in Rural Tanzania

Alphoncina Kagaigai

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Department of Health Management and Health Economics

Institute of Health and Society

Faculty of Medicine

University of Oslo

Norway

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Dedication

To

My miraculous children, Daniel and Angel-Karungi

The source of my strength and reasons for not giving up. Thank you for your patience when I stole your time and left you all by yourself. You were too little but you understood my reasons for being away from you.

To

My guardian Angel on earth Mr. Stephen Kagaigai

I am who I am because of you. Endless love, prayers, support and motivation. You have always trusted and have confidence in me to face whatever life would bring to me.

To

My Father in Heaven, Mr Philipo Kagaigai

May his beautiful soul rest in eternal peace. You departed too early before witnessing one of your daughters being awarded a PhD. It would have been so nice if you were here today to celebrate with me. Don't worry though, you left me in the safe hands of our brother Stephen who has played well his role as the best father we could ask for.

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Preface

Back in 2013 while doing my master's in economics, I got into a terrible car accident. I was admitted to a hospital for almost two months and I was confined to a wheelchair for some months after being discharged. I had to postpone my studies for a year and resumed when I was able to walk with crutches. This accident made me think of what and how my family and I would have financed my medical bills if I had no health insurance. In 2012, I had to quit my job to begin my master's and as a master's student, I had an option of enrolling into a student voluntary insurance scheme which cost about $22 (Tshs 50,000/=) per year. With the stipend I received from the scholarship program, I managed to pay the premium. Six months later I was involved in a car accident. Luckily enough, my insurance covered almost all my hospital expenses with a small co-payment that my family managed to cover.

Before I could freeze my studies, I was taking Economics majoring in environmental economics and financial economics. When I resumed my studies, the department introduced health economics as one of the options students could take. Looking at the course outline, I discovered that, there was a healthcare financing module which covers health insurance and other means of financing. I then dropped the financial economics module and opted for health economics. This was in order for me to understand how the insurance company works and how they get money to pay for all the bills and all the people who get sick.

However, in 2014 I got more reason to want to understand the role of health insurance and access to healthcare services. This is when I was sure that I wanted to pursue a PhD in health economics, and I even had a specific area already before I knew I would get an opportunity to pursue a PhD. So, I had a terrible experience of losing my unborn baby girl who died in my womb before she could be born (May her beautiful soul rest in eternal peace). I went to one of the largest health

facilities and I was admitted so that the following day I could have the stillbirth. While in the maternity ward, we were divided into two groups. Those with National health insurance had rooms equipped with two beds covered with a mosquito net. Those without insurance were put together in the open space in the big room which looked like a common area. The common area had few beds, and the beds had no mosquito nets. Some had to share a bed, and some slept on the floor. The sad part was during the night, the women in the common area, especially those who had already given birth, would come with their infants to ask if we could sleep with their newborn babies under the net to protect them from malaria.

Some weeks later, I resumed my classes, and we had a topic on health insurance. I explained the scenario to the lecturer and asked if he could explain how was it possible that we are in the same hospital but treated differently. My first question was, who are these women? Why were they treated that way and why was I treated differently? The next question was, what shall we do? To answer my questions, he advised me to do some research and advise the policymakers. Unfortunately, my master's scholarship had a condition of pursuing a project related to environmental economics. I had to promise myself that I would do a PhD in health economics and look into how those who cannot be covered by National health insurance can also be protected.

When I got a chance to be enrolled in a PhD, my aim was health insurance, but I had no specific area to focus on. After a back-and-forth discussion with my supervisors, we decided to study health insurance for people in the informal sector and in rural areas because that is the majority of the Tanzanian population. About 70% of the population are in the informal sector and almost 80% of these people have no financial protection against illness.

This is how this study came into being.

Summary

This thesis aims to identify the factors that influence a household's decision to enroll into a voluntary insurance scheme among rural households in Tanzania. The study also aims to assess the effectiveness of the voluntary scheme in question with respect to healthcare accessibility and exposure to catastrophic health expenditure (CHE) among rural households.

Paper I studies the important perception factors influencing households' decision to enroll into the iCHF scheme. Paper II identifies the difference between factors associated with households enrolling or dropping out of the scheme, and which policy implications are relevant to implement for each enrollment status. Paper III studies the role of risk preference among members and nonmembers of the iCHF insurance scheme in rural Tanzania. Whereas, paper IV studies the effect of iCHF on healthcare utilization and CHE among members and nonmembers of the scheme across their socioeconomic status.

The study found that household perception factors such as perceived quality of care, household knowledge and understanding of the scheme, scheme convenience and household beliefs, affect enrollment decisions. Risk preference was observed to be the most important factor determining whether an individual should enroll or drop out of the scheme. Furthermore, the enrollment factors varied across the two non-insurance statuses (*never-insured* and *dropouts*). We found that younger age (18–25 yrs.), being a male household head and positive perceptions towards the benefit-premium ratio, were positively associated with never being insured relative to being currently insured. While, lower income and negative perceptions towards premium affordability were positively associated with being a dropout relative to being currently insured. Moreover, both decisions were associated with high education level, absence of chronic disease, negative

perceptions towards the quality of services, trust in scheme leaders and positive perceptions towards the traditional healers.

The results from paper IV suggest that healthcare services were highly utilized by insured households compared to uninsured households, and the incidence of CHE was highest among the non-insured households. When healthcare utilization and CHE were compared among members and nonmembers across socioeconomic status, we found that households members of the iCHF insurance scheme belonging to the lowest socioeconomic status groups, utilized more healthcare services and were less exposed to CHE relative to nonmembers households in the same SES groups.

Based on the results from papers I, II & III, we provide recommendations to policymakers on how the enrollment rate can be increased and how the dropout rate can be reduced. Policymakers should put in place strategies that can increase the understanding among community members so that future decisions become informed decisions. Paper IV recommends policymakers identify possible barriers to enrollment into the health insurance and barriers that hinder the utilization of healthcare services among the poorest households when formulating policies for Universal Health Coverage in Tanzania.

Sammendrag

Målet med denne avhandlingen er å identifisere faktorene som er assosiert med tanzanianske rurale husholdninger på sine beslutninger om å melde seg inn i en forsikringsordning som heter iCHF. Studien vurderer også hvor effektiv forsikringsordningen er når det gjelder å øke tilgjengeligheten til helsetjenester samt redusere frekvensen av katastrofale helseutgifter (CHE).

Arbeid I studerer i hvilken grad persepsjonsvariable påvirker husholdningenes beslutning om å melde seg inn i forsikringsordningen. Arbeid II ser på eventuelle forskjeller mellom faktorer som er forbundet med det å forsikre seg og faktorer som er forbundet med det å melde seg ut av forsikringsordningen Arbeid II ser på hvilken betydning husholdningenes risikopreferanser har for beslutningen om å bli medlem samt beslutningen om å melde seg ut av ordningen. Arbeid IV studerer effekten av å være forsikret og ikke forsikret på forbruk av helsetjenester og på frekvensen av å ha erfart katastrofale helseutgifter (CHE).

Studien fant at persepsjonsvariable som opplevd kvalitet på tjenestene, kunnskap om og forståelse av forsikringsordningen, samt forventinger til ordningen påvirker beslutningen om a være forsikret eller ikke. Holdninger til risiko synes å være den variabelen som er mest betydningsfull for om man er forsikret eller ikke forsikret og for om man velger å forlate forsikringsordningen eller ikke. Man finner også at de variablene som er assosiert med beslutningen om å være forsikret relativt til aldri å ha vært forsikret ikke er de samme som variablene som er assosiert med beslutningen om å forlate ordningen relativt til å forbli forsikret. Vi finner at lavere alder (18–25 år), det å være mann og positive oppfatninger om forsikringsordningen (dekningsgrad i forhold til premiesatsen), er assosiert positivt med det med å aldri ha vært forsikret (relativt til å være forsikret), mens lavere inntekt og oppfatninger om at premienivået er for høyt, er positivt forbundet med å ha forlatt forsikringsordningen (relativt til å forbli i den). I tillegg er begge beslutningene assosiert med

utdanningsnivå, fravær av kronisk sykdom, negative oppfatninger om kvaliteten på helsetjenestene, grad av tillit til forsikringsordningens representanter og positive oppfatninger om tradisjonell medisin.

Resultatene fra arbeid 4 viser at forbruket av helsetjenester er høyest blant forsikrede husholdninger samt at forekomsten av katastrofale helseutgifter (CHE) er høyest blant de ikke-forsikrede husholdningene. Når vi sammenligner forbruket av helsetjenester, korrigert for sosioøkonomisk status, så finner man at husholdninger med forsikring, sammenlignet med de uten forsikring, så har gruppene med lavest sosioøkonomisk status det høyeste forbruket av helsetjenester og den laveste forekomsten av CHE.

Basert på resultatene fra arbeid I, II og III, så følger det noen anbefalinger om hvordan man kan oppnå at flere husholdninger tegner forsikring samtidig som færre melder seg ut. Det er for eksempel viktig at beslutningstakere identifiserer strategier som kan øke forståelsen blant husholdningene om forsikringsordningens svakheter og styrker slik at husholdningene blir i stand til å foreta mer informerte valg. Fra arbeid IV så følger det at hvis man skal bevege seg i retning av en universell forsikringsordning så blir det viktig at man klarer å tilveiebringe institusjoner som beskytter de mest ressurssvake gruppene mot den finansielle risikoen som følger av sykdom og dårlig helse.

List of papers

This thesis is based on the four original papers:

Paper I: Kagaigai Alphoncina, Amani Anaeli, Amani Thomas Mori, and Sverre Grepperud. "Do household perceptions influence enrollment decisions into community-based health insurance schemes in Tanzania?" *BMC Health Services Research* 21, no. 1 (2021): 1-11. https://doi.org/10.1186/s12913-021-06167-z.

Paper II: Kagaigai Alphoncina, Amani Thomas Mori, Amani Anaeli, and Sverre Grepperud. "Whether or not to enroll, and stay enrolled? A Tanzanian cross-sectional study on voluntary health insurance." *Health Policy OPEN* 4 (2023): https://doi.org/10.1016/j.hpopen.2023.100097.

Paper III: Kagaigai Alphoncina, and Sverre Grepperud. "The role of risk preferences: voluntary health insurance in rural Tanzania." *Health Econ Rev* 13, 20 (2023). https://doi.org/10.1186/s13561-023-00432-z.

Paper IV: Kagaigai Alphoncina, Amani Anaeli, Sverre Grepperud and Amani Thomas Mori. "Healthcare utilization and catastrophic health expenditure in rural Tanzania: does voluntary health insurance matter?" *BMC Public Health* 23, 1567 (2023). https://doi.org/10.1186/s12889-023-16509-7.

Abbreviations

BJKS   Barsky, Juster, Kimball, and Shapiro

CBHIs   Community-Based Health Insurance Schemes

CHE   Catastrophic Health Expenditure

CHF   Community Health Fund

CI   Confidence Interval

DMO   District Medical Officer

FA   Factor Analysis

FGD   Focus Group Discussion

GDP   Gross Domestic Product

HIV   Human Immunodeficiency Virus

iCHF   improved Community Health Fund

KMO   Kaizer Measure

LMICs   Lower-Middle Income Countries

MOHCDGEC   Ministry of Health, Community Development, Gender, Elderly and Children

MoH   Ministry of Health

MUHAS   Muhimbili University of Health and Allied Sciences

MPL   The Multiple-Price List

NHI   National Health Insurance

NHIF   National Health Insurance Fund

NIMR   National Institute of Medical Research

ODK   Open Data Kit

OOP	Out of Pocket
OR	Odds Ratio
PCA	Principal Component Analysis
RA	Risk Aversion
RRR	Relative Risk Ratio
SDG	Sustainable Development Goal
Tshs	Tanzanian Shillings
UHC	Universal Health Coverage
UiO	University of Oslo
UN	United Nations
USD	United State Dollar
WHO	World Health Organization
WTP	Willingness to Pay

Administrative definitions

Region The largest administrative and geographical unit in Tanzania. A regional commissioner is a political leader and representative of the president while a regional administrative Secretary is the chief executive officer.

District The largest sub-division of a region governed by a district commissioner as a political leader and a district administrative secretary as the chief executive officer. It is an arena for health planning and implementation at the local level.

Division The largest sub-division of a district governed by a divisional secretary. It is not a popular unit in different national procedures.

Ward The largest sub-division of a division governed by a ward executive officer. There is also a councilor who is a political representative of the unit.

Village The largest sub-division of a ward in the rural setting and administered by a village executive officer. The political leader of this unit is a village chairman elected by fellow villagers.

Chapter 1: Introduction

According to the World Health Organization (WHO), Universal Health Coverage (UHC) is "having equal access to the full range of quality health services needed by all people without incurring financial hardship, covering essential health services, from promotive, preventive, curative, rehabilitative and palliative care across the life course" (WHO, 2021, p. 4). This definition is based on the 1948 WHO Constitution, which declares health as a fundamental human right and commits to ensuring the highest attainable level of health for all (WHO, 2019b). The United Nations (UN) passed a resolution for the 2030 Sustainable Development Goals (SDGs) in 2015, and UHC is discussed under SDG 3 (UN, 2019). Besides focusing on ensuring good health and well-being, SDG 3 also refers to the importance of providing financial risk protection (WHO and The World Bank, 2017). In September 2019, during the UN General Assembly High-Level Meeting, the world leaders from the UN member states committed to achieving UHC by 2030 (WHO, 2021b).

Despite significant efforts by various governments and organizations, achieving UHC has been challenging for the majority of the low and lower-middle-income countries (LMICs). Together with other strategies employed by the LMICs, the introduction of voluntary health insurance schemes, commonly known as Community-Based Health Insurance schemes (CBHIs)[1], has been an important strategy for including the informal sector. However, most of the LMICs have experienced difficulties in attaining high coverage rates. A recent review by Barasa et al. (2021) showed that out of 36 countries in sub-Saharan Africa only Ghana, Rwanda, Gabon and Burundi have an insurance coverage above 20% (Barasa et al. 2021). In the period 2017-2018, 79%-83%

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[1] CBHIs are prepayment schemes that mainly target the poor and those in the informal sector.

of the population of Rwanda was covered by CBHIs (Nyandekwe et al. 2020; Barasa et al. 2021), while for Ghana the coverage rate was 54% in 2016 (Awoonor-Williams et al. 2022). Ghana and Rwanda have probably managed to achieve high coverage due to stable financing sources and a strong commitment from the governments. For example, in 2003 Ghana introduced the National Health Insurance Scheme (NHIS), financed by revenues from a value added tax (VAT), from the Social Security and National Insurance Trust (SSNIT) and from premiums payments (Cashin et al. 2017; Agyepong et al. 2016). The revenues from VAT and SSNIT contribute to about 90% of the total funding of the NHIS while the remaining 10% is covered by premiums, donations and gifts (Cashin et al. 2017).

Tanzania introduced CBHI, known as Community Health Fund (CHF) in 1996. For more than a decade after its introduction, the enrollment rate remained below 10% of the population. In addition to a low enrollment rate, CHF also suffered from dropout rates that exceeded 20% in most districts (Marwa et al. 2013). Possible reasons for low enrollment and high dropout rates include weak scheme management, a poor understanding of the concept of risk pooling, poor quality of public healthcare services, a benefit package that is restricted to outpatient healthcare services and the inability or unwillingness to pay annual premiums amounting to between 5,000 to 10,000 Tshs (Anaeli, 2013; Kamuzora and Gilson, 2007).

Low enrollment and high dropout rates have left many households without insurance coverage hence exposing them to high out-of-pocket health expenditure (OOP) that far exceed their capacity to pay. As a consequence, many households have experienced catastrophic health expenditure (CHE) defined as the case when a household's health expenditures exceed a certain threshold level varying between 10% to 25% of the household's annual income or 40% of total household expenditure less food expenditure (capacity to pay) (WHO and the World Bank, 2017; Xu *et al.*

2018). The share of OOP health expenditure in Tanzania was recorded to be 22.2% in 2018 (Knoema, 2019), while the percentage of people who suffered from catastrophic health expenditures in 2020 was recorded to be 20.2% and 32.2% calculated at the thresholds of 25% and 15% of the total household income, respectively (Ssewanyana and Kasirye 2020).

In 2011, the government responded to the challenges faced by CHF by reforming the scheme and naming it the "Improved Community Health Fund (iCHF)" (Kalolo et al. 2015). While the iCHF scheme seems to have increased healthcare access for people in rural Tanzania and those employed in the informal sector, the enrollment rate is still a challenge (Lee et al. 2016). Poor quality of health services, lack of trust in the scheme leaders, limited benefit package, low scheme awareness and negative beliefs were documented to be important explanations for the low enrollment rate (Modest et al. 2021; Lambrecht 2016).

1.1 Aim of the thesis

Therefore, the overall aim of this thesis is to identify factors that are associated with the enrollment status of households in rural areas of Tanzania in the improved Community Health Fund insurance scheme (iCHF). Specifically, the study aims to answer the following research questions;

1. What factors influence a household's decision to be insured relatively to be non-insured in the improved Community Health Fund (iCHF)? In particular, what is the role of perception factors?

2. To what extent do variables associated with the enrollment decision differ from variables associated with the dropout decision when it comes to the improved Community Health Fund (iCHF)?

3. What is the role of risk preferences on enrollment status into the improved Community Health Fund (iCHF)?

4. To what extent is the improved Community Health Fund (iCHF) able to reduce the incidence of catastrophic health expenditure (CHE) and increase healthcare utilization?

To address these research questions, a cross-sectional household survey was conducted to collect quantitative data on health insurance coverage status and other socio-demographic factors which were considered as important in influencing enrollment decisions. We used a household questionnaire with structured closed-ended questions that was pre-tested before the data collection. The data include socio-demographic variables, perception variables, health-related variables, expenditure variables and risk attitude variables. To measure self-reported health state and risk attitudes, well-established instruments such as EQ-5D and BJKS were applied.

1.2 Outline of the dissertation

The thesis contains seven chapters. Chapter 2 presents background information on healthcare financing and insurance including a presentation of the main Tanzanian health financing sources. Chapter 3 presents important insurance concepts and provides a literature review. In Chapter 4, material and methods are discussed to provide an overview of the design and analysis of the four sub-studies. The main results from the four papers are summarized in Chapter 5 and discussed in Chapter 6. Finally, Chapter 7 presents the main conclusions including some policy recommendations.

Chapter 2: Background

This chapter provides some background information on healthcare financing and insurance. First, a brief general overview over health financing sources is presented. Second, the organizational structure of the health system in Tanzania is described. Third, a brief history of healthcare financing in Tanzania is provided.

2.1   Healthcare financing – a global overview

Healthcare spending is mainly financed by the following sources; the public sector (general tax revenues and social insurance), the private sector (out-of-pocket payments and private insurance), and external sources such as aid, grants and loans from international agencies (Schieber et al. 2006). Globally, spending on healthcare services as a share of the global Gross Domestic Product (GDP) has over time shown an increasing trend although at a slower rate for the past two decades (WHO, 2021). In the period between 2001 to 2019, the percentage of global spending on health as a share of GDP increased from 9.0% to 9.8% (Schieber et al., 2006; WHO, 2021).

As concerning the relative importance of the different financing sources, a recent report on global health financing finds that public spending in the period 2015-2019 has accounted for about 60%, while private funding has accounted for about 40% (IHME, 2023). However, overall spending varies significantly between high-income countries (HICs) and low and middle-income countries (LMICs). For example in 2020, the global spending on healthcare accounted for about 9.8% of the global GDP, of which 80% was allocated to the HICs and the remaining to the LMICs (WHO 2021a).

Back in 2001, HICs spent an average of 7.7% of their GDP on healthcare while the LMICs spent about 4.7% (IHME, 2017). In the same year, African LMICs committed to increase the share of healthcare public spending up to 15% of GDP by 2015, but they did not succeed. As of 2021, the

percentage of GDP spent on health care in LMICs was only 4.5% compared to 12.4% in HICs (IHME, 2023). Tanzanian healthcare financing sources are similar to the one in LMICs. The share of GDP spent on healthcare is currently significantly lower than 10% (5.0%) and the main sources of financing are external sources (40%), public financing (36%) and OOPs (23%), while the share from health insurance (premiums) is relatively low (8%) (URT, 2022). As countries become wealthier (a higher GDP), the share of public spending typically increases while the share of private spending decreases.

2.2   Study context—the United Republic of Tanzania

Tanzania is a union of Tanganyika (Tanzanian mainland) and Zanzibar, located in the Eastern part of Africa with a population of 61.3 million people, an annual growth rate corresponding to 3.2% and a life expectancy of 66 years (64 years for men and 68 years for women) (URT, 2022). The population is young on average; 44.9% is between 0-14 years, 52.1% between 15-64 years and only 3% are aged 65 years or above. Tanzania is divided into 32 regions and 185 districts, containing about 125 ethnic groups that are connected with Swahili as a common language. The country is mainly bordered by Lake Victoria, Kenya and Uganda to the North, Lake Nyasa, Zambia, Malawi and Mozambique to the South and Lake Tanganyika, Rwanda, Burundi and the Democratic Republic of Congo to the West with the Indian Ocean to the East (Figure 1).

The country has a total area of 945,087 sq. km, and its economy mainly depends on agriculture, which employs about 80% of the total population. Other activities that significantly contribute to GDP are transport and storage, mining and quarrying, construction and manufacturing. The current GDP growth rate was 5.2% in 2022. The food and basic needs poverty levels accounted for about

7.3% and 26% respectively in 2020 (URT, 2022; NBS, 2023; URT, 2021).[2] The income is unequally distributed between rural and urban areas and between the wealthiest and the poorest households. For example, in 2018 the income share held by individuals in the poorest quintile (20%) had only 6.9% of the total national income, while the wealthiest quintile had almost half (48.1%) of the total income (World Bank 2022).

Figure 1: A map of Tanzania

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[2] Basic need poverty is a situation where a household lacks the resources to meet their essential requirements such as access to food, clean water, shelter, clothing, and healthcare for a decent standard of living.
Food poverty or food insecurity, occurs when a household faces inadequate availability of food options, leading to uncertain food intake or being unable to afford a balanced diet. to maintain an active and healthy lifestyle.

2.3 Organizational structure of Tanzania's health system

Tanzania has a health system that follows the national administrative hierarchical structure that flows from the national level to the community level creating a pyramidal structure (URT and WHO, 2004; Todd et al. 2017). The system has a mixture of both public and private health facilities providing different types of services depending on the level of administration (see Figure 2).
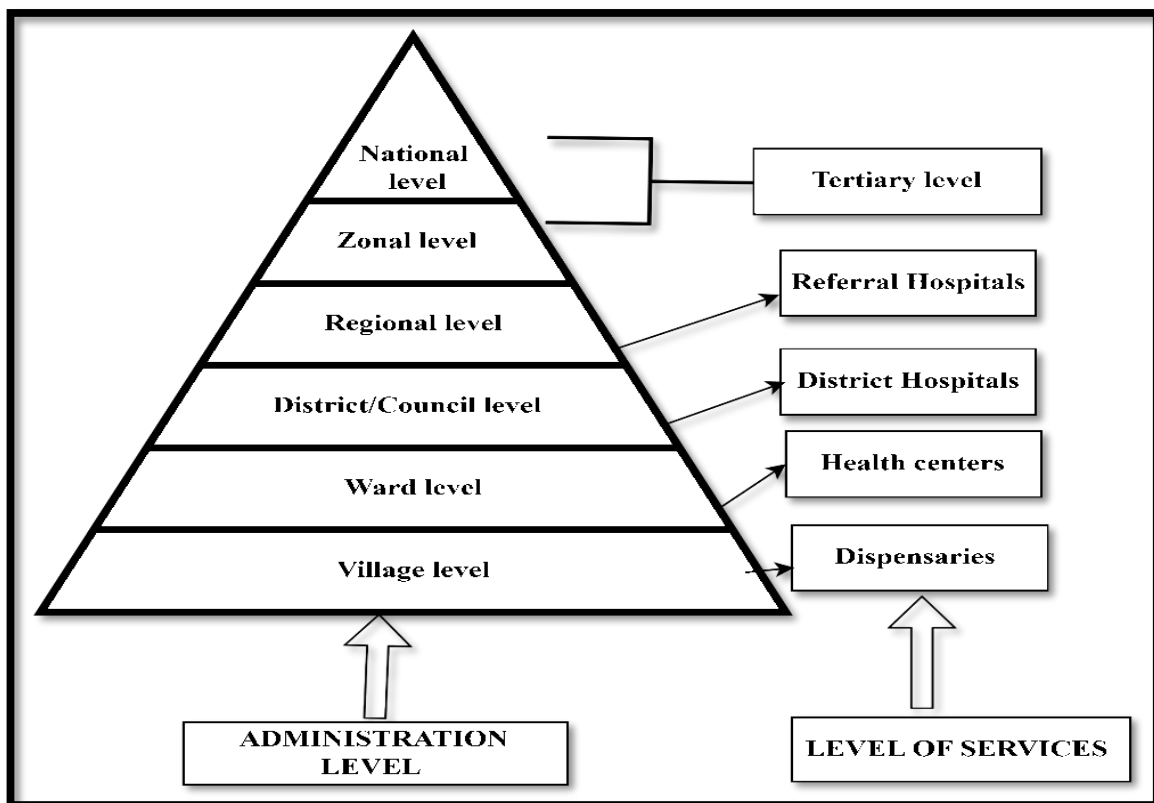
Figure 2: The organizational structure of the Tanzanian healthcare system

At the bottom, there are dispensaries[3] that are found in every village and above this level there are health centers found at the ward level. Both dispensaries and health centers provide primary healthcare such as outpatient curative and preventive services like childcare, prenatal care and

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[3] Dispensaries are health facilities found at the lowest community level (Village), consisting of outpatient, maternal, child health services and community health services within its catchment area. Most dispensaries have 2 beds for observation (bed rest) and delivery (MoHCDGEC, 2019).

obstetrical care. Some inpatient care services are provided at health centers. The village and ward leaders have a direct influence on the operations of the facilities and the health centers in charges are answerable to the ward leaders.

At the district level, we have district (Council) hospitals receiving patients referred from the dispensaries and health centers. The district hospitals provide services such as emergency care, major and minor surgery, delivery services, X-ray, and ultrasound services. At the regional level, we have regional referral hospitals providing specialized medical care such as general surgery, cardiology, nephrology, and gynecology. District hospitals, health centers and dispensaries constitute the primary healthcare system. More than 95% of the healthcare facilities in Tanzania are primary health facilities, most of which are dispensaries (Table 1).

Finally, at the tertiary level there are Zones with referral or consultant hospitals and at the national level we have a national hospital and specific disease specialized hospitals. We have five Zonal hospitals, six national super specialized hospitals and one National hospital with highly specialized medical specialists. This level provides advanced medical care such as radiology services, CT scan, intensive care services and ultrasound, and also functions as teaching hospital for medical, paramedical, and nursing schools. According to the Ministry of Health, by 2022, there were 8,807 health facilities in Tanzania (60.4% public and 39.6% private) (URT, 2023).

Table 1: Tanzanian Coverage of health facilities by 2022

S/N	Level of Administration	Level of Service	Number of health facilities
1	National	Tertiary level	1
2	Zonal	Tertiary level	5
3	Region	Referral Hospital	27
4	Districts/Councils	Hospital	167
5	Wards	Health Centre	1,056
6	Villages	Dispensaries	7,551
		Total number of facilities	8,807

Source: https://hfrportal.moh.go.tz/

2.4 Health financing

Health financing is the major component of a health system that deals with revenue collection, pooling of resources, and purchasing of care. It is a key determinant of equity, efficiency, and health outcomes of the health system performance (Schieber et al. 2006).

Currently, the Tanzanian health system is financed mainly through public sources (taxes and donor contributions), external sources (grants and loans) and private sources (out-of-pocket payments and insurance premiums). The main health insurance schemes in Tanzania are the National Health Insurance Fund (NHIF), the Social Health Insurance Benefits (SHIB)[4] and the Improved Community Health Fund (iCHF). In addition, there are some minor private health insurance schemes. Figure 3 shows the development over time of the different financing sources, presented as a percentage share of total Tanzanian health expenditure (THE).
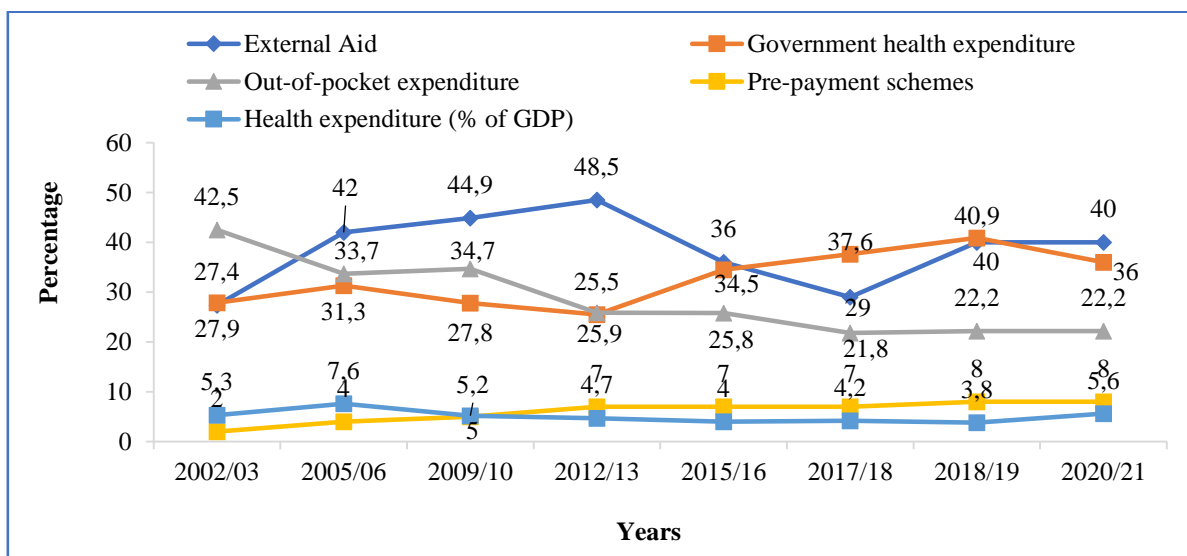
Figure 3: The development of financing sources as percentage share of the total Tanzanian health expenditures
Sources: (NHIF, 2020, 2021; World Bank, 2022)

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[4] SHIB insurance is provided by the National Social Security Fund (NSSF) where the private employees who are members of NSSF would opt to be insured by such scheme.

Historically, Tanzania has gone through different phases of financing reforms, which warrants further explanation. After her independence from the British colonialists on the 9th of December 1961, the government took full responsibility for the provision and financing of healthcare services (Semali et al. 2009). In 1967 the then president of Tanzania, Julius Nyerere, initiated the Arusha Declaration which outlined the principles of Ujamaa 'socialist ideology' to develop the national economy (Toussaint 1964). This marked the beginning of a series of health sector reforms intended to increase access to healthcare services (URT 2007). In the mid 1990's different health sector reforms were initiated especially focusing on improving the capacity of the district health services. The reforms included managerial reforms (decentralization), financial reforms, the mix of public – private funding and the integration of various health programs into general health services.

A decade after the Arusha declaration, the government committed itself to providing healthcare services for free (no out-of-pocket payments), and private for-profit medical practices were banned (Mubyazi et al. 2006; Semali et al. 2009). Following the economic downfall and the rise of healthcare costs in the early 1990s, the government introduced mixed financing mechanisms through cost-sharing policies as part of the financial reforms (Treichel 2005; Masenya et al. 2018). These reforms included the introduction of user fees (1993), the establishment of the Community Health Fund (CHF) in 1996 and the National Health Insurance Fund (NHIF) in 2001 (URT 1990). User fees were introduced in four phases from 1993 to 1995, to raise more funds since the free provision of services made it difficult to provide the essential services to the public (Gilson 1997). Exemptions and waivers to vulnerable groups such as pregnant women, children under five years and elderly people were introduced in 1994 (Mubyazi et al. 2006).

2.5   Health insurance

As already mentioned, the NHIF was established under the Act of Parliament No. 8 of 1999 and began its operations in June 2001. The main aim was to increase the access to healthcare services for public servants and their families through resource pooling and risk distribution. Recently, this scheme also allows for private membership. Employees pay a mandatory contribution amounting to 3% of their monthly gross salary and the government, as employer, contributes the same amount. This scheme covers the principal member, spouse and up to four legal dependents being 18 years or younger. In recent years, the NHIF fund has also introduced voluntary enrollment for individuals who are not employed in the formal sector such as "Toto Afya card". There has been a steady increase in coverage over time from 2% of the total population in 2001/2002 to 8% in 2022 (Binyaruka and Borghi, 2021, p. 4; URT, 2022, p. 79).

The Government established the Community Health Fund (CHF) under the community health fund Act (URT 2001), targeting over 70% of the population that reside in the rural areas and those employed in the informal sector (NBS 2013). The scheme was first introduced as a pilot in 1996 in the Igunga district (Tabora region) and thereafter, scaled-up in other districts (URT, 2002). CHF was a voluntary prepayment scheme with a flat user-fee that primarily provided access to primary healthcare services. Each district authority determined the premiums per household which covered 6-8 members and the premiums varied from Tshs. 10,000 to 15,000 (equivalent to 4.5 USD to 7 USD (URT, 2002).

The membership of CHF was voluntary as members were free to join and leave the scheme. When a premium was paid, the head of the household was given a single CHF card that could be used by all registered household dependents for a period of one year. After a year the household was free to renew the membership by paying the annual premium. The vulnerable groups that had the right

to exemptions included the elderly (60 +), children under 5 years and pregnant women. These groups had the right to predefined services free of charge at any health facility (Maluka 2013).

In 2011, the government decided to reform CHF to improved Community Health Fund (iCHF) following more than a decade of underperformance (Kalolo et al. 2015). The enrollment rate remained below 10% and as of 2013, the rate was as low as 7% (Anaeli 2013). iCHF was established in 2011/2012 as a pilot in five regions of Tanzania (Dodoma, Shinyanga, Kilimanjaro, Manyara and Arusha). Unlike CHF which was under the district level management, iCHF is now managed at the regional level. However, at the district level, the council health service boards (CHSB) and the health facilities governing committees (HFGC) are responsible for overseeing the operations of the scheme. The iCHF scheme covers 6 beneficiaries (the head of household and 5 dependents) and charges an annual flat premium equal to Tshs 30,000 (15 USD).

The iCHF benefit package has over time improved to include referrals up to the regional hospital level, improving the marketing strategies and improving the enrollment process for example by allowing for mobile enrollment at the village level. After the reform of the scheme, the enrollment rate increased up to 25% in 2018 (Binyaruka and Borghi 2021). However, in 2021 the enrollment rate was down to 7% (URT, 2022, p. 79). Tanzania also has some smaller insurance schemes such as the Social Health Insurance Benefit (SHIB) as well as some private schemes. SHIB is part of the National Social Security Benefits introduced in 2007 under the NSSF Act of 1997 (NSSF, 1997). The NSSF board appoints and agrees to both public and private health facilities to provide healthcare services to insured persons and their eligible families. The insured individual will have access to medical care through SHIB after undergoing a registration process with health facilities of their choice among those that have been accredited by NSSF. The insurance benefits cover the insured individual together with 5 dependents (spouse and 4 children under 18 years). The benefits

package includes preventive and curative care, essential drugs, X-'rays, laboratory tests, minor surgery and hospitalization. All NSSF members are eligible to be insured by SHIB as long as they have contributed to the fund for a minimum period of 3 months (NSSF, 1997).

Some private health insurance companies (PHI), both international and domestic ones, started to operate in Tanzania after the health sector reforms were introduced in the late 1990s. Currently there are about 5 major private insurance companies in Tanzania, in sum covering less than 1% of the total population (White et al, 2013). The main clients are typically high-income earners residing in urban areas and that are employed in the private sector. These companies are monitored by the Tanzania Insurance Regulatory Authority (TIRA) being responsible for the regulation of all private insurance companies that operate in Tanzania. The market for private insurance has not grown much over time despite having extensive benefit packages.

Despite the presence of multiple insurance schemes, the overall coverage rate has remained low in Tanzania. Recent available data show that as of December 2021, only 15% of the Tanzanians were enrolled in one of the health insurance schemes available, meaning that 85% of the population were without any insurance cover (URT, 2022,Pg 78). This number is significantly lower when compared with the situation in 2018 where about 33% of the population was enrolled in either of the insurance schemes, of which 8% were covered by NHIF, 25% were covered by iCHF, and 1% was covered by private health insurances and the SHIB (Binyaruka and Borghi, 2021, Pg 4).

CHAPTER 3: Insurance, Literature review and conceptual framework

This chapter presents some of the main concepts in the literature on insurance and health insurance, followed by a review of the empirical literature focusing on works that apply both quantitative and qualitative methods to investigate the role of possible enrollment status determinants. Finally, a conceptual framework of access to healthcare is presented and discussed in relation to access to healthcare insurance.

3.1   Insurance concepts and the demand for insurance

"An individual's future health state is uncertain as well the demand for healthcare is also uncertain with respect to when people will fall sick and the amount of expenditure on healthcare that is required to become well again. As a solution to uncertainty of illness and its associated medical costs people will resort to buying health insurance" (Morris et al. 2007)

3.1.1   Uncertainty, risk and risk preferences

Risk and uncertainty can be mistakenly taken as synonyms; however, the two concepts differ in that uncertainty exists when any one of the number of states of the world may occur but we do not know the probability for each state. On the other hand, risk is used when the probability of each possible state of the world can be estimated; example cigarette smokers are 20 times more likely to die of lung cancer than non-smokers (Morris et al. 2007). Hence, risk describes a situation, in which there is a chance of loss and the size of the loss as well as the probability of the loss can be calculated (predicted) by observing the frequency of such events. As for the uncertainty, the outcome is also unknown.

Risk preferences of individuals can be expressed in terms of the following three types of risk attitudes; risk aversion, risk neutrality and risk loving. A person is risk averse if his/her utility of the expected value of a gamble (lottery) is greater than his/her expected utility from the same gamble. For example, a risk averse person would prefer $200 with certainty to a 50-50 percent gamble between $0 and $400 which yields an expected value equal to $200. Hence the higher the degree of risk aversion, the less desirable becomes the 50-50 percent gamble. A person is risk loving (risk seeking) if he/she prefers the 50-50 percent gamble to $200 with certainty while a risk neutral person is indifferent between the gamble and $200 with certainty (Frank 2006).

