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Morbidity Cost and Willingness to Pay for Healthcare Insurance among Wheat Farmers in Jigawa State of Nigeria

Abstract. The study determined the costs of morbidity and farmers' willingness to pay for health insurance in the Jigawa State of Nigeria using a cross-sectional data collected from 284 farmers through a multi-stage sampling technique. Using an easy-route cost approach, a well-structured questionnaire coupled with interview schedule was used for data collection. Besides, the collected data was then analysed using both descriptive and inferential statistics. Empirically, the majority of farmers utilised an accumulation strategy for livelihood sustenance, alongside enterprise diversification – which acted as a catalyst in increasing their stocks and consumption outcomes, thus smoothing their income and consumption. However, financial and, at worst, physical livelihood capitals posed challenges that affected farmers' livelihood assets in the study area. Furthermore, malaria emerged as the major health issue affecting livelihoods; consequently, slightly over half of the sampled population agreed to the notion of a social health insurance scheme for a healthy livelihood. However, this inclination was largely influenced by the overlooked or nearly neglected social learning aspect of extension service delivery. Therefore, as a method to reduce public capital expenditure on healthcare for livelihoods in the study area, the study recommends that policymakers expand the healthcare scheme to include the farming community, going beyond formal organisations, thereby enhancing farm family livelihoods specifically and overall economic growth and development in general. Nonetheless, enhance institutional factors, alongside social extension, financial and infrastructural facilities are recommended.

Keywords: healthcare, insurance, livelihood, morbidity, farmers, Nigeria

JEL Classification: D31, D81, I13, I15, I18, I31, I38

Introduction

Due to farmers' poor health and climate change, the agricultural sector may be under additional stress. Understanding that farmers' health negatively impacts the industry, with noticeable effects on productivity, is concerning. If farmers' ill-health is not properly addressed, food crop production will continue to be significantly affected in developing nations in Africa (Adewuye et al., 2021). Without prompt actions taken, along with appropriate legislation to improve farmers' health, the situation is expected to deteriorate in the near future. According to Adewuye et al. (2021), those who are ill or in poor health bear a heavy load of responsibility. Although challenging to quantify, individuals who are

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seriously ill can experience significant welfare losses, particularly in underdeveloped countries with limited social security and healthcare infrastructure (Njie et al., 2023). Severe illness can impose a substantial financial burden on households, leading them to the point where they may need to sell assets, accrue substantial debts and fall deeper into poverty (Kalyango et al., 2021). These households are often compelled to shorten necessary treatment periods due to inadequate social security and low income levels. This has lasting consequences on the health and poverty levels among the workforce, as well as on economic growth, labour productivity and social welfare. A high disease burden, however, is likely to have an adverse impact on a nation's productivity, growth and, ultimately, economic development (Sadiq et al., 2017). To address the threat of poverty, particularly in developing nations, there is a need for strong health systems and productive agriculture, as low productivity resulting from farmers' poor health not only affects their income, but also exacerbates the prevalence of poverty and ill health.

Self-expenditure on health causes an estimated 100 million people to enter poverty each year and adds 1.2 billion more individuals to the world's population currently living in poverty (Busyra et al., 2023). Annually, a total of 150 million individuals in 44 million households experience financial ruin as a result of directly paying for healthcare and an estimated 13 billion individuals worldwide lack the opportunity to receive effective and inexpensive healthcare (Omotowo et al., 2016; Anbesu et al., 2022). Access to necessary financing continues to be a major barrier to development for many developing nations. It is no longer acceptable for certain people to endure suffering or pass away due to a lack of accessibility to basic healthcare as a result of the development of medical technology and the rise in living standards (Cheno et al., 2021). Under objective 3.8 of the Sustainable Development Goals (SDGs), governments and the global community are tasked with achieving universal health coverage (UHC) (Nzowa et al., 2023). Governments must shift from an out-of-pocket healthcare financing model predominately used in Africa to a prepayment model to achieve UHC (Abu-Zaineh et al., 2022). Despite global pressure and numerous national and regional efforts, many African nations still have poor levels of health insurance coverage (Bolarinwa et al., 2021).

In recent years, many low- and middle-income countries have placed high importance on having access to high-quality healthcare, with achieving universal health coverage being a key component (Kado et al., 2020). Concerns about the needy and vulnerable having limited access to excellent healthcare is still a problem in low- and middle-income countries (Haile et al., 2019). In contrast to industrialised nations, access to healthcare as a fundamental need is constrained in developing nations due to underfunded healthcare systems (Wang and Zhang, 2019; Busyra et al., 2023). Financial limitations severely restrict access to high-quality treatment and the World Health Report emphasises that financial equality is an essential element of the effectiveness of the health system. The health industry has frequently encountered situations when its budget has significantly decreased in real terms for a variety of reasons. Major development issues in Africa, particularly in Nigeria, include poverty and inadequate accessibility to healthcare resources (Sadiq et al., 2017). Policymakers are fully aware of the need for a strong healthcare system to ensure that everyone has access to sufficient medical care. Budgets for healthcare have decreased as a result of the economic downturn in some developing nations (Mekonne et al., 2020). Therefore, the government's top priority is finding a different way to effectively finance healthcare.