In case of risk and uncertainty, a pertinent question that an individual will ask himself/herself is how to deal with it? Assume you are subject to a severe illness that prevents you from having an income, how will you pay for the medical expenses? In the following, we present various risk-coping strategies that are presented by Getzen (2007).

Savings: Savings imply that people postpone current consumption in exchange for higher consumption in the future and this mechanism can be used to protect against future unexpected events (consumption smoothening). However, one limitation of using savings as a risk-protection mechanism is that it only allows for tradeoffs for a given individual.

Family and friends: When people are unable to accumulate savings of their own, they may rely on the financial resources of families and friends in the event of a bad outcome (e.g. illness). This mechanism means that bad events are covered by others savings which again may involve an obligation to cover others future losses. Despite the fact that family and friends may act out of good will, one may feel obliged to pay back the kindness received (reciprocity).

Charity: As an act of human nature, people may care about others even when they do not know them personally implying that they cannot be compensated for their kindness. Such behavior may

follow from the rule of rescue, whereby people feel they have a moral obligation to prevent others from bad outcomes (McKie and Richardson 2003). Charity is a means of social exchange and has been used to pay medical bills before insurance was introduced. Charity has a limitation as not being reliable and as for sick individuals, they may not be in a position to choose the desired treatment.

Insurance: Insurance is a contract that protects the insured (the policy holder) from losses where the insurer (insurance company) guarantees a certain payment to the insured for an unforeseen event (e.g., death, accident, and illness) in return for the payment of premiums over time (Anderson and Brown 2005). Insurances cover various items, services and states such as automobiles, homes, travels, disability, liability, malpractice, life, and health expenditures. Insurance can be seen as a trade between two possible states of the world in the sense that money is shifted from the state in which individuals have more (when healthy) to the state in which they have less (when ill). This is similar to how savings works, shifting money (assets) from a good period to a bad period. Unlike saving and the use of family/friends, insurance represents trades between people.

Social insurance: Unlike private insurance which is voluntary in nature, most social insurances are mandatory (for example for premiums paid via payrolls). The policyholders are obliged either by law or under the terms and conditions of employment, to insure against certain contingencies such as old age, unemployment, illness, or long-term care. Such insurances are typically setup in the form of pay-as-you-go and can cover an entire community or a part of a community, and they are typically imposed, controlled and partly financed by governments (OECD 2020). However, one setback of social insurances is that they often rely on employment-related contributions. This is especially the case in developing countries where social insurances tend to be targeted at better-off workers, leaving a large proportion of the informal sector behind (OECD 2019; Scruggs 2006).

3.1.2 The law of large numbers (Risk pooling)

Insured individuals collectively create risk pools through the premiums paid to an insurer that again redistribute the funds among those experiencing bad states. To determine the amount of premiums to be paid, insurers use previous information obtained from historic losses to calculate the expected future compensations. The premiums will typically be set in such a way that it is able to cover the expected compensations, the administrative expenses and the profit of the insurer (Santerre and Neun 2012).

The insurer covers the losses according to the contract terms. The pooling of risks across a large number of insured individuals acts according to the *law of large numbers*. The law states that the larger the number of events the more precise is prediction of the average outcome (Morris et al. 2007). "If an event happens independently with the probability P in each of the N instances, the proportion of cases in which the event occurs approaches P as N grows large" (Frank 2006). The law of large numbers explains how the insurer reduces the risky.

3.1.3 Insurance – supply and demand

The rationale behind the demand for health insurance can clearly be explained by the theory of the consumer and the expected utility theory. According to these theories, individuals who are cautious about risks opt for health insurance because they prefer the security of paying a modest premium as opposed to the potential of facing a substantial medical expense in the future. This inclination arises from individual willingness to sacrificing a small sum of money (premium) to mitigate the unpredictability of encountering a more substantial future loss.

When a person purchases insurance (demand side), they establish a contract with the insurance provider (supply side), agreeing to pay a predetermined sum known as an "insurance premium". In return, the insurer commits to providing a payout to the insured individual if they experience a

health issue. An individual will demand health insurance as long as the expected utility derived from being insured is equal to or greater than the expected utility that follows from being a non-insured. The maximum sum that individuals are willing to pay for insurance will depend on the level of risk aversion. Individuals who are risk-averse should opt for health insurance.

The body of work concerning the economics of asymmetric information focuses on issues of moral hazard and adverse selection. In the context of health insurance, adverse selection happens when individuals who are unhealthy (having a greater risk of falling ill) are more likely to buy insurance compared to healthier individuals (Arrow 1963). Consequently, a for-profit insurance provider might experience financial losses if the insurance premiums are not adjusted upwards to account for the rise in anticipated payouts. Information asymmetry between insurance seekers, who possess knowledge about their own risk level, and the insurer, who lacks knowledge about an individual's specific risk of falling ill, is the primary driver of adverse selection (Getzen 2007; Morris et al. 2007).

To avoid losses, the insurer must raise the premium, consequentially, those with the lowest risk may choose to leave the insurance scheme. Addressing adverse selection challenges within the insurance market could involve implementing mandatory insurance and adopting experience rating[5]. Another approach, would be to assess individual risk factors such as smoking habits, alcohol consumption, or preexisting medical conditions when determining the premium rates.

According to Pauly (1968), moral hazard refers to the concept of "demanding more at zero price than at a positive price" (Pauly 1968, pg 535). Generally, scholarly literature categorizes moral hazard into the following two types: ex ante moral hazard and ex post moral hazard. Ex ante moral

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[5] Experience rating is when an applicant or group's medical history and claims experience is taken into consideration when premiums are determined (Norris 2022).

hazard emerges when the insured individual has the potential to influence the probability of an undesirable event (like illness) or the magnitude of the payout from the insurance provider (Morris et al. 2007). An example of ex-ante moral hazard is when insured individuals deliberately expose themselves to the risk of illness knowing that their medical expenses will be covered by insurance. On the other hand, ex-post moral hazard pertains to a situation where having insurance results in a welfare loss due to an increase in the demand for healthcare services that is driven by the lowered price on healthcare services (Getzen 2007). This behavior aligns with rational economic agents, who tend to consume more when the prices become lower. In addition, moral hazard can also emerge from healthcare providers advocating for increased medical services on behalf of their patients) ultimately leading to higher expenditures for the insurance provider. This phenomenon is often referred to as supply-induced demand or supply-side moral hazard.(Morris et al. 2007). Mitigating the moral hazard issue can involve implementing co-payment[6] arrangements, wherein the insured individual jointly bears the financial impact of an event with the insurer. Similarly, introducing deductibles is another strategy to curtail the moral hazard dilemma. Under this approach, the insured party is responsible for a fixed sum upon filing a claim, irrespective of the actual medical expenses. Both of these methods for minimizing moral hazard might lead to a decrease in demand for healthcare services, as the practical cost of medical services could increase due to the shared financial responsibility.

3.2 Literature review

A number of empirical studies on the community-based health insurance schemes (CBHIs) in low- and middle-income countries (LMICs), including Tanzania, have been carried out. The review of

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[6] Co-insurance rate is the percentage of the insurance loss that is paid by the insured.

previous studies has helped in identifying relevant variables that should be included in the analyses being part of this thesis. In this subsection, first, an overview of previous empirical studies on enrollment and dropout rates from LMICs is provided. Secondly, a review of previous qualitative and quantitative studies that analyze the different factors that are associated with enrollment decisions is presented. Thereafter, a presentation of the more recent studies, being related to the thesis, is provided. Finally, we present some studies that concern catastrophic health expenditures and their determinants.

3.2.1. Enrollment and Dropout rates for Community-Based Health Insurance schemes

Community-Based Health Insurance schemes (CBHIs) are often characterized by low coverage rates due to low enrollment rates and high dropout rates (Mladovsky 2014; Adewole et al. 2015; Nshakira-Rukundo et al., 2021). Due to this, the degree of risk pooling and resource mobilization for the long-term sustainability of such schemes are limited. Previous studies from Ethiopia shows that the enrollment rate has declined from 48% (2013) to 36% (2017) (Eseta et al., 2020), while for Uganda the dropout rate was estimated to be about 25% in 2021 (Nshakira-Rukundo et al., 2021). A study by Dong et al. (2009) in Burkina Faso found a 46% dropout rate in 2006 while studies done in Ghana by Atinga et al., (2015) and Nsiah-Boateng et al. (2019) found the drop-out rates to be 35% and 53% in 2015 and 2016 respectively.

For some Asian countries, Panda et al. (2015) reports that the dropout can be as high as 80%. This study used longitudinal data from rural Bihar and Uttar Pradesh to analyse the determinants of membership renewal into CBHIs over a period of two years. They found that the initial enrollment rate was approximately 24% but two years later only 20% of the initial enrollees were still members (Panda et al. 2015). In Tanzania, the enrollment rate has remained low over time (below

20%) while the dropout rates vary significantly from district to district (Lambrecht 2016; Anaeli 2013; Maluka and Asantemungu 2020; URT and SDC 2019).

3.2.2. Factors associated with the enrollment decision in Community-Based Health Insurance schemes in LMICs

Several studies have explored factors that influence both enrollment and dropout decisions into the CBHIs in low and middle-income countries. These studies employ qualitative, quantitative or mixed method approaches. A systematic review by Nosratnejad et al., (2016) that included 18 quantitative studies in LMICs published between 2003 and 2013 concluded that low income levels, poor provider quality, and scheme leader trust, all affect enrollment negatively. A systematic review by Dror et al. (2016), that included a total of 42 studies (36 quantitative and 6 mixed methods), from sub-Saharan Africa and Asia, identified household size, gender, household income, education, age and chronic illness episodes as main predictors of enrollment status.

Additional quantitative studies on enrollment decisions in LMICs confirm that, socio-economic variables make a significant contribution to enrollment decisions (Chanie and Ewunetie 2020; Minyihun et al. 2019; Wielen et al. 2018). Income (wealth) is frequently identified as a significant determinant (Duku 2018; Wielen et al. 2018). On the other hand, Mebratie et al. (2015), Dong et al. (2009) and Wielen et al. (2018) find a positive association between higher education and enrollment. Probably because respondents with higher education are better informed about the economic consequences of illness and the benefits of being insured. Gender (being female) has been recognized as an important determinant of the decision to enroll. A possible explanation introduced by the authors is that female household heads were found to be more risk-averse than men (Chanie and Ewunetie 2020, Dong et al. 2009 and Minyihun et al. 2019). On the other hand,

Finnoff (2016) and Chirwa et al. (2021) finds male household heads to be more willing to enroll than female while Kapologwe et al. (2017) found that married respondents were two times more likely to enroll or re-enroll as compared to non-married respondents. Household size also influences enrollment decisions, as reported by Dong et al. (2009). Having less children and less elderly in the household increased the probability for dropping out and decreased the probability for being insured.

A study from Mumbai (India) conducted in 2011, mentioned that people with good or a fair health state were less likely to join a health insurance scheme thus implying that the existing health status of the household head plays an important role (Ghosh and Mondal 2011). These findings were similar to those of Savitha and Banerjee (2021) who found that individuals with a low health status enroll more often than those with a better health status. However, Duku (2018) found that self-assessed health status did not play a significant role for the enrollment decision. In addition, Ashagrie et al. (2021) found that self-rated health status and the number of sick adults in the household, did not have any effect on enrollment decision.

As concerning chronic diseases, the reviews by Nosratnejad et al. (2016) and Dror et al. (2016), concluded that households with at least one member with a chronic illness history, had a higher probability of being insured relatively to households without a chronic illness history. Similar findings were observed by Mirach et al. (2019), who finds that both family health status and the presence of chronic diseases to be significant enrollment determinants. In addition, a household's health status, past illnesses, having had a morbidity episode and previous healthcare expenditures were found to have an important role in determining the demand for CBHI (Kahssay 2014; Salari et al. 2019).

Studies concerned with the role of perception variables on enrollment status have concluded that such variables are important in LMICs. The perceived quality of care, premium affordability and poor scheme management are mentioned in several studies (Dong et al. 2009; Chee et al. 2002; Kamuzora and Gilson 2007). Furthermore, other studies mention convenience of scheme office location, opening hours, the registration process, the modality of collecting membership cards and travel distance to CBHIs offices (Winani 2015; Jehu-Appiah et al. 202 and Carrin et al. 2005). In addition, Mladovsky (2014), in a study from Senegal, mentions scheme leader trust and satisfaction with scheme operations as important determinants..

According to Mebratie et al. (2015) and Ashagrie et al. (2021), a low understanding of voluntary insurance schemes was a main barrier to enrollment in Ethiopia. Similar views were expressed by Macha et al. (2014) and Msacky and Mmassy (2022) for Tanzania as well as for Kenya, South Africa, Uganda and Nigeria (Setswe et al. 2015; Ogben and Ilesanmi 2018; Mulupi, Kirigia, and Chuma 2013; Basaza et al. 2017). Studies by Nguyen and Hoang (2017); Borghi et al. (2013); Mirach et al. (2019) and Adewole et al. (2015) concluded that scheme awareness positively affects the decision to enroll while Mebratie et al. (2015) finds the lack of scheme understanding to contribute to low enrollment rates while Panda et al. (2015) finds that a better understanding of the scheme boosts membership renewal. Finally, a number of studies have shown that people prefer extended benefit packages which covers more household members (Macha et al. 2014; Mulupi et al. 2013; Durizzo et al. 2022; Kalolo et al. 2018; Kuwawenaruwa et al. 2011; Gidey et al. 2019).

3.2.3. Recent literature on the determinants of CBHIs enrollment

In this sub-section, related works that are published quite recently, are discussed. These works were not published at the time the four sub-articles were completed. Mustapha (2020) assessed the implementation and effectiveness of iCHF in the rural communities of Kibaha districts in Tanzania using a mixed method approach. The findings were inconclusive. Some informants acknowledged the improved service quality provided by iCHF relatively to CHF, however, they expressed dissatisfaction with factors such as registration, administration and scheme management.

A recent publication by Ngowi Nuru, (2023), examined factors influencing iCHF enrollment in the Manyara region, Tanzania. Data were collected from 403 respondents via a structured questionnaire and analyzed using multivariable logistic regression. The results showed a 39% enrollment rate and significant associations were identified for marital status, average income, chronic disease, family size, and awareness of the iCHF scheme.

Bayked et al. (2021) conducted a systematic review on community-based health insurance uptake in Ethiopia. The study found that key factors influencing uptake included socio-demographics (income, education, marriage, occupation, family size), health service aspects (benefits package, awareness, previous healthcare costs, service quality), and health status (illness experience). Negative predictors included premium size and bureaucratic complexity.

Additional Ethiopian study on CBHIs was conducted by Wassie et al., (2023). The study identified factors such as perceived quality of care, CBHI knowledge, absence of chronic illness, affordability, and expenses linked for household dropouts in Mecha district. These findings are also in line with conclusions from Uganda (Nshakira-Rukundo et al.'s , 2021). This cross-sectional study with 464 respondents showed a 25% CBHI dropout rate. Factors linked to dropping out included household socio-economic status (wealth), larger household sizes and distance from the hospital. Additionally, Akwaowo et al. (2023) investigated rural residents' readiness to participate

in health insurance schemes in Nigeria' (Akwa Ibom). This cross-sectional survey of 286 respondents referred to barriers such as limited funds, high premiums, and trust issues. Gender, education, illness frequency, and borrowing for treatment were key predictors of CBHIS enrollment in this study.

Furthermore, a Ghanaian study examined health insurance enrollment and expenditure using data from the Ghana Living Standards Survey (GLSS 7), focusing on risk preferences and community health facility access. Risk aversion was measured by a binary variable, where individuals classified as being risk-averse preferred option A over option B where option A was to invest in a business with zero risk of loss combined with modest profits, while option B involved investing in a business with a slight risk of loss combined with potentially high profits. The findings of this study highlighted that risk-averse individuals and very poor households influenced insurance scheme enrollment (Adjei-Mantey and Horioka 2022).

3.2.4. Catastrophic health expenditure

Three Tanzanian studies investigated catastrophic health expenditure (CHE), defined as healthcare expenditures exceeding 40% of non-food expenditures (household's capacity to pay), using national household budget survey data. WHO (2016) reported a 0.4% CHE incidence rate Mtei and Makawia (2014) reported a rate equal to 2.7%, while Binyaruka and Joachim (2020) reported a rate equal to 1%. On the other hand, Brinda et al. (2014), using the 2008 Tanzania National Panel Survey, found a rate equal to 18% when using the 40% threshold while Macha (2015) reported a rate equal to 26.6% when using thresholds between 10-20% among 276 households.

Research from Mongolia, Malawi, Nigeria, and Vietnam found the CHE incidences that was lower than 10% (5.5%, 9.3%, 9.6%, and 10%, respectively) (Adisa 2015; Dorjdagva et al. 2016;

Mchenga et al. 2017; Kien et al. 2016). Studies in Zambia, Kenya, and Uganda showed higher rates: 11.2%, 17.6%, and 23%, respectively, calculated at different thresholds (Kwesiga et al. 2015; Chuma and Maina 2012; Masiye, Kaonga, and Kirigia 2016).

Other studies were concerned with the determinants of CHE in various countries. Two studies from China Yang et al. (2016) and Li et al. (2012), one from Tanzania by Kihaule (2015) and one multi-country study by Xu et al. (2003), explored this relationship between enrollment status and CHE and found that being a member of a health insurance scheme reduces the incidences of CHE compared to non-members. An increase in age, education level, sex of the household head, and occupation, were identified as determinants of CHE in studies conducted in Tanzania (Macha 2015), China (Yang et al. 2016; Xu et al. 2003) Egypt (Rashad and Sharaf 2015), India (Pandey et al. 2018) and other Sub-Saharan-African countries (Ssewanyana and Kasirye 2020). The socioeconomic status and income were reported in (Brinda et al.2014; Aregbeshola and Khan 2018; Li et al. 2012 and Dorjdagva et al. 2016). Other factors related to health such as chronic diseases and visit to healthcare facilities for inpatient or outpatient services were noted to be associated with CHE in the previous studies (Su TT and Kouyaté B 2006; Li et al. 2012; Brinda et al. 2014).

3.3   Conceptual framework

The conceptual framework for this thesis is adapted from Jean-Frederic Levesque and co-authors. This particular framework was developed after conducting an extensive systematic literature search on studies concerned with access to healthcare (Levesque et al., 2013). After the review process, healthcare access was defined by introducing five dimensions of accessibility (Approachability, Acceptability, Availability and Accommodation, Affordability and

Appropriateness) and five types of abilities (Ability to perceive, Ability to seek, Ability to reach, Ability to pay and Ability to engage).

According to Levesque et al., (2013), the determinants of access to healthcare services is a combination of factors related to health systems, institutions, organizations and providers as well as factors related to individuals, households, the community and the population. This framework can be said to represent a multidimensional view on the determinants to healthcare access since combining system dimensions with abilities (capabilities) that can be measured by various socioeconomic determinants such as gender, marital status, income and education. In this perspective, this conceptual framework can be applied to identify barriers that may arise from both the health care system itself and from various household-level factors (Cu et al. 2021).

The conceptual model of Levesque is also relevant for explaining access to health insurance since access to healthcare access is closely related to health insurance access. For example, access to health insurance will typically improve the access to healthcare. As a consequence, the barriers to healthcare access may, in many aspects, be similar to health insurance barriers in the sense that the abilities (capabilities) needed to overcome healthcare access barriers may be similar to the abilities needed to overcome health insurance access barriers. Variables such as health status, location, availability, income and costs, knowledge, attitudes, perceptions, and skills are relevant for both types of access. Additionally, the presence of health insurance in itself, represents a healthcare system dimension that will facilitate the access to healthcare for example via dimensions such as Availability and Affordability.

According to economic theory, access is a function of both supply and demand and the demand for health insurance is derived from the demand for health. As a consequence, the demand for health insurance will depend on factors such as income, prices and preferences including risk

preferences (Parker and Wong 1997; Grossman 1972). Levesque's conceptual framework describes dimensions and determinants that integrate demand and supply-side factors and this framework enables researchers to operationalize access to health care (Levesque et al., 2013, p.3).

Individual and household factors
Age
sex
household size
marital status
occupation
education
income
risk preference
health status
chronic illness

Scheme factors

Scheme trust.
scheme accessibility
Attitude towards the scheme
Awareness of the scheme
Knowledge of the scheme
Premium affordability

Enrollment decision

Provider factors

Quality of care
medicine availability
waiting time
Benefit package

Community factors
Community leaders.
Influence from peers
Use of traditional healers

Figure 4:Conceptual framework adopted from Levesque et al. (2012) for the determinants of household enrollment in the iCHF
Source: Author construction

In this thesis, the focus is on factors that determine access to a particular voluntary health insurance scheme (iCHF) and the conceptual framework of Levesque can be applied to understand the inclusion of variables believed to be associated with a household's enrollment decision. In Figure 4, we have summarized the possible relationships between the dependent variable (enrollment

decision) and the various independent variables included in our analyses being adopted and modified from the Levesque framework. The independent variables included in this thesis are classified into the following four groups of factors; (i) individual factors (age, gender, education, occupation, religion, health state and risk preference) and household factors (marital status, household size, income/wealth and chronic illness), (ii) organizational (scheme) factors (perception towards scheme trust, convenience, premium affordability and scheme awareness), (iii) provider factors (perceived quality of care and benefit package), and (iv) community and population level factors (use of traditional healers, influence from peers and community leaders). However, some of the factors included in the Levesque framework are not included in the conceptualization of this thesis. Examples of factors being excluded are the ability to reach (travel distance to the point of care, mobility and social support) and the ability to engage (information and care giver support).

Chapter 4: Materials and methods

This chapter presents the study methodology in general. It is divided into five sections: the first section presents the research design and study setting while section two discusses the sample size and sampling procedures. Section three describes the research processes including data collection tools and procedures, data management and variables together with a description of the pre-testing of the questionnaire. Data processing and analyses are presented in section 4 and the final section presents some ethical considerations.

4.1   Study design and settings

A cross-sectional study was carried out in the form of a household survey in Bahi and Chamwino districts of Dodoma region in central Tanzania (Figure 5). This design provides a snap-shot evaluation of the variables under investigation at a particular point in time. Given some resource constraints in terms of time and money, cross-sectional design was considered relevant to answer my research questions. The study design has been adopted from previous studies (Barros and Hirakata, 2003; Mikolajczyk *et al.*, 2008; Brinda et al., 2014; Mladovsky, 2014). A quantitative approach was used to gather the required information for this thesis where the questionnaire was designed with structured questions.

Data was collected from two districts (councils) Chanmino and Bahi in Dodoma Region located in the central part of Tanzania. Dodoma region is comprised of 7 administrative councils (Dodoma city, Bahi, Chamwino, Kongwa, Kondoa, Chemba and Mpwapwa) with 29 divisions, 209 wards and 607 villages. The region is bordered by Manyara region to the North, Singida region to the West, Iringa region to the South and Morogoro Region to the Southeast (Andrew et al., 2022). According to the 2022 National Census survey, Dodoma region has a population of 3,085,625 with an annual growth rate of 2.1% (URT, 2022). Dodoma was chosen out of the 32 regions of Tanzania

since it was the first region where the piloting of the improved community health fund (iCHF) was done. The two districts were also chosen because of the relative higher iCHF enrollment status as compared to other districts during the time of study (17.4% for Bahi and 16.5% for Chamwino) (Stoermer 2015). Since the households were randomly selected (systematic random sampling), high enrollment rate was used as a criterion so that a sufficient number of enrolled was obtained.

4.1.1   Bahi District

Based on the 2022 National Population and Housing Census Survey, Bahi District has a total population of 322,526 out of which 156,427 are males, and 166,099 are females with an annual average growth rate of 2.3% and the average household size of 4.3. The life expectancy is about 50 years with a population density of 37 person per square kilometer. The District occupies an area of 5,948 square kilometers, and its main economic activities are; agricultural, livestock keeping, and small-scale informal business. The district has in total 43 health facilities (6 health centers and 37 dispensaries) (URT 2022) and the iCHF enrollment rate was about 10% in 2022. Administratively, the Bahi district is divided into 4 divisions, 22 wards and 59 villages. This district borders with Manyoni District (Singida Region) on the Western part, Chemba District in the North, Dodoma Municipal on the East and Chamwino on the Southwest part.

4.1.2   Chamwino District

Chamwino District has a population of 486,176, with 236,583 male and 249,593 females (URT, 2022). The annual average population growth rate is 2.8% and the average household size is 4.1, with the life expectancy equal to 64.4 years and a population density of 34 person per square kilometer. Administratively, this district is divided into 5 divisions, 36 wards and 107 villages.

There are about 63 health facilities in this district (1 hospital, 5 health centers and 57 dispensaries) and by 2022 the iCHF enrollment rate was around 13.4%. The district has a total area of 8,056 square km and its main economic activities are agricultural (crops and livestock keeping) and small-scale businesses. It is bordered to the North by Chemba District, to the East by Manyara Region, Kongwa and Mpwapwa Districts, to the South by Iringa Region, and to the West by Singida Region, Bahi and Dodoma Districts.
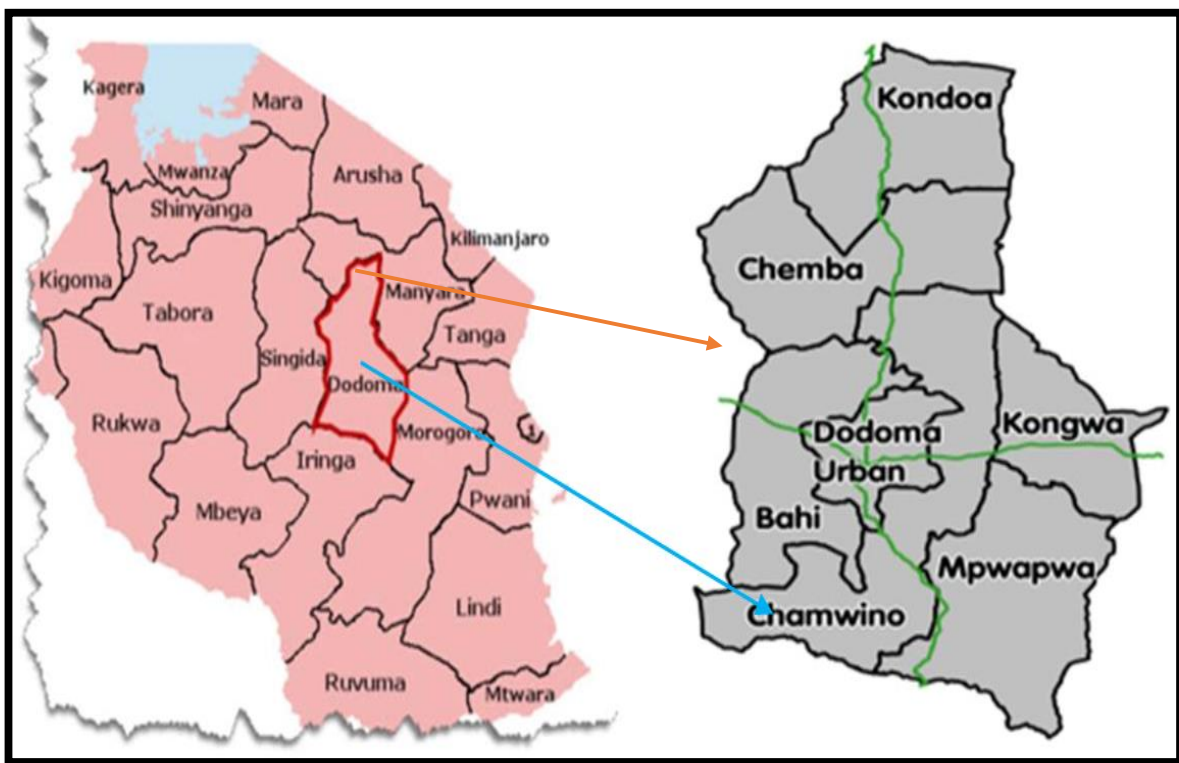
Figure 5: The Map of Tanzania showing the study region and districts
Source: Modified from (SIMBOWE 2017)

4.2 Sample size estimation and sampling procedures

4.2.1   sample size estimation

For this study, the minimum sample size necessary to draw inferences about the target population was calculated using the following formula;

$$Minimum sample N = \frac{Z^2 P(1-P)}{D^2}$$

where N is minimum sample size of the study group, Z is the confidence level (1.96 for a 95% confidence interval), P is the proportion of enrolled population among the total households in Dodoma region obtained from the previous studies (17%), while D is the Margin of error (3%) (Cochran, 1977). We arrive at the following

$$N = \frac{(1.96)^2 0.17(1-0.17)}{(0.03)^2} = 602$$

After adjusting for an assumed non-response rate of 10% (+ 60 households), the minimum sample size became equal to 662 households.

To arrive at several households for each district, a "proportional to size" sampling procedure was used. The number of households from each district was divided by the total number of households from the two districts and then multiplied by the estimated minimum sample size (662 households). The number of households used in sample size calculation for each district were obtained from the 2012 National Population and Housing Census Survey which was by then the current available survey. Chamwino and Bahi had 73,454 and 49,254 number of households respectively, adding up to 122,708 households (NBS 2013).

For Chamwino: Minimum sample size was $\left(\frac{73,454}{122,708}\right) * 662 = 396 households$

For Bahi: Minimum sample size was $\left(\frac{49,254}{122,708}\right) * 662 = 266 households$

However, the study managed to interview more respondents than required by the minimum sample size calculated thus ending up with a total of 722 respondents (303 from Bahi and 419 from Chamwino).

4.2.2 Sampling procedures

A multistage sampling technique was used to select study sites and respondents. First, two district councils (Bahi and Chamwino), out of seven districts in Dodoma region were purposively selected due to their high iCHF enrollment rates. Second, two wards were randomly selected from each division in the district (8 from Bahi and 10 from Chamwino). Thereafter two villages from each ward were purposively selected (16 from Bahi and 20 from Chamwino). The selection of villages was based on two criteria; (i) health facility availability (one village with a facility and one without) and (ii) easily accessible and reachable, hence saving both time and resources. A systematic random sampling technique was employed in the selection of households. This method involves selecting households at a regular interval starting from a random point and selecting every n-th household in the community. The iCHF household was defined as persons who share the same iCHF membership. The household members may come from the same family or different families and join together to form one iCHF household with not more than six members[7]

4.3 Research process

This thesis is comprised of four sub-studies that were conducted in a similar setting with a similar design. The four sub-studies are interconnected in the sense that all were designed to identify factors that were associated with the enrollment status of the households. The description of data collection methods and analysis is provided in the following proceeding sub-sections.

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[7] A household is normally defined as one or more people, related or unrelated, who share meals and who live in the same dwelling unit (Smeeding and Weinberg 2001; Sullivan et al. 2014).

4.3.1 Data collection tools and data collection procedures

This thesis used primary data collected from a household questionnaire. Data were obtained both from members and non-members of iCHF insurance scheme in the two districts using a pre-tested structured household questionnaire. The questionnaire was administered to the household head and in the absence of the head of the household, any adult person available in the household could respond to the questionnaire during the time of data collection. Overall, the questionnaire guide contained 99 questions with information on different topics/subjects. One major strength of the data collection process was that all the approached households agreed to take part leading to a response rate of 100%.

The actual community entry procedures began on the first day of data collection in each selected village, where an introductory visit was done before data collection to familiarise with environment and explain the aim of the study. A clear introduction was made to all local leaders who then introduced the research team to the field guides who were supposed to introduce the team to the community during the fieldwork. A research team was formed by the principal researcher and the research assistants. Before the beginning of data collection, the research assistants would ask to speak to a household head who was either a father or mother depending who was available. Data were collected from June to August in 2019 using a pre-tested structured questionnaire.

4.3.2 Study variables and measurement

The enrollment status was the main outcome variable for the first three sub-studies and consisted of the following three categories of questions with yes/no responses; (i) if the household is

currently insured by iCHF (*currently-insured*), (ii) if the household was previously insured by iCHF (*drop-outs*), and, (iii) if the household has never been insured by iCHF (*never-insured*). A catastrophic health expenditure (CHE) variable was used as an outcome variable in the 4th sub-study, and this variable was constructed by using expenditure data. The Expenditure data was concerned with household's food expenditure (FE), nonfood expenditure (NFE) and healthcare expenditure (HE). The data collected on expenditure were either consumed within the last four weeks (one month), or last 12 months (one year) on a date of data collection. Those that were consumed for more than or less than a month, let say 1 year like school fees, the amount was recomputed into one month recall period (See more details in the appendix paper IV).

The explanatory variables were classified into different groups such as: socio-demographic variables, perception variables, health-related variables, risk preferences (BJKS), healthcare utilization and wealth/socioeconomic status (SES). A total of 8 socio-demographic characteristics were included in the questionnaire being a mixture of both continuous (age, income) and categorical variables (gender, marital status, religion, occupation and household size). For the perception variables, 38 statements were ranked on a 5-point Likert scale ranging from strongly disagree to strongly agree. The statements were mainly concerned with perception about the iCHF scheme (convenience, affordability, knowledge and awareness) about healthcare providers (medicine availability, waiting time, quality of care), as well as other factors regarded as relevant (the use traditional healers).

The health-related variables in the questionnaire included two health state variables (EQ-5D and H-5, and two disease-related variables (chronic disease and fear of diseases). EQ-5D is a generic instrument mostly used in the economic evaluation literature to derive values (cost utilities) for health states that can be used to estimate quality-adjusted life years (QALYs) (David and Black

2005; Rabin and Charro 2001). It describes health state using five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression), where each dimension is divided into three levels. The EQ-5D index was then generated as a continuous variable with values ranging from 1 (full health state) to 0 (worst possible health) using STATA statistical software. Thereafter, it was grouped into three categories: <0.5 (poor health), 0.5-0.8 (fair health) and 0.8-1.0 (good health). H-5 describes health status by asking respondents to rank their health condition on a Likert scale from 1-5 where 1 is very poor and 5 very good. This scale was thereafter reduced to the following three categories: 1 and 2 (poor health), 3 (fair health), 4 and 5 (good health). The two disease-related variables were constructed by asking; (i) whether or not, any household member had a chronic disease, and (ii) to what extent the respondent feared the future occurrences of diseases (yes or no).

As for the BJKS instrument which was used to measure the risk preferences of the respondents was constructed using the hypothetical stated income measure. Each respondent was presented with the questions as they appear in Box 1. Based on the combinations of answers, each respondent was assigned a value from 1 to 4 where the highest value refers to a higher degree of risk aversion. Category 4 (Strong) if the answer to the questions is "job 1" and thereafter "job 1", category 3 (Medium) if the answers are "job 1" followed by "job 2", category 2 (Moderate) if the answers are "job 2" then "job 1", and category 1 (Weak) the answers are "job 2" then "job 2". The 4 categories were further reduced to two groups for subsequent analyses by combining categories 1 and 2 to form Low category and 3 and 4 to form High categories.

The respondents were asked to provide information about healthcare utilization by asking if they had visited a health facility for either (a) outpatient services (OPD) within the last 4 weeks or (b) inpatient services (IPD) within the last 12 months. The healthcare utilization variables were

measured as binary with yes/no responses. They were also asked about the household expenditures incurred (in local currency i.e., Tshs) for payments of healthcare expenses including diagnosis, treatment, and the associated non-medical expenses such as transport and accommodation costs for patients and their companions on either outpatient or inpatient care. They were also asked about the household's monthly expenditure on food and non-food items that were used to estimate total household consumption expenditure that again was then used to create a wealth variable (socio-economic status).

Box 1: **The BJKS – instrument (the version presented by Schroyen & Aarbu (2018)**

Suppose that you are the only income earner in your household. Suppose also that reasons beyond your control force you to change occupation. You can choose between two alternatives. Job 1 guarantees you the same income as your current income. Job 2 gives you a 50% chance of income twice as high as your current income, but with a 50% chance it results in the reduction of your current income by one-third. What is your immediate reaction? Would you choose job 1 or job 2?

If the respondents select the safe alternative (job 1), she is presented with a new pair of alternatives, the only difference being that the downside risk of job 2 is one-fifth of the current income (20% reduction) instead of one-third (33% reduction). If, on the other hand, job 2 is selected, the follow-up question presents the respondent with a choice between the safe alternative and a risky job 2 where the downside risk increases from one-third (33% reduction) to one-half (50% reduction).

4.3.3 Pre-*testing of the data collection tools*

Prior to data collection, the questionnaire guide was pre-tested among a selected small sample and it took place in a district known as Kisarawe in the Coastal region. About 20 respondents were interviewed, thereafter, the principal investigator and the research assistants sat down and discussed what transpired from the pilot. Questions that were identified as being ambiguous or unclear were revised or removed from the questionnaire. The pre-testing was done to ensure that

the questions were relevant, understandable, consistent, and logical. The pilot study also assisted the principal investigator determining the time needed for undertaking the interviews.

In order to ensure the quality of the collected data, research assistants (RAs) with research experience were recruited. Prior to the actual fieldwork, they were trained for two days by the principal investigator (PI). The training provided them with an overview of the study and familiarization with the questionnaire guide. The RAs were also introduced to research ethics and to administrative issues such as work schedule, how to take field notes and other logistics. They were also reminded that, at the end of each day during the fieldwork, there would be a daily feedback meeting between the PI and RA to evaluate their experiences and discuss problems encountered.

4.3.4   Data management, quality check and assurance

The questionnaire was originally written in English and later translated into Swahili, which is the spoken language by the majority of Tanzanians. Translation from English to Kiswahili was intended to increase the validity of the responses, as the respondents typically were more conversant in Swahili than English. However, before administering the instruments, there was a back-translation of instruments from Kiswahili to English to check the accuracy of translation. The PI did all the translation and back-translation and discussed the questions with a small panel that included colleagues and supervisors.

The data was collected using tablets which were installed with an Open Data Kit (ODK) software which allowed data to be collected offline and be sent to the system later on with an internet connection. The principal investigator appointed one of the research assistants to be the field supervisor who assisted on checking and evaluating the quality of the data before sending it to the saver by using a checklist tool developed by the PI. This helped to detect commonly raised

problems that were immediately responded to. The principle investigator examined the data as it came in the system from the ODK software. Daily feedback meetings were held between the investigators and the RAs to review and mitigate problems in the data collection process. All the data collection materials and tools were cross checked at the end of each day to make sure that the desired quality was achieved.

4.4 Data processing and analysis

Data cleaning to detect and correct errors such as incorrect coding, missing responses and any other abnormalities and validation was performed using excel and STATA version 14.0 and 17.0 software. All the descriptive analyses were performed using the same software. The study included both continuous and categorical variables. Some variables such as income and age, were collected as continuous but in some of the analyses undertaken, they were constructed as categorical variables. Income (y) was grouped into three categories following the poverty line definition (Z), per adult for the mainland of Tanzania (World Bank 2018) where $Z = TZS$ 49,320 ($22.4)): (i) low income ($y < Z$), (ii) medium income ($Z \leq y < TZS$ 499,999), and (iii) high income ($Z \geq TZS$ 500,000). Age was grouped into 4 categories (18–25 years, 26–39 years, 40–59 years, and 60+) following the Tanzanian 2012 population survey reports (NBS 2013). Econometric analyses for each of the four sub-studies were performed using different statistical methods and included different sets of variables. The presentation of data analysis methods and variables included in each sub-study is given below;

Paper I: The enrollment status was the outcome variable with two categories; member of iCHF (yes) and non-member (no) of iCHF. The main explanatory groups of variables were the perception

factors, socio-economic variables and demographic characteristics. The identification of the most important perception factors influencing household decision to enroll in the iCHF was done using both Factor Analysis (FA) and Principal Component Analysis (PCA). The two methods were independently employed to investigate the degree of robustness of the findings since the underlying assumptions differ. PCA assumes that there is no unique variance, the total variance is equal to common variance while FA assumes that the total variance can be partitioned into common and unique variance(Tabachnick (1989); Costello and Osborne, 2005).

Statistical tests such as Bartlett's test of sphericity, to test for correlations among the variables, Kaiser-Meyer-Olkin (KMO) for sampling adequacy, and Cronbach's alpha test for internal consistency and scale reliability, were performed to examine the suitability of the data both for PCA and FA. Finally, multivariate logistic regressions were run to determine possible associations between the identified factors and the insurance enrollment status. Logistic regression method was chosen because the outcome variable was binary ("Yes" for members and "No" for non-members) (See details information in paper I).

Paper II: The outcome variable was enrollment status with three categories (never-insured, dropouts, and currently insured). The paper aimed at assessing whether the factors associated with the household's decisions to enroll or not to enroll into the voluntary health insurance, differed from those factors associated with the decisions to drop out or not. The main explanatory variables in this paper were the health-related variables and we controlled for socio-demographic variables, and perception factors. The reported health state variable was measured using the EQ-5D instrument that measures the health status of the respondents. Chronic disease (yes or no) and the extent to which the respondents feared the future occurrence of diseases (yes or no), were the two additional health-related variables that were included.

The paper applied a multinomial logistic regression model to determine such relationship with the *currently insured* as the reference category (base outcome). Thus, the probability of being *never-insured* or a *dropout was* compared with the probability of being *currently insured*. To address potential multicollinearity problems, we conducted tests such as Spearman's rank (rho) correlation coefficient matrix (Belsley 1984) and the variance inflation factor (VIF) test (Bowerman and O'Connell 1990).

Paper III: The models from paper I and II were used as benchmark models in this work in the sense that the risk preference variable was added to the two former models. In this paper, the models were analyzed using both simple logistic regression and a multinomial logistic regression. The outcome variable was the iCHF enrollment status which was measured as a binary outcome with a "Yes" response if the respondent was a member of the iCHF scheme and a "No" if not a member for the logistic regression model ((Kagaigai et al. 2021) as a benchmark model). As for multinomial regression, the enrollment status was constructed as a categorical variable with three multiple response (currently insured if the insurance contract was valid at the time of data collection, never insured if the household has never been insured and previously insured/dropout if the contract has expired and has not renewed) ((Kagaigai et al. 2023) as a benchmark model). The main explanatory variable was risk preference which was measured based on the combinations of answers given to the hypothetical questions. Each respondent was assigned a value from 1 to 4 (categories) where a higher number referred to a higher degree of risk aversion (category 4; Strong) while category 1 referred to a low degree of risk aversion (category 1, Weak) Other control variables included health related variables (EQ-5D index, chronic illness and fear of sickness), perception variables (quality of care, traditional healers, benefit package, premium affordability

and knowledge of the insurance scheme) and socio-demographic variables (income, education, age, marital status, occupation, religion, household size and gender).

Data description was done and presented in terms of either frequencies and percentages with a chi square test, or means and standard deviations with a t-test statistic. Results from the logistic regression and multinomial logistic regressions were presented in terms of odds ratios (OR) and relative risk ratios (RRR) respectively, where the currently insured acted as the reference category (base outcome).

Paper IV: The outcome variable was the catastrophic health expenditure (CHE) measured as a binary outcome (1 if health expenditure > 40% of the non-food expenditure and 0 if otherwise). CHE was defined as household health expenditure that exceeds 40% share of total non-food expenditure (Xu et al., 2008; Wagstaff et al., 2018). For this paper, the main explanatory variables were iCHF enrollment status and wealth (socioeconomic status). Other control variables included socio-demographic characteristics (age, gender, marital status, household size, education and number of children under 14 years), health related variables (reported health state (H-5) and chronic illness) and healthcare utilization variables (inpatient and outpatient services).

To measure the socioeconomic inequality in the distribution of healthcare utilization among the iCHF members and non-members, the concentration curve was plotted and concentration indices were estimated (ranging between -1 and 1) using total household expenditure as a ranking variable (O'Donnell et al. 2007). To test whether the levels of inequality were statistically different, a dominance test was conducted. Multivariate logistic regression analysis was employed to assess the association between CHE and enrollment status and socioeconomic status after adjusting for other socio-demographic and healthcare utilization variables. Results were reported as adjusted odds ratios and statistical significance was set at the 5% level. The statistical differences between

groups were tested using Chi-square statistical test. Table 2 summarises the aim, the design, and

the variables included for the four articles (sub-studies).

Table 2: An overview of the study methodologies used in the thesis for each sub-study

Papers	Aim/research question	Study design	Variables	Analysis techniques
Paper I	What factors influence a household's decision to enroll in the iCHF?	*Cross-sectional design & quantitative approach*	Dependent variable*: enrollment status (binary outcome {0=uninsured 1=insured})* *Independent variables*: i. perception factors ii. demographic variables	*i. principal component analysis and factor analysis* ii. logistic regression
Paper II	To what extent do variables associated with the enrollment decision differ from variables associated with the dropout decision in the iCHF) scheme?	*Cross-sectional design & quantitative approach*	Dependent variable: *enrolment status (categorical variable with three outcomes {0=currently insured 1=previously insured 2=never insured})* *Independent variables:* i. health state ii. perception factors iii. demographic variables	*multinomial logistic regression*
Paper III	What is the role of risk preferences to the iCHF enrollment status?	Cross-sectional design & quantitative approach	Dependent variable*: two outcome variables; enrolment status (a. binary outcome {0=uninsured, 1=insured}* *b. categorical variable with three outcomes {0=currently insured, 1=previously insured, 2=never insured})* Independent variables: i. risk preference ii. health state variables iii. perception factors iv. demographic variables	i. logistic regression ii. multinomial logistic regression
Paper IV	To what extent can iCHF insurance scheme reduce the incidences of catastrophic health expenditure (CHE) and increase healthcare utilization?	Cross-sectional design & quantitative approach	*Dependent variable*: Catastrophic health expenditure (CHE) *Independent variable;* i. enrolment status ii. social economic status iii. healthcare utilization iv. health state variables v. demographic variables	i. concentration index curve ii. logistic regression

4.5   Ethical considerations

4.5.1   Ethical considerations and permissions

Ethical permits were obtained from the National Institute of Medical Research in Tanzania (NIMR)- (Ref.No.NIMR/HQ/R.8a/Vol.IX/3077) and from Norwegian Centre for Research Data (NSD)- (Ref. No. 807876). The PhD candidate obtained a research permit to carry out the study in Dodoma Region from the Prime Minister's Office Regional Authority and Local Government (PORALG-TAMISEMI). Thereafter introduction letters to Bahi and Chamwino District Executive Director (DED) and District Medical Officer (DMO) were obtained from Dodoma Regional Administrative Secretary. The study also was introduced to local leaders (Wards Executive Officers and Village Executive Officers) through an introduction letter from the DEDs. Ethical considerations have been a concern throughout the study process, particularly about issues around informed consent and confidentiality. Privacy was assured to all study participants and the study findings were promised to be disseminated widely to the stakeholders involved in this study and made available to the scientific community through peer reviewed publications.

4.5.2   Informed consent

Informed consent was obtained from all respondents because the research involved human subjects (Shrestha and Dunn 2020). Informed consent ensures that all the study participants in a research project agree to participate of their own free will, without being persuaded or pressured, and that they are fully aware of the implications of their participation (Nijhawan et al. 2013; Holm, Hofmann, and Laake 2015). Once the participants have agreed to take part in the research, it will mean that they have fully understood the information provided to them about the project. Usually the informed consent information is given either orally or in a written form depending on the

literacy level of the study participants (Holm and Olsen 2015). In this study we used a written form to obtain the informed consent from the participants.

All participants in this study received the necessary information about the study in Kiswahili language. The RAs were trained on how to inform the participants about the content of the informed consent form in a way that everybody could understand either being literate or illiterate. The consent form included information about: the aim of the study, the rights of the participant, such they are free to withdraw from the study at any time during the interview, that they are free to refuse to answer any question as the interview is in progress and that they have the right to withdraw consent for the use of their data.

Furthermore, the benefits and consequences of participating in the researcher were made clear to the participant (Nijhawan et al. 2013). At the end of the consent form, contact details of the principal investigator and the director of research and publications of Muhimbili University of Health and Allied Sciences, were provided to them so that the participants could raise any complaints related to the study. All the respondents were given two consent forms in Swahili explaining the right to voluntary participate in the study. The forms were signed by both a researcher and a respondent before the start of the interview as a proof of consent to participate in the study. One copy of the consent was left with the participant while the other one remained with the researcher.

4.5.3   Confidentiality

Several steps were taken to ensure the confidentiality of the study participants. No identifying information such as name, phone number or address was recorded. The participants were informed about confidentiality and were assured that, all the information given was confidential and would

be used for study purpose only. Each questionnaire was given a unique identification number instead of the name for recording purposes but was not included during the analysis. The signed consent forms were kept in a locked box at all times during data collection, and in a safe at Muhimbili University of Health and Allied Sciences after the field work. Furthermore, the study ensured that all the questions were straight forward, not causing stress or psychological effects to the participants as one way of observing ethical considerations. All the respondents that were asked to participate in the study immediately gave their consent.

Chapter 5: Findings

This chapter provides a summary of the findings for each sub-study of this thesis. First, we present the general descriptive results of all four sub-studies since all use the same dataset (section 5.1). Section 5.2 to 5.5 provide a summary of the main findings arrived at for paper I to paper IV.

5.1 Summary results

The primary conclusions from this thesis are that household perceptions, individual risk preferences, and the health state of household members play significant roles in influencing a household's decision to enroll into the voluntary health insurance scheme considered (papers I, II & III). Furthermore, the voluntary insurance scheme in question is shown to be effective in reducing the occurrences of catastrophic health expenditures and the scheme has led to an increase in the utilization of healthcare services among the poorest households (paper IV).

The household survey included 722 respondents, with 30.2% being currently enrolled in the iCHF scheme, while 69.8% were not enrolled (54.7% were previously enrolled/dropped out while 15.1% had never been enrolled). From Table 3, we observe that the majority of respondents were female (57.9%), and about 72% were married. The sample included more farmers (74%) than non-farmers, 72% had primary education, while only 10% had secondary education or higher education. The respondents' average age was 44.7 years (SD: 13.7) and the mean household size was 5 members (SD: 2.3). Among the 722 respondents, 256 had sought inpatient care (16%) or outpatient care (35%). Over 35% had chronic diseases, and roughly 79.2% exhibited a high degree of risk-aversion. Overall, about 15% of households incurred catastrophic health expenditure (CHE) at the 40% threshold of total non-food expenditure. Insured individuals experienced a slightly lower CHE (13%), relatively to the non-insured (15%).

Table 3: Households socio-demographic characteristics compared across enrollment status

Variables	Enrollment status; (%)		
	Insured **N = 218**	**Uninsured** **N=504**	**Total** **N=722**
Age			
18-25	5.9	5.6	5.8
26-39	28.9	34.	33.1
40-59	47.3	47.2	47.2
60+	17.9	12.1	13.9
Mean age =44.7 years (SD: 13.7)			
Sex			
Male	38.5	43.7	42.1
Female	61.5	56.3	57.9
Marital status			
Married	74.8	71.6	72.6
Not married	25.2	28.4	27.4
Education			
No formal education	16.5	18.1	17.6
Primary education	70.6	72.6	72.0
Secondary education and above	12.8	9.3	10.4
Occupation			
Farmer	73.4	74.4	74.1
Non-farmer	26.6	25.6	25.9
Household Income			
Low	30.3	40.7	37.5
Medium	61.9	54.8	59.9
High	7.8	4.6	5.5
Household size			
1-3	18.4	20.0	19.5
4-6	51.7	51.8	51.7
7-9	25.7	24.2	24.7
10+	4.6	3.9	4.2
Mean household size = 5 members (SD: 2.3)			
Outpatient services (OPD)			
Yes	50.0	29.2	35.5
No	50.0	70.8	64.5
Inpatient services (IPD)			
Yes	18.8	15.3	16.3
No	81.2	84.7	83.7
Chronic illness			
Yes	41.7	32.54	35.3
No	58.3	67.5	64.7
Risk-aversion			
Low Risk-aversion	14.7	23.4	20.8
High Risk-aversion	85.3	76.6	79.2
CHE as a share of nonfood expenditure			
CHE>40	13.3	15.1	14.5
CHE<40	86.7	84.9	85.5

5.2 Summary of results for Paper I

Do Household Perceptions Influence Enrollment Decisions into Community-Based Health Insurance Schemes in rural Tanzania?

Paper I aimed to identify important perception factors influencing households' decisions to enroll in rural Tanzanian community-based health insurance (CBHI) scheme. The study employed both factor analysis (FA) and principal component analysis (PCA) to assess household perceptions. PCA identified seven key factors, in sum explaining 60% of the variance, while FA identified four factors, explaining about 91% of the variance. The factors were ranked according to their relative importance (following the percentage of he explained variance). The ranking for PCA was as follows; quality of healthcare services (11%), social beliefs (10%), scheme convenience (7%), and understanding of the iCHF scheme (5%) The three most important factors for FA were; quality of healthcare services (34%), preferences/understanding (27%), and scheme convenience (20%). Multivariate logistic regression demonstrated that positive perceptions towards the quality of care (OR=1.28, 95%CI=1.10-1.49) and scheme convenience (OR=1.49, 95%CI=1.17-1.68) increased the odds of being enrolled into the iCHF scheme, while negative perceptions towards scheme preference (OR=0.61, 95%CI=0.59-0.72) and scheme understanding (OR=0.83, 95%CI=0.72-0.96), decreased the odds of being enrolled.

5.3 Summary of results for Paper II

Whether or not to enroll, and stay enrolled? A Tanzanian cross-sectional study on voluntary health insurance

The main aim of paper II was to examine to what extent variables associated with the enrollment decision differ from those associated with the dropout decision. The study applied multinomial

logistic regression to determine the associations between the explanatory variables and enrollment status (never-insured, dropouts, or currently insured). The currently insured enrollment status was chosen as a benchmark/base outcome. The study found that younger age (18-25 years) increased the probability of not being insured relative to being insured compared to older age (40-59 years) (RRR = 2.33, 95%CI = 1.49-3.65). Female-headed households and household heads with a positive perception about the benefit packages, decreased the probability of being never-insured relative to being insured.

As concerning the drop-out decision, income and premium affordability played key roles. A higher household income and affordable premiums lowered the probability of dropping-out compared to staying insured (RRR=0.38, 95%CI = 0.15-0.93) and (RRR = 0.69, 95%CI = 0.51-0.95), respectively. Notably, several factors were significantly associated with both decisions. For example, favorable perceptions towards quality of care and trust in scheme leaders correlated negatively with both decisions. Conversely, positive perceptions of traditional healers and the absence of chronic diseases correlated positively with both staying uninsured and dropping out.

5.4   Summary of results for Paper III

The role of risk preferences: voluntary health insurance in rural Tanzania

This paper had the following two goals: (i) to determine the role of risk preferences on enrollment status (currently insured, previously insured, and never insured) into iCHF scheme using the BJKS instrument, and (ii) to explore if the inclusion of risk preferences into the models presented in paper I (Model 1) and paper II (Model 2) affected the independent variables (covariates). Logistic regression revealed that respondents with a high degree of risk-aversion had 2.18 times the odds of being insured compared to those with lower degrees of risk-aversion (OR=2.18, 95%CI=1.38-

3.46). In multinomial regression, a low degree of risk-aversion, relative to a high degree of risk-aversion, increased the probability of being never-insured or having dropped-out, relatively to being currently insured (RRR=3.03: 95%CI=0.79-11.57 and RRR=1.89, 95%CI=1.38-2.61, respectively). Age, income, and 6 out of 7 the perception factors for Model 1, and age, gender, education, chronic diseases, and 4 out of the 5 perception factors for Model 2 were associated with enrollment status.

To address the second goal, we examined the stability of the variables after the inclusion of the risk preference variable. The results indicated that the odds ratios (OR), relative risk ratios (RRR), and significance levels (P-value) of the independent variables remained relatively stable in both models, except for income in Model 1 and age (60+ years) in Model 2. One income group (0-49,990 TZS) shifted from being insignificant to significant at the 1% significant level, while the 500,000-999,990 TZS group became insignificant. In Model 2, only one age group (18-25 years) was significant at the 1% level. After introducing the risk preference variable, the 60+ age group became significant at the 10% level for the never insured and at the 5% level for the previously insured relative to currently insured (RR=0.75, 95%CI=0.54-1.04 and RRR=0.63, 95%CI=0.41-0.97, respectively).

5.5   Summary of results for Paper IV

Healthcare utilization and catastrophic health expenditure in rural Tanzania: does voluntary health insurance matter?

Paper IV aimed to compare healthcare utilization and catastrophic health expenditure (CHE) incidences across iCHF scheme members and non-members. The paper used concentration indices (CI) and logistic regressions to examine socioeconomic inequalities in healthcare utilization and

the association between iCHF enrollment and CHE respectively. When healthcare utilization was compared across socioeconomic status (SES) and enrollment status, the study found that for the insured, the percentages of households belonging to the lowest and highest socioeconomic status (SES) that had utilized outpatient care services (OPD) were 39% and 56%, respectively (see Figure 6). In contrast, for those without insurance, the corresponding percentages were 17% and 43%. This observation validates the fact that households belonging to lower SES were less likely to utilize outpatient care services compared to those belonging to a higher SES, irrespective of the insurance status.

Overall, insured individuals utilized both OPD services and IPD services more frequently across all levels of SES when compared to those without any insurance. However, the rate of utilization for individuals belonging to a low SES, when comparing the insured and uninsured, had a minimal impact as concerning inpatient care services
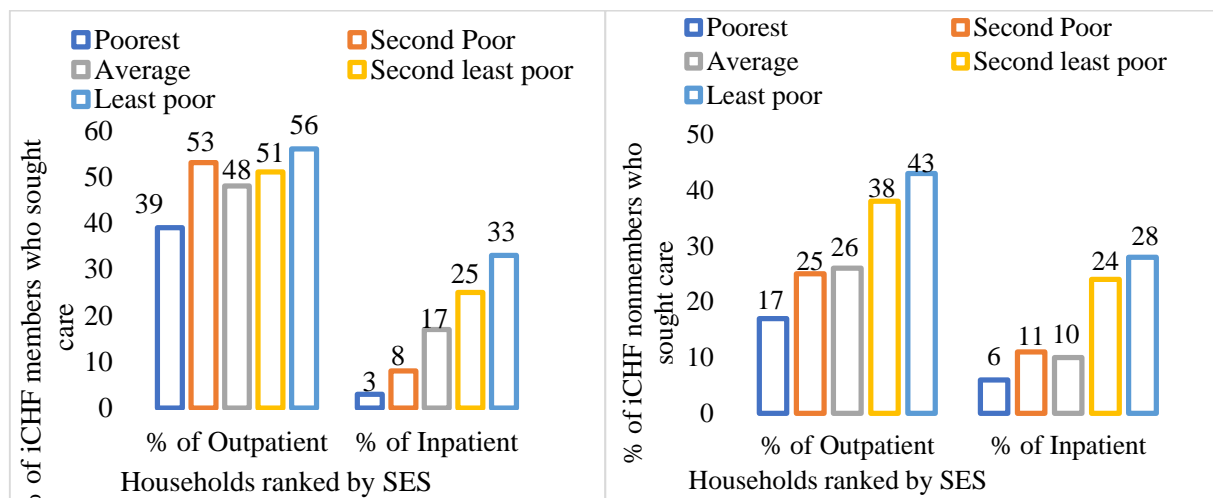
Figure 6: Proportion of households who utilized healthcare services by enrollment status

Our analysis identified an incidence rate equal to 15% for catastrophic health expenditure (CHE) in the study population. When disaggregated the rate by enrollment status, the incidence was 15%

for non-insured households while being 13% for insured households (Figure 7). Notably, the least

poor experienced more CHE than the poorest, regardless of insurance status. Being insured

reduced the risk of falling into CHE in lower quintiles for instance, in the second poorest quintile,

the rates were 8% for insured and 14% for uninsured.
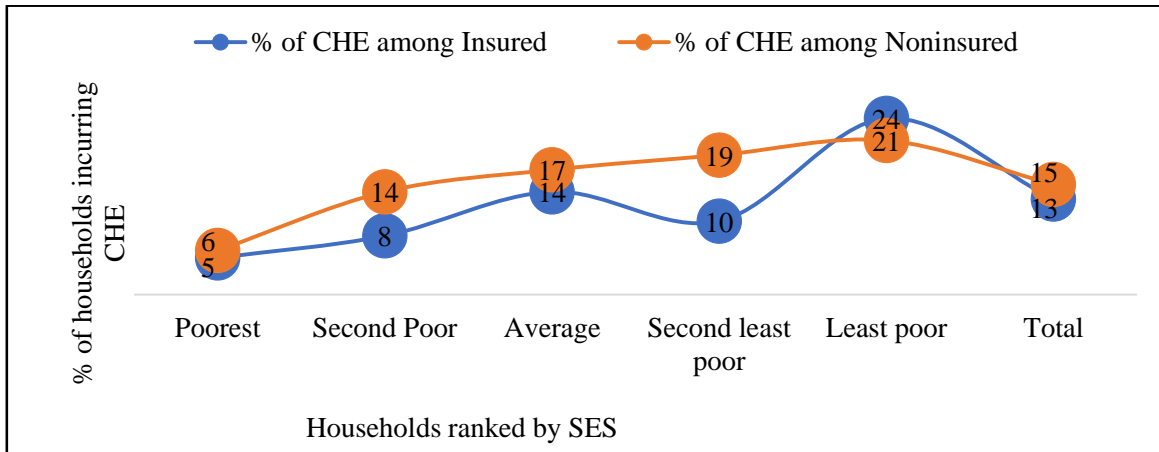
Figure 7: Proportion of households incurring CHE disintegrated by wealth and enrollment status

When concentration index was computed to determine the degree of inequality in healthcare

utilization, we found that the degree of inequality for inpatient care (insured CI=0.38, uninsured

CI=0.29) was higher than for outpatient care (insured CI=0.09, uninsured CI=0.16). Moreover, the

odds of iCHF members to incur CHE were 0.4 times lower compared to non-members (OR=0.41,

95%CI: 0.27-0.63). Other significant CHE determinants included the reported health state,

socioeconomic status, presence of chronic illness, and utilization of inpatient/outpatient care.

CHAPTER 6: Discussion

The objective of this study was to identify various factors influencing households' decisions to enroll into the improved community health insurance fund (iCHF) scheme in rural Tanzania and its role in protecting against catastrophic health expenditures (CHE). The first three papers (I, II, and III) shed light on the existing gap between the intended goal of achieving high enrollment rates and the actual situation characterized by a low enrollment rate and a high dropout rate in rural Tanzania. Furthermore, paper IV assessed the effectiveness of the iCHF scheme in reducing the incidence of CHE and enhancing healthcare utilization. The findings indicate that the decision to enroll into the iCHF scheme correlates with household socio-economic characteristics, perceptions of the households, risk preferences, and health status of household head/members (see Paper I, II, and III). Additionally, the outcomes from Paper IV demonstrate the effectiveness of the iCHF scheme in increasing the access to healthcare as well as decreasing CHE. This section will discuss our main findings and comment upon the methodological strengths and limitations.

6.1 Individualism centeredness to voluntary health insurance schemes

Our findings highlight the significant role of individual factors, such as risk preferences, age, health, gender and income have in shaping household decisions regarding participation in the voluntary health insurance scheme. Such findings closely align with previous studies that reach similar conclusions. For example, a study conducted in Ghana revealed that 81.9% of the respondents were risk-averse, and such preferences were significantly associated with enrollment status (Adjei-Mantey and Horioka 2022). Chanie and Ewunetie (2020) and Minyihun et al. (2019) established a connection between age and enrollment status, while Bayked et al. (2021); Wassie et

al. (2023) and Akwaowo et al. (2023) identified associations between the presence of chronic illnesses and enrollment status.

Female-headed households were more likely to enroll in comparison to male-headed households. Chanie and Ewunetie (2020) and Minyihun et al. (2019) demonstrated that households led by females significantly increased the probability of enrolling in the CBHI scheme. Dong et al. (2009) and Mebratie et al. (2015), on the other hand, found no significant gender-based effects on enrollment status. In addition, there are studies, that find female-headed households to be less likely to join CBHI compared to their male counterparts (Finnoff 2016). According to Finnoff (2016), such an observation can be attributed to traditional gender roles where men, often the primary earners, are more likely to afford premium than women who are predominantly housewives. Duku (2018) supports these explanations since highlighting that increased wealth and higher educational levels will contribute to the decision to enroll.

According to Arrow (1963), risk-averse individuals demand insurance to protect themselves from the uncertainties of illness and to financial risks. Arrow (1963) argues that households will purchase insurance when their valuation of the insurance benefits in terms of reduced risk are higher than the sum of the premium payments. Since the valuation of the insurance benefits are increasing with the degree of risk-aversion, one would expect from theory that the insured, ceteris paribus, are more risk-averse than the non-insured. Our findings confirm this theoretical prediction since the insured in our study, on average, are more risk-averse than the non-insured (both never-insured and drop-outs). However, a significant proportion of respondents in the sample exhibited a substantial degree of risk-aversion (79.2%) regardless of their enrollment status. Surprisingly, despite strong risk aversion among the respondents, the enrollment rate was relatively low (equal to 30%) and was accompanied by a considerable dropout rate (about 54%).

Possible reasons for this finding might include dissatisfaction among the insured households with respect to the iCHF benefit package, leading to a reduction in contract renewals. The iCHF scheme primarily covers primary healthcare services, thus failing to adequately cater to individuals with chronic illnesses who require specialized treatments. Consequently, even though individuals exhibit a high degree of risk-aversion, they might be unwilling to enroll or renew memberships since substantial risks persist despite being insured. This explanation can potentially be supported by some of our findings highlighted in Paper I and Paper II since the non-coverage of chronic diseases, may correspond to low quality of care and limited scheme benefits. In both papers, the ratio of benefits to premiums and the perceived quality of care significantly impacted the enrollment status.

In accordance with insurance theory, individuals with a poor health (high risk of illness) would demand insurance to a higher extent than individuals with a better health. Thus, the insured should on average, have a lower health state than the non-insured (adverse selection). These findings align with our findings since households with at least one member having a chronic illness has a higher likelihood of being current enrolled. Wang et al. (2006) and Parmar et al. (2012) reported similar results in their earlier research within low and middle-income countries (LMICs). Low enrollment rates combined with adverse selection could impede the nation's capacity to generate sufficient pooled funds, hindering the attainment of financial sustainability and Universal Health Coverage (UHC) which is the primary objectives behind establishing voluntary insurance schemes. These findings provide insight to the challenges faced by such schemes in countries like Tanzania upon implementation. It is therefore of great importance to have healthier individuals (weak averse) in the risk pool for cross-subsidization of the non-healthy individuals.

6.2 Households' dynamics and the enrollment to voluntary health insurance schemes

Household perception factors were found to play a significant role in influencing enrollment decision. These important factors included perceived quality of care, scheme understanding, benefit-to-premium ratio, scheme convenience/accessibility, trust in scheme leaders, and use of traditional healers.

The quality of care and insurance benefit packages shapes how individuals value an insurance scheme. The perceived quality of care ranked highest in importance, among the included perception factors across the first three sub-articles. This suggests that a better quality of care increases enrollment and reduces the likelihood of dropping-out from the insurance scheme. The components of quality of care being considered important by the respondents were drug availability, diagnostic equipment, waiting times, referral mechanisms, and healthcare workers' attitudes. The majority of respondents expressed negative perceptions about these aspects, suggesting a dissatisfaction with the quality of care offered by public health facilities.

Such beliefs are consistent with prior Tanzanian research (Macha et al. 2014b; Chee et al. 2002; Marwa et al. 2013) and studies in other Sub-Saharan African countries such as Burkina Faso (De Allegri et al. 2006), Ethiopia (Atafu and Kwon 2018), Rwanda (Schneider 2005), and other LMICs (Criel and Waelkens 2003; Adebayo et al. 2015). Other studies have identified the presence of inadequate quality of care as an important contributor to high dropout rates (Lekashingo et al.2012; Mebratie et al.2015; Mladovsky 2014). Also, more recent studies (Amani et al. 2023; Mustapha 2020; Alex and Mwamfupe 2020), published after 2019 when data collection for this thesis had already been done, also highlights poor quality of care as a barrier to enrollment and as a driver for dropping-out (Wassie et al. 2023).

High quality expectations among households before joining the scheme would produce demoralized households if the expectations are not met. Furthermore, there might be expectations about full coverage (no OOP), however, this is not always the case since some drugs are not covered by the iCHF and frequent stock outs pose regular challenges; like being forced to buy drugs from the private pharmacies and co-payments for some services that are not included in the benefit package.

Understanding (knowledge) about the scheme was shown to be a challenge for both the insured and non-insured respondents. Respondents struggled to understand the main mechanism of the insurance scheme. This lack of scheme understanding could follow from unclear communication about the benefits package. Similar findings are also noted in other studies (Macha et al. 2014; Basaza et al. 2008; Ngowi and Nuru 2023; Wassie et al. 2023; Bayked et al. 2021).

Our respondents had a poor understanding of the scheme's functioning. For example, many had unrealistic expectations since anticipating full coverage and that the scheme would return annual premiums if not needing health care services. Such unrealistic expectations may have led to significant dropout rates. Insufficient knowledge of the scheme could discourage enrollment or cause enrolled individuals to withdraw. To increase enrollment and decrease dropouts, advocating and raising awareness through campaigns is crucial.

Previous research has identified premium affordability as a key barrier to enrollment (Basaza et al. 2008; Nyandekwe et al. 2020; Gidey et al. 2019). However, our findings, contrast such conclusions. About 63% of our respondents agreed that the premiums were affordable, however, 45% reported that they were unwilling to pay the premiums despite its affordability. This finding suggests that factors beyond the premium size are important. For instance, Marwa et al. (2013) noted that the timing of premium payments could be a more important barrier than the size of the

payments, and especially so for those with seasonal incomes (for example farmers). As a consequence, sensitizing payments during harvest periods may enhance enrollment.

The benefits package was perceived as being unsatisfactory by most respondents due to its lack of comprehensiveness (for example Non-combinable diseases (NCDs) like cancer and diabetes are not included). Moreover, those who are referred to regional hospitals are subjected to significant co-payments which again may lead to catastrophic health expenditures. Correspondingly, Mulupi et al. (2013) and Marwa et al. (2013) found similar concerns arising from incomplete coverage. Such concerns may also reduce the trust in the insurance scheme. Therefore, policymakers should consider redesigning the benefit package by extending the coverage, however, more funds may be needed in terms of governmental subsidies or higher premiums. Transparency and clear communication between the community and the scheme leaders about the coverage might help to manage people's expectations and hence increase enrollment rate and lower the dropout rates hence achieving UHC.

6.3 Effectiveness of voluntary insurance scheme in reducing the catastrophic health expenditure and improving accessibility to healthcare services

Observations from paper IV indicate that households with insurance tend to utilize more healthcare services than uninsured households, thus confirming the hypothesis that enrolling into iCHF improves healthcare access. A similar trend was identified from Ghana, where those covered by the National Health Insurance scheme (NHIS) were more likely to seek formal healthcare compared to the uninsured (Kusi et al. 2015). This aligns with the anticipated outcome since insurance reduces some of the financial barriers to healthcare access.

Furthermore, the incidence of catastrophic health expenditure (CHE) was higher among noninsured households in comparison to insured households, suggesting that iCHF in facts offers some financial protection. This finding coincides with studies by (Dorjdagva et al. 2016 and Moreno-Serra et al. 2011). However, despite iCHF reducing CHE incidences, some insured households were still significantly exposed to CHE. Similar observations were also noted in the Indian study which found that insured individuals were still vulnerable to CHE (Shahrawat and Rao 2012). Possible reasons could be due to adverse selection or due to utilization of uncovered services; for instance, services related to NCDs, the insured households might have utilized more care than the non-insured hence CHE.

Notably, the least poor (wealthiest) households seemed to utilize more care (both outpatient and inpatient) hence, increasing the probability of incurring CHE compared to the poorest households. This observation is not surprising given the nature of the benefits package covered by the scheme. As observed in paper I, II and III, poor quality of care and an unsatisfactory benefit package might have discouraged the wealthiest households from seeking care from the public facilities. This could have forced them to seek care from the private facilities and pharmacies where OOP is the main means of payment, and hence exposing them to CHE. These findings are consistent with the conclusions of Durizzo et al. (2022) in Tanzania and Aregbeshola and Khan (2018) in Nigeria, who found that individuals with lower socioeconomic status (SES) utilized healthcare services less than their wealthier counterparts. A likely explanation for this could be that individuals with higher SES (the rich) can afford out-of-pocket payments in favor of getting access to high quality of care which cannot possibly be afforded by the poor. As highlighted by Kihaule (2015) and Nalwanga (2021), the latter group might opt for traditional healers or forego care altogether to avoid the burden of out-of-pocket expenses.

6.4   Voluntariness in health insurance and the dream of universal health coverage

Achieving universal health coverage is a long-term goal for the Tanzanian Government as well as for other LMICs. Paper IV finds that the iCHF insurance scheme increases access to healthcare services and reduces the incidences of catastrophic health expenditure (CHE). Among the households in the first two poorest quintiles, insured members had 39% and 53% seeking outpatient care, compared to 17% and 25% for noninsured in the same quintiles respectively. This implies that, iCHF is important in enabling households to access healthcare services. Regarding CHE, we observed that some insured households still incurred significant out-of-pocket expenses, but overall, the CHE incidence rate was lower among the insured, with the exception of the least poor quintile.

Despite the positive results in Paper IV regarding the role of iCHF to increase healthcare utilization and reduce the incidence of CHE, Paper I, II, and III suggest that there are various challenges associated with achieving a high enrollment rate combined with a low drop-out rate. To strengthen the iCHF scheme, additional efforts are needed to establish a sufficiently large risk pool. Possible avenues for improvements may be strong leadership, political commitment, an effective coordination of health care facilities, enhanced community involvement, and a more robust healthcare system that oversees quality of care and financing strategies. Moreover, increasing the financing situation (risk pool) of the scheme could be facilitated by introducing higher co-payments and by diversifying the financing sources (not only relying on member contributions). An example is Rwanda, where the CBHI is financed with multiple sources and has managed to achieve an enrollment rate equal to 83%. This success has been partly attributed to the lend of funding sources that include member contributions, government subsidies, external donor support,

and a modest co-payment charged at the point of care (ILO 2018).

To ensure inclusivity, subsidies targeted at the impoverished and vulnerable population could be considered. This approach would guarantee that those unable to afford membership contributions are covered by the Tanzanian government. On the other hand, individuals being less vulnerable might benefit from some subsidization of the premium payments while, the wealthiest groups could be expected to pay the full premium. This thesis argues that iCHF cannot effectively lead to UHC on a longer term unless the government demonstrates a strong commitment to establish a compulsory single health insurance system with a stable funding. Such a scheme must be governmentally managed and serve as a revenue source for healthcare financing to decrease the burden of out-of-pocket (OOP) payments in Tanzania. A tax-based insurance system, akin to the social Insurance schemes in European countries such as the Scandinavian countries and England, could aid in Tanzania's UHC achievement.

Many other countries have also adopted tax-funded schemes. Countries such as Japan and the Republic of Korea have achieved UHC through Social Health Insurance (SHI). Thailand significantly expanded its social health insurance scheme through government subsidies, achieving a 95% coverage within a decade (WHO 2003). Others have enforced mandatory contributions to insurance schemes via payroll taxes (both private and public employees), reducing the reliance on member contributions. A combined financing approach has also produced positive UHC outcomes in African nations like Ghana and Rwanda (Wang et al. 2012; Cashin et al. 2017; Chemouni 2018). Furthermore, countries like Turkey, the Philippines, and Egypt have introduced "health taxes" on items such as tobacco, sugary beverages, and alcohol where the tax-income are earmarked for the funding of health insurances. Revenue generated from health taxes is used as insurance subsidies for specific groups like students in Egypt and for expansion of NCD prevention services (Ahmed

et al. 2021 and Lasco et al. 2019).

Generally, Tanzania requires a strong healthcare system to address various necessary components to achieve Universal Health Coverage (UHC). Currently, our healthcare system is fragmented, overwhelmed by numerous inefficiencies that must be rectified in the event that policymakers opt for different financing strategies to achieve UHC. Recently, there was an effort in Tanzania to pass the Universal Health Insurance Bill. Unfortunately, this attempt failed due to various system challenges. The challenges included the unpreparedness of political leaders to implement the bill, inadequate management, and a lack of community participation, particularly in understanding people's needs before making decisions.