According to Babatunde et al. (2016), rural households often forgo high-value care while still paying significant amounts for subpar care. These high healthcare costs lead to short-term health crises and can result in debt, the selling of assets and the expulsion of children from school, ultimately leading to a long-term increase in poverty. Concerns for the nation and other low- and middle-income African nations have been raised by the catastrophic effect of this healthcare finance structure on the region's poor and often rural population. As a result, proponents have been in favour of creating alternative financing plans to handle the unpredictable nature of healthcare expenses to protect poor rural residents. Health insurance is one method through which a community can be financially safeguarded from unforeseen health risks (Busyra et al., 2023). According to Cheno et al. (2002), health insurance is commonly viewed as a way to shield against financial risk and provide access to healthcare for low-income families. Health insurance helps spread the financial risk across all insured members, enhancing access to medical treatments (Anbesu et al., 2022). This is accomplished by preventing patients from directly paying for services out of pocket. By pooling risks across various demographic segments, it significantly reduces the financial burden that catastrophic illnesses place on individuals.

Social insurance and community-based insurance are the two different types of health insurance systems (Jofre-Bonet and Kamara, 2018). Social health insurance primarily targets individuals with jobs in the government and private sectors (Abbas et al., 2019). The World Health Organisation has promoted the widely adopted social health insurance programme as a means to increase access to healthcare services and ensure that everyone is covered by the healthcare delivery system (Wolff et al., 2020; Baillon et al., 2022). However, since a significant portion of the population works in the informal economy, middle- and low-income countries rarely implement this approach. Therefore, the main sources of finance for healthcare are out-of-pocket expenses and general income (Miti et al., 2021). Typically, individuals or families use their own labour or resources to pay for healthcare providers. Out-of-pocket expenses account for approximately 40% of all healthcare costs in sub-Saharan Africa, imposing a heavy financial burden on the underprivileged (Kado et al., 2022). When governments are unable to directly support healthcare costs for the poor, a contributory system like community-based health insurance (CHI) is a particularly likely means to achieve widespread health insurance coverage (Cheno et al., 2021).

Additionally, as employees in the informal sector and households in rural parts of low-income nations have erratic income, Anbesu et al. (2022) state that community-based health insurance systems are the most suitable insurance models for these groups. It has been established that CHI, which consists of mandatory and/or voluntary health programmes, provides access to health insurance coverage for people who are unable to immediately take advantage of a social insurance programme or a private health insurance programme (Cheno et al., 2021). Governments and donor organisations in a number of developing nations are now implementing CHI schemes as a social safety net and an alternative strategy to achieve universal health coverage in response to dwindling budgets and other institutional challenges in the provision of high-quality, reasonably priced healthcare services.

According to Azhar et al. (2018), the market-based healthcare system is financed significantly by health insurance. The wisest solution, presently and in the future, might not solely rely on paying taxes or out-of-pocket expenses. With medical costs rising rapidly, it

is necessary to receive support from health insurance plans, specifically to pay for expensive medical care, lessen the financial burden on the healthcare system and lower catastrophic health costs for the rural poor. Farmers face difficulties in receiving basic medical care due to the out-of-pocket payment system, which also excludes those unable to pay the fees.

Policymakers in Nigeria need to focus on ideas for health insurance for the underprivileged considering the high level of out-of-pocket healthcare expenses, the desire to enhance the efficiency and equality of healthcare funding and the standard of care provided and other factors. It is unequivocal that social protection increasingly plays a crucial role in poverty reduction efforts to reduce susceptibility to socioeconomic, natural and other shocks, particularly among rural residents. A study on the actions taken by wheat farmers in Nigeria's Jigawa State to achieve better and more sustained health was necessary. The capacity and willingness to pay for health insurance have been associated with improvements in public health, including better healthcare services accessibility, a healthier population and financial protection from health risks. Consequently, this research aimed to determine the wheat farmers' morbidity cost and willingness to pay for healthcare insurance in Nigeria's Jigawa State. The specific objectives were: to determine the livelihood status of the farmers; identify the morbidity affecting the farmers' livelihood; estimate the economic cost of morbidity; assess the farmers' willingness to pay for health insurance; identify the key driving force behind farmers' willingness to pay for health insurance in the study area.