However, Mori (2023) has criticized the proposition of implementing mandatory health insurance for the informal sector. He contends that due to the informal sector's characteristics and the poverty it experiences, executing such a scheme would prove exceedingly challenging. Instead, he advocates for a predominantly tax-based approach, similar to Ghana's model, along with the imposition of progressive health taxes on items detrimental to health, such as tobacco, alcohol, and sugary beverages. Mori (2023) additionally argues in favor of enhancing resource utilization efficiency through realistic prioritization of public services, incorporating Health Technology Assessment (HTA), and strategic procurement.

6.5   Methodological consideration

This research was conducted using quantitative approaches to collect and analyze data. This subsection describes possible methodological strengths and limitations that are associated with the research methods being applied in this thesis.

6.5.1   Choice of methods

This thesis employed a cross-sectional survey research design to provide a quantitative description of background characteristics, attitudes and opinions among a sample of households. A structured questionnaire for data collection was used to generalize the results to a study population (Creswell 2009). Normally, quantitative research uses a set of interrelated constructs (variables) formed into hypotheses or research questions, that specifies the relationship among variables in terms of magnitude and direction. Thereafter, variables are measured by converting data into numbers and the data are then analyzed by using statistical procedures.

The quantitative method is adopted from the philosophy of science, known as the Postpositivist view (scientific method). The researchers supporting this view have challenged the traditional notion of the absolute truth of knowledge and have recognized that we cannot be "positive" about our claims of knowledge when studying the behavior and actions of humans (Phillips and Burbules 2000). With quantitative methods, it is easy to collect focused information and such methods allow a fast processing of data from a large sample size by using well-established scientific tools (Creswell 2009). A quantitative approach was considered appropriate to gain some understanding of factors that may be associated with household's decision to enroll in the iCHF scheme in rural Tanzania and how this insurance scheme can increase healthcare utilization and reduce CHE among insured households. The strength and limitations of the methods applied in this thesis are discussed below.

6.5.2   Strength of the study.

First, to the best of our knowledge, this is the first study to examine the role of risk preferences, measured by the BJKS instrument, in Tanzania and other countries in the sub-Saharan Africa. In this perspective, this thesis adds to the body of knowledge concerning risk preference assessment.

Second, the response rate of the survey was 100%. This is very high given the sampling procedure being random. All households that were approached agreed to take part in the study meaning that the study was not confronted with any selection bias.

Third, to increase the accuracy, reliability and validity of the study, the data collection tools were adjusted to the local context. For example, the questionnaire, originally written in English, was translated into Swahili, which is widely spoken and considered the official language in Tanzania, and adjusted for local expressions to minimize communication barriers between respondents and the interviewers (research assistants), as suggested by Heale and Twycross (2015). In addition, the research assistants were trained and a pre-testing of the research tools was done before the actual data collection to minimize the misunderstandings in self-reporting.

Fourth, the study used well-established and scientifically approved instruments to assess risk preferences (BJKS) and the health state of the respondents (EQ-5D). BJKS measures income risk by allowing respondents to choose between a certain income and a lottery. Depending on the response to the initial question, the respondents were confronted with new lotteries and then classified into different risk preference categories ranging from having strong risk averse preferences to having weak risk averse preferences. As for EQ-5D instrument, the respondents were asked to report their health state by evaluating own health relatively to the following five dimensions; mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, where each dimension is divided into three levels. After applying a conversion procedure, the EQ-5D index was constructed and this index ranges from 0 to 1, 1 (full health state) and 0 (worst possible health) (David and Black 2005; Rabin and Charro 2001).

Fifth, the strength of this thesis lies in methodology used to estimate wealth/socioeconomic status (SES). We used consumption expenditure rather than income which is considered the best measure

of wealth status for study settings like ours because people in the informal sector often have no formal or reported income sources, which might result into measurement error (Fahme and Ali 2019; Meyer and Sullivan 2013; Brewer et al. 2017; Deaton and Zaidi 2002). The study setting was concerned with rural populations and people working in informal sectors, therefore it is difficult to measure their income since they do not have a stable income source and because people may be reluctant to report their true income. Moreover, individuals may over report or under report depending on the impression they want to make (Aryeetey et al. 2016).

Finally, this thesis used primary data obtained through face to face interviews which is regarded to be appropriate when the illiteracy rate is considered to be high i.e. in rural areas. This also provided us with an opportunity to meet the respondents which probably is the reason why the response rate became so high. A self-administered questionnaire would probably yield a much lower response rate. Additionally, unlike health facility exit interviews, household survey enables the inclusion of the poorest households that would otherwise be missed in facility surveys because they tend to forgo visiting health facilities.

6.5.3   Potential bias and limitation

Firstly, the study employed a cross sectional study design which implies that the statistical analyses will investigate associations. The study was conducted in two districts selected from one region in Tanzania. Therefore, the findings must be interpreted with caution when generalizing the results to other regions in Tanzania that have implemented the iCHF scheme or to other countries with similar schemes.

Second, our analysis leaves out some variables that might have been of interest. One example is travelling distance (or travel time) to the nearest health facility. It would have been interesting to see how this variable would affect the enrollment decisions of the households.

Third, possible measurement problems associated with the BJKS instrument might have affected the analysis *(Paper III)*. This instrument has not been applied before in a study setting like Tanzania, I therefore feel that, it might have been difficult for some of the respondents to understand the hypothetical questions and be able to make the right choice among the available options.

Fourth, some of the variables included can potentially be associated with reverse causality problems. Examples are the risk preference variable and household income. For example, choosing to be insured is a risk-coping strategy and such a choice might also impact risk preferences. If this is the case, a potential problem of reverse causation can be introduced and hence the odds-ratio could be underestimated. Future studies should investigate to what extent such mechanisms are important.

CHAPTER 7: Conclusion, implications and recommendations

7.1   Conclusion

This study has shed light on important factors that influence the decision to enroll or not into a voluntary insurance scheme in Tanzania. Through a comprehensive analysis of various factors, we have gained valuable insights regarding variables that are associated with the enrollment decision, and the role of voluntary health insurance on healthcare utilization and catastrophic health expenditure. Findings of this study highlight the importance of raising awareness about the scheme as well as providing accessible and relevant information about the functioning of the scheme. The lack of precise knowledge among the respondents appears to be one significant barrier to enrollment. Additionally, trust in the scheme leaders and the perceived value of benefit package also are important determinants when it comes to influencing individuals' decision to enroll.

Furthermore, the study shows that being a member of the scheme somehow protects against catastrophic health expenditures and it improves access to healthcare services. Besides the direct implications for those being insured, such outcomes, if being conveyed to the non-insured, may contribute to the future sustainability of the scheme. However, it is essential to acknowledge the existing challenges such as the need for more tailored insurance products that meet the specific needs of a diverse population. Policies that address quality of care concerns and build trust through transparent and efficient operations represent promising avenues for the growth of enrollment rate in the voluntary scheme.

Moving forward, policymakers, scheme leaders, and other stakeholders should collaborate to create an enabling environment that promotes the growth and sustainability of the insurance scheme. This involves implementing targeted educational campaigns, fostering partnerships with community leaders and organizations, and exploring innovative approaches to enhance

accessibility and affordability for vulnerable groups. By leveraging the findings of this study and working collectively, we can pave the way for a stronger, more resilient society where voluntary insurance catalyzes individuals' wellbeing and progress towards universal health coverage. With a comprehensive understanding of the dynamics surrounding iCHF scheme, we can move in the direction of a future where an increasing number of individuals are being protected against health care treatment costs.

7.2   Policy implication and Recommendations

The findings arrived at in this study have some evidence-based policy suggestions. The table below (table 3) provides a series of policy recommendations.

Table 4: List of recommendations

S/N	Recommendations
1	Enhance understanding and awareness (community sensitization)
2	Provide incentives for continued membership (loyalty rewards)
3	Expand the benefit package to meet people's need (improving the quality of care)
4	The scheme management being independent of district authorities
5	Risk pool expansion (higher premiums, co-payments and exemptions)
6	Alternative funding sources (partnerships and governmental subsidies)
7	Poverty alleviation strategies
8	Mandatory enrollment

A first recommendation is to enhance the understanding of and the awareness about the scheme in question (community sensitization). The policymakers should focus on improving the understanding among people about the insurance scheme since some people held misconceptions about the functioning of the scheme and the benefit package offered. For example, some believe that being insured imply a 100 percent coverage of all medical costs at the regional hospitals, while in reality, the scheme only covers basic primary healthcare services and co-payments are charged at the regional hospitals. Therefore, having more people with an adequate understanding may

remove some of the misconceptions and this can be done by launching campaigns that convey simple messages to the public. The local governments may also consider the launching of community workshops, seminars, and awareness campaigns that inform people. The use of beneficiaries that are positive to the scheme might yield positive results. Our findings have shown that many of our respondents joined the scheme because of family or friends that recommended the scheme.

Second, scheme management should consider providing incentives for continued participation for example by linking membership duration to premium discounts (loyalty rewards). This may serve as incentive for not dropping out of the scheme.

Third, expanding the benefit package to better meet the preferences of the households. By doing so, the scheme may better cater to the diverse healthcare requirements of the population in the rural areas. Examples of services that could be included are essential medical services such as various outpatient treatments, prescription drugs, and some specialized treatments at the referral hospitals. Additionally, the inclusion of services that are needed if having chronic diseases and pre-existing problems such as TB, hypertension, cancer and HIV related diseases, would address the concerns of many households. By offering a comprehensive benefit package that aligns with people's healthcare needs, the voluntary insurance scheme would become more appealing thus likely to promote greater participation. However, the expansion of the benefit package is resource-demanding, hence additional funds must be provided.

Fourth, currently the scheme is managed by the District Executive Director (DED) in every district where the scheme is operating, however, policymakers and local governments should consider disconnecting the scheme from such political leaders. Letting the scheme be an independent one with its own management may foster greater transparency and accountability. An independent

scheme may ensure that the operations of the scheme becomes independent of potential conflicts of interests in this way enhancing the public trust as well ensuring a more effective scheme administration. Dedicated professionals with expertise in insurance management can focus solely on optimizing the functioning of the scheme, including enrollment processes, premium collection, claims processing and the service delivery for the scheme members.

Fifth, currently the scheme relies heavily on member contributions (premium payments), however, this source of funding is not sufficient for supplying satisfactory services to the members. One reason for this is because the paying members have to cross-subsidize individuals that are eligible for exemptions. One possibility would be for the government to reimburse such scheme expenditures.

Sixth, the risk pool size may also increase if the premium is raised since many of our respondents did not find the current premium rate to be too high (unaffordable). A rise in the premium from the current TZS 30,000 to a somewhat higher level may enable the scheme to expand the benefit package for example by also including services delivered by private providers. However, a higher premium may prevent some of the poorest household from enrolling. A possible solution to such a problem could be to differentiate the premium rate across household income (capacity to pay).

Seventh, the possibilities for alternative funding sources such as partnerships with other stakeholders and additional governmental funding should be considered. Additional funding may be necessary to ensure the future sustainability of voluntary schemes of this type. Policymakers should also consider to make it mandatory for the formal sector to provide some funding to the schemes in question. However, on a longer term, the introduction of effective poverty alleviation strategies that increase the purchasing power of the rural households may be necessary to ensure scheme sustainability.

Finally, policymakers may consider the introduction of a tax-based insurance system that will provide financial protection coverage of a large population with equitable health for all members of such scheme. This way the government has to strengthen the health system and health policy to be able to accommodate the challenges that will come along with the establishment of the universal health insurance.

7.3   Future studies

This thesis suggests the following areas for future research;

1) The use of qualitative methods to explore the experiences of iCHF members and non-members. This could help identify deeper social, cultural, and economic factors influencing enrollment decisions. For example, research could explore how people perceive the iCHF, what their expectations are, and what barriers they face in enrolling.

2) The study of the perceptions of healthcare providers and scheme leaders may be of importance to balance the story since this thesis is mainly based on household perceptions (Paper I).

3) Research to evaluate the effectiveness of different enrollment interventions would be another important study area that can help identify the most effective ways to increase the iCHF enrollment rate. For example, future researchers may consider evaluating the effectiveness of different community mobilization strategies, provision of financial incentives, and transportation assistance programs.

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Appendices and publications

Appendix 1: Informed consent form

Appendix 2: Questionnaire guide

Appendix 3: Papers

Paper I

Paper II

Paper III

Paper IV

<center>**INFORMED CONSENT**</center>

Title of the research: Towards Universal Health Coverage: The Case of the Improved Community Health Fund in Rural Tanzania.

Introduction: My name is _____ and I am an interviewer who is engaged to perform interviews with households in this region. The survey is part of a research project headed by MS. Alphoncina Kagaigai, who is a PhD student at the University of Oslo, Norway. This survey concerns mainly members and nonmembers of the improved Community Health Fund (iCHF) insurance scheme and those who are not enrolled in any insurance schemes such as NHIF, SBHI or Private Health Insurance (PHI). The community health fund insurance scheme was introduced in 1996 and lasted up to year 2011. However, in 2011/2012 this insurance scheme was reformed into the Improved Community Health Fund (iCHF) and it was piloted first in the Dodoma region.

Purpose(s) of research: The research aims to identify the factors influencing enrollment decisions into the iCHF scheme in rural Tanzania and the effectiveness of the scheme in reducing catastrophic health expenditures. The questionnaire contains questions concerned with one's opinions and experiences regarding iCHF health insurance. The questions will also be based on reporting your health status, the household socio-economic status, your willingness to pay for health insurance and your household consumption expenditures on food, nonfood and healthcare services.

Expected duration of the interview: the expected time for the interview is 30-45 minutes.

Risk(s): there are no risks in participating in this study, the results for all respondents will be presented in aggregate, and no identifiable information will be presented with the study findings. Your participation is voluntary, and you are not forced to take part in the study. You are free to stop participating in the research at any time if you feel uncomfortable and can tell me (the interviewer) if you don't want to continue. You will participate in this study by answering our questions. The information that is collected will be confidential and will be used for academic purposes only. I would like to stress that no names, phone numbers or any other identifying information of the participants will be recorded in this survey. Furthermore, participation in this survey is voluntary and you may stop the interview at any time desired.

Costs to the participants, if any, of joining the research: Participation in responding to this survey is cost-free. You will not incur any cost to participate in answering the survey.

Benefit(s): The results from this study will inform policymakers to improve the availability of affordable and sustainable health insurance schemes in rural settings.

Due inducement(s): You will not be paid for participating in this study

Confidentiality: We will NOT ask for the participant's name, address, phone number, or signature. A unique identifier number will be assigned to each respondent. The answers provided by respondents during the interview will be kept secure, and all results will be used for academic purposes. No one other than the team doing the study will know what each individual participant's responses were. Answers will be recorded on a tablet/smartphone, and the data will be transmitted and stored in secure analytical software.

Voluntariness: Participation in this study is entirely voluntary. You may refuse to continue answering questions if you are not comfortable.

Do you have any questions?

Would you be willing to participate by answering our questions?   a) yes ……….

b) no …….

_____   _____   _____

Unique identification no   Place   Date

Proposed household questionnaire on insurance scheme perceptions, health status, access to healthcare, medical expenditures, socio-economic status, demographic characteristics, risk preferences and willingness to pay.

Id number………

SECTION A: SOCIO-DEMOGRAPHIC AND ECONOMIC INFORMATION OF THE RESPONDENTS (Household head or representative of the household head)

02	03	04	05	06	07	08	09	010
Age (in years)	Sex Male....1 Female..2	Marital status Single …...1 Married......2 Living together…3 Divorced.....4 Widowed......5 Separated….6	How many people, including yourself, live in this household? …………	How many members of your household are less than 14 years of age? …………	Your highest level of education being completed No formal education……….1 Primary school ……2 Ordinary level Secondary school ..3 Advance level secondary school…4 Vocational training…5 College/…………6 University……….7	Your religion Christian………1 Muslim……….2 Traditional……3 None believer…4 Other (specify)...5	Your Main Occupation? Farmer……...1 Livestock breeder…2 Retired ……………3 Craftsman…………4 Merchant…………5 Civil Servant……..6 Daily wage laborer………7 Not earning any income……….8 Other (specify)………..9	What is the average monthly income of your household? *(This should be the sum of what all household members bring in taken together….Tshs*

SECTION B: FOOD EXPENDITURES

I am now going to ask you some questions about food consumption expenditures.

011. Have your household purchased any food items in the last seven days (1 week)? Yes.....1 No.....2 (go to 013)	012. How much did your household then use in total to purchase food items in the last seven days (1 week)? ……..Tshs.	013. Have your household consumed any food items that were produced at your home in the last one week? Yes....1 No....2 (go to 015)

014. If you were to buy the same amount of food from the shop or market, how much would you have to pay in total? ....Tshs.	015. Have your household, during the last seven days /1 week) consumed any food items that were given to your household by relatives, friends, neighbours etc. Yes............1 No.............2 (go to 017)	016. If your household were to buy the same amount from the shop or market, how much would you have to pay in total? ....

SECTION C: NON-FOOD EXPENDITURES

I am now going to ask you questions about non-food expenditures

017. In the last ONE MONTH (the last 30 days), how much has your household approximately spent on the following items?	Qnty (Kgs/Lts)	Amount (Tshs)
Items	Qnty (Kgs/Lts)	Amount (Tshs)
Personal care items (tooth paste, lotion, soap, etc.) ....1 Electricity..............2 Petrol and/ diesel and/kerosene.................3 Charcoal and firewood.................4 Batteries..................5 Salary permanent worker (Maid, cattle herder)...............6 Salary seasonal worker (daily laborers) ......7 Public transport................8 Air time.................9 Shoes and clothes............10 Household appliances and utensils.......11 Others (specify)................12		

018. In the last ONE YEAR (the last 12 months), how much has your household approximately spent on the following items?	Qnty (Kgs/Lts)	Amount spent (Tshs)
Items	Qnty (Kgs/Lts)	Amount spent (Tshs)
Education (school fees, stationary, etc.) ....1 Fertilizers or seeds..................2 Building materials................3 Agricultural equipment...............4 Business inputs.................5 Radio andTV...................6 Sewing machine..................7 Cell phone....................8 Bicycle......................9 Furniture (chairs, beds, tables etc) ...10 Household repairs...............11 Others (specify)...............12		

SECTION D: HEALTH EXPENDITURES

I will now ask some questions on health care expenditures

019. During the last ONE MONTH (last 4 weeks), have you, or any other member of your household, demanded outpatient care?

Yes.........1
No ....2 (jump to 024)

020. At what type of institution were the outpatient services demanded? *(you can tick more than one response)*

Hospital.............1
Health centre............2
Dispensary.............3
Clinic.............4
Pharmacy/Drug shop...5
Traditional Healer.....6
Other (Specify).......7

021. Was the institution visited a public or a private facility? *(you can tick more than one response)*

Public.............1
Mission.............2
Private.............3
Designated.........4

022. How were the received services paid for? *(You can tick more than one response)*

Out of Pocket......1
Health Insurance..2
Exemption...........3
Other (Specify)....4

023. If you made out of pocket payments, what was the total amount (in Tshs) being paid by the household during the visit during the the last month (last 4 weeks)?

Registration fee Tshs............1
Consultation fee Tshs............2
Tests and supplies (including gloves) Tshs. 3
Drugs Tshs............4
Unofficial payments Tshs............5
Transport costs (to and from the facility) Tshs.........6
Other (specify)............7

024. During the last ONE YEAR (last 12 months), has any member of your household been admitted to stay overnight at a healthcare facility (in-patient services)?

Yes.....1
No.......2 (jump to 028)

025. At what type of healthcare facility was the household member admitted? *(you can tick more than one response)*

Hospital.............1
Health Centre...........2
Other (Specify)............3

026. How did you pay for the in-patient services? *(You can tick more than one response)*

Out of Pocket......1
Health Insurance..2
Exemption...........3
Other (Specify)....4

027. In total, how much did your household spend on the following items in connection with the healthcare facility admission?

Hospital Bills Tshs............1
Drugs Tshs............2
Supplies (syringes, gloves, etc.) Tshs............3
Unofficial payments Tshs............4
Transport costs (to and from the facility) Ths.....5
Other (specify)............6

SECTION E: ASSESSMENT OF THE HEALTH STATUS OF THE RESPONDENT

028	**Quality of life (QAL) (*EQ-5D-3L*)**
	EQ-5D is a standardized measure of health status developed in order to provide a simple, generic measure of health for clinical and economic appraisal. Each of the 5 dimensions is divided into 3 levels of perceived problems: Level 1: indicating no problem Level 2: indicating some problems Level 3: indicating extreme problems By placing a tick in one statement in each group below, please indicate which statements best describe your current health situation.
QL01	Mobility 1. I have no problems in walking about 2. I have some problems in walking about 3. I am confined to bed
QL02	Self-Care 1. I have no problems with self-care 2. I have some problems washing or dressing myself 3. I am unable to wash or dress myself
QL03	Daily Activities (*e.g. work, housework, family or leisure activities*) 1. I have no problems with performing my usual activities 2. I have some problems with performing my usual activities 3. I am unable to perform my usual activities
QL04	Pain and Discomfort 1. I have no pain or discomfort 2. I have moderate pain or discomfort 3. I have extreme pain or discomfort
QL05	Anxiety/Depression 1. I am not anxious or depressed 2. I am moderately anxious or depressed 3. I am extremely anxious or depressed

EQ-VAS Scale

To help people say how good or bad a health state is, we have drawn a scale (rather like a thermometer) on which the best state you can imagine is marked 100 and the worst state you can imagine is marked 0.

We would like you to indicate on this scale how good or bad your own health is today, in your opinion. Please do this by drawing a line from the box below to whichever point on the scale indicates how good or bad your health state is today.

Best imaginable
health state

100
90
80
70
60
50
40
30
20
10
0

**Your own health
state today**

Worst
imaginable

| 029. Imagine that you were offered a free membership to iCHF for your remaing lifetime. However, in order to receive such a gift, you need to give away parts of your remaining life time. Would you be willing to do this in order to get the free membership to iCHF for your remaining lifetime?

Yes..............1
No................2 (go to 031) | 030. If yes, what is the maximal number of time you would be willing to give away (you may answer in days, weeks, months, or years) ?

.... | |
| 031. In general, how would you assess your average health situation in the last 30 days?

Very good......1
Good............2
Fair.............3
Bad..............4
Very bad.......5 | 032. Do yourself or any of your household members have a permanent illness (a chronic disease)?

Yes.....1
No......2 | 033. Do you worry that yourself, or any of the household members, will get a future health problem?

Yes............1
No.............2 |

SECTION F: MEMBERSHIP STATUS

| 034. Are you enrolled into the iCHF scheme?

Yes..........1
No.........2 (go to 038) | 035. How many household members are registered members of the iCHF scheme?

...........number | 036. For how long time have you/your household been members of the iCHF scheme?

......Months/Years | 037. Are you/your household planning to stay enrolled into the iCHF scheme in the future?

Yes.....1
No.......2 |
| 038.NON-members Have you/your household been former members of the CHF/iCHF scheme?

Yes.........1(go to 040)
No..........2 | 039. NON-members Do you/your household consider to become a future member of the iCHF scheme?

Yes....1
No....2 | 040. Are there any members of your household that are members of any other health insurance scheme besides iCHF?

Yes......1
No......2 (go to 042) | 041. What type of insurance scheme?

NHIF.................1
PHI...................2
SHIB................3 |

SECTION G: PERCEPTION TOWARDS THE iCHF SCHEME, ITS' MANAGEMENT AND THE ROLE OF HEALTHCARE PROVIDERS

In the following, you will be confronted with various statements. For each statement you will be asked to express to what degree you agree with it or not. This is done by reporting a number between 1 to 5. Nnumber 1 means that you strongly disagree while number 5 means that you strongly agree

A: Information, knowledge, and recruitment factors (11)

	Statement		1 Strongly Disagree	2 Disagree	3 Neither Agree nor Disagree	4 Agree	5 Strongly agree
042	Only households with family members being prone to diseases should enroll into a health insurance scheme	Understanding of the scheme		1			
043	Health is a matter of fate (in the hands of God) and health insurance schemes cannot help me deal with its consequences	Traditional belief		2			
044	I do not have much knowledge about the iCHF scheme	Information/understanding		3			
045	The purchase of health insurances may bring bad luck to the purchasers	Traditional belief		2			
046	Health insurance schemes are typically prepayments for health care services	Understanding of the scheme		1			
047	Paying premiums to health insurance schemes is no different from paying taxes to the government	Understanding of the scheme		1			
048	The iCHF scheme is only for workers in the public sector	Understanding of the scheme		1			
049	I have never been approached by iCHF representatives that wanted to convince me to enroll into the CHF or the iCHF scheme	convincing		4			
050	People that I know well, such as relatives, friends and colleagues, have given me the advice to enroll into the iCHF scheme.	convincing		4			
051	Many people that I know well are members of the iCHF scheme	Peer presure		5			

No.	Statement	Category	Value
052	My decision to enroll or not enroll into the iCHF scheme is very much depending on the experiences and advices given by friends, relatives and colleagues.	Convincing	4

SCHEME FACTORS (14)

No.	Statement	Category	Value
053	Health insurances are basically a loss of money	**Priority of the scheme**	**6**
054	The benefits from the iCHF scheme are clear to me	**information**	**3**
055	The iCHF scheme will become more important to me if additional health care expenditures were covered by the scheme despite a corresponding increase in the premium	**Benefit coverage**	**7**
056	The iCHF scheme is especially valuable if all household members are covered by the scheme	**Scheme coverage**	**8**
057	In order to enroll into the iCHF scheme you need to have a sufficient amount of cash	**Affordability of the premium**	**9**
058	The iCHF premiums are affordable	**Affordability of the premium**	**9**
059	The location of the iCHF scheme district office is convenient	**Convinient of the scheme**	**10**
060	The opening hours of the iCHF scheme district office are convenient	**Convinient of the scheme**	**10**
061	The collection of the iCHF insurance cards is convenient	**Convinient of the scheme**	**10**
062	The iCHF benefit package is too low relatively to the premium charged	**Benefit coverage**	**7**
063	Low income makes it hard to give priority to a health insurance scheme	**Pririty of the scheme**	**6**
064	The iCHF scheme managers are generally trustworthy	**Trust of the scheme**	**11**
065	I am fully aware of the size of both the premiums and the registration fee associated with the iCHF scheme	**Information of the scheme**	**3**

PROVIDER FACTORS (8)

066	The health care providers produce services of an adequate quality to the members of the iCHF scheme	**Quality of hcs**	12				
067	The members of the iCHF scheme are receiving treatment within reasonable time at the health care facilities in this district	**Time to receive hc at the facility**	13				
068	The quality of the health care personell is satsfactory	**Quality of hcs**	12				
069	By becoming a member of the iCHF scheme the avilaibility of drugs is improved	**Medicine and equipments**	14				
070	In order to increase the enrollment rate of the ICHF scheme, the attitudes of the health care personell need to be improved	**Attitude of hc personel**	15				
071	The health care facilities in my district have adequate equipments and rooms	**Medicine and equipments**	14				
072	I am of the opinion that the iCHF scheme members are being discriminated against when visiting health care facilities	**Attitude of hc personel**	15				
073	The waiting time for healthcare-services is too long for those being memebrs of the iCHF insurance scheme.	**Time to receive hc at the facility**	13				

Preferences and outside options (6)

074	Generally, I tend to give importance to current needs over future problems	**Pririty of the scheme**	6				
075	I prefer to save money rather than spending them on health insurance	**Pririty of the scheme**	6				
076	I prefer to visit tradition healers (traditional medicine rather) than enrolling into an insurance scheme	**Traditional belief**	2				
077	It is better to stay uninsured and borrow money to cover any significant health expenditures than purchasing a heath insurance	**Pririty of the scheme**	6				
078	Health insurance schemes are partcularly suitable for people with irregular incomes	**Understanding of the scheme**	1				

| 079 | Community members who cannot afford insurance premiums should be enrolled into the scheme without paying any premiums | Affordability of the premium | 9 | |

SECTION H: RISK PREFERENCE (BJKS)

080.	081.	082.
Suppose that you are the only income earner in your household. Suppose also that reasons beyond your control force you to change occupation. You can choose between two work alternatives. Alternative 1 guarantees you the same income as your current income. Alternative 2 gives you a 50% chance of an income twice as high as your current income, but with a 50% chance it results in a reduction of your current income by **one third.** Just to make it clear I will provide you with an example; Assume that in a current job you earn Tshs. 500,000 per month, but you have to move to another type of work. There are two alternatives. In alternative 1 you will also earn Tshs. 500,000 per month, while in alternative 2 the income is uncertain. Here there is a 50% chance of making 1 million Tshs while there is a 50% chance of making an income equal to approximately Tshs. 330,000 What is your immediate reaction? Would you choose alternative 1 or alternative 2?" Alternative 1.................1 Alternative 2.................2	If the respondent choses alternative 1. Suppose now that the income changes for the uncertain alternative (alternative 2). Alternative 1 still guarantees you the current income. For alternative 2 you still have a 50% chance for an income twice as high as your current income but now there is a 50% chance of a reduction in your current income by one fifth **Given our example this now means that** there is a 50% chance of an income equal to 1 million Tsh and a 50% chance of making an income equal to Tshs. 400,000. What is your immediate reaction? Would you choose alternative 1 or alternative 2?" Alternative 1.................1 Alternative2.................2	If the respondent choses alternative2. Suppose again that the income changes for the uncertain alternative (alternative 2). Again, you have a chance of 50% for an income twice as high as your current income but now there is a 50 % chance of a reduction in your current income by one half. Given our example this now means that there is 50% chance of an income equal to 1 million Tsh and a 50% chance of making an income equal to Tshs. 250,000. What is now your immediate reaction? Would you choose alternative 1 or alternative 2?" Alternative 1.................1 Alternative2.................2

SECTION I: WILLINGNESS TO PAY

I would now like to ask you some questions for which your answers will say something about the value you attain to being or becoming a member of the iCHF scheme.

083. iCHF Members:	084.	085. Non-members	086.Non-members
Currently, the iCHF annual premium is Tshs. 10,000/=. If the premium was increased to 20,000, would you still stay on as a iCHF member? Yes………1 (continue until you get the maximum WTP) No………2 (reduce up to his /her WTP)	What is the maximum amount that your willing to pay so that you stay on as a iCHF member?? ……………….Tshs.	Currently the annual premium for iCHF is Tshs. 10,000/=. Is it that you are not enrolled because it is too expensive? Yes………1 (go to 086) No…………2(go to 087)	If the annual premium is reduced up to 7,000/=, will you be willing to pay so that you become a member? Yes………1 (continue until you get the maximum) No………2 (reduce up to his/her WTP is reached)
087.	088.	089.	
If it is not too expensive, are you willing to pay Tshs. 10,000/= so that you become a member? Yes………1(continue until the maximum WTP is attained) No………2 (reduce up to his/her WTP)	What is the maximum amount that your willing to pay so that you become an iCHF member?? ……………….Tshs.	Are you willing to add a little amount to the amount you have agreed to pay above to cover the health insurance of your neighbor/friend who cannot afford the premium? Yes…………1 No……………2	

SECTION J: MOBILE TECHNOLOGY

090.	091.	092.
Did you use a mobile phone to enroll into the scheme? Yes………1 No…………2 (Go to 093)	How satisfied are you with the possibility to use the mobile phone to enroll into the scheme? Excellent……1 Very good……2 Good…………3 Fair…………4 Bad…………5	Do you think the possibility of using a mobile phone will increase the enrolment rate into the iCHF scheme? Yes…………1 No…………2

SECTION K: OTHER QUESTIONS

093.	094.
For members:	For members,
In your own opinion; Why is the iCHF insurance scheme important for you and your household?	What do you consider as the main reason for being enrolled into the iCHF scheme?
	095.
	For members,
	What were your expectations when deciding to enroll into iCHF?
096.	097.
In your opinion, why is it that some people prefer to pay out-of-pocket payments rather than staying insured?	In your opinion, what should be done to increase the number of enrollees into the iCHF scheme? ………………
	098.
	There could be members in your community or neighbors who are able to pay for iCHF insurance but they are not willing to enroll. From your perspective, what do you think are the reasons for them not enrolling into iCHF?

Thank you for your time and participation

ARTICLES

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RESEARCH ARTICLE

Open Access

Do household perceptions influence enrolment decisions into community-based health insurance schemes in Tanzania?

Alphoncina Kagaigai[1,2]* , Amani Anaeli[2], Amani Thomas Mori[3] and Sverre Grepperud[1]

Abstract

Background: Several countries including Tanzania, have established voluntary non-profit insurance schemes, commonly known as community-based health insurance schemes (CBHIs), that typically target rural populations and the informal sector. This paper considers the importance of household perceptions towards CBHIs in Tanzania and their role in explaining the enrolment decision of households.

Methods: This was a cross-sectional household survey that involved 722 households located in Bahi and Chamwino districts in the Dodoma region. A three-stage sampling procedure was used, and the data were analyzed using both factor analysis (FA) and principal component analysis (PCA). Statistical tests such as Bartlett's test of sphericity, Kaiser-Meyer-Olkin (KMO) for sampling adequacy, and Cronbach's alpha test for internal consistency and scale reliability were performed to examine the suitability of the data for PCA and FA. Finally, multivariate logistic regressions were run to determine the associations between the identified factors and the insurance enrolment status.

Results: The PCA identified seven perception factors while FA identified four factors. The quality of healthcare services, preferences (social beliefs), and accessibility to insurance scheme administration (convenience) were the most important factors identified by the two methods. Multivariate logistic regressions showed that the factors identified from the two methods differed somewhat in importance when considered as independent predictors of the enrollment status. The most important perception factors in terms of strength of association (odds ratio) and statistical significance were accessibility to insurance scheme administration (convenience), preferences (beliefs), and the quality of health care services. However, age and income were the only socio-demographic characteristics that were statistically significant.

Conclusion: Household perceptions were found to influence households' decisions to enroll in CBHIs. Policymakers should recognize and consider these perceptions when designing policies and programs that aim to increase the enrolment into CBHIs.

Keywords: Community-based health insurance scheme, Cross-sectional household survey, Principal component analysis, Factor analysis, Perceptions factors

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* Correspondence: akagaigai@gmail.com
[1]Department of Health Management and Health Economics, University of Oslo, P.O. Box 0315, Oslo, Norway
[2]Department of Development Studies, Muhimbili University of Health and Allied Sciences, P.O. Box 65001, Dar es Salaam, Tanzania
Full list of author information is available at the end of the article

Background

According to the World Health Organization (WHO), at least half the world's population living in low- and middle-income countries (LMICs) lack access to essential health services [1]. Out-of-pocket health expenditures in these countries contribute to more than 40% of the total health budget [2] and more than 800 million people spend more than 10% of their household budget on healthcare [3]. Policymakers in LMICs are looking for strategies to improve access to health services, and the most important one has been the establishment of voluntary non-profit insurance schemes commonly known as Community Based Health Insurance Scheme (CBHIs), targeting rural populations and the informal sector [3, 4]. Such schemes are given different names such as; community health insurance [5, 6], micro health insurance [7, 8], community health funds (CHF) [9, 10], and mutual health organizations [11]. In Tanzania, the scheme is named the Community Health Fund (CHF) and in this paper, we will apply this concept.

In 1996, Tanzania piloted a "Community Health Fund" denoted as CHF, which was later scaled-up countrywide after showing promising results. CHF is a voluntary pre-payment scheme that primarily provides access to primary care services. Before 2016, each district had different arrangements for the premium amount paid by each household per annum [12]. A total of 6–8 family members were covered under CHF and could receive the primary health services up to the district level from public health facilities only. The main rationale behind the establishment of CHF was the need to provide risk protection to rural residents and people working in the informal sector comprising more than 70% of the total national population [13]. Despite concerted efforts to promote the scheme, the enrolment rate has remained below expectations [14]. Various explanations for the low enrolment include unaffordable premiums, poor quality of services, poor scheme management, and lack of trust [9, 15].

In 2011, the Tanzanian government decided to reform the CHF and introduced an "improved Community Health Fund" (iCHF) as a pilot in the Dodoma region, with a flat annual premium of about 15 USD [8]. The iCHF included additional services such as x-rays, ultrasounds, and in-patient services (including major surgery) from both hospital levels (District and Regional). iCHF also simplified the enrolment process by using a mobile application (an insurance management information system). Services such as CT-scan, HIV services, screening for cancer, and other non-communicable diseases are exempted from the scheme. By 2018, the scheme was fully implemented in Dodoma and seven more regions. The government target was for at least 70% of the population to be covered by National Health Insurance Fund

(NHIF) and iCHF by 2020 [16], which are the two main public insurance schemes. The future iCHF enrolment growth rate remains highly uncertain due to limited knowledge about its' attractiveness to the informal sector. There is an urgent need to explore the factors that determine the enrolment behaviors of rural residents. Such information will enable policymakers to adjust implementation strategies before the scheme is rolled out at the national level.

Furthermore, this study tackles an important and relevant issue in the health insurance literature which is to understand the factors that influence CBHI in developing country's context. This aspect is important for the achievement of the Sustainable Development Goal (SDG) 3, target 3.8: on the universal health coverage which includes; financial risk protection, access to quality essential healthcare services and access to safe, effective, quality and affordable essential medicines and vaccines for all.

Two previous studies have applied factor analysis when studying the role of household perceptions in association with insurance schemes in LMICs [17, 18]. The first one studied mixed urban-rural populations in Ghana and found scheme factors (price, benefits, and convenience) to be the most important ones [17]. The second study studied urban populations in India and identified "lack of awareness about the need for insurance" and "low and irregular income" as the most important barriers to enrolment [18]. Our study utilized an approach similar to the one used in Ghana and India when analyzing the role of perceptions towards the iCHF scheme in rural Tanzania. We apply both principal component analysis (*PCA*) and factor analysis (*FA*).[1] The importance of the perception factors is determined by the amount of variation explained by them. To study the associations between the identified perception factors and the enrolment decision, multivariate logistic regressions will be used. In the following sections, we present the method used, followed by the presentation of the results and the concluding discussion.

Methods

We used an observational cross-sectional study design to conduct a household survey in Bahi and Chamwino districts of Dodoma region in central Tanzania. This design was used because it provides a snap-shot evaluation of variables under investigation at a particular point in time.

Study setting and sampling

Dodoma region consists of seven districts with a population of more than 2 million people according to the

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[1]Study [18] applies factor analysis (FA), while study [17] applies principal component analysis (PCA).

2012 national population census where 10% live in Bahi and 15% in Chamwino [13]. The prime economic activity in both districts is agriculture and livestock keeping. Administratively, each district in Dodoma is divided into divisions, wards, and villages. Bahi is organized into 4 divisions, 22 wards, and 59 villages while Chamwino is divided into 5 divisions, 36 wards, and 107 villages. Furthermore, Bahi contains 6 primary health care centers and 37 primary care clinics (dispensaries) while Chamwino contains 1 hospital, 5 primary care centers, and 66 primary care clinics (dispensaries).

We used a multistage sampling technique to select wards and villages in each district. First, we used a purposive sampling technique to select 2 districts from Dodoma region. Then we selected wards from each division in the two districts. A total of 8 wards were selected from Bahi and 10 wards from Chamwino. Thereafter we selected two villages from each ward based on criteria such as health facility availability and location (16 villages from Bahi and 20 from Chamwino). At stage three, we employed systematic random sampling techniques in the selection of households.[2] The first household was selected randomly from within the sampling frame. The office of the Executive Officer in each village was selected as a central point where the trained research assistants met. Each of the four trained interviewers walked in different directions (north, east, south, and west) and every third household was approached. The aim of doing this was to make sure that the population is evenly sampled and to obtain a good representative of the targeted population. The total sample size was 722 households (303 for Bahi and 419 for Chamwino). Data were collected from June to August in 2019 using a pre-tested structured questionnaire.

Variables
Insurance status was our outcome variable with two categories; member (yes) and non-member (no) of iCHF. The possession of health insurance (iCHF) was determined by asking if the respondents were currently members of iCHF or not members. The explanatory variables in this study were the perception factors that influence an individual decision to enroll or not into the improved community health fund. The questionnaire (attached as Additional file 1) contained 38 questions/statements on household perceptions which were then subjected to factor analysis and principal component analysis to obtain factors to use as variables. The questions were formulated as statements and the respondents were asked to

express their opinions by using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The choice of statements was inspired by the ones applied by Jehu-Appiah, and Kansra [17, 18] but also from previous literature that has been conducted on health insurance such as [5, 21, 22]. Of the 38 perception questions/statements, we included those for which we had a prior belief about the direction of the effects on the membership decision, thus leaving us with a total of 33 statements. These statements were then divided into three different groups (i) provider-related, (ii) preferences (beliefs and attitudes), and, (iii) scheme-related. The scheme-related statements were further subdivided into the following subgroups; convenience (access), recommendation, affordability, and understanding (information). Another category of explanatory variables was socio-economic variables and demographic characteristics. These variables were selected based on factors cited from different literature as factors that influence the individual decisions to enroll in health insurance such as [23, 24].

Data analysis
A descriptive statistics summary was conducted on the socio-demographic household characteristics followed by factor analysis (FA) and principal component analysis (PCA) for the statements intended to measure household perceptions. The two methods were independently employed to demonstrate the robustness of our findings since the underlying assumptions differ. PCA assumes that there is no unique variance, the total variance is equal to common variance while FA assumes that total variance can be partitioned into common and unique variance [25].

Before performing PCA and FA, we conducted reliability, validity, and consistency tests. First, the Bartlett test of sphericity was calculated to test for correlations among the variables which showed that there was a correlation among variables. Second, the Kaiser-Meyer-Olkin measure (KMO), a test for sampling adequacy, was performed and found that the value of KMO > 0.5. Third, Cronbach's Alpha test was performed to measure internal consistency and scale reliability which was > 0.7. Finally, logistic regressions were done to determine possible associations between the extracted factors and the membership status to iCHF. We chose to use the Logistic regression method because our outcome variable is a binary outcome ("Yes" for members and "No" for non-members). Data cleaning, validation, and all statistical analysis were performed using STATA 14.0 software.

Results
The results are presented in three different subsections where the first presents the study population (descriptive

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[2]A household is defined as one or more people, related or unrelated, who share meals and who live in the same dwelling unit [19, 20]. For this study, the household definition had to be modified since, in some cases, household members from more than one household come together to join an iCHF household.

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statistics), the second present the results from PCA and FA methods, while the third presents the findings of the regression analyses.

Characteristics of the study population

Tables 1 and 2 present some of the background characteristics of our respondents. Table 1 presents the mean and standard deviations of the background variables, while Table 2 shows how our outcome variable (membership status) differs across different explanatory variables. Our study consisted of 722 respondents, 304 (42.1%) of them being men while 418 (57.9%) were female. The mean age of the respondents was 44.7 years (SD. 13.67). Most of the respondents i.e. 72% had completed primary school education and almost three-quarter were engaged in small-scale farming. The mean household size was 5.4 members (SD. 2.3). Thirty-seven percent of the respondents had a monthly income below 50,000 Tanzanian shillings (TZS), which is equivalent to 22 USD, while 1% had a monthly income above 1 million TZS (435 USD). It also follows from Table 2 that 30% of the respondents reported that their households were enrolled in the iCHF as members, of which 61.5% were female and 39% were men.

Principal component and factor analysis

We start by reporting the various statistical tests performed before PCA and FA. Results for Bartlett's test of sphericity, Kaiser-Meyer-Olkin measure (KMO), and Cronbach's alpha are reported in Table 3. According to the literature [26, 27], such diagnostic procedures indicate to what extent PCA and FA are appropriate. We observed that the standard requirements for KMO and Cronbachs alpha (see the right column of Table 3) were fulfilled.

Both *PCA* and *FA* apply eigenvalues higher than one as the inclusion criteria [28]. According to Costello and Osborne, variables whose loadings are ≥ |0.3| should be retained [25], We also carried out Orthogonal rotation (varimax) to improve the interpretation of the extracted factors.

Our findings on *PCA* are presented in Table 4. For this method, 10 factors met the eigenvalue criteria and they accounted for 60% of the explained variation. Three of the 10 factors did not fulfill the factor-loading criteria (two or more statements within each factor and a factor loading ≥ |0.3|), leaving us with seven factors that in sum contained 28 of the 33 statements. The number of statements belonging to each factor varied from two to six. The seven factors are quite homogenous in the sense that they include statements that are concerned with similar subjects. The exception is the two statements that are concerned with affordability (price-income considerations) that are grouped into Preferences (S11) and Knowledge (S24). We also observe that the 9 statements that measure the degree of understanding are grouped into three different factors denoted as Understanding, Knowledge, and Awareness.[3] It follows that the most important factor is provider-related (Quality) since accounting for almost 11% of the explained variance. This factor includes statements that all measure various quality dimensions of health care services. The least important factors are the five scheme-related factors of which Convenience is the most important one (7% of the explained variance). Preferences are the second most important factor since explaining more than 9% of the variance. This factor reflects general preferences as well as alternative strategies to insurance (borrowing and saving) and curing (traditional medicine).

The findings for the factor analysis (*FA*) are presented in Table 5. For this method, four factors were identified that accounted for 91% of the explained variation. All four factors fulfilled the factor-loading criteria and in sum, the 4 factors include 22 of the 33 statements. The number of statements belonging to each factor varied from two to eight. The most significant changes, compared with *PCA*, are that Preferences (P2) and Understanding (P4) now are collapsed into one single factor denoted as Preferences/Understanding (F2). Furthermore, we observe that; (i) an additional provider quality dimension (facilities, S29) becomes part of Quality (F1), (ii) the affordability statements (S11 and S24) are now ignored, and, (iii) two of the three factors that measured the degree of understanding (Knowledge and Awareness) are now excluded.

Table 1 Characteristics of the study participants

Variables	Mean	SD
Age (years)	44.67	13.67
Household size	5.39	2.28
Monthly income (in TZS)	124,358	188,538
Sex (1 = female)	0.42	0.49
Marital status (1 = married)	2.67	1.37
Religion (1 = Christian)	0.86	0.35
Occupation (1 = farmer)	0.74	0.44
Education level		
No formal Education(1 = yes)	0.18	0.38
Primary Education (1 = yes)	0.72	0.45

Source: Authors' calculation based on primary data
Note: Primary data were collected from two rural districts of Dodoma region (Bahi and Chamwino)

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[3]Both Understanding, Knowledge and Awareness are dominated by statements concerned with measuring the respondents' understanding of the iCHF scheme, and to what degree they are informed about the contract terms.

Table 2 Characteristics of the respondents by membership status

Characteristics	Member(s)(%)	Non-Member(s)(%)	Total
Age (years)			
60+	39 (17.9)	61 (12.10)	100 (13.9)
40–59	103 (47.2)	238 (47.2)	341 (47.2)
26–39	63 (28.9)	176 (34.9)	239 (33.1)
18–25	13 (5.9)	29 (5.8)	42 (5.8)
Sex			
Female	134 (61.5)	284 (56.4)	418 (57.9)
Male	84 (38.5)	220 (43.7)	304 (42.1)
Education			
Secondary and higher education	28 (12.8)	47 (9.3)	75 (10.4)
Primary education	154 (70.6)	366 (72.6)	520 (72)
No education	36 (16.5)	91 (18.1)	127 (17.6)
Marital status			
Unmarried	55 (25.2)	143 (28.4)	198 (27.4)
Married	163 (74.8)	361 (71.6)	524 (72.6)
Household size			
≥ 10	10 (4.6)	20 (4.0))	30 (4.2)
7–9	56 (25.7)	122 (24.2)	178 (24.7)
4–6	112 (51.4)	261 (51.8)	373 (51.7)
≤ 3	40 (18.4)	101 (20.0)	141 (19.5)
Occupation			
Non-farmer	58 (26.6)	129 (25.6)	173 (25.9)
Farmer	160 (73.4)	375 (74.4)	535 (74.1)

Source: Authors' calculation based on primary data
Note: Primary data were collected from two rural districts of Dodoma region (Bahi and Chamwino)

The three most important factors for *FA* are Quality (*F1*), Preferences/Understanding (*F2*), and Convenience (*F3*), and they account for about 34, 27%, and about 20%, respectively, of the total variance. This means that the four most important factors identified for *PCA* (*P1-P4*) are also the most important ones for *FA*, however, for the latter two of the four factors are integrated into one single factor (Preferences/Understanding).

The various perception factors, together with household characteristics, are introduced as independent variables in multivariate regressions where iCHF membership status is the dependent variable. Based upon the statements belonging to each of the factors, we expect positive associations between membership and Quality (*P1* and *F1*), Convenience (*P3 and F3*) Knowledge (*P6*), and Recommendation (*P5* and *F4*) while we expect negative associations for Preferences (*P2*), Understanding (*P4*) and Preferences/Understanding (*F2*). As concerning the household characteristics, education, income, and household size are expected to increase the probability of being enrolled in the iCHF.

Table 3 KMO measure, Cronbach's alpha and Bartlett's test of sphericity

S/N	Test	Values	Requirements
1	Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy	0.815	KMO > 0.5
2	Cronbach's alpha measure of scale reliability	0.801	α > 0.7
3	Bartlett's test of sphericity		
	Chi-square	4892.747	
	Degrees of freedom	703	
	Significance	*p* < 0.000	*p* < 0.05

Source: Author's illustration

Table 4 Principal Component Analysis (*PCA*): Household perceptions towards iCHF

S/N	Factors and statements	The explained variance (%)	Factor Loadings
P1	*Quality (health care services)*	10.6	
S1	Healthcare services		0.76
S2	Healthcare personnel		0.72
S3	Long waiting time		−0.71
S4	Reasonable treatment time		0.71
S5	Discrimination of members		−0.65
S6	Availability of drugs		0. 56
P2	*Preferences (beliefs and priorities)*	9.5	
S7	iCHF is a loss of money		0.69
S8	I save money in case of illness		0.68
S9	I borrow money in case of illness		0.66
S10	Prefer traditional healers		0.59
S11	Low benefit-premium ratio		0.50
S12	Insurance brings bad luck		0.42
P3	*Convenience (iCHF accessibility)*	7.2	
S13	Office hours		0.83
S14	Opening location		0.78
S15	Card collection		0.72
P4	*Understanding (iCHF)*	5.1	
S16	Only relevant for chronic diseases		0.80
S17	Health is in the hands of God		0.74
S18	iCHF is for government workers		0.39
P5	*Recommendation (iCHF)*	5.1	
S19	iCHF representatives		0.85
S20	Relatives and friends		0.83
P6	*Knowledge (iCHF)*	4.8	
S21	Awareness about the iCHF premium		0.78
S22	The iCHF benefits are clear to me		0.51
S23	Knowledge about the iCHF scheme		−0.39
S24	The iCHF Premium is affordable		0.38
P7	*Awareness (iCHF)*	4.7	
S25	iCHF is for irregular incomes earners		−0.65
S26	I know people that are members of iCHF		0.57
S27	Current needs are prioritized		0.44
S28	iCHF is like paying taxes		0.42

Source: Authors' calculation of PCA based on primary data
Note: Primary data were collected from two rural districts of Dodoma region (Bahi and Chamwino)

Regression analysis

The logistic regression results are presented in Table 6. A total of fifteen variables influencing the household membership status were included in the first model and 12 variables in the second model. The first model included seven perception factors identified from PCA combined with eight household characteristics while the second model had 4 perception factors identified by FA and 8 household variables. From Table 6 we observe that 6 out of the 7 perception factors given *PCA* were significant (Awareness was non-significant) and 2 out of 8 household characteristics variables were significant. For *FA*, all 4 perception factors were significant and 2 of the household variables were significant.

The signs of the factors are as expected except for Recommendation (*P5* and *F4*). The factors that appear

Table 5 Factor Analysis (*FA*): Household Perceptions towards iCHF

S/N	Factors and included statements	The explained variance (%)	Factor Loadings
F1	*Quality (health care services)*	34.1	
S1	Healthcare services		0.74
S2	Healthcare personnel		0.71
S3	Long waiting time		−0.63
S4	Reasonable treatment time		0.60
S5	Discrimination of members		−0.55
S6	Availability of drugs		0.67
S29	Facilities (equipment)		0.33
F2	*Preferences/Understanding*	27.4	
S7	iCHF is a loss of money		0.50
S8	I save money in case of illness		0.50
S9	I borrow money in case of illness		0.60
s10	Prefer traditional healers		0.60
S12	Insurance brings bad luck		0.55
S16	Only relevant for chronic diseases		0.33
S17	Health is in the hands of God		0.43
S18	iCHF is for government workers		0.54
F3	*Convenience (iCHF accessibility)*	19.6	
S13	Office hours		0.69
S14	Opening location		0.66
S15	Card collection		0.53
S21	Awareness about the iCHF premium		0.31
S30	iCHF is a prepayment scheme		0.36
F4	*Recommendation (iCHF)*	9.9	
S19	iCHF representatives		0.59
S20	Relatives & friends		0.59

Source: Authors' calculation of FA based on primary data
Note: Primary data were collected from two rural districts of Dodoma region (Bahi and Chamwino)

to be most important, evaluated by significance levels and the size of the odds-ratios, are Preferences, Convenience, Knowledge, and Quality for *PCA* while for *FA* they are Convenience, Preferences/Understanding, and Quality.

Three factors for PCA and two factors for FA have a positive association with enrolment status. For PCA, the odds of a household being enrolled into iCHF, increase by 28, 40, and 39% as Quality, Convenience, and Knowledge, respectively, become higher. For FA, the odds of enrolling in the iCHF scheme increase by 46% (Quality) and 49% (Convenience). Factors that are decreasing the odds of enrolling (both for PCA and FA) are; Preferences, Understanding, and Recommendation.

We also observed that two of the eight variables (age and income) are statistically significant in both model 1 and model 2. The odds of being an iCHF member are 51, 58, and 44% lower for households whose respondent was aged between 18 and 25 years, 26−39 years, and 40−

49 years relatively to households whose respondent is aged 60 years or older. Regarding household's income, the odds of being insured by iCHF are 76% lower for households with income between 0 and 49,999 Tshs, relatively to households with income of 1,000,000 TZS or higher. Contrary to our expectations, household size and education level turned out insignificant.

Discussion

We have applied principal component analysis and factor analysis methods to analyze the perception of households towards a community-based insurance scheme (iCHF). Both methods reduce many variables (statements) into fewer and more manageable variables or factors. *PCA* assumes there is no unique variance thus the total variance is equal to the common variance while *FA* assumes that the total variance can be partitioned into common and unique variances.

Table 6 Multivariate Logistic Regression results of perception factors and household characteristics on membership status

Variables	Model 1: PCA Results	Model 2: FA Results
	OR* (SE)	OR* (SE)
Quality P1, F1	1.279 *** (0.101)	1.464*** (0.129)
Preferences P2, F2	0.614*** (0.052)	0.577*** (0.063)
Convenience P3, F3	1.402*** (0.128)	1.497*** (0.171)
Understanding P4	0.830 ** (0.061)	
Recommendation P5, F4	0.826*** (0.052)	0.843** (0.068)
Knowledge P6	1.390 *** (0.109)	
Awareness P7	1.075 (0.078)	
Household characteristics		
Sex		
Female	1	1
Male	0.753 (0.146)	0.753 (0.145)
Age (years)		
60+	1	1
40–59	0.571** (0.156)	0.567** (0.154)
26–39	0.459*** (0.136)	0.466*** (0.136)
18–25	0.582 (0.268)	0.562 (0.252)
Education		
Secondary and higher education	1	1
Primary education	1.029 (0.325)	0.918 (0.282)
No education	1.268 (0.489)	1.049 (0.394)
Marital status		
Unmarried	1	1
Married	1.165 (0.257)	1.193 (0.263)
Family size		
≥ 10	1	1
7–9	0.760 (0.361)	0.751 (0.357)
4–6	0.736 (0.338)	0.737 (0.336)
≤ 3	0.677 (0.325)	0.679 (0.327)
Religion		
Muslim	1	1
Christian	1.119 (0.289)	1.162 (0.296)
Occupation		
Non-farmers	1	1
Farmers	0.951 (0.202)	0.968 (0.206)
Income (in TZS)		
1.000.000 and higher	1	1
500.000–999.999	0.683 (0.562)	0.599 (0.488)
100.000–499.999	0.480 (0.349)	0.416 (0.299)
50.000–99.999	0.357 (0.264)	0.317 (0.231)
0–49.999	0.267* (0.198)	0.218** (0.159)
Number of observations	722	722
Log-likelihood	− 391.5037	− 396.7734

Table 6 Multivariate Logistic Regression results of perception factors and household characteristics on membership status *(Continued)*

Variables	Model 1: PCA Results	Model 2: FA Results
	OR* (SE)	OR* (SE)
Likelihood ratio test	84.02	77.42
Prob >chi2	0.000	0.000
Pseudo R2	0.1145	0.1028

Source: Authors' calculation of logistic regression based on primary data
Notes: (1) Primary data were collected from two rural districts of Dodoma region (Bahi and Chamwino) (2) Significance level: ***($p \leq 0.01$); **($p \leq 0.05$); *($p \leq 0.1$)

The results for the two methods differ somewhat for the number of factors identified and how much each factor explains the total variance. However, the most important perception factors are the same across the two methods; These were; Convenience (as exemplified by location and opening hours of iCHF offices), Quality (healthcare services), Preferences (the importance of alternative risk-reducing strategies such as saving and borrowing) and Knowledge.

Our findings partly contrast earlier studies on community-based insurance and household perception factors. Jehu-Appiah et al., (2012), in a study from Ghana, identified scheme factors (premiums, scheme benefits, and scheme convenience) as the most important perception factors [17]. In our study, the same factors, except for scheme convenience, were not important. Kansra and Gill (2017), in a study conducted in India, identified "lack of awareness and information about the insurance scheme" and "low and irregular income" as the most important perception factors [18]. In our study, however, the statements concerned with affordability (price-income statements) did not turn out as important. A possible explanation for this could be due to differences in study settings of the three studies. The study in Ghana was conducted in both rural and urban areas and the study in India was conducted in urban areas while this study was conducted in rural areas. As a result of differences in settings, the urban population might have different perceptions towards provider's factors as compared to the rural population. This is because healthcare services in urban areas typically are of better quality hence being perceived more positive. This may explain why there were no statistical differences in the provider's factors in the two studies and why the provider's factors were the most significant ones in our study. Majority of the rural population have negative perceptions towards provider's factors implying that if such factors are improved, more rural people will join the insurance scheme.

Using logistic regression analysis, we found that the quality of care, access to the iCHF offices, and

preferences had the most significant influence on iCHF membership status. Furthermore, the presence or non-presence of household characteristics did not impact our results in important ways. The only socio-demographic variables that turned out significant, in combination with the perception factors, were age and income. However, the age groups 18–25, 26–39, and 40–49 years (economically active group) had lower odds of enrolling in the iCHF, relative to the aged 60 years or older. A possible explanation for this could be due to the positive association between age and healthcare utilization. Demand for healthcare services tends to increase with age. Surprisingly, education was not statistically significant for any of the regressions performed. Possible explanations for this finding are because; first, the scheme targets the informal sector most of whom are not highly educated. Secondly, when people increase their education level, they are more likely to be employed either by the Government or private sector that have different types of insurance (NHIF and PHI). As a result, those with primary education or no education are the ones who purchase the premium for iCHF. Also, the education level of the respondent was not representative of the education level of the household (the average education level). Furthermore, for the regression that considers household characteristics alone, gender was significant ($p = 0.03$), however, when including the perception factors, gender became insignificant. This last finding may suggest confounding effects between the perception factors and gender.

Our findings concerning provider quality indicate that people are more willing to purchase insurance if the quality of health care services is improved. This finding is consistent with results from other research conducted in Tanzania. Several studies have identified a positive association between quality of care and the enrollment into the predecessor of the iCHF scheme [10, 15, 29]. Similar findings have also been reported in Uganda [30] and Kenya [31].

Another interesting finding is that the statements about the role of prices (premiums) and low income (affordability) were not important predictors of enrollment. This suggests that purchasing power is not an important barrier for enrolling in the iCHF in Tanzania. The answer to one of the statements, not included in our factor analysis, seems to confirm this. From the survey it follows that 93% of the respondents strongly agreed or agreed to the following statement; "the ICHF scheme will become more important to me if additional health care expenditures were covered despite a corresponding increase in the premium." Furthermore, 2/3 of all respondents agreed or strongly agreed with the statement "the iCHF premiums are affordable to me."

Access to the iCHF offices (location, opening hours, and modality of collecting membership card) is the most important scheme factor in our analysis. This finding is in line with Winani (2015) who found that a longer distance between the community and the nearest CHF office acted as a barrier to enroll in the health insurance scheme in Tanzania [32]. Other studies from Africa also confirm such effects [17, 33]. The factor concerned with beliefs and alternatives, confirms as expected that, respondents that consider alternatives to insurance (saving and borrowing) and cure (traditional healers, health is in the hands of God) are less likely to be members of iCHF. The sign of the factor that includes recommendations from relatives, friends, and iCHF representatives turned out opposite of what was expected. A possible explanation is that the recommendations given to the respondents from family and friends are not very plausible, in this way affecting their enrolment decision negatively.

The results from the multivariate regressions performed by Jehu-Appiah et al. (2012) and Kansra and Gill (2017) confirm that the most important perception factors also became the most important determinants in the regression analyses [17, 18]. The study from Ghana found the benefits of the insurance scheme, the premiums, and convenience to be important while factors related to the quality of care were not associated with insurance scheme enrolment [17]. The study from India, on the other hand, identified a lack of awareness and low and irregular income as the most important determinants [18]. Thus, our findings differ from both studies since provider quality is important while affordability (income and premiums) is not important. As concerning household characteristics, our study identifies age and income to have some relevance, while in [17] most household characteristics (education, income, gender, age, and religion) became significant while [18] did not identify any household characteristics (gender, age, income, marital status, and education) as being significant. The two studies differ somewhat from our study since [17] surveys a mix of urban and rural populations with more than 60% of the respondents being males, while [18] surveys urban populations with 91% of the respondents being males. Our study, in contrast, study rural populations (mainly farming households) and 58% of the respondents were females.

From the similarities and contradictions of these findings, relative to the health financing policy implications, we learn that the scheme coverage for Tanzania is still low, more efforts to advertise/promote the scheme is needed. Moreover, the health system should also be improved as a means to increase the enrolment rate so that more people are protected. Furthermore, we learn that each country/society has different factors that drive people to enroll or not to enroll. As seen from the three

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countries, findings suggest that, in Tanzania, improvement in the quality of care (providers' factors) is needed to influence enrolment decisions, from Ghana, scheme factors such as convenience, benefit package, and affordability are the most important factors to influence enrolment decision. In India, Information, knowledge, and income are important factors to influence decisions.

Limitations and strengths

A cross-sectional study is not without some limitations. This study was conducted in two districts of Tanzania within one region, which makes it difficult to generalize the interpretation of the results to the other regions implementing the iCHF scheme. We, therefore, argue that the findings should be interpreted with some caution. Furthermore, a majority of the respondents were female (58%) thus introducing the possibility of gender bias. We can not rule out that female respondents differ from male respondents along some dimensions. However, our survey had a participation rate equal to 100%, meaning that we are not confronted with any selection bias.

Conclusions and recommendations

Our study shows that household perceptions influence households' decision to enroll in CBHIs. It was interesting to note that provider-related factors such as the quality of health care play an important role while affordability (income and premiums) does not seem to play a significant role. These findings suggest that efforts to achieve a higher enrolment rate in Tanzania should focus on improving the quality of healthcare services in terms of drug availability, reduced waiting time, and better services.

Poor perceived quality of care emerged as a significant barrier for household decision to enroll in iCHF. Majority of respondents had poor perceptions of quality of care and they were not satisfied with services received at the health facility. Several measures must be put in place to improve the quality of care by hiring more healthcare providers and by increasing the number of medical supplies used at the facilities.

The improvement of the quality of health services alone might not guarantee an increase in the enrolment rate in the iCHF. This study identified beliefs in traditional healers and other life preferences such as saving for the future to be the other important factors that deter people from buying health insurance premiums. Therefore, raising awareness to the community on the importance of having health insurance is still of paramount importance.

Furthermore, the unimportant role of affordability suggests that, for most households, income and premiums are less likely to be the barriers to enrolment into the community-based insurance scheme (iCHF). This in turn implies that the premium might be raised with less worry of experiencing a significant decline in the enrolment rate and the corresponding increase in revenues can be invested into improving the quality of services as well as extending insurance coverage. In this way, policymakers will ensure that community expectations concerning the iCHF scheme are met, thus increasing the future enrolment rate. However, despite the insignificance of affordability factors (premiums and income) for the whole study group, policymakers should also pay attention to the groups being most vulnerable to out-of-pocket health care expenditures. For this group, premium subsidization and more flexible payment arrangements should be considered.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12913-021-06167-z.

Additional file 1. English language version of the questionnaire guide used in this study.

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to voluntary participation in the study and were asked to sign it before the start of the interview. The researcher provided background information and the reasons for conducting the study and ensuring the confidentiality of the information provided.

Consent for publication

Written informed consent for publication was obtained from the study participants in parallel with consent to participate in the study.

Competing interests

The authors declare that they have no competing interests.

Author details

[1]Department of Health Management and Health Economics, University of Oslo, P.O. Box 0315, Oslo, Norway. [2]Department of Development Studies, Muhimbili University of Health and Allied Sciences, P.O. Box 65001, Dar es Salaam, Tanzania. [3]Department of Global Public Health and Primary Care, University of Berge, P.O. Box 7804, 5020 Bergen, Norway.

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II

II

Whether or not to enroll, and stay enrolled? A Tanzanian cross-sectional study on voluntary health insurance

Alphoncina Kagaigai [a,b,*], Amani Thomas Mori [c], Amani Anaeli [b], Sverre Grepperud [a]

[a] University of Oslo, Institute of Health and Society, Department of Health Management and Health Economics, P.O. Box, 0315 Oslo, Norway
[b] Muhimbili University of Health and Allied Sciences, School of Public Health and Social Sciences, Department of Development Studies, P.O. Box, 65001 Dar es Salaam, Tanzania
[c] University of Bergen, Department of Global Health and Primary Health Care, P.O. Box, 5007 Bergen, Norway

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ABSTRACT

Lower-middle income countries (LMICs) have invested significant effort into expanding insurance coverage as a means of improving access to health care. However, it has proven challenging to fulfill these ambitions. This study investigates to what extent variables associated with the enrollment decision (stay never-insured or enroll) differ from variables associated with the dropout decision (stay insured or drop out). A cross-sectional survey that included 722 households from rural districts in Tanzania was conducted and multinomial logistic regressions were performed to determine the associations between independent variables and member-ship status (never-insured, dropouts, or currently insured). Both the decision to enrollment and the decision to drop out were significantly associated with the presence of chronic disease and perceptions about the quality of services provided, insurance scheme management, and traditional healers. The effect of other variables, such as age, gender and educational level of the household head, household income, and perceptions about premium affordability and benefit-premium ratios, varied across the two groups. To improve voluntary health insurance coverage, policymakers must simultaneously increase the enrollment rate among the never-insured and reduce the dropout rate among the insured. Our conclusions suggest that policies to increase insurance scheme enroll-ment rates should differ for the two uninsured groups.

1. ntroduction

Health financing mechanisms in lower-middle income countries (LMICs) are insufficient since out-of-pocket payments (OOPs) relative to income are high [1,2]. On average, OOPs constitute about 40 % of the total health expenditure in LMICs which is high compared to higher-income countries [3]. One way of protecting households from OOPs in LMICs has been the implementation of voluntary insurance schemes known as community-based health insurance (CBHIs) [4–6]. Such non-profit schemes, primarily targeting rural and informal sectors, are typically subsidized by governments and premiums are set independent of ability to pay and individual health risks [7,8].

CBHIs are often characterized by low coverage rates due to low enrollment rates (recruitment rates) in combination with high and fluctuating dropout rates. In Senegal, Uganda and Nigeria, coverage has remained low over time [9–11], while in Ethiopia coverage has declined from 48 % (2013) to 36 % (2017) [12]. In Uganda the drop-out rate was 25 % in 2021 [13]; in Burkina Faso the rate varied between 31 and 46 % in the period 2005–2006 [14] while in Ghana it varied between 35 and 53 % in the period 2015–2016 [15,16]. In view of this, it is of interest to understand what mechanisms are impor-tant for households choosing to stay without health insurance to be able to launch effective policies.

The Tanzanian CBHI scheme, known as the Community Health Fund (CHF), was introduced in 1996 to improve access to primary care services for people working in informal sectors and those residing in rural areas. However, the enrollment rate has remained low (below 10 %) despite concerted governmental efforts to promote the scheme [8,17–19]. In 2011, the government reformed the scheme by introduc-ing an "improved Community Health Fund" (iCHF). The iCHF was introduced as a pilot in the Dodoma region and five additional regions (Shinyanga, Singida, Arusha, Manyara and Kilimanjaro). Since then, the scheme has been gradually extended to other regions of Tanzania. By 2019, it had been introduced into 19 of Tanzania's 31 regions. In 2016 the iCHF enrollment rate was 9.2 % [20] while in 2013 the drop-out rate was 7.3 % [21].

The reforms included the introduction of a uniform annual premium for all rural districts of TZS 30,000 ($ 15) per household of six members (households larger than six may opt to form two separate households). The premiums, however, are higher in urban areas: in Dar es Salaam the premium amounts to TZS 150,000 ($ 65) per household of six members [22]. Households pay the premium annually and are free to renew the membership or drop out when the membership period expires. In general, there are no premium exemptions; however, children younger than 5 years, pregnant women and elderly people (60 + years), independent of membership status, do not pay co-payments for visits at public health facilities. Additional iCHF reforms included (i) additional scheme benefits such as X-rays, ultrasounds, and some in-patient services; (ii) the facilitation of the registration process by appointing enrollment officers at the village level (close to the community) and by making it possible to use mobile phones for registration and membership renewal; and (iii) improvement of the regional hospital referral systems [19,22,23].

Several studies have explored factors that influence enrollment decisions and/or willingness to pay for insurance. A systematic review by Nosratnejad et al. [24] that included 18 quantitative studies in LMICs published between 2003 and 2013 concluded that low-income levels, poor provider quality, and low levels of trust are factors that affect enrollment negatively. A systematic review by Dror et al. [25] that included 42 studies (36 quantitative and 6 mixed methods) mainly from sub-Saharan Africa and Asia found that enrollment was positively associated with household income, education, age, household size, gender, and chronic illness episodes. Recent studies have confirmed that perception variables are important in explaining enrollment decisions in LMICs [26–28]. In addition, there are experimental studies that examine the impact of various interventions on the adoption of CBHIs. Interventions that have been analyzed are premium subsidies and premium costs [29–33], more intensive information campaigns [30,31,34], registration assistance [29,30], enrollment locations [32], and the possibility of making lower but more frequent premium payments [30].

The quantitative literature concerned with the effects of background characteristics on enrollment decisions in LMICs typically studies binary dependent variables. Such approaches, however, ignore household subgroups, for example, the never-insured or dropouts, or they treat these subgroups as a single one. Both approaches might leave out valuable information. In this work, we extend such approaches by using an outcome variable that can take three different values (never-insured, previously insured, and currently insured). Doing this enables us to investigate to what extent determinants vary across subgroups. In doing so, we include socio-demographic, health-related and perception variables. Health-related variables applied in the literature typically include self-reported health state, chronic disease status, or disease history. In this study, we include health state, chronic disease status, and a variable that measures risk exposure and risk perceptions (the fear of future disease). Health state is measured by an instrument that, to our knowledge, has not been previously applied in the insurance literature that analyzes household survey data from LMICs (the EQ-5D instrument). The choice of perception variables is based on previous studies [26–28].

2. Material and methods

2.1. Study design and setting

The Tanzanian government has invested much effort in increasing enrollment in rural areas where the majority of the Tanzanian population resides (70 %). For this reason, we chose to undertake a cross-sectional study based on a rural household survey carried out in the Dodoma region (central Tanzania) between June and August 2019. Dodoma was selected as a study region because it was one of the six

pilot regions where the iCHF insurance scheme was first introduced. Hence, the focus was on a region where the iCHF scheme had been in place for several years, implying that households had some experience with the scheme. Two rural districts (Bahi and Chamwino) were selected out of Dodoma's seven rural districts. Chamwino was the most populated district of Dodoma with a population of 330,000, of which 17.4 % were iCHF members by 2019, while Bahi was the least populated district with 220,000, of which 16.5 % were members [35]. The primary economic activities in both districts are peasantry agriculture and livestock keeping [36]. Bahi district consists of 4 divisions, 22 wards and 59 villages while Chamwino consists of 5 divisions, 36 wards and 107 villages.

2.2. Sampling techniques and sample size

A three-stage sampling procedure was used to select households. In the first stage, two wards were randomly selected from each division of both Bahi and Chamwino, resulting in 8 and 10 wards, respectively. In the second stage, purposive sampling was used to select two villages (from each ward) that differed with respect to health facility availability and accessibility, providing us with a total of 16 (Bahi) and 20 (Chamwino) villages. In the third stage, we employed systematic random sampling by selecting every third household in each village (see [15,37]). The total sample size of 722 households (303 for Bahi and 419 for Chamwino) was calculated following the probability-proportional-to-size sampling approach (given a 95 % confidence level and a margin of error equal to 3 %) [38]. The study unit (the household) was defined as one or more individuals, related or unrelated, who share meals and who live in the same dwelling unit [39,40]. The interviewers asked for an interview with the household head (60 % were female); however, in rare cases, the household head was absent and the interview was done with a household member aged 18 years or older. The response rate was 100 %.

2.3. Variables

A household is free to renew or drop out once the membership period has expired. The respondents who had not renewed their membership before the data collection were classified as *dropouts*, those never been enrolled into the scheme were classified as *never-insured,* and those with a valid membership card were classified as *currently insured.*

The independent variables belong to the following three groups: health-related variables, socio-demographic variables, and perception variables. The respondents were asked to report their health state using the EQ-5D instrument, a generic instrument that uses five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression), where each dimension is divided into three levels. The EQ-5D index was generated as a continuous variable with values ranging from 1 (full health state) to 0 (worst possible health). This conversion process is common in the economic evaluation literature [41,42] and is performed using statistical software such as STATA. Two additional health-related variables followed from asking (i) whether any household member had a chronic disease (yes or no) and (ii) to what extent the respondent feared the future occurrence of diseases (yes or no).

The socio-demographic variables included household income, household size, gender, marital status, education, and age. The reported monthly income (y) was grouped into the following three income categories (using the poverty line definition (Z), per adult for the mainland of Tanzania [43] where Z = TZS 49,320 ($22.4)): (i) low income ($y < Z$), (ii) medium income ($Z \leq y <$ TZS 499,999), and (iii) high income ($Z \geq$ TZS 500,000). Age was recorded as a continuous variable; thereafter it was grouped into 4 categories (18–25, 26–39, 40–59, and 60 +) following the Tanzanian 2012 population survey reports [36]. Education was classified into three cate-

gories (no education, primary education, or secondary education and higher).

The third group of independent variables, the perception variables, were elicited by asking to what extent the respondents agreed with five statements ranked on a Likert scale from 1 to 5 with 1 being "strongly disagrees" and 5 being "strongly agrees." The statements were concerned with the quality of services, the insurance scheme benefit package, premium affordability, scheme trustworthiness, and attitudes towards traditional healers. The selection of the statements was based on previous literature from Tanzania [44,45]. For the purpose of the descriptive analysis, we grouped the responses into three categories with 1 being "Disagrees," 2 being "Neutral," and 3 being "Agrees." For regression analysis we treated the variables as being continuous, moving from strongly disagree to strongly agree.

2.4. Data analysis

Our analysis applies a multinomial logistic regression model with the *currently insured* as the reference category (base outcome); thus, the probability of being *never-insured* or a *dropout* is compared with the probability of being *currently insured*. To address potential multi-collinearity problems, tests using Spearman's rank (rho) correlation coefficient matrix methods and the variance inflation factor (VIF) were applied. Neither of the independent variables had a Spearman's rho correlation coefficient greater than 0.4 for the correlation matrix [46] and the VIF mean value was 1.32 (see Table A2 in the appendices), suggesting no multi-collinearity [47]. Data cleaning, validation, and all statistical analysis were performed using STATA 17.0 software.

Since our independent variable had multiple responses (3 categories), a multinomial logistic regression method was used to predict the relationship between the dependent and independent variables. Two multinomial logistic regressions were run. In the first, age and income were treated as categorical variables to account for the possibility of non-linearity and measurement errors (see Table 2). In the second regression, age and income were treated as continuous variables (see Table 2B in the appendix).

3. Results

Our results are presented in two subsections. The first presents descriptive statistics for the independent variables across membership groups, while the second presents the regression results.

3.1. The distribution of independent variables across membership groups

As indicated in Table 1, *dropouts* are by far the largest membership group (54.7 %) while the *currently insured* are the second largest (30.2 %). The *never-insured* differ from the *currently insured* and *dropouts* with respect to age and gender. Educational level and marital status were distributed relatively equally between the groups but there is a difference in household income. The percentage of respondents classified as having a medium or high income amounted to 71 % for *currently insured,* while being 63 % and 59.7 %, for the *never-insured* and the *dropouts,* respectively. Concerning age, the never-insured are younger on average compared to the other two groups. Our sample is somewhat skewed towards older age groups compared to the Tanza-

Table 1

Descriptive statistics for sociodemographic and health-related variables across iCHF membership status. Number of observations (column percentage).

Variables	Membership status				*p-value*
	Never insured N = 109	Currently insured N = 218	Dropouts N = 395	Total N = 722	
Socio-demographic variables					
Age (in years)					
18–25	12(11.0)	13(6.0)	17(4.3)	42(5.8)	*0.008*
26–39	45(41.3)	63(28.9)	131(33.2)	239(33.1)	
40–59	39(35.8)	103(47.3)	199(50.4)	341(47.23)	
60+	13(11.9)	39(17.9)	48(12.2)	100(13.9)	
Gender					
Male	61(56.0)	84(38.5)	159(40.1)	304(42.1)	*0.006*
Female	48(44.0)	134(61.5)	236(59.8)	418(57.9)	
Educational level					
No formal education	21(19.3)	36(16.5)	70(17.6)	127(17.6)	*0.366*
Primary education	74(67.9)	154(70.6)	292(73.9)	520(72.0)	
Secondary education +	14(12.8)	28(12.8)	33(8.4)	75(10.4)	
Marital status					
Married	79(72.5)	163(74.8)	282(71.4)	524(72.6)	*0.668*
Unmarried	30(27.5)	55(25.2)	113(28.6)	198(27.4)	
Household size					
1–3	25(22.9)	40(18.4)	76(19.2)	141(19.4)	0.901
4–6	58(53.2)	112(51.4)	203(51.4)	373(51.7)	
7–9	23(21.1)	56(25.7)	99(25.1)	178(24.7)	
10+	3(2.8)	10(4.6)	17(4.3)	30(4.2)	
Income					
Low	40(37.0)	61(28.6)	156(40.3)	257(36.3)	*0.034*
Medium	61(56.5)	135(63.4)	215(55.6)	411(58.1)	
High	7(6.5)	17(8.0)	16(4.1)	40(5.7)	
HEALTH-RELATED VARIABLES					
Fear of diseases					
No	54(49.5)	109(50.0)	211(53.4)	374(51.8)	*0.631*
Yes	55(50.5)	109(50.0)	184(46.6)	348(48.2)	
Chronic diseases					
No	70(64.2)	127(58.3)	270(68.4)	467(64.7)	*0.043*
Yes	39(35.8)	91(41.7)	125(31.7)	255(35.3)	
EQ-5D					
Poor	9(8.3)	27(12.4)	47(11.9)	83(11.5)	*0.781*
Fair	18(16.5)	39(17.9)	64(16.2)	121(16.8)	
Good	82(75.2)	152(69.7)	284(71.9)	518(71.8)	

Table 2

Multinomial logistic regression (age and income as categorized variables).

Variables	Never-insured (N = 109)		Drop-outs (N = 395)	
	RR (95 % CI)	*p-value*	RR (95 % CI)	*p-value*
Base outcome (currently insured)				
Socio-demographic variables				
Age (40–59 years)				
18–25	2.33 (1.49–3.65)	*0.000****	0.58 (0.21–1.59)	*0.289*
26–39	1.64 (0.50–5.40)	*0.418*	1.07 (0.52–2.22)	*0.852*
60+	0.82 (0.56–1.21)	*0.323*	0.66 (0.39–1.10)	*0.112*
Income (Low)				
Medium	0.77 (0.22–2.67)	*0.684*	0.64 (0.60–0.69)	*0.000****
High	0.57 (0.11–2.85)	*0.495*	0.38 (0.15–0.93)	*0.033***
Gender (Male)				
Female	0.52 (0.30–0.89)	*0.018***	0.93 (0.48–1.82)	*0.838*
Education level (no education)				
Primary education	0.84 (0.84–0.85)	*0.000****	1.10 (1.08–1.12)	*0.000****
Secondary education +	0.72 (0.68–0.77)	*0.000****	0.82 (0.67–1.01)	*0.056**
Household size (1–3 members)				
4–6	1.02 (0.67–1.56)	*0.926*	0.97 (0.64–1.46)	*0.885*
7–9	0.85 (0.43–1.65)	*0.622*	0.99 (0.36–2.79)	*0.998*
10+	0.74 (0.47–1.16)	*0.184*	0.99 (0.40–2.50)	*0.994*
Marital status (unmarried)				
Married	0.75 (0.49–1.14)	*0.178*	0.90 (0.51–1.59)	*0.723*
Health-related variables				
EQ-5D	2.62 (0.23–30.45)	*0.441*	1.43 (0.47–4.31)	*0.530*
Fear of sickness (No)				
Yes	1.43 (0.41–4.96)	*0.572*	1.08 (0.90–1.29)	*0.421*
Chronic diseases (No)				
Yes	0.81 (0.69–0.95)	*0.010****	0.58 (0.34–0.99)	*0.045***
Perception variables				
Quality of care	0.68 (0.53–0.87)	*0.003****	0.86 (0.81–0.91)	*0.000****
Benefit-premium ratio	0.93 (0.85–1.01)	*0.065**	1.16 (0.85–1.60)	*0.345*
Premium affordability	0.89 (0.43–1.86)	*0.766*	0.69 (0.51–0.95)	*0.021***
Scheme leader trust	0.47 (0.24–0.88)	*0.020***	0.76 (0.55–1.06)	*0.094**
Traditional healers	1.84 (1.19–2.84)	*0.006****	1.20 (1.18–1.23)	*0.000****

Notes: ***, ** and * denote 1%, 5% and 10% significance level (p-value), respectively.
Reference category: Currently insured.

nian population as a whole, while the age distribution fits well with the Dodoma region (see Table A3 in the appendix) [36]. Respondents reporting poor health based on the EQ-5D represented about 11 % of the sample and the *never-insured* reported a somewhat better health state than the two other groups. Concerning chronic diseases, about one third of respondents confirmed the presence of at least one household member having a chronic disease while almost 50 % stated that they feared the future onset of disease.

Concerning the five perception variables (see Table A1 in the appendix), the *currently insured* have the most positive perceptions of the insurance scheme (premium affordability, quality of service providers, and trust in scheme leaders) while being the most skeptical about the use of traditional healers. The *never-insured,* on the other hand, are most in favor of visiting traditional healers and have the most distrust when it comes to service quality and the performances of scheme leaders. The *dropouts* are somewhere in between the *never-insured* and the *currently insured* except they are significantly more dissatisfied with the benefit-premium ratio (51.7 %) compared to the *currently insured* (41.7 %) and the *never-insured* (39.5 %).

3.2. Regression results

The multinomial logistic regression results are presented in Table 2 as adjusted relative risk ratios (*RR*). The probability of being *never-insured* (*RR = 0.81, CI: 0.69–0.95*) or a *dropout* (*RR = 0.58, CI: 0.34–0.99*), relative to being *currently insured*, is lower (since *P-value < 0.05)* when the household reports having at least one member with a chronic disease. Self-reported health (EQ-5D) and the fear of sickness, on the other hand, are insignificant for both groups (*never-insured* and *dropouts*).

As for socio-demographic variables, the variables that are insignificant for both decisions are household size and marital status. Concerning income and age, the probability of being *never-insured,* relative to being *currently insured,* is insignificant for income while age is significant for the youngest (18–25 yrs.) relative to the reference category (40–59 yrs.). The probability of being *never-insured* (*RR = 2.33, CI: 1.49–3.65*) relative to being *currently insured,* decreases as age increases. Furthermore, the same probability decreases if the household is headed by a female and for higher educational levels. The probability of being a *dropout,* relative to being *currently insured,* decreases with a higher income but is insignificant for all age categories. Concerning educational level, both categories are significant; however, the effects differ. Having secondary education (relative to no education) corresponds to a lower probability of being never-insured and of being a dropout, while having primary education (compared to no education) only increases the probability of being never-insured. Concerning the perception variables, quality of care, scheme leader trust and the use of traditional healers are important for both decisions while premium affordability and benefit-premium ratio significantly impact the *dropout* decision and the *never-insured* decision, respectively (*p < 0.10*). Finally, when introducing the continuous versions of age and income, we found that age is only significant for the decision to stay never-insured: a lower age was associated with the decision to stay never–insured. Income, on the other hand, was only significant for the dropout decision, with a lower income being associated with the decision to leave the scheme.

To simplify the presentation of the impact of the variables relative to our research question, the significant variables (*p < 0.10*) from Table 2 have been classified into three groups (see Table 3) and interpreted in relation to the types of changes that are associated with a

Table 3

Type of changes in significant variables that are associated with a non-insurance status (*p ≤ 0.09*).

Groups	Type of decisions	Type of variable changes
1.	Changes that are associated with a non-insurance status (staying never-insured and dropping out)	Higher education (secondary education relative to no education) The absence of chronic disease Negative perceptions of the quality of services Positive perceptions of traditional healers Negative perceptions of scheme leaders
2.	Changes that are associated with the decision to stay never-insured	Younger age (being 18–25 yrs. relative to being 40–59 yrs.) Higher education (primary education relative to no education) Being a male household head Positive perceptions of the benefit-premium ratio
3.	Changes that are associated with the decision to leave the scheme (dropout)	Lower education (no education relative to primary education) Lower income (a low income relative to medium and high income) Negative perceptions of premium affordability

non-insurance status (*never-insured* and *dropouts*). The first group consists of variables that show a positive correlation for both decisions while the second and third groups refer to changes that are unique to each decision. For Group 1 it follows that three of the perception variables, the absence of a chronic disease, and having secondary education all are associated with a non-insurance status. Furthermore, being younger and male and having primary education and a positive perception of the benefit-premium rate increase the probability of being *never-insured* (Group 2) only, while having no primary education, a lower income, and a negative perception of premium affordability increase the probability of being a *dropout* (Group 3). From this we can conclude that age, education, gender, income, and two perception variables differ across the two decisions.

4. Discussion

4.1. Discussion of study findings

Of the three health-related variables, only chronic diseases were found to be significant in the sense that the absence of such disease promoted the decision to opt for a non-insurance status. This finding may appear surprising but is expected considering that the insurance scheme in question only covers primary healthcare services, thus excluding treatments for non-communicable diseases, such as cancer, kidney disease, cardiovascular disease and diabetes, as well as for HIV/AIDS. The insignificant role of health state (EQ-5D) and of fear of future disease suggests that self-selection into an insurance scheme is not based on an individual's health state. However, such a conclusion ignores that the health condition of other household members is not taken into account. Furthermore, the role of chronic diseases suggests the opposite conclusion with regard to self-selection.

A possible explanation for why being young, relative to being old, increases the probability of being *never-insured* might be the positive association between increasing age and the need for healthcare. Another possible explanation could be that those in the youngest group (18–25 yrs.) have less purchasing power compared to those in an older age category (40–59 yrs.) However, we observed that among the younger age groups, becoming older increased the probability of

dropping out, although the effect was insignificant. This finding may be explained by the fact that some households withdraw from the scheme after some years of membership.

Concerning education, having secondary education (relative to non-education) increased the probability of both being never-insured and being a dropout while having primary education increased the probability of being never-insured but decreased the probability of being a dropout. The effect on the decision to stay *never-insured* might follow from those with more education having a greater awareness of the scheme; at the same time, those with more education might have higher expectations and thus be more easily disappointed with the scheme, leading them to drop out.

Surprisingly, income is not associated with the decision to stay *never-insured* while lower income increases the probability of leaving the scheme (*dropout*). Interestingly, economic factors such as income and perceptions about premium affordability are not important (insignificant) while positive perceptions of the benefit-premium ratio pull in the direction of staying *never-insured*. Furthermore, we know that perceptions about premium affordability and the benefit-premium ratio are more positive among *never-insured* relative to *dropouts*. On the other hand, economic factors play an important role for *dropouts* since lower income and negative perceptions of premium affordability promote the decision to leave the scheme. In sum, these findings suggest that the *never-insured* are more concerned with the quality of services and the performances of scheme leaders, while purchasing power (income relative to prices) and "value for the money" (benefit-price ratio) are important for those who have left the scheme. These findings point to structural differences between the two decisions and this interpretation is reinforced by the presence of different effects from age and education and from the descriptive statistics confirming that the *never-insured*, relative to the *dropouts*, have more positive perceptions of the benefit-premium ratio and premium affordability. The *never-insured*, on the other hand, are more positive towards outside options (traditional medicine) and have less confidence in the performance of scheme leaders. In addition, this group is more sensitive to negative perceptions of the quality of care. A more general explanation for the structural differences may be that *dropouts* have personal experience with the scheme in question when making their decision while the *never-insured*, to a greater extent, make their decision based on expectations about the scheme in combination with information provided to them by others.

The literature on enrollment-related decisions in LMICs is extensive and includes different designs and settings. In the following, we compare our findings with previous cross-sectional analyses performed in sub-Saharan African countries. This literature can be classified into the following three groups base on the outcome variables used: (i) currently insured and dropouts; (ii) currently insured and currently non-insured; and (iii) currently-insured, never-insured, and dropouts.

Several studies have analyzed a binary dependent variable with the outcomes *currently insured* and *dropouts* [6,9,13–15,48]. Since the *never-insured* are ignored, a comparison with our findings must look at *dropouts*. In contrast to Mladovsky [9] and our study, Dong et al. and Mebratie et al. [14,48] did not identify any significant effects of age and gender. These two studies [14,48] identified an effect from education, as we did, but neither included income as an independent variable. Two of the studies [9,14] included perception variables that resemble ours. For example, Mladovsky [9] found both "trustworthy of scheme leader" and "satisfactory scheme operation" to increase the probability of being insured, while Dong et al. [14] reached the same conclusion when "scheme quality" was perceived as being satisfactory.

The second group of studies that analyze binary dependent variables looks at members and non-members, which means that the *never-insured* and the *dropouts* are treated as one group. More recent work within this tradition includes [24,26,45,49,50]. Three of the studies found that being a female and being older significantly increased the probability of being a member [24,45,50]. Two of the

studies included perception variables, with both finding that positive perceptions of the insurance scheme were important [24,45]. These studies [24,45] included education, wealth (income), marital status, and household size, with the latter two variables found to be insignificant. However, Duku [49], in contrast to Kagaigai [26], found that a higher wealth status and higher education level promoted membership.

The study by Kagaigai et al. [26] is particularly interesting since it analyzed the same dataset as ours. Interesting differences concerning gender, education, and income can be observed. The probability of being a non-member decreased when the head of household was female, while in our study, the same effect was found for the *never-insured* only. Furthermore, they found the effects of education to be insignificant, which was not the case in our study. They also found that a lower income (from high to low income) increased the probability of being a non-member, while our study found this to be the case for *dropouts* only.

We have identified two multinomial studies, both from Ghana, in which the outcomes of the dependent variable are (i) currently insured, (ii) never-insured, and (iii) previously insured [27,51]. In contrast to our paper, both papers identify effects that pull in the same direction for the *never-insured* and *dropouts* but the effects are somewhat stronger for the first group. A direct comparison with Jehu-Appiah et al. [27] is complicated since their choice of baseline differs from ours (the never-insured). Their main conclusion is that the perception factors (scheme benefits, scheme convenience, and scheme price) have the strongest associations with the enrollment decision and the dropout decision [27]. Van der Weilen et al. [51] do not include perception factors but find that lower education level, being younger, and lower wealth level (income) increase the probability of being never-insured and previously insured. Furthermore, this study finds, as we do, that self-reported health is not important for either group.

The two systematic reviews commented upon in the introduction, refer to higher income as the most important factor for the enrollment decision, while, in our study, this variable is relevant for the *dropouts,* only [24] finds that perceptions towards health care quality and scheme leader trust as important. Our analysis reaches similar conclusions since both perceptions are relevant for both decisions (*never-insured* and *dropouts*) [24,25] find that lower age, fewer chronic illness episodes and lower education, all pull in the direction of not being insured. Our study, as concerning the never-insured, found the same results for age and chronic disease while education has the opposite effect. Concerning the dropouts, we found that chronic diseases had the same effect, while age was insignificant and the effects of age were opposite across the two age categories.

4.2. Limitations and strengths

This study has limitations. First, the study was conducted in two districts in the same region of Tanzania, which makes it difficult to generalize our findings to the entire country (for example the age distribution of the sample is skewed towards older age groups). Second, several variables, such as age, gender, education, self-reported health state and the perceptions variables, are associated with the household head, or in some cases another adult household representative, thus ignoring other household members that potentially have a say in insurance decisions. Third, our analysis leaves out some variables (e.g. risk preferences and household wealth) that are potentially important for enrollment decisions. Fourth, our analysis does not capture the full dynamics of insurance decisions since households might enroll and drop out repeatedly over time. However, our survey had a participation rate of 100 %, meaning that we are not confronted with any selection bias.

5. Conclusions

The main purpose was to investigate to what extent variables associated with the decision to enroll differ from those associated with the decision to leave (dropout). Our findings show that several variables play different roles across the two decisions because they have significant but opposite effects (i.e. education) and because some are significant for only one of the decisions (i.e. gender, income and some perception variables). These conclusions contrast with those of previous studies that also compared groups with different membership status, since they identified variables that typically pull in the similar direction.

The knowledge gained in this study might be important for policy reasons since it suggests the use of discriminatory measures in promoting insurance coverage. Policies targeting the never-insured should be concerned with changing expectations about the scheme while policies targeting dropouts should pay attention to "value for money." A policy that improves the quality of care and extends the benefits package is likely to make membership more attractive for both groups; however, such improvements, in combination with lower premiums, are difficult to achieve without additional funding. In the absence of external funding (e.g., government subsidies and donor contributions), one possibility would be to finance improvements through higher introductory premiums, with premium discounts being contingent upon on membership duration. Another possibility would be to offer a menu of benefit packages that differ in price depending on the services provided.

In our study area, the share of dropouts far exceeds the share of never-insured, which might suggest that policies targeted at dropouts should be given priority. On the other hand, the never-insured are younger and have better overall health than dropouts, meaning that recruiting the never-insured, in relative terms, might provide more financial resources that can be invested into scheme improvements. Finally, more knowledge about how sensitive households are to changes in quality, scheme benefits and premiums is clearly needed. In addition to quantitative studies, future qualitative studies will be important for reducing the knowledge gap regarding the design of effective policy measures.

CRediT authorship contribution statement

Alphoncina Kagaigai: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft. **Amani Thomas Mori:** Conceptualization, Supervision. **Amani Anaeli:** Conceptualization, Supervision. **Sverre Grepperud:** Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A

See Tables A1–A3 and Table 2B.

Table A1
Distribution of the perception variables across membership status.

Variables	Response categories	Membership status			Total N = 722	p-value
		Never-insured N = 109	Currently-insured N = 218	Dropouts N = 395		
Quality of services iCHF members receive quality services from the providers.	Disagree	43(39.5)	51(23.4)	137(34.7)	231(32.0)	0.000
	Neutral	29(26.6)	15(6.9)	28(7.1)	72(10.0)	
	Agree	37(33.9)	152(69.7)	230(58.2)	419(58.0)	
Benefit-premium ratio The iCHF benefit package is too low relative to the premium charged.	Disagree	45(41.3)	120(55.1)	172(43.5)	337(46.7)	0.000
	Neutral	21(19.3)	7(3.2)	19(4.8)	47(6.5)	
	Agree	432(39.5)	91(41.7)	204(51.7)	338(46.8)	
Premium affordability The iCHF premiums are affordable.	Disagree	33(30.3)	47(21.6)	159(40.3)	239(33.1)	0.000
	Neutral	10(9.2)	6(2.8)	10(2.5)	26(3.6)	
	Agree	66(60.6)	165(75.7)	226(57.2)	457(63.3)	
Scheme leader trust iCHF leaders are trustworthy.	Disagree	27(24.8)	19(8.7)	65(16.5)	111(15.4)	0.000
	Neutral	39(35.8)	26(11.9)	66(16.7)	131(18.1)	
	Agree	43(39.5)	173(79.4)	264(66.8)	480(66.5)	
Traditional healers I prefer to visit traditional healers rather than enrolling in iCHF.	Disagree	84(77.1)	197(90.4)	342(86.6)	623(86.3)	0.001
	Neutral	3(2.8)	10(4.6)	17(4.3)	30(4.2)	
	Agree	22(20.2)	11(5.1)	36(9.1)	69(9.6)	

Table A2
Variance inflation factor (VIF) for independent variables.

Variable	VIF	1/VIF
Fear of sickness	1.22	0.818
Chronic diseases	1.26	0.793
EQ-5D	1.31	0.766
Age	1.28	0.780
Sex	1.19	0.837
Education level		
Primary education	1.57	0.635
Secondary education and above l	1.69	0.593
Household size		
3–6	1.85	0.539
7–9	1.87	0.536
10 +	1.22	0.819
Marital status	1.24	0.809
Income		
Medium income	1.2	0.834
High Income	1.19	0.843
Quality of care	1.2	0.836
Benefit-premium ratio	1.08	0.925
Premium affordability	1.12	0.893
Scheme leader trust	1.17	0.855
Traditional healers	1.05	0.948
Mean VIF	**1.32**	

Table A3
Population distribution by age in Dodoma region and Tanzania.

Age group	Number of Persons	
	Dodoma	Tanzania
20–39	543,519 (57.9 %)	13,278,557 (62.6 %)
40–59	255,903 (27.3 %)	5,805,004 (27.4 %)
60 +	139,363 (14.8 %)	2,125,942 (10,02 %)
Total	**938 785**	**21 209 503**

Source: *Tanzania Population and Household Census Report of 2012* [36].

Table 2B

Multinomial logistic regression: Age and Income treated as continuous variables.

Variables	Never-insured (N = 109)		Dropouts (N = 395)	
	RR (95 % CI)	P > z	RR (95 % CI)	P > z
Base outcome (currently insured)				
Socio-demographic variables				
Age	0.98 (0.96–0.99)	0.028**	0.99 (0.98–0.99)	0.19
Monthly income	0.83 (0.47–1.46)	0.515	0.79 (0.69–0.91)	0.001***
Gender (Male)				
Female	0.53 (0.28–0.97)	0.04**	0.94 (0.49–1.80)	0.846
Education level (no education)				
Primary education	0.77 (0.64–0.93)	0.007***	1.10 (0.90–1.36)	0.341
Secondary education +	0.73 (0.60–0.90)	0.003***	0.83 (0.80–0.85)	0.000***
Household size (1–3 members)				
4–6	0.94 (0.66–1.36)	0.752	1.03 (0.76–1.40)	0.841
7–9	0.87 (0.59–1.28)	0.473	1.08 (0.45–2.62)	0.86
10+	0.68 (0.33–1.38)	0.284	1.03 (0.50–2.10)	0.939
Marital status (unmarried)				
married	0.74 (0.47–1.17)	0.205	0.84 (0.43–1.63)	0.600
Health-related variables				
Fear of sickness (No)				
Yes	1.47 (0.45–4.86)	0.525	1.20 (0.86–1.67)	0.292
Chronic diseases (No)				
Yes	0.81 (0.76–0.85)	0.000***	0.58 (0.33–1.02)	0.060*
EQ-5D	2.49 (0.31–20.24)	0.395	1.40 (0.72–2.72)	0.320
Perception variables				
Quality of care	0.70 (0.56–0.88)	0.002***	0.85 (0.78–0.92)	0.000***
Benefit-premium ratio	0.93 (0.84–1.02)	0.132	1.16 (0.85–1.57)	0.342
Premium affordability	0.89 (0.47–1.70)	0.734	0.70 (0.54–0.90)	0.005***
Scheme leader trust	0.46 (0.26–0.83)	0.01***	0.76 (0.52–1.10)	0.149
Traditional healers	1.80 (1.10–2.96)	0.02***	1.17 (1.14–1.20)	0.000***

Notes: ***, ** and * denote 1%, 5% and 10% significance level (p-value), respectively.
Reference category: Currently insured.

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III

III

The role of risk preferences: voluntary health insurance in rural Tanzania

Alphoncina Kagaigai[1,2]* and Sverre Grepperud[1]

Abstract

Background Lower-middle-income countries (LMICs) have a common goal to achieve universal health coverage (UHC) through voluntary health insurance schemes. This is important to improve access to healthcare services and ensure financial protection for all by reducing out-of-pocket expenditures. This study aimed to examine the role of risk preferences on enrollment status (currently insured, previously insured, and never insured) into a Tanzanian voluntary health insurance scheme targeted at the informal sector.

Methods Data were collected from households in a random sample of 722 respondents. The risk preference measure was based on a hypothetical lottery game which applies the BJKS instrument. This instrument measures income risk where the respondents are to choose between a certain income and a lottery. Both multinomial and simple logistic regression models have been used to analyze the relationship between risk aversion and enrollment status.

Results On average, the respondents have a high degree of risk aversion, and the insured are more risk averse than the uninsured (previously insured and never insured). There is a weak tendency for the wealthiest, measured by household income or total household expenditure, to be somewhat more risk averse than the less wealthy. Logistic and multinomial logistic regressions show that risk aversion is strongly associated with enrollment status. A higher degree of risk aversion significantly increases the probability of being insured, relative to being previously insured, and relative to being never insured.

Conclusion Risk aversion matters in a decision to enroll into the iCHF scheme. Strengthening the benefit package for the scheme, might increase the enrollment rate and hence improve access to healthcare services for people in rural areas and those employed in the informal sector.

Keywords Risk preferences, Lottery choices, Health insurance, Medical expenditure risk

Background

Risk is an inherent part of decision making, especially so for members of the informal sector in developing economies. Accordingly, it becomes of interest to understand what particular role risk preferences might play. In this paper, we are concerned with assessing the risk preferences for a sample of Tanzanian households and how the distribution of such preferences relates to purchasing power (income and expenditures). Furthermore, we are concerned with the importance risk preferences might have for the decision to enroll or not to enroll into a voluntary health insurance scheme and whether, or not, the

*Correspondence:
Alphoncina Kagaigai
akagaigai@gmail.com
[1] Institute of Health and Society, Department of Health Management and Health Economics, University of Oslo, P.O. Box 0315, Oslo, Norway
[2] School of Public Health and Social, Sciences, Department of Development Studies, Muhimbili University of Health and Allied Sciences, P.O. Box 65001, Dar Es Salaam, Tanzania

inclusion of risk preferences has implications for other explanatory variables (covariates).

The economic literature on risk preferences is typically concerned with the following two research questions: (i) the determinants of risk preferences (attitudes) with a special focus on income and wealth, and (ii) how risk preferences impact decision-making and behavior (choices). In both cases, risk preferences must be estimated where one approach is field studies where environments in which people's real-world economic behavior is observed [1]. The second is the use of experiments and surveys (questionnaires) to elicit such preferences (non-market behavior). This last approach contains a series of techniques including those that apply lotteries. [2, 3] gives an oversight of various elicitation techniques.

The multiple price list (MPL) techniques, popularized by [4], asks respondents to choose between a sequence of pairwise lotteries (a menu of 10) where each choice is between a safe lottery (where high and low payouts are close) and a risky lottery (the payouts are further apart). For each pairwise lottery, the assigned probabilities are the same across the safe and the risky lottery, however, the probabilities are gradually changed over the lotteries so that the risky lottery becomes increasingly attractive relative to the safe lottery. The number of times the subject chooses the safe lottery in each pairwise lottery is often used as a measure of risk aversion. The MPL technique is widely used, see e.g. [5–9].

Another instrument being frequently used is the one suggested by [10] (the BJKS instrument). This instrument measures income risk and is used in representative samples from several countries. Here the respondents are to choose between a certain income and a lottery. Depending on the response to the initial question, the lottery is changed either upwards or downwards, and the respondents must again choose between a certain income and the revised lottery. Depending on the pair of answers, this instrument classifies the respondents into four different risk categories.

In this work, we apply the BJKS instrument to elicit risk preferences. We are concerned with the distribution of risk preferences and to what extent such preferences differ across enrollment groups and income. The above questions are addressed in connection with a Tanzanian voluntary non-profit insurance scheme—the Community-Based Health Insurance scheme (CBHI). Schemes similar to the CBHI are adopted by several developing countries, often as a response to recommendations given by WHO, but they run under different headings such as Community health insurance [11], Micro health insurance [12], Community health funds [13] and Mutual health organizations [14].

The CBHI scheme of Tanzania was first introduced at the district level in 1996 and the target group was the population living in rural areas and those employed in the informal sector. The scheme was reformed in 2011/2012 by implementing better management systems and by expanding the benefit package [12]. The revised scheme is known as the improved Community Health Fund (iCHF) and was first introduced as a pilot in 6 regions of Tanzania (Dodoma, Shinyanga, Morogoro, Arusha, Manyara and Kilimanjaro). The insurance scheme does primarily provide protection against basic outpatient services meaning that some of the costlier services (inpatient services and medication) are not included unless defined as being qualified for exemptions (pregnant women, elderly and children).

According to [3, 15], there is no consensus on whether risk preferences differ across income and wealth. For western samples, wealthier households (higher annual incomes) are found to display lower levels of risk aversion (examples are Denmark [5], USA [6], Germany [16] and Norway [17]). For developing economies, similar conclusions are arrived at by [18–21], while [7, 22, 23] reach the opposite conclusion. Other studies again, find no relationship between such attitudes and income [24–27].

There is now extensive literature on developing countries that use household survey data to identify associations with insurance enrollment status, however, to the best of our knowledge, this literature does not analyze the role that risk preferences might play. Several systematic reviews on enrollment status confirm this impression. [28] included 25 studies from low-income and middle-income countries published between 2003 and 2013, [29], reviewed 18 studies from sub-Saharan Africa and Asia, published between 2003 and 2013, while [30] reviewed 54 studies, published from 1990 to 2016, mainly from sub-Saharan Africa. The various studies included in the three reviews typically contain socio-demographic variables as independent variables while some, in addition, consider health-related and/or perception variables.

There are, however, studies that consider the role of risk preferences in relation to crop insurance and technology adoption in smallholder agriculture. [31], using survey data from Malawi, finds the adoption of hybrid maize to be lower for farmers who exhibit risk aversion. [32] examined the uptake of crop insurance amongst small scale farmers in India and find that wealthy households are more likely to take up such

insurance, while the uptake is lower among credit-constrained households. They also find risk averse households to be less likely to purchase such insurance if they are unfamiliar with insurance in general, or with the microfinance organization offering it. [23], in a study of Chinese farmers, finds that risk averse and loss averse farmers adopt new technologies later in time. [33], studying short-term labor allocation decisions among poor households in Uganda, find that risk preferences and risk perceptions impact household production decisions, particularly for the poorer farmers.

In this study, we extend two previous research papers that apply the same dataset as the one being analyzed here, by adding a variable that measures risk preferences. In the first paper [34], in the following denoted benchmark model 1, a logistic regression model is performed since the dependent variable was dichotomous (insured and uninsured) while the independent variables included socio-demographic variables and perception factors. In the second paper [35], in the following denoted benchmark model 2, multi-nominal logistic regression was performed since the dependent variable had three outcomes (currently insured, previously insured and never insured) while the independent variables now also included health-related variables.

We find, using the BJKS instrument, that our respondents on average are quite risk averse and the insured are more risk averse than the uninsured (never insured and drop-outs), and the previously insured are somewhat more risk averse than the never insured. Second, risk preferences are only weakly correlated with the purchasing power of households in the sense that households with higher incomes and higher total expenditures are somewhat more risk averse. Third, a higher degree of risk aversion, when controlling for a set of variables (socio-demographic, health-related and perceptions), significantly increases; (i) the probability of being insured relative to being uninsured, (ii) the probability of being insured relative to being previously insured, and (iii) the probability for being insured relative to being never insured. Fourth, the inclusion of risk- preferences did not have important effects on the magnitude and direction of other independent variables (covariates).

Methods
A cross-sectional study design was employed to conduct a household survey in Bahi and Chamwino districts of the Dodoma region in central Tanzania.

Study setting and sampling
The data for our study were collected through a survey conducted in 2019 for two districts (Bahi and Chamwino) in the Dodoma region of central Tanzania. Administratively, Dodoma is comprised of 7 districts and each district is divided into wards that are subdivided into villages. Bahi is organized into 4 divisions, 22 wards and 59 villages while Chamwino is divided into 5 divisions, 36 wards and 107 villages. The prime economic activity in both districts is agriculture and livestock keeping. According to the National Survey of 2012, Dodoma has a total population of about 2.3 million where 10% live in Bahi and 15% in Chamwino [36].

A multistage sampling technique was used. First, the two districts (Bahi and Chamwino), out of seven, were selected. Second, wards were randomly selected from each district (8 from Bahi and 10 from Chamwino). Thereafter two villages from each ward were selected based on health facility availability and location (16 from Bahi and 20 from Chamwino). We employed systematic random sampling techniques in the selection of households. This was done by starting from the office of the Executive Officer in each village and each interviewer walked in different directions (north, east, south, and west) and selected every third household. The total sample size was 722 households (303 for Bahi and 419 for Chamwino).

All respondents were interviewed face-to-face using a structured pretested questionnaire. The respondents were asked to provide information concerning socio-demographic characteristics, household monthly income and household expenditures. They were also asked about their enrollment status (currently insured, previously

Table 1 The BJKS – instrument (the version presented by Schroyen & Aarbu (2018)

Suppose that you are the only income earner in your household. Suppose also that reasons beyond your control force you to change occupation. You can choose between two alternatives. Job 1 guarantees you the same income as your current income. Job 2 gives you a 50% chance of income twice as high as your current income, but with a 50% chance it results in the reduction of your current income by one-third. What is your immediate reaction? Would you choose job 1 or job 2?

If the respondents select the safe alternative (job 1), she is presented with a new pair of alternatives, the only difference being that the downside risk of job 2 is one-fifth of the current income (20% reduction) instead of one-third (33% reduction). If, on the other hand, job 2 is selected, the follow-up question presents the respondent with a choice between the safe alternative and a risky job 2 where the downside risk increases from one-third (33 % reduction) to one-half (50 % reduction).

insured or never insured) and asked questions relating to the BJKS instrument. The response rate was 100%.

Variables

The risk preference variables

To measure risk preferences each respondent was presented with the questions presented in Table 1. Based on the combinations of answers, each respondent was assigned a value from 1 to 4 (categories) where a higher number refers to a higher degree of risk aversion. Category 4 (Strong) follows if the answer to the conditional sequence of questions (see Table 1) is "job 1" and thereafter "job 1", for category 3 (Medium) the answers are "job 1" and then "job 2", for category 2 (Moderate) the answers are "job 2" then "job 1", while for category 1 (Weak) the answers are "job 2" then "job 2". This categorical four-scale risk variable is in the following denoted RP4. For subsequent analyses, we also use a dichotomous version of RP4 to measure risk preferences. This variable is constructed by collapsing categories 3 and 4 into one category denoted High and categories 1 and 2 into one category denoted Low. The dichotomous risk preference variable is in the following denoted RP2.

Other independent variables.

Both benchmark models included the following socio-demographic variables; age (4 categories), gender, marital status, household size, and education (3 categories). Both also include household income but they were categorized differently across the two models. In benchmark model 1, income contained 5 categories while in benchmark model 2 income contained 3 categories. In addition, benchmark model 1, in contrast to benchmark model 2, includes religion and occupation as independent variables. As concerning the perception variables, benchmark model 1 consisted of seven variables that were extracted from 38 statements (questions) in the structured questionnaire after subjecting them to principal component analysis (PCA). The questions were formulated as statements and the respondents were asked to express their opinions by using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). In benchmark model 2, however, 5 of the 38 statements were selected as independent variables without undertaking any principal component analysis. The selection of statements was based on previous literature from Tanzania [38, 39] and was concerned with the quality of services, the insurance scheme benefit package, premium affordability, scheme leaders' trustworthiness, and attitudes about traditional healers. Finally, health-related variables were only part of benchmark model 2 and included the following three variables; (i) Chronic diseases (Whether the household had at least one member with a chronic disease or not?),

(ii) Fear of sickness (Do you fear the future occurrence of diseases or not?), and, (iii) self-reported health state (EQ-5D) measured by using the EQ-5D instrument which is a generic instrument that uses five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression), where each dimension is divided into three levels. The EQ-5D variable was generated as a continuous variable with values ranging from 1 (full health state) to 0 (worst possible health).

Data analysis

Data were collected using an Open Data Kit (ODK) application and were exported, cleaned, coded, and analyzed using STATA version 17. Data description was done and presented in terms of either frequencies and percentages with a chi square test, or means and standard deviations with a t-test statistic. Results from the logistic regression are presented in terms of odds ratios (OR) (see Table 2). Results from the multinomial logistic regressions are presented as relative risk ratios (RRR) where the currently insured acts as the reference category (base outcome) (see Tables 3 and 4).

Results

Descriptive statistics

Two Hundred Eighteen of the 722 households were insured (30.1%) while 504 were uninsured (69.9%). Of the uninsured, 395 had previously been insured (dropouts), while the remaining 109 had never been insured by the scheme in question (54.7% and 15.2%, respectively, of the total sample)**.** The average age of the respondents was 44.7 years, there were more females (57.9%), 3 out of 4 were married, the average household size was 5.4 members, the majority were farmers (74%) and 72% had primary education while 18% had no education.

The distribution of observable household characteristics across insured and uninsured are available in Table 5. The two enrollment groups did not differ with respect to education, marital status, household size and occupation, while they differed to some extent for gender and age (females and those belonging to the oldest age groups (+60 years) were more likely to be insured), and differed significantly for the two income variables (Income 5 and Income3) in the sense that those with the highest income were more likely to be insured.

By cross tabulating the socio-demographic characteristics across risk preference groups (RP2), we find that the risk preferences differ significantly with respect to the occupation ($p=0,013$), enrollment status ($p=0,014$) and health state (EQ-5D) ($p=0,059$) and to some extent with respect to mean income and household size (see Table 6). The other variables (age, gender, education and marital status) are not significant.

Table 2 Risk preferences as an enrollment-status determinant: Model 1. Logistic regressions (insured vs uninsured)[a]

Base outcome = Insured		Benchmark model 1 (Kagaigai et al., 2021) [34]		Model 1:RP4		Model 1:RP2	
		OR (95% CI)	P>z	OR (95% CI)	P>z	OR (95% CI)	P>z
Risk aversion							
RP4 (Weak = 1)	RP2 (Low =1)						
Moderate=2	*High = 2*	-	-	0.53 (0.19-1.45)	0.22	2.18 (1.38-3.46)	0.00***
Medium=3		-	-	1.22 (0.58-2.53)	0.60	-	-
Strong = 4		-	-	1.96 (1.17-3.28)	0.01***	-	-
Control variables							
Socio-demographic variables							
Age (60+ = 1)							
40-59		0.57 (0.33-0.97)	0.04**	0.52 (0.30-0.89)	0.02**	0.53 (0.30-0.91)	0.02**
26-39		0.46 (0.26-0.82)	0.01**	0.44 (0.24-0.78)	0.01**	0.44 (0.24-0.79)	0.01**
18-25		0.58 (0.24-1.44)	0.24	0.55 (0.22-1.36)	0.20	0.53 (0.21-1.33)	0.18
Income5 (1,000,000+ = 1)							
0 - 49,990		0.68 (0.14-3.43)	0.64	0.27 (0.06-1.21)	0.09*	0.26 (0.06-1.13)	0.07*
50,000 - 99,990		0.48 (0.12-2.00)	0.31	0.37 (0.08-1.65)	0.19	0.35 (0.08-1.53)	0.16
100,000 - 499,990		0.36 (0.08-1.52)	0.16	0.49 (0.11-2.13)	0.34	0.47 (0.11-2.01)	0.31
500,000 - 999,990		0.27 (0.06-1.14)	0.08*	0.72 (0.14-3.75)	0.70	0.69 (0.14-3.53)	0.66
Gender (female = 1)							
Male		0.75 (0.51-1.10)	0.15	0.75(0.51-1.11)	0.15	0.75 (0.51-1.10)	0.14
Education (Secondary + =1)							
Primary education		1.03 (0.55-1.91)	0.93	1.03 (0.55-1.93)	0.93	1.01 (0.54-1.89)	0.97
No formal education		1.27 (0.59-2.70)	0.54	1.22 (0.57-2.62)	0.62	1.21 (0.56-2.59)	0.63
Household size (>10 = 1)							
7-9		0.76 (0.30-1.93)	0.56	0.81(0.32-2.03)	0.65	0.81 (0.32-2.03)	0.65
4-6		0.74 (0.30-1.81)	0.51	0.84 (0.34-2.05)	0.70	0.84 (0.35-2.05)	0.71
≤3		0.68 (0.26-1.74)	0.42	0.75 (0.29-1.91)	0.55	0.75 (0.29-1.90)	0.54
Marital status (unmarried = 1)							
Married		1.17 (0.76-1.80)	0.49	1.17 (0.75-1.82)	0.49	1.18 (0.76-1.83)	0.46
Occupation (non-farmers = 1)							
Farmers		0.95 (0.63-1.44)	0.82	1.20 (0.35-4.10)	0.77	1.25 (0.37-4.25)	0.73
Religion (Muslim = 1)							
Christian		1.12 (0.68-1.86)	0.66	1.13 (0.68-1.88)	0.63	1.13 (0.68-1.87)	0.65
Perception factors							
Quality P1		1.28 (1.10-1.49)	0.00***	1.32 (1.13-1.54)	0.00***	1.31 (1.12-1.53)	0.00***
Preferences P2		0.61 (0.52-0.72)	0.00***	0.60 (0.50-0.71)	0.00***	0.60 (0.51-0.71)	0.00***
Convenience P3		1.40 (1.17-1.68)	0.00***	1.44 (1.21-1.73)	0.00***	1.44 (1.20-1.72)	0.00***
Understanding P4		0.83 (0.72-0.96)	0.01**	0.81 (0.70-0.94)	0.01**	0.82 (0.71-0.94)	0.01**
Recommendation P5		0.83 (0.73-0.93)	0.00***	0.81 (0.72-0.92)	0.00***	0.81 (0.72-0.92)	0.00***
Knowledge P6		1.39 (1.19-1.62)	0.00***	1.38 (1.19-1.61)	0.00***	1.37 (1.18-1.60)	0.00***
Awareness P7		1.08 (0.93-1.24)	0.32	1.06 (0.92-1.23)	0.39	1.06 (0.92-1.22)	0.44

[a] ***, ** and * denote significance levels (*p*-value) at 1%, 5% and 10% respectively

As concerning enrollment status, more than 70% of the respondents in each enrollment group belong to the high risk preference group and the currently insured were significantly more risk averse (85.3%) than the never insured (72,5%) and the previously insured (77.7%). In Appendix A, we also present the distribution of risk preferences across enrollment groups when risk preferences are categorized into 4 groups (RP4). Again the currently insured are on average more risk averse than the previously insured and the never insured,

Table 3 Risk preferences as an enrollment-status determinant: Model 2. Multinomial logistic regressions (never insured vs. currently insured) [a]

Variables		Benchmark model 2 (Kagaigai et al., 2023) [35]		Model 2.RP4		Model 2.RP2	
		RRR (95%CI)	P > z	RRR (95%CI)	P > z	RRR (95%CI)	P > z
Base outcome (currently insured)							
Risk aversion							
RP4 (Strong = 1)	RP2 (High = 1)						
Medium = 2	*Low = 2*			0.99 (0.48–2.03)	0.990	3.03 (0,79–11.57)	0.098*
Moderate = 3				3.74 (1.52–9.22)	0.004***		
Weak = 4				2.88 (0.89–9.27)	0.077*		
Control variables							
Socio-demographic variables							
Age (40–59 years = 1)							
18–25		2.33 (1.49–3.65)	0.000***	2.47 (2.04–2.99)	0.000***	2.49 (1.87–3.31)	0.000***
26–39		1.64 (0.50–5.40)	0.418	1.57 (0.51–4.88)	0.433	1.55 (0.49–4.84)	0.448
60+		0.82 (0.56–1.21)	0.323	0.74 (0.54–1.01)	0.056*	0.75 (0.54–1,04)	0.085*
Income3 (Low = 1)							
Medium		0.77 (0.22–2.67)	*0.684*	0.85 (0.31–2.31)	0.753	0.84 (0.32–2.20)	0.727
High		0.57 (0.11–2.85)	0.495	0.72 (0.19–2.63)	0.621	0.72 (0.19–2.59)	0.613
Gender (Male = 1)							
Female		0.52 (0.30–0.89)	0.018**	0.51 (0.30–0.85)	0.009**	0.51 (0.31–0.85)	0.010**
Education (no formal edu = 1)							
Primary education		0.84 (0.84–0.85)	0.000***	0.82 (0.81–0.84)	0.000***	0.82 (0.77–0.88)	0.000***
Secondary educ. +		0.72 (0.68–0.77)	0.000***	0.69 (0.55–0.86)	0.001***	0.68 (0.54–0.86)	0.001***
Household size (1–3 = 1)							
4–6		1.02 (0.67–1.56)	0.926	0.96 (0.63–1.46)	0.862	0.96 (0.67–1.39)	0.846
7–9		0.85 (0.43–1.65)	0.622	0.86 (0.41–1.79)	0.682	0.86 (0.45–1.62)	0.632
10+		0.74 (0.47–1.16)	0.184	0.87 (0.47–1.62)	0.654	0.71 (0.41–1.85)	0.708
Marital status (unmarried = 1)							
Married		0.75 (0.49–1.14)	*0.178*	0.73 (0.47–1.12)	0.156	0.73 (0.47–1.15)	0.173
Health-related variables							
EQ-5D		2.62 (0.23–0.45)	0.441	2.34 (0.17–33.12)	0.529	2.34 (0.18–30.78)	0.517
Fear of sickness (No = 1)							
Yes		1.43 (0.41–4.96)	0.572	1.41 (0.44–4.47)	0.560	1.42 (0.45–4.52)	0.551
Chronic diseases (No = 1)							
Yes		0.81 (0.69–0.95)	0.010***	0.82 (0.80–0.85)	0.000***	0.82 (0.77–0.87)	0.000***
Perception variables							
Quality of care		0.68 (0.53–0.87)	0.003***	0.64 (0.47–0.88)	0.007***	0.64 (0.46–0.89)	0.009***
Benefit-premium ratio		0.93 (0.85–1.01)	0.065*	0.93 (0.86–1.01)	0.066*	0.93 (0.87–0.99)	0.039**
Premium affordability		0.89 (0.43–1.86)	0.766	0.89 (0.43–1.85)	0.765	0.89 (0.43–1.85)	0.766
Scheme leader trust		0.47 (0.24–0.88)	0.020**	0.46 (0.27–0.79)	0.005***	0.46 (0.27–0.78)	0.004***
Traditional healers		1.84 (1.19–2.84)	0.006***	1.96 (1.37–2.79)	0.000***	1.95 (1.39–2.73)	0.000***

[a] ***, ** and * denote significance level (*p*-value) at 1%, 5% and 10% respectively

however, now the two uninsured groups do not differ much and the differences are insignificant (*p* = 0.112), possibly being the result of a limited number of observations for one of the risk categories (Moderate).

From Table 6, we also observe that a higher mean household income, to some extent, is associated with higher risk aversion, however, this might be the result of income being correlated with other variables for example occupation and education. In Appendix B, we present the distribution of risk preference, measured by RP4 and RP2, by income3. It follows that more risk aversion, measured by RP4, is associated with higher

Table 4 Risk preferences as an enrollment-status determinant: Model 2. Multi-nominal regressions (previously insured vs. currently insured)[a]

Variables		Benchmark model 2 (Kagaigai et al., 2023) [35]		Model 2:RP4		Model 2:RP2	
		RRR (95%CI)	P > z	RRR (95%CI)	P > z	RRR (95%CI)	P > z
Base outcome (currently insured)							
Risk aversion							
RP4 (Strong = 1)	RP2 (High = 1)						
Medium = 2	*Low = 2*			1.27 (0.86–1.85)	0.223	1.89 (1.38–2.61)	0.000***
Moderate = 3				2.76 (1.20–6.33)	0.017**		
Weak = 4				1.72 (0.99–2.97)	0.053*		
CONTROL VARIABLES							
Socio-demographic variables							
Age (40–59 years = 1)							
18–25		0.58 (0.21–1.59)	0.289	0.58 (0.23–1.46)	0.246	0.60 (0.22–1.65)	0.321
26–39		1.07 (0.52–2.22)	0.852	1.07 (0.49–2.29)	0.863	1.06 (0.52–2.14)	0.879
60+		0.66 (0.39–1.10)	0.112	0.62 (0.43–0.89)	0.011**	0.63 (0.41–0.97)	0.036**
Income3 (Low = 1)							
Medium		0.64 (0.60–0.69)	*0.000***	0.73 (0.69–0.77)	0.000***	0.72 (0.71–0.72)	0.000***
High		0.38 (0.15–0.93)	0.033**	0.51(0.41–0.65)	0.000***	0.51 (0.41–0.63)	0.000***
Gender (Male = 1)							
Female		0.93 (0.48–1.82)	0.838	0.91 (0.45–1.84)	0.791	0.91 (0.46–1.82)	0.797
Education (no formal education = 1)							
Primary education		1.10 (1.08–1.12)	0.000***	1.06 (1.05–1.08)	0.000***	1.07 (1.05–1.09)	0.000***
Secondary educ. +		0.82 (0.67–1.01)	0.056*	0.81 (0.58–1.13)	0.223	0.79 (0.59–1.08)	0.149
Household size (1–3 = 1)							
4–6		0.97 (0.64–1.46)	0.885	0.95 (0.64–1.39)	0.768	0.95 (0.65–1.39)	0.8
7–9		0.99 (0.36–2.79)	0.998	1.03 (0.36–2.88)	0.968	1.03 (0.38–2.77)	0.96
10+		0.99 (0.40–2.50)	0.994	1.12 (0.43–2.85)	0.831	1.09 (0.49–2.42)	0.824
Marital status (unmarried = 1)							
Married		0.90 (0.51–1.59)	*0.723*	0.91 (0.49–1.67)	0.749	0.89 (0.50–1.60)	0.716
Health-related variables							
EQ-5D		1.43 (0.47–4.31)	0.53	1.44 (0.55–3.79)	0.462	1.42 (0.53–3.81)	0.49
Fear of sickness (No = 1)							
Yes		1.08 (0.90–1.29)	0.421	1.07 (0.79–1.44)	0.681	1.09 (0.82–1.45)	0.548
Chronic diseases (No = 1)							
Yes		0.58 (0.34–0.99)	0.045**	0.58 (0.33–0.97)	0.047**	0.58 (0.33–1.02)	0.057*
Perception variables							
Quality of care		0.86 (0.81–0.91)	0.000***	0.83 (0.76–0.91)	0.000***	0.83 (0.75–0.92)	0.000***
Benefit-premium ratio		1.16 (0.85–1.60)	0.345	1.16 (0.86–1.57)	0.328	1.17 (0.85–1.61)	0.342
Premium affordability		0.69 (0.51–0.95)	0.021**	0.69 (0.50–0.96)	0.029**	0.69 (0.51–0.96)	0.026**
Scheme leader trust		0.76 (0.55–1.06)	0.094*	0.76 (0.59–0.97)	0.03**	0.75 (0.57–0.98)	0.040**
Traditional healers		1.20 (1.18–1.23)	0.000***	1.25 (1.24–1.27)	0.000***	1.25 (1.16–1.34)	0.000***

[a] ***, ** and * denote significance level (*p*-value) at 1%, 5% and 10% respectively

household income in a significant way (*p* = 0.04). The same pattern matters for RP2, however, now the associations are insignificant (*p* = 0.25).

An alternative to household income as a measure of purchasing power (living standard) is household expenditures [40]. In appendix C, we present the distribution of risk preference across total household expenditure (socioeconomic status). Both for RP4 and RP2, there is a weak tendency for the households in the highest quintile (highest socioeconomic status) to be somewhat

Table 5 Socio-demographic characteristics by enrollment status ($n = 722$). Frequencies (%)

Sample characteristics	Insured	Uninsured	Total sample	*P > Z*
Age (years)				
18–25	13 (5.9)	29 (5.8)	42 (5.8)	
26–39	63 (28.9)	176 (34.9)	239 (33.1)	0.147
40–59	103 (47.2)	238 (47.2)	341 (47.2)	
60+	39 (17.9)	61 (12.1)	100 (13.9)	
Gender				
Female	134 (61.5)	284 (56.4)	418 (57.9)	0.201
Male	84 (38.5)	220 (43.7)	304 (42.1)	
Education				
No education	36 (16.5)	91(18.1)	127 (17.6)	
Primary	154 (70.6)	366 (72.6)	520 (72.0)	0.350
Secondary and higher	28 (12.8)	47 (9.3)	75 (10.4)	
Marital status				
Unmarried	55 (25.2)	143 (28.4)	198 (27.4)	0.385
Married	163 (74.8)	361 (71.6)	524 (72.6)	
Household size				
≤ 3	40 (18.4)	101 (20.0)	141 (19.5)	
4–6	112 (51.4)	261 (51.8)	373 (51.7)	0.918
7–9	56 (25.7)	122 (24.2)	178 (24.7)	
≥ 10	10 (4.6)	20 (4.0)	30 (4.2)	
Occupation				
Non-farmer	53 (24.3)	120 (23.8)	173 (23.9)	0.885
Farmer	165 (75.7)	384 (76.2)	549 (76.0)	
Income5 (5 categories))				
0—49,999	66 (30.3)	205 (40.6)	271 (37.5)	
50,000—99,999	59 (27.1)	132 (26.2)	191 (26.5)	
100,000—499,999	76 (34.9)	144 (28.6)	220 (30.5)	0.037 **
500,000—999,999	12 (5.5)	19 (3.8)	31 (4.3)	
1.000,000+	5 (2.3)	4 (0.8)	9 (1.3)	
Income3 (3 categories)				
Low	66 (30.3)	205 (40.7)	271 (37.5)	0.013 ***
Medium	135 (61.9)	276 (54.8)	411 (59.9)	
High	17 (7.8)	23 (4.6)	40 (5.5)	
Total	218 (30.2)	504 (69.8)	722 (100)	

Table 6 Socio-demographic characteristics by risk preferences (RP2) (mean and percentage shares)

Sample characteristics	Low RP	High RP	Total sample	Pr (|T| >|t|) =
	Mean	Mean	Mean	
Income	107,480	128,785	124,359	0.218
Age (years)	44.8	44.63	44.67	0.894
Household size	5.2	5.44	5.39	0.241
EQ-5D	0.79	0.76	0.76	0.059 *
	Low RP n (%)	**High RP n (%)**	**Total sample n**	*P > z*
Enrollment status				
Never insured	30 (27.5)	79 (72.5)	109	0.014 ***
Currently insured	32 (14.7)	186 (85.3)	218	
Previously insured	88 (22.3)	307 (77.7)	395	
Gender				
Female	90 (21.5)	328 (78.5)	418	0.557
Male	60 (19.7)	244 (80.3)	304	
Education				
No education	27 (21.3)	100 (78.7)	127	
Primary education	105 (20.2)	415 (79.8)	520	0.741
Secondary and higher	18 (24.0)	57 (76.0)	75	
Marital status				
Unmarried	41 (20.7)	157 (79.3)	198	0.978
Married	109 (20.8)	415 (79.2)	524	
Occupation				
Non-farmer	27 (14.4)	160 (85.6)		0.013 ***
Farmer	123 (22.9)	412 (77.0)		
Total	150 (20.8)	572 (79.2)	722 (100)	

Table 7 Comparisons across countries (shares): The BJKS instrument

	Weak	Moderate	Medium	Strong
Our sample (Tanzania) ($n = 720$)	14.1	6.7	10.8	68.4
Norway ($n = 1,554$)	13.3	8.6	41.3	36.8
USA ($n = 3,591$)	11.7	9.6	15.3	63.4
Chile ($n = 11,475$)	4.7	4.1	9.3	81.8

Sample size (*n*). The data sources for the different countries are; Norway (Schroyen & Aarbu, 2018) [37], the USA (Kimball et al., 2008) [41] and Chile (Martinez & Sahm, 2009) [42]

more risk averse as compared to households in the lowest quintile (lowest socioeconomic status), however, the overall associations are strongly insignificant ($p = 0.87$ for RP4 and $p = 0.57$ for RP2).

In Table 7 we present the distribution of answers to the BJKS lottery questions together with results from three national surveys (Norway, USA, and Chile) all using the BJKS instrument. Such a comparison enables us to say something about the relative significance of risk-averse preferences for our sample relative to the national samples. The surveys were collected in 2002 for the USA ($n = 3,591$) and Chile (n=11,475) and in 2006 for Norway ($n = 1,554$) (for

further details on the three surveys, see [37]). From Table 7 we observe that the distribution is skewed since 2 out of 3 households belong to category 4 (Strong). The same pattern is present for the other three countries although being less pronounced for Norway. Our sample is on average less risk averse than Chileans but more risk averse than Norwegians. When aggregating Weak and Moderate into the category

Low and Medium and Strong into the category High, the distributions become as follows; Norway (22.9% vs. 78.1%), the USA (20.6% vs. 79.4%), our sample (20.8% and 79.2%) and Chile (8.8% vs. 91.2%). Hence, the shares for category High are almost the same for Norway, the USA, and our sample (almost 80%), and of these, 81% (the USA) and 84% (our sample) belong to the category Strong while this share for Norway is only 47%. The above discussion suggests that out of the three countries, the distribution of risk preferences for our sample is closest to the one of the USA.

Regression results

The results from performing the logistic regression analysis are presented in Table 2 while the results from performing the multivariate analysis are presented in Tables 3 and 4. The results presented in the first column of all three tables are models that do not include the stated risk aversion measure as an independent variable (the benchmark models) while the next two columns present the results when adding each of the two risk aversion measures (RP4 and RP2).

For benchmark model 1 (see Table 2), we observe that six of the seven perception variables (P1 to P6) and two age groups are significant (5%). For Model 1:RP4 (adding RP4), we observe that the only significant risk preference group is Strong. In this case, the odds of being insured (relative to uninsured), when moving from Weak to Strong, is almost as twice as high (OR=1.96, $p = 0.01$). The odds ratios, when moving from Weak to Moderate and from Weak to Medium, are both insignificant and pull in opposite directions (0.53 vs. 1.22). For the dichotomous risk preference variable (Model 1:RP2), the odds ratio for a higher degree of risk aversion is strong and significant (OR $= 2.18$, $p = 0.00$). In this case, belonging to High, relative to Low, implies that the odds of being insured (relative to uninsured), are more than twice as high.

We also observe from the odds ratios and the significance levels of the control variables, in both models, maybe except for income, that they remain stable in response to the introduction of risk preferences. Furthermore, to investigate the role of the control variables, we also conducted bivariate logistic regressions by regressing RP2 on enrollment status. The odds ratio remained significant, but the magnitude became somewhat lower relative to Model 1:RP2 (OR $= 1.78$ and $p = 0.008$) (see Appendix D).

The next two tables (multi-nominal regression) present the results for the never insured (Table 3) and the previously insured (Table 4), relative to the currently insured. For the benchmark model that concerns the never insured (see Table 3), the significant variables are chronic diseases, one age group (18-25 yrs.), gender, both educational groups, and, four, out of, the five perception variables. As concerning the effects of risk aversion

(Model 2:RP4), we find that having a Moderate degree of risk aversion or a Weak degree of risk aversion, compared to a Strong degree of risk aversion, increases significantly the probability of being never insured relative to being currently insured (*RRR= 3.74, p=0.004 and RRR=2.88, p=0.077,* respectively). For the dichotomous risk preference variable (Model 2:RP2), the relative risk ratio (RRR) is significant and of a quite high magnitude (RRR=3.03, p=0.098), saying that a low degree of risk aversion, relative to having a high degree of risk aversion, increases the probability of being never insured relative to being currently insured. Both for Model 2:RP4 and Model 2:RP2, the introduction of risk preferences does not change the relative risk ratios and the significance levels of the control variables relative to benchmark model 2, with the exception of one of the age groups (60+ yrs.) that becomes significant at 1% level for both models.

For the benchmark model that concerns the previously insured (see Table 4), the identity of the significant variables differs somewhat from the findings of Table 3. Chronic disease and both educational groups remain significant while age and gender become insignificant. In addition, both income categories are significant. The relative risk ratios (RRR) for the two risk variables pull in favor of being previously insured for a lower degree of risk aversion (Strong to Moderate and Strong to Weak for Model 2:RP4 and from High to Low for Model 2:RP2). However, the magnitude of such effects is somewhat weaker relative to the same effects presented for the never insured in Table 3. Also for the previously insured, the introduction of risk preferences typically does not change the relative risk ratios and the significance levels of the control variables for both models (Model 2:RP4 and Model 2:RP2), relative to the benchmark model. The only exception matters for one of the age groups (60+ yrs.) in Model 2:RP2 (becomes significant at 5% level) and for one of the education groups (secondary education+) in both models (becomes insignificant).

Finally, we conducted bivariate multinomial logistic regressions by regressing RP2 on enrollment status (see Appendix D). The relative risk ratios both for the never insured (RRR=2.21, p=0.11) and the previously insured (RRR=1.67, p=0.002) became somewhat weaker relative to the relative risk ratios presented in Table 3 (RRR=3.03, p= 0,098) and Table 4 (RRR=1.89, p=0.00).

Discussion

Based on the BJKS instrument, our respondents on average envisage a relatively high degree of risk aversion. This finding is consistent with [3], surveying 300 smallholder farmers in Vietnam for eight different elicitation methods. Similar conclusions are reached by [7] who

surveyed farmers in southern Vietnam. However, other studies reach different conclusions. A recent study by [21], taking place in the same region as the study by [7] performs a broad set of experimental measures of risk preferences. [21] found that the farmers were on average risk neutral and more risk tolerant than typical Western sample populations. The Vietnamese farmers were significantly less risk averse than American students and slightly more risk averse than Vietnamese students. Our sample is on average more risk averse than adult Norwegians and less risk averse than adult Chileans, while it does not differ much from the adult population of the USA. This last finding is somewhat surprising given that 75% of our sample is farmers – an occupation exposed to livestock and crop risks. On the other hand, in the USA, lower income people are living with a large background risk and the social network they can rely on for support may not be as good as in some developing countries.

Our results must also be evaluated in view of the elicitation methodology applied. We know that risk preference measurements vary across elicitation methodologies. [8] used a wide range of elicitation methods (eight) and found when examining consistency across methods, that the various measures were significantly correlated but weak. Furthermore, our lottery is a hypothetical one which implies that our results are stated rather than revealed. This means that, if using actual payments (payoffs), our measurement of risk preferences could have changed. [4] shows that the difference between an individual's response to questions with and without payoffs increases with the size of payoffs.

Furthermore, the elicitation method might be unable to reflect the true risk preferences for other reasons as well. The majority of our respondents are farmers typically exposed to income risk (crop risk) and some of our respondents have low education or are without any formal education. Such factors imply that the respondents might be unfamiliar with the type of question raised by the BJKS instrument. On the other hand, we know that the BJKS instrument correlates well with different kinds of risk behaviors and hypothetical lotteries are necessary when considering large risks [37], as will be the case when considering health-related risks (quality of life, income and treatment expenditures).

Our analysis shows that the degree of risk aversion increases, to some extent, with a higher income for all three enrollment groups. Furthermore, higher risk aversion, measured by RP4, is significantly associated with higher income. This conclusion appears to be in line with other studies, for example [24–27] arrive identify weak positive (or absent) correlations between risk aversion and income. In contrast, [21] found strong negative correlations between risk aversion and income amongst Vietnamese farmers but no correlations with wealth**.** From theory, under certain assumptions, absolute risk aversion is decreasing and convex in wealth (see e.g. [43]).

There is also literature that discusses to what degree risk attitudes capture more than intrinsic preferences such as experiences, economic circumstances, and the environment. [33] is concerned with the ability and capacity to deal with shocks when markets are incomplete and uses wealth as a proxy for a household's ability to deal with risks since wealthier households have better access to credit markets. In addition to credit markets, income shocks can be traded across time via transfers from family and friends, from having access to social networks and from adjusting the stock of assets. According to [33], the ability and capacity to deal with risks might induce lower risk aversion. [43] are concerned with sources of uncertainty that characterize the environment in terms of background risk. They find that higher background risks (income risk and liquidity constrained) induce a higher degree of absolute risk aversion. [37] the study, to what extent, welfare state generosity (protection against unemployment, sickness and medical expenditures) will reduce background risks and find that more extensive welfare states induce a higher average risk tolerance.

The above literature suggests that survey questions on risk preferences measures might capture individual preferences (tastes) as well as the ability and capacity to deal with risks and that risk preferences are endogenous in the sense that lower background risk (e.g. higher income and the existence of insurance markets) leads to lower risk aversion. For Tanzania, crop insurance might represent a device for coping with risk, however, such insurance is not very common and is most relevant for maize producers that typically are not located in the study area of our survey [44–47]. However, there are other mechanisms that potentially might impact the risk preferences of our sample. Examples are savings, the building-up of various assets (jewellery, land and livestock) and informal risk-management institutions that utilize social networks and kinship. Furthermore, choosing to be insured is a risk-coping strategy and such a choice might also impact risk preferences. If this is the case, a potential problem of reverse causation is introduced in our study. However, given such a mechanism, our odds-ratio estimates would be underestimated. [33], in her study on poor households in Uganda, simultaneously consider the effects of risk preferences and risk perceptions on agricultural production decisions. Our study on health insurance decisions has similarities since including three health-related variables (chronic disease, fear of future disease and EQ-5D health state). The three variables are self-reported and might represent subjective risk perceptions. Two of the

three health related variables are insignificant while the chronic disease variable is significant in our analyses. However, omitting these variables introduces only minor changes in the relative risk ratios for the risk preference variables.

Our analysis confirms that the degree of risk aversion is higher for the insured relative to the uninsured and somewhat higher for the previously insured relative to the never insured. Furthermore, risk preferences are associated with the enrollment decision in the sense that moving from Strong to the next two categories (Moderate and Weak) has a significant effect while moving from Strong to Medium has insignificant effects (Model 1 and Model 2). These findings suggest that the difference in risk preferences, measured by BJKS, must be sufficiently high to be associated with the enrollment decision.

The literature on insurance and enrollment in LMICs is extensive and includes different designs and settings. Two systematic reviews [29, 30] are undertaken that include studies primarily from sub-Saharan Africa and Asia and where the outcome variable is binary (insured or uninsured). None of the reviewed studies (18 in [29] and 42 in [30]) include risk-preferences. [29] finds that higher income and positive perceptions towards health care quality and scheme leaders promote enrollment while [30] finds that enrollment increases with variables such as higher income, higher education and higher age. These conclusions correspond fairly well to our findings concerning the perception factors (quality and thrust) and age while the roles of income and education are partly different. For the logistic regression (Table 2), education is insignificant while higher income is significant only when moving from the poorest to the richest quintile. For the multi-nominal regressions (Tables 3 and 4), however, higher education promotes insurance, both for never insured and previously insured while higher income only matters for the previously insured.

Our analyses identify insured and high-income earners as on average being more risk averse than the uninsured and low- and middle-income earners. However, the share of respondents belonging to the highest risk-averse category (Strong) is high in all income groups and all enrollment groups. For example, among the poorest, 63.1% are strongly risk averse while among the never insured, 63.3% are strongly risk averse. Hence, we are in a situation with seemingly strong risk preferences combined with a low enrollment rate (about 30%). There are several possible explanations for such a finding. First, the BJKS instrument might be unable to differentiate between respondents belonging to the highest risk aversion group, meaning that only a share of the respondents in this group possesses preferences significant enough

to trigger enrollment. Second, the voluntary insurance scheme in question yields only partial coverage since providing protection primarily against outpatient treatment costs while some of the expensive services (inpatient services and medication) are not part of the benefit package unless being qualified for exemptions (elderly and children). Hence, the insured households are still confronted with significant risks. Third, despite a low enrollment rate (30%), the previously insured represent almost 54% of the total sample and together with the currently insured they amount to about 85% of the sample. Given this, one possible explanation might be that significant risk-averse preference promotes enrollment but other factors, such as adverse scheme experiences, induce households to withdraw from the scheme over time.

Our analysis is clearly of importance since shedding light on the significance of risk preferences in connection with enrollment decisions in LMICs, however, this knowledge is difficult to transform into actual policies since risk preferences do not appear as a policy variable. However, in view of the significant risk preferences identified, a reduction in treatment-cost risks (an extension of the benefit package) might increase the net benefit from insurance, in this way promoting enrollment. It is not straightforward to compare the magnitude of the various estimated coefficients (odds ratios and relative risk ratios) in our analysis since the independent variables are measured differently and since some variables are categorical while others are not. However, besides risk-preferences, the perception variables appear as being important suggesting that policies that address quality of care, benefit-premium ratios, scheme leader trust and knowledge (traditional healers) might promote enrollment. In addition, income is relevant for being previously insured, relative to being insured, while income is not relevant for being never insured, relative to being insured. Our analysis might be relevant also in other aspects since our results remain surprisingly stable in response to the introduction of risk preferences. This finding suggests that the inclusion of risk preferences does not impact the relationships between the decision to enroll and other independent variables (control variables). As a consequence, former cross-sectional studies using household surveys from LMICs, that do not include risk preferences, might remain relevant.

Conclusion
To the best of our knowledge, this paper is the first to study possible associations between risk aversion and enrollment into voluntary health-insurance schemes in LMICs using the BJKS elicitation method. It is also the first household survey in Tanzania that used the BJKS instrument to elicit people's preferences. We identify strong associations

between enrollment status and the degree of stated risk aversion among rural households in a region of Tanzania, in the sense that higher risk aversion increases the odds of being insured and reduces the odds of being uninsured (never insured or previously insured). A possible explanation for our findings is that individuals sort themselves in such a way that the more risk averse are enrolled into the scheme. A less likely explanation is that being insured increases the degree of risk aversion. Based on the literature on background risks, one would rather expect that lower health risks (treatment expenditures) would reduce the degree of risk aversion. Interesting topics for future research would be to assess the impact of being insured (lower health risks) on risk preferences and consider to what extent such changes impact other decisions that involve risks (spill-over effects) for example in terms of risky production choices (the adoption of new technologies).

Our findings confirm the presence of relatively strong risk-averse preferences when using the BJKS instrument to elicit such preferences. This finding is not necessarily surprising given the background risks typically present in developing economies. It is maybe more surprising that our sample, where the majority are smallholders from rural areas, is comparable to the sample from the USA when it comes to risk preferences. This raises the question as to whether the methods used to elicit risk preferences are valid for populations both in developed and developing economies and to what extent stated preferences are comparable across cultures and countries.

Appendix A: Risk preferences and enrollment status
Table 8

Table 8 Risk preferences (RP4) by enrollment status (shares): Bivariate analysis

	Insured	Uninsured		Total	*p*-value
		Never insured	Previously insured		
Risk preferences (RP4)					
Weak	11.5	18.4	14.1	14.1	0.112
Moderate	3.2	9.2	7.9	6.7	
Medium	11.0	9.2	11.1	10.8	
Strong	74.3	63.3	66.6	68.4	

Appendix B: Risk preferences and household income
Table 9

Table 9 Risk preference groups (RP4 and RP2) by household income (shares). Bivariate analysis

	Income3				*p*-value
	Lower	Middle	High		
Risk preferences (RP4)					
Weak	14.8	13.4	17.5	14.1	
Moderate	9.2	5.6	0.0	6.7	0.04
Medium	12.9	10.2	2.5	10.8	
Strong	63.1	70.8	80.0	68.4	
Risk preferences (RP2)					
Low	24.0	19.0	17.5	20.8	0.25
High	76.0	81.0	82.5	79.2	

Appendix C: Risk preferences and household expenditures (socioeconomic status)
To construct the socioeconomic status (SES)variable, we used total household expenditures that were collected by askingrespondents to state how they have spent on expenditures healthcare, food, andnon-food items in the previous four weeks. The total household expenses werethen divided into quintiles (20%) ranked from poorest to wealthiest(socioeconomic status). Expenditures are by some scholars preferred over incomebecause peoplein the informal sector often have multiple income sources (a risk ofmeasurement error). Furthermore, survey questions on household expenditures areless sensitive than questions on household income [48–50]. Table C1 shows the distribution of riskaversion across socioeconomic status. We observe that there are not any significantdifferences across risk categories across socioeconomic status. For RP4,however, there is a weak tendency for the two wealthiest socioeconomic groupsto be somewhat more risk averse than the three least wealthy socioeconomicgroups. The same tendency is prevalent when considering the dichotomous riskpreference variable (RP2)

Table 10

Table 10 Percentage distribution of risk preferences (RP4 and RP2) by socioeconomic status (total household expenditures)

| | Socioeconomic status (wealth quintiles) | | | | | | |
	Poorest	Poor	Average	Wealthy	Wealthiest	Total	*p*-value
Risk Preferences (RP4)							
Weak	15.2	13.2	15.2	13.2	13.9	14.1	
Moderate	9.7	6.3	7.6	4.9	4.9	6.7	
Medium	11.0	12.5	11.0	11.8	7.6	10.8	0.87
Strong	64.1	68.1	66.2	70.1	73.6	68.4	
Risk preferences (RP2)							
Low	24.8	19.4	22.8	18.1	18.8	20.8	0.57
High	75.2	80.6	77.2	81.3	81.3	79.2	

Appendix D: Bivariate regressions

Table 11

Table 11 Bivariate logistic regression for risk preferences (RP2) on enrollment status (insured vs. uninsured)

Enrollment status	OR(95%CI)	P>z
Risk preferences (RP2)		
Low	1	
High	1.78 (1.16-2.73)	0.008***

note: ***, ** and * denote significance level (*p*-value) at 1%, 5% and 10% respectively

Table 12

Table 12 Bivariate multinomial logistic regression for risk preferences (RP2) on enrollment status (currently insured, previously insured and never insured)

Enrollment status	RRR (95% CI)	P>z
Base outcome = currently insured	0	
Never insured		
Risk preferences (RP2)		
High	1	
Low	2.21 (0.83-5.89)	0.114
Previously insured		
Risk preferences (RP2)		
High	1	
Low	1.67 (1.20-2.31)	0.002***

Note: ***, ** and * denote significance level (*p*-value) at 1%, 5% and 10% respectively

Abbreviations
LMICs   Lower-middle income countries
UHC   Universal health coverage
BJKS instrument   Barsky, juster, kimball, and shapiro
CHF   Community health fund
iCHF   Improved community health fund
CBHIs-Community   Based health insurance schemes
MPL   The multiple price list
WHO   World Health Organization
RP (RP1, RP2, RP3, RP4)   Risk preference variables
H-5   Reported- health state
ODK   Open Data Kit
USA   United states of America
OR   Odds ratio
RRR   Relative risk ratio

Availability of data and materials
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
Ethical clearance was obtained from the National Institute of Medical Research in Tanzania (NIMR)- (Ref.No.NIMR/HQ/R.8a/Vol.IX/3077) and Title Page Click here to access/download;Title Page;Title page HER.docx from Norwegian Centre for Research Data (NSD) in Norway- (Ref. No. 807876). All the respondents were given a consent form in Swahili explaining the right to voluntary participation in the study and were asked to sign it before the start of the interview. The researcher provided background information and the reasons for conducting the study and ensuring the confidentiality of the information provided.

Consent for publication
Written informed consent for publication was obtained from the study participants in parallel with consent to participate in the study.

Competing interests
The authors declare that they have no competing interests.

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Publisher's Note

IV

IV

Healthcare utilization and catastrophic health expenditure in rural Tanzania: does voluntary health insurance matter?

Alphoncina Kagaigai[1,2*], Amani Anaeli[2], Sverre Grepperud[1] and Amani Thomas Mori[2,3]

Abstract

Background Over 150 million people, mostly from low and middle-income countries (LMICs) suffer from catastrophic health expenditure (CHE) every year because of high out-of-pocket (OOP) payments. In Tanzania, OOP payments account for about a quarter of the total health expenditure. This paper compares healthcare utilization and the incidence of CHE among improved Community Health Fund (iCHF) members and non-members in central Tanzania.

Methods A survey was conducted in 722 households in Bahi and Chamwino districts in Dodoma region. CHE was defined as a household health expenditure exceeding 40% of total non-food expenditure (capacity to pay). Concentration index (CI) and logistic regression were used to assess the socioeconomic inequalities in the distribution of healthcare utilization and the association between CHE and iCHF enrollment status, respectively.

Results 50% of the members and 29% of the non-members utilized outpatient care in the previous month, while 19% (members) and 15% (non-members) utilized inpatient care in the previous twelve months. The degree of inequality for utilization of inpatient care was higher (insured, CI = 0.38; noninsured CI = 0.29) than for outpatient care (insured, CI = 0.09; noninsured CI = 0.16). Overall, 15% of the households experienced CHE, however, when disaggregated by enrollment status, the incidence of CHE was 13% and 15% among members and non-members, respectively. The odds of iCHF-members incurring CHE were 0.4 times less compared to non-members (OR = 0.41, 95%CI: 0.27–0.63). The key determinants of CHE were iCHF enrollment status, health status, socioeconomic status, chronic illness, and the utilization of inpatient and outpatient care.

Conclusion The utilization of healthcare services was higher while the incidence of CHE was lower among households enrolled in the iCHF insurance scheme relative to those not enrolled. More studies are needed to establish the reasons for the relatively high incidence of CHE among iCHF members and the low degree of healthcare utilization among households with low socioeconomic status.

Keywords Tanzania, Catastrophic health expenditure, Community-based health insurance scheme, Cross-sectional household survey, Out-of-pocket expenditure, Concentration index

*Correspondence:
Alphoncina Kagaigai
akagaigai@gmail.com
Full list of author information is available at the end of the article

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Background

Globally, the proportion of total health expenditure is less than 10% of the Gross Domestic Product (GDP). Additionally, the proportion of out-of-pocket (OOP) health expenditure has remained above 40% of the total health spending in low and middle-income countries (LMICs) [1]. It is commonly considered that OOP payments that exceed 10% of a household's income or 40% of a household's total non-food expenditure often referred to as capacity to pay, represents catastrophic health expenditures (CHE) [1–3]. From 2010 to 2015, the global population that incurred CHE at a 10% income threshold, increased from about 570 million to more than 900 million. When the 25% income threshold was used, the number of people with CHE increased from about 100 million to about 200 million in the same period. Furthermore, about 90 million people (1.2%) were pushed into extreme poverty (spending below $1.90 per person per day) due to OOP health spending in 2015 [4]. The largest number and percentage of the world population impoverished by OOP health spending are from countries in Asia and Africa [4].

The majority of people in some LMICs, particularly low-income earners rely on public health facilities for affordable services [2]. However, public health systems face many challenges including low quality of care, frequent stock-outs of essential medicines, and shortage of healthcare workers [5], hence forcing patients to seek costly services from private health facilities. Unfortunately, health insurance coverage is low in most LMICs, hence most people are unprotected from unexpectedly high healthcare costs [1]. As a result, OOP continues to be the main means of healthcare financing, thus exposing many people to CHE [6–8]. In Tanzania, OOP accounts for about 22% of the total health expenditure, while health insurance schemes (premium payment) account for about 8% [9].

The challenge of raising sufficient funds to finance healthcare is one of the major reasons for LMICs not being able to meet the healthcare needs of their citizens [10, 11]. Community-based health insurance schemes (CBHIs) represent one important strategy for protecting rural and informal sector workers from impoverishing OOP payments [11–13]. According to the WHO, CBHIs are micro health insurance schemes primarily targeted at low-income households. Generally, the pooling of health risks occurs within a community or a group of people that share common characteristics such as geographical location or occupation. The membership premiums are typically flat rates (independent of individual health risks) and the schemes operate on a non-profit basis [14–17]. However, such schemes have not been always successful in providing an adequate level of financial protection [16, 18, 19]. Limited financing sources, the absence of scheme promotion initiatives, and the lack of governmental commitment have contributed to the limited growth of CBHIs, thus delaying the progress toward universal health coverage (UHC) [18].

In Tanzania, the CBHI scheme, commonly referred to as Community Health Fund (CHF), was introduced in 1996 to enhance access to primary healthcare services among rural and informal workers [15]. Despite concerted promotion efforts, the enrollment rate to CHF has remained low leaving the targeted population at risk of CHE [16, 20, 21]. To address this problem, the government reformed the CHF into the "improved Community Health Fund" (iCHF) in 2011, first as a pilot in Dodoma region. The reforms included a flat annual premium of about 15 USD covering 6 household members. The benefits package was also expanded to include x-rays, ultrasounds, in-patient services (excluding major surgery), and a referral system from District to Regional hospitals [22]. Table 1 summarizes the characteristics of the improved CHF (iCHF).

Literature review on CHE

The existing literature highlights a range of factors associated with CHE and the variation in the prevalence across

Table 1 Key characteristics of the improved CHF (iCHF)

S/N	Characteristics
1.	A reorganized structure that displays the different roles of the purchaser (CHF) and healthcare provider (health facilities)
2.	More advanced data management system including a central server with online and offline modes
3.	Active close-to-client strategy with village-level enrollment officers
4.	Expanded range of services to include hospitalization and portability of CHF cards within the region (improved referral system)
5.	Active mobilization campaigns with social marketing strategies that involve both community-based campaigns and mass media campaigns
6.	Each member of the household is given individual membership cards
7.	A flat rate premium in all districts equal to 30,000/= per household that covers 6 household members

Source: Kalolo et al., 2018 [23]

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countries. In Tanzania, three studies have assessed the incidence of CHE using the National Household Budget Surveys and they found that about 0.4% and 2.7% of the population experienced CHE at the 40% threshold of non-food expenditure (capacity to pay) [24–26]. Brinda et al. (2014), using data from the first round of the Tanzania National Panel Survey (TNPS) collected in 2008, found that 18% of the population experienced CHE at 40% threshold of non-food expenditure [7]. Macha (2015) found an incidence of 26.6% among 276 households when CHE was calculated based on the 10–20% threshold of the capacity to pay [10]. Studies from Mongolia, Malawi, Nigeria, and Vietnam found the incidence of CHE to be lower than 10% (i.e., 5.5%, 9.3%, 9.6%, and 9.9%, respectively) [27–30]. Studies conducted in Zambia, Kenya, and Uganda found incidences higher than 10% (i.e., 11.2%, 17.6%, and 23%, respectively) [31–33].

Previous studies on the determinants of CHE in various LMICs have primarily focused on demographic characteristics, disease patterns, and health-seeking behaviors. Some studies refer to higher age, higher educational level, sex of the household head, and occupation [10, 34–38], others refer to socioeconomic status and income [7, 8, 28, 34], while a few more mention chronic diseases and visits to health facilities [7, 34, 39].

A few studies have also explored the relationship between insurance status and CHE [34, 35, 39–41]. Two studies from China by Yang T. et al., (2016) and Li Y. et al., (2012) [34, 37], one study from Tanzania by Kihaule (2015) [38], and one multi-country study by Xu K. et al., (2003) [42], explored such relationships and found that being a member of a health insurance scheme reduced the incidence of CHE. Despite being insured, it is not uncommon for households to incur OOP expenditures, which may expose them to CHE [35, 36, 40]. A study by Aryeetey et al., (2016) from Ghana found that members of the National Health Insurance Scheme (NHIS) preferred to pay OOP so that they can get faster treatment [36]. Furthermore, informal fees, stock-outs of essential medicines at health facilities, and the exclusion of some services from the benefits package are also likely to expose patients to CHE [36].

Tanzania is currently considering implementing a mandatory health insurance scheme to raise additional funds for health [43]. Therefore, it is important to understand to what degree iCHF scheme contributes to better protection against CHE and how such protection varies across households belonging to different socioeconomic classes. Such knowledge may assist policymakers to improve the design of such schemes, which will ultimately enhance progress toward realizing the UHC goal. For this reason, this study aims to compare healthcare utilization and the incidence of CHE among improved Community Health Fund (iCHF) members and non-members in two rural districts located in central Tanzania.

Methods

Study design and setting

A cross-sectional study was used to collect primary data from Bahi and Chamwino Districts in Dodoma region between June to August 2019. Dodoma contains seven districts with a total population of nearly 2.3 million, of which 330,543 and 221,645 live in Chamwino and Bahi, respectively, according to the 2012 census [44]. The proportion of people enrolled in iCHF scheme in Dodoma region at the time of data collection was about 11%, however, there were some variations in coverage between the seven districts, with Bahi having a coverage of 16.5% and Chamwino of 17.4% [41].

Sampling

A multistage sampling method was used to identify study participants. First, the two study districts were selected out of the seven districts in Dodoma. Second, four and five divisions were selected from Bahi and Chamwino, respectively. Third, for each division, two wards were selected, thus making a total of eight wards for Bahi and ten wards for Chamwino. Finally, 16 and 20 villages were selected from the wards in Bahi and Chamwino, respectively. The probability-proportional-to-size sampling approach was employed to obtain the sample size for each district by dividing the number of households in each district by the total number of households in the two districts multiplied by the estimated sample size (722), as explained in [45]. Out of the 722 households, 304 were from Bahi and 418 from Chamwino. Next, we used systematic random sampling by selecting every third household in each village to select the respondents. The office of the Village Executive Officer (VEO) in each village was selected as the central point. The trained research assistants walked in different directions (North, East, South, and West)approaching every third household.

Data collection and variables

Six research assistants were trained for three days, followed by pretesting of the tools. Data were collected by these trained research assistants between June and August 2019. The questionnaire for this study was adapted from different sources [46–48]. The questions on health-related behavior, healthcare utilization, health expenditures, and insurance status were modified from the World Bank's Living Standards Measurement Study questionnaire (LSMS) [49]. All respondents were interviewed face-to-face using a questionnaire with structured questions. After providing informed consent, the interviews started by asking the respondents whether or

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not they were members of the iCHF scheme. We did not interview households that were enrolled in other health insurance schemes.

The outcome variable was catastrophic health expenditure (CHE), which was defined as any health expenditure (HE) that exceeds 40% share of the total non-food expenditure [50, 51]. The main explanatory variables were iCHF enrollment status and socioeconomic status (SES). Enrollment status was measured as a binary variable with a "Yes" response if the respondent was a member of the iCHF scheme and a "No" if not a member. Socioeconomic status (SES) was measured as a categorical variable with 5 levels (lowest, low, average/middle, high, and highest)). Other explanatory variables are summarized in Table 2 and further details on how other variables concerning household expenditure (food, non-food, and health expenditure) were collected and measured are attached as Additional file 3.

Data analysis

To measure the socioeconomic inequality in the distribution of healthcare utilization among the iCHF members and non-members, we plotted the concentration curves and estimated the concentration index (CI) that ranges between -1 and 1. A positive value indicates a higher incidence among those in higher SES while a negative value would indicate a higher incidence among those in the lower SES [49]. To test whether the degree of inequality was statistically different, we conducted a dominance test. The dominance test is a common test for inequality measurement that uses the criterion that if one concentration curve (B) lies completely below the other concentration curve (A), then the inequality represented by curve A is higher than the inequality represented by curve B (curve A dominates curve B) [49, 52]. This type of test is done through a visual inspection of the concentration curves in comparison with the 45-degree line or another concentration curve. However, a visual inspection may not be sufficient to conclude whether or not dominance is statistically significant, therefore, the standard errors for the differences between the curves ordinates must be computed. Dominance will exist if the null hypothesis of non-dominance is rejected in favor of dominance when there is at least one significant difference between curves in one direction and no significant difference in the other i.e. $p < 0.05$ [49]. To calculate the CHE, OOP health expenditure was divided by non-food household expenditures and multiplied by 100 [7]

$$CHE = \left(\frac{HE}{NFE} \right) * 100$$

Where HE = average household monthly OOP health expenditure; NFE = average household monthly non-food expenditure. Thereafter, CHE was coded as '1', if exceeded the threshold of 40%, and '0' if otherwise. Multivariate logistic regression was employed to assess the associations between CHE and enrollment status and socioeconomic status (SES) when controlling for socio-demographic variables, health-related variables, and healthcare utilization variables. A list of the variables included in the regression model is available in Table 2. The results are reported as adjusted odds ratios and

Table 2 A list of the variables for the regression model

Variable	Variable labels
Dependent variable	
Catastrophic health expenditure (CHE)	1 = CHE > 40%, 0 = otherwise
Main explanatory variables	
Insurance status	1 = insured (iCHF member), 0 = noninsured (iCHF nonmember)
Socioeconomic status (SES)	1 = lowest, 2 = low, 3 = average/middle, 4 = high, 5 = highest
Healthcare and Health-related variables	
Outpatient services (OPD)	1 = yes, 0 = no
Inpatient services (IPD),	1 = yes, 0 = no
Presence of chronic illness	1 = at least one household member with chronic illness, 0 = otherwise
Self-reported health state	1 = bad health, 2 = average, 3 = good health
Socio-demographic variables	
Age	1 = 18–25, 2 = 26–39, 3 = 40–59, 4 = 60 +
Sex	1 = male, 2 = female
Marital status	1 = unmarried, 2 = married
Household size	1 = 1–3, 2 = 4–6, 3 = 7–9, 4 = 10 +
Educational level	1 = No formal education, 2 = Primary education, 3 = Secondary education +
Number of children under 14 years	1 = 0, 2 = 1–4, 3 = 5–9 +

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statistical significance was set at the 5% level. The statistical differences between groups were tested using the Chi-square statistical test and data analysis was carried out using STATA version 17 software.

Results

Socio-demographic characteristics of the households

Table 3 presents the socio-demographic characteristics of the sampled households compared across enrollment status (insured and non-insured) using a chi-square statistical test (p-value). The mean age of the household head was 44.67 years (18–90 years), 58% of the respondents were female and 73% were married. The majority of the household heads (72%) had completed primary education and 74% were farmers. The only variable that was significantly different across enrollment status was the presence of chronic diseases, which was more frequent among the insured. The mean household monthly income was $54 (2.2–870) and the average non-food expenditure (capacity to pay) was $44 (0.7–1,100).

Table 3 Socio-demographic characteristics of the households compared across enrollment status

Variables	Enrollment status; n (%)			*p*-value
	Insured	Noninsured	Total	
Age of the household head				
18–25	13 (5.9)	29 (5.6)	42 (5.8)	0.147
26–39	63 (28.9)	176 (34.9)	239 (33.1)	
40–59	103 (47.3)	238 (47.2)	341 (47.2)	
60+	39 (17.9)	61 (12.1)	100 (13.9)	
Sex of the household head				
Male	84 (38.5))	220 (43.7)	304 (42.1)	0.201
Female	134 (61.5)	284 (56.3)	418 (57.9)	
Marital status of the household head				
Married	163 (74.8)	361 (71.6)	524 (72.6)	0.385
Not married	55 (25.2)	143 (28.4)	198 (27.4)	
Education level of the household head				
No formal education	36 (16.5)	91 (18.1)	127 (17.6)	0.350
Primary education	154 (70.6)	366 (72.6)	520 (72.0)	
Secondary education and above	28 (12.8)	47 (9.3)	75 (10.4)	
Occupation of the household head				
Farmer	160 (73.4)	375 (74.4)	535 (74.1)	0.776
Non-farmer	58 (26.6)	129 (25.6)	187 (25.9)	
Household size				
1–3	40 (18.4)	101 (20.0)	141 (19.5)	0.918
4–6	112 (51.7)	261 (51.8)	373 (51.7)	
7–9	56 (25.7)	122 (24.2)	178 (24.7)	
10+	10 (4.6)	20 (3.9)	30 (4.2)	
Number of children under 14 years				
0	29 (13.3)	72 (14.3)	101 (13.9)	0.496
1–4	151 (69.3)	357 (70.8)	508 (70.4)	
5–9	38 (17.4)	75 (14.9)	113 (15.7)	
Chronic illness				
Yes	91 (41.7)	164 (32.54)	255 (35.3)	0.018
No	127 (58.3)	340 (67.5)	467 (64.7)	
Self-reported health state				
Good	124 (56.9)	291 (57.7)	415 (57.5)	0.759
Average	74 (33.9)	175 (34.7)	249 (34.5)	
Bad	20 (9.2)	38 (7.5)	58 (8.0)	
	Mean (USD)	Minimum (USD)	Maximum (USD)	
Household monthly income	54	2.2	870	
Capacity to pay (non-food expenditure)	44	0.7	1,100	

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Table 4 Healthcare utilization by enrollment status

Variable	Enrollment status; frequency (percentage)			P-value
	Insured	**Noninsured**	**Total**	
Outpatient services (OPD)				
Yes	109 (50.0)	147(29.2)	256(35.5)	0.000
No	109 (50.0)	357(70.8)	466(64.5)	
Inpatient services (IPD)				
Yes	41 (18.8)	77 (15.3)	118 (16.3)	0.239
No	177 (81.2)	427 (84.7)	604 (83.7)	
Type of health facility (OPD)				
Hospital	8 (7.3)	15 (10.2)	23 (9)	0.137
Health center	56 (51.4)	66 (44.9)	122 (47.7)	
Dispensary	34 (31.2)	36 (24.5)	70 (27.3)	
Clinic	0 (0.0)	1 (0.7)	1 (0.4)	
Pharmacy	1 (0.9)	11 (7.5)	12 (4.7)	
More than one	10 (9.2)	18 (12.2)	28 (10.9)	
Payment Modality (OPD)				
Out of Pocket (OOP)	15 (13.8)	98 (66.7)	113 (44.1)	0.000
Health Insurance	55 (50.5)	0 (0)	55 (21.5)	
Exemption	9 (8.3)	31 (21.1)	40 (15.6)	
More than one pay modality	30 (27.5)	18 (12.3)	48 (18.8)	
Type of health facility (IPD)				
Hospital	14 (34.2)	30 (38.9)	44 (37.3)	0.553
Health center	25 (61)	40 (52)	65 (55.1)	
More than one	2 (4.9)	7 (9.1)	9 (7.6)	
Payment modality type (IPD)				
Out of Pocket (OOP)	7 (17.1)	53 (68.8)	60 (50.9)	0.000
Health Insurance	13 (31.7)	0 (0)	13 (11.0)	
Exemption	4 (9.8)	10 (13.0)	14 (11.9)	
More than one pay modality	17 (41.5)	14 (18.2)	31 (26.3)	

Healthcare utilization

From Table 4, it follows that 35.5% and 16.3% of the sampled households are reported to have utilized outpatient care (OPD) and inpatient care (IPD) respectively. More than half (50.9%) of those who utilized inpatient care, financed their medical expenses through the OOP payments modality followed by the group that used more than one means of financing modalities (26.3%). An example of a case with more than one payment modality (means of payment) would be the combination of premium payments and OOP payments.

When healthcare utilization was categorized by enrollment status and types of care sought, it follows from Table 4 that, 50% of the insured and 29.2% of the noninsured households had utilized outpatient care in the previous 4 weeks, while 18.8% of the insured and 15.3% of the noninsured households had utilized inpatient care in the previous 12 months. These findings confirm that the insured households had a higher healthcare utilization rate compared to the noninsured. The two groups (insured and non-insured) differ significantly in terms of OPD care utilization ($P < 0.000$) while there is no statistical difference in the utilization of IPD care ($P < 0.239$).

Furthermore, the proportion of insured households which utilized outpatient services and paid through OOP was 14% while 28% used more than one payment modality. This was not the case for the noninsured households where 66.7% and 12.3% of the households used OOP and the combination of different payment modalities, respectively. Concerning the inpatient care and the payment modality, we found that 17.1% and 41.5% of the insured households and 68.8% and 18.2% of the noninsured households incurred OOP expenditure alone or used more than one payment modality, respectively.

As shown in Fig. 1, we found that among the insured, the proportions of the households with the lowest and the highest SES that utilized OPD care were 39% and 56% respectively, while for the noninsured the proportions were 17% and 43%, respectively. This confirms that the
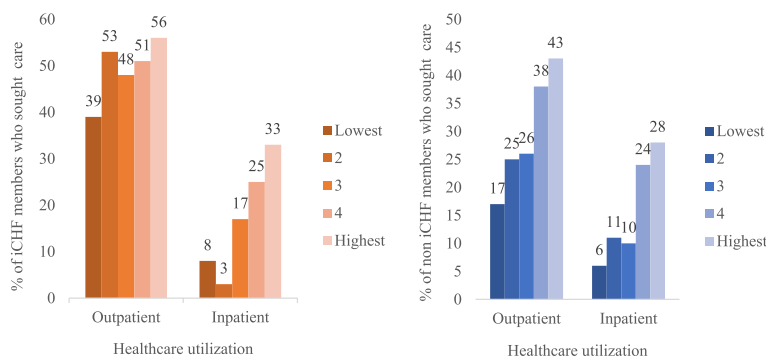

Fig. 1 Proportion of households utilizing healthcare services by enrollment status

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households with low SES were less likely to utilize health-care services compared to those with the highest SES, both for the insured and the noninsured. Overall, the insured utilized OPD and IPD care across all the wealth quintiles more than the noninsured; however, the utilization rate for those with low SES in the insured vs the noninsured had little impact on inpatient but potentially significant difference for outpatient care.

Figure 2 presents the corresponding concentration curve of healthcare utilization among members and nonmembers. The figure indicates that utilization of OPD and IPD care was pro-rich among iCHF members and nonmembers. This means that the households with high SES had much higher utilization of OPD and IPD care compared to those with low SES regardless of the insurance status. However, utilization is more equitable for the insured relative to the non insured households in the case of OPD with concentration indices of 0.09 for the insured and 0.16 for the noninsured compared to the IPD care with CI of 0.38 for the insured and 0.29 for the noninsured.

The dominance test was statistically significant at $p < 0.001$ for both OPD and IPD care, suggesting that the noninsured strongly dominate the insured with respect to the utilization of healthcare services. From a visual inspection of Fig. 2, it follows that dominance exists in the utilization of OPD care among the noninsured because its curve lies above the insured curve and the two curves did not overlap one another. However, there was no dominance among the two groups (iCHF insured and noninsured households) in the utilization of IPD care since the concentration curves overlapped with one another. According to O'Donnell et al. (2007),

dominance occurs only if one curve completely lies above the other [49].

Catastrophic health expenditure

The overall incidence of CHE was 15%; however, when disaggregated by enrollment status, the incidence was 15% among the noninsured and 13% among the insured. From Fig. 3, it is observed that regardless of enrollment status, the incidence of CHE increases with an increase in SES status (from the lowest to the highest SES). The only exception is for the insured when moving from the average/middle SES class to the high SES class.

Determinants of catastrophic health expenditure

The regression results are presented in Table 5 and the model output is attached as Additional file 2. The results show that the insured households were less likely to incur CHE compared to the non-insured households. The odds of the insured household incurring CHE were 0.41 times less compared to the non-insured (OR=0.41, 95%CI: 0.27–0.63) when controlling for the other factors that were likely to influence CHE. Moreover, household heads reporting a good health state, having secondary education or more, and who were married, were less likely to incur CHE compared to their counterparts. For example, the odds of a household head with secondary education or more incurring CHE was 0.07 times less compared to the household head without no formal education (OR=0.07, 95%CI: 0.01–1.02).

For the socioeconomic status (SES), households with at least one member with chronic illness, and households with at least one member that had received IPD care, or OPD care, were more likely to experience CHE. SES
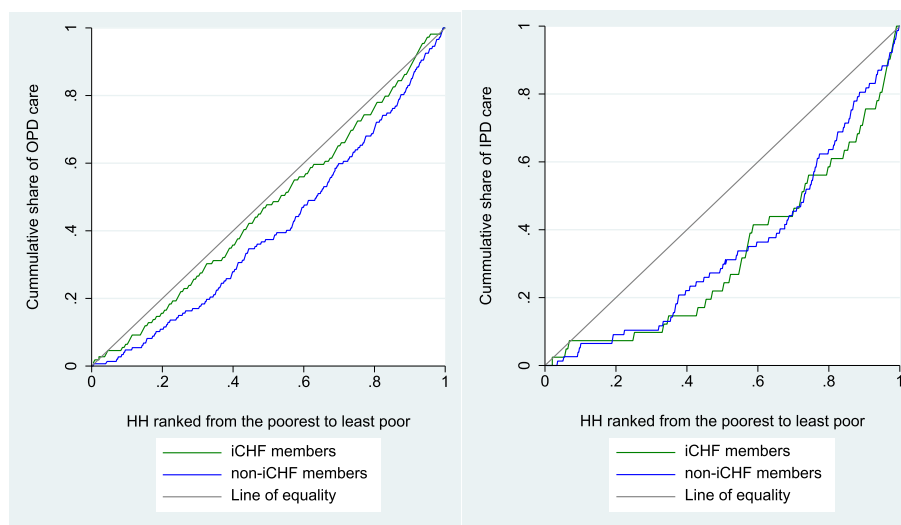

Fig. 2 Concentration index curves for utilization of outpatient care (OPD) and inpatient care (IPD). Note: HH= household
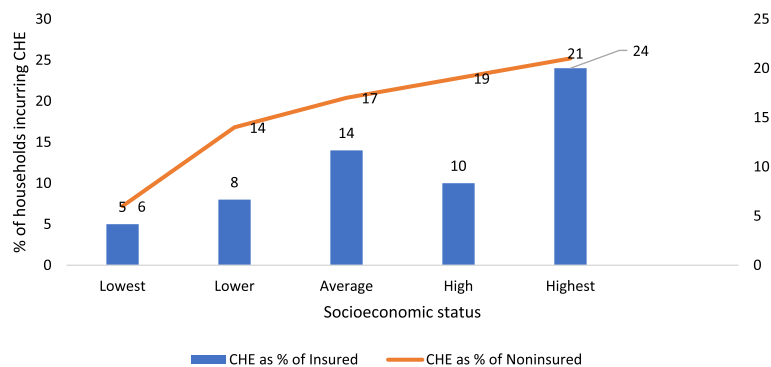
Fig. 3 Proportion of households incurring CHE disintegrated by SES and enrollment status

was positively associated with CHE, however the odds ratio first increased from the lowest to the average/middle), then decreased when moving to high and, again increased when moving to the highest SES. Households that belonged to the low, average/middle, and the highest SES were 2.45, 4.05, and 2.43 times more likely to incur CHE compared to those belonging to the lowest SES. Not surprisingly, the odds ratios for OPD and IPD are very high. Households that received inpatient care were 37.69 times higher likely to incur CHE compared to their counterfactuals (OR = 37.69, 95%CI: 36.53–38.88) while for those who received outpatient services the odds ratio was 9.18 times higher relatively to those that did not (OR = 9.18, 95%: 4.66–18.10).

Discussion

This paper compared healthcare utilization and the incidence of catastrophic health expenditure (CHE) among households enrolled into the improved Community Health Fund (iCHF) and those not enrolled. This topic is of considerable interest given the ongoing Tanzanian efforts to reach Universal Health Insurance coverage. The incidences of CHE provide us with insights about the ability of a health system to provide risk financial protection for its citizens as well as the financial burdens that are carried by households.

Our findings show that the insured households utilized healthcare services (both outpatient and inpatient) to a higher degree than the noninsured households. One of the advantages of voluntary health insurance is to provide financial risk protection and improve healthcare accessibility [36, 53–55]. Our findings show that the iCHF scheme has managed to improve access to care among the members than non-members. The observed improvement is likely to follow from healthcare being less costly, however, a higher degree of utilization may also, at least in part, be explained by adverse selection. According to David et al., (1998), individuals who expect

high future healthcare costs would prefer to be insured [56]. Since the iCHF scheme in question does not screen its potential clients before purchasing the premium, and since the potential clients know more about their health conditions than others, then adverse selection may arise in the sense that the utilization rate among the insured becomes higher relatively to the noninsured. Our findings are in line with findings from Ghana in the sense that those insured by the Ghanaian National Health Insurance Scheme (NHIS) were more likely to seek formal healthcare compared to noninsured [55].

A second observation is that households in the highest SES class utilized both outpatient and inpatient services more frequently than those in the lowest SES class and were also more likely to incur CHE. These findings are in line with studies conducted in Nigeria and Mongolia [28, 57, 58]. A recent study using 26.3 million claims data from the National Health Insurance Fund (NHIF) in Tanzania, showed that the lowest-income group had a lower probability to visit accredited facilities than the reference middle-income category [53]. A possible explanation for such findings could be that households with higher SES in contrast to those with lower SES are able and willing to pay for healthcare services [59]. Several studies have pointed out that high OOP payments discourage households with low SES from seeking appropriate healthcare services, and instead opt to go to pharmacies/drug shops or traditional providers [35, 38, 60, 61].

In this study, we found that overall, 15% of the households experienced CHE at a 40% threshold of the capacity to pay (non-food expenditure). This incidence is smaller compared with the 26.6%, which was reported by Macha (2015) but quite similar to 18% reported by Brinda et al., (2014), both in Tanzania [7, 10]. fThe incidence of CHE estimated from our study seems to be higher compared to other studies from Tanzania [24–26]. A study by Mchenga et al., (2017) found that about 1% of the population experienced CHE at a 40% threshold of the capacity to pay,

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Table 5 Multivariable logistic regression analysis of the determinants of CHE

Variables	OR (95% CI)	P-value
iCHF enrollment status		
Non-member	1	
Member	0.41 (0.27–0.63)	0.000***
Socioeconomic status		
Lowest	1	
low	2.45 (1.14–5.27)	0.022**
Average/Middle	4.05 (3.71–4.42)	0.000***
High	1.22 (0.67–2.24)	0.514
Highestt	2.43 (2.12–2.80)	0.000***
Outpatient services (OPD)		
No	1	
Yes	9.18 (4.66–18.10)	0.000***
Inpatient services (IPD)		
No	1	
Yes	37.69 (36.53–38.88)	0.000***
Reported health state		
Bad	1	
Average	0.83 (0.76–0.92)	0.000***
good	0.67 (0.39–1.12)	0.127
Presence of chronic illness		
No	1	
Yes	1.49 (1.34–1.68)	0.000***
Age of the household head		
18–25	1	
26–39	0.66 (0.35–1.27)	0.215
40–59	0.73 (0.50–1.06)	0.099*
60+	0.52 (0.34–0.81)	0.003***
Sex		
Male	1	
Female	0.91 (0.67–1.23)	0.543
Education level		
No formal education	1	
Primary education	0.85 (0.44–1.68)	0.648
Secondary education and above	0.07 (0.01–1.02)	0.052*
Marital status		
Unmarried	1	
Married	0.41 (0.31–0.54)	0.000***
Household size		
1–3	1	
4–6	1.48 (0.25–8.72)	0.664
7–9	1.01 (0.09–11.75)	0.996
10+	1.73 (0.81–3.69)	0.156
Number of children under 14 years		
0	*1*	
1–4	1.77 (0.39–8.00)	0.458
5–9+	1.23 (0.08–18.53)	0.883

Notes: ***, ** and * denote 1%, 5% and 10% significance level (*p*-value), respectively

while WHO (2016) and Binyaruka (2020) found that, at 40% threshold, about 0.4% and 2.7% of the population in Tanzania suffered CHE [24, 25, 29]. Possible explanations could be that these studies used relatively old data from Household Budget Surveys (HBS) while our data was collected more recently and from districts that are susceptible to CHE. Compared to studies done in other countries, our estimates are relatively similar to those reported in Malawi (9.3%), Nigeria (9.6%), Zambia (11.2%), Kenya (17.6%), and Uganda (23%) [27, 29, 31–33, 62]. It should be noted that the above studies differ in terms of study settings and health system context.

Our results show that the incidence of CHE was higher among the noninsured households than the insured. This is not surprising, since health insurance per definition provides financial risk protection. However, quite a high share of insured households were also confronted with CHE. We can only speculate that these households purchased healthcare services that were not included in the iCHF benefit package or because medicines were out-of-stock forcing them to purchase from private pharmacies and drug shops. Furthermore, treatments for some common Non-Communicable Diseases (NCD) are not covered by Ichf scheme, meaning that OOP remains the only option to finance such expenditures. Our findings are similar to the findings of other studies which also found that CHE was more pronounced among the noninsured households compared to the insured households [28, 62, 63].

The study found that CHE was influenced by socio-economic variables, healthcare variables, and health-related variables. For the socioeconomic variables, CHE was associated with age (60 + groups), education (secondary education and above), marital status (married), and SES. For the healthcare variables, CHE was associated with a household having at least one member who received inpatient care in the last 12 months or outpatient care in the last month. For the health-related variables, CHE was associated with households having at least one member suffering from chronic diseases and a household head that report having a good health status.

A negative relationship was observed between the age of the household head and CHE. This suggests that, as the age of the household head increases, the likelihood of experiencing CHE decreases. A possible explanation for this could be the exemption policy that matters for the elderly, which excuses them from paying OOP at public health facilities. Similar findings were reported in a previous study that identified an inverse relationship between higher age and CHE [9]. However, studies from Uganda, India, and China found that households with older household heads were more likely to face CHE

compared with households having younger household heads [37, 51, 64].

Our results have also revealed that a higher educational level (secondary level and above) and being married were negatively associated with CHE. A study conducted in China found that the incidences of CHE decreased with a higher educational level [34]. The explanation could be that educated people are more forward-looking (time preferences) implying that future outcomes are given more weight relative to less educated people. Our finding concerning marital status contradicts Choi et al., (2016) who found that household heads who were married or living together had higher odds of incurring CHE than those who were divorced or separated [65]. One possible reason for our finding can be that single-headed households typically are more vulnerable (marginalized), in terms of household income and the number of dependants per adult, thus making it more difficult to avoid CHE.

The results show that SES typically has a positive association with CHE, although the odds were not consistent across all classes. This provides a clear picture that the average household is more vulnerable to CHE due to a combination of income and spending where those with low SES are less likely to access care, unlike the ones with high SES who are more likely to access care because they can afford it. Another possible explanation could be that as SES increases, so does the household capacity to pay for health care, which may translate to more OOP payment without exposing them to CHE compared to those with low SES whose budgets are more constrained and hence becomes difficult to visit health facilities when sick. Our findings are in line with other studies, which also found that low SES increased the probability of households incurring CHE [7, 10, 28, 64, 66].

Self-reported health status and households having at least one member with chronic diseases were found to be associated with CHE, same as households having at least one member who sought IPD or OPD care. These findings are in line with what has been reported by other studies [7, 10, 34, 39]. Healthcare needs are probably key determinants of CHE and our findings are as expected since a low health state and the presence of chronic diseases may imply a low household income (due to low productivity) in combination with a high demand for healthcare services that include services that are not covered by the benefit package in question.

Strengths and limitations of the study

This study was faced with some limitations, we, therefore, request caution with the interpretation of its findings. First, this was a cross-sectional study conducted in two districts in one region, which limits the generalization of the results beyond the study districts. Secondly, the health expenditure data reported by the study participants may have been misrepresented due to recall bias. Respondents were asked to state the quantity of resources purchased or the expenditure on food, nonfood items and health services in the past 4 weeks, or the past 12 months. We feel that it might have been difficult for the respondent to accurately remember the value and quantities of some consumed items. Another reason for underestimation is that we only took into consideration those who had visited the health facilities within the last month for OPD care or last year for IPD care. If the respondent had not visited the health facility, then the expenditure was not captured. Despite these limitations, our findings are robust in the sense that they are comparable to previous studies that used the same methodology. Furthermore, household expenditures rather than household income is in the literature considered to be the most reliable measure of wealth status for study settings like ours because people in the informal sector often have no formal or reported income sources, which might result in measurement error [67–70].

Conclusion

The study found that the utilization of healthcare services was relatively higher and the incidence of CHE was lower among households enrolled in the iCHF insurance scheme compared to those not enrolled into the scheme. Despite the odds of an insured household incurring CHE being lower compared to noninsured households, we found that being insured did not eliminate the possibility of experiencing CHE. Therefore, more studies are needed to establish the reasons behind the relatively high incidence of CHE among insured households. Our findings also show that healthcare utilization and incidence of CHE were lower among households with low SES compared to those with higher SES. Therefore, researchers and policymakers must seek to identify other possible barriers beyond enrollment into health insurance that hinder the utilization of healthcare services among households with low SES when formulating policies for Universal Health Coverage in Tanzania.

Abbreviations

CHF	Community Health Fund
iCHF	Improved Community Health Fund
CBHIs	Community –Based Health Insurance Schemes
CHE	Catastrophic Health Expenditure
CI	Concentration index
GDP	Gross Domestic Product
IPD	Inpatient services
LMICs	Lower-Middle-Income Countries
OOP	Out-of-Pocket

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OPD	Outpatient services
Tshs	Tanzanian shillings
USD	United State Dollar
WHO	World Health Organization

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-023-16509-7.

Additional file 1. Proposed household questionnaire on insurance status, health status, access to healthcare, expenditures, socioeconomic status, and demographic characteristics.

Additional file 2. Model output for Multivariate Logistic regression.

Additional file 3. Data collection and variable measure.

Availability of data and materials
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
All methods were carried out in accordance with relevant guidelines and regulations. The study was approved by the Ethics committee of the National Institute of Medical Research in Tanzania (NIMR)- (Ref.No.NIMR/HQ/R.8a/Vol.IX/3077) and from Norwegian Centre for Research Data (NSD) in Norway- (Ref. No. 807876). Written informed consent for participation was obtained from the study participants and their legal guardians in the study. The consent form was written in Swahili explaining the right to voluntary participation in the study and the respondents were asked to sign it before the start of the interview. The researcher provided background information and the reasons for conducting the study and ensured the confidentiality of the information provided.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Author details
[1]Institute of Health and Society, University of Oslo, P.O. Box 0315, Oslo, Norway. [2]School of Public Health and Social Sciences, Muhimbili University of Health and Allied Sciences, P.O. Box 65001, Dar Es Salaam, Tanzania. [3]Department of Global Health and Primary Health Care, University of Bergen, P.O. Box 5007, Bergen, Norway.

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