Theoretical framework

S.V. Ciriacy Wantrup initially proposed the contingent valuation method of willingness to pay theory in 1947 as a technique for extracting market valuation of a non-market product using the open-ended protocol. Davis and Randal put it into practice in 1963 and 1974, respectively (Azhar et al., 2018). The contingent valuation method, based on a fictitious market scenario, is frequently used to gauge public willingness to pay. It is also commonly employed in cost-benefit analyses in health economics. The fact that welfare economics serves as the methodology's theoretical underpinning is a notable aspect of WTP's (willingness to pay) approach to economic evaluation. According to Abbas et al. (2019), "welfarism valuation methods, such as willingness to pay", have their theoretical roots in the methods used to estimate quality-adjusted life year (QALY) methods. One of the most popular participative approaches for determining the total economic value (TEV) of different categories of environmental goods and services that are difficult to exchange on the open market is the contingent valuation method (CVM). Because of the simplicity of reading the results of CVM, it is enticing.

Neoclassical welfare economics, rooted in two well-known monetary metrics of welfare changes, serves as the theoretical cornerstone of the method; specifically, the Hicksian Equivalent Variation (EV) and Compensating Variation (CV) measurements of changes in welfare. Let's use the welfare modifications to a person (consumer) brought about by a new proposed policy plan (such as environmental improvement) as an example. Let W_i^0 represent welfare prior to policy intervention (or the status quo) and W_i^1 represent welfare following policy intervention. Additionally, let W_i^0≡ (y_i^0, P^0) and

$W_i^1 \equiv (y_i^1, P^1)$ reflect, respectively, the budgets that gauge the prices (p) and incomes (y) that consumer i will encounter under the new policy plan. Therefore, the change from the status quo level to the level following the implementation of the policy is just the variation in the indirect utility denoted by:

$$v(y_i^1,P^1)-v(y_i^0,P^0) \quad \ldots\ldots (1)$$

If $v(y_i^1,P^1)-v(y_i^0,P^0) > 0$, the consumer i will consent to the modification brought on by the new insurance plan. On the other hand, if $(y_i^1,P^1)-v(y_i^0,P^0) < 0$, the customer will rejects the proposal. The constraint on participation is represented by this. It is typically convenient to use a money metric technique to measure the resultant change in welfare; however, the majority of policymakers are mainly interested in the actual financial value of a planned novel legislation intervention (Fonta et al., 2018). The most straightforward strategy is to use the lowest expenditure function, which, as stated in Fonta et al. (2018), is dual to the indirect utility function. In other words, m(q; y, P) tells us how much money a particular person, i, would require at a vector of pricings, q, in order to be well off as they would be facing prices, P, while having income, y. As a result, Equation 1 can be expressed as follows:

$$m(q;y_i^1,P^1)-m(q;y_i^0,P^0) \quad \ldots\ldots (2)$$

If the sole difference between the pre-policy intervention and post-policy intervention levels is a price shift, such as $q \equiv P^0$ or $q \equiv P^1$, this results in the CV and EV indicators of welfare changes, respectively. They are each defined as follows:

$$EV=m(P^0;y_i^1,P^1)-m(P^0;y_i^0,P^0)=m(P^0;y_i^1,P^1)-y_i^0 \quad \ldots\ldots (3)$$

$$CV=m(P^1;y_i^1,P^1)-m(P^1;y_i^0,P^0)=y_i^1-m(P^1;\,[\![P^0,y]\!]\_i^0) \quad \ldots\ldots(4)$$

The Hicksian Equivalent Variation (EV) metric for measuring a change in welfare is found in equation (3). It improves welfare when it is more than zero, and it does the opposite when it is less than zero. To put it another way, if EV > 0, equation (3) reflects the sum of money that a person is ready to accept from the policy planner in exchange for forgoing a boost from W_i^0 to W_i^1. If EV is less than zero, equation (3) shows how much a person is prepared to spend to avoid moving to the ex-post decreasing welfare level W_i^1. A welfare change's Hicksian Compensating Variation (CV) metric is represented by equation (4). In order to make consumer i indifferent between W_i^0 and W_i^1, it reveals how much money would be withdrawn from her wages at her new welfare level, W_i^1. Equation (4), when expressed in absolute terms, reflects the consumer's Willingness to Pay (WTP) to be at W_i^1 or the amount of money the customer is Willingness to Accept (WTA) from the policy planner to maintain the previous, declining level of welfare W_i^1.

Typically, the valuation issue at hand or the type of proposed policy intervention heavily influences the technique chosen to be used. The CV is the most suitable welfare metric if the new policy plan's objective is to establish a compensation system at the new price P^1. The EV measure, however, is the best choice if the objective is to establish a benefit plan at the current price (Fonta et al., 2018). Table 1 depicts this connection.

Table 1. Relation between EV, CV, WTP and WTA

Items	EV measure	CV measure
Utility increases	WTA	WTP
Utility decreases	WTP	WTA

Source: Fonta *et al*. (2018); Haab and McConnell (2002).

WTP recognises individual preferences throughout the decision-making process and captures the broader advantages of health, such as the non-health benefits of related health outcomes. In nations where citizens are expected to pay a sizable portion of healthcare expenses, its importance is amplified. Similarly, the level of desire for health-related products is a crucial indicator for choosing wisely between competing health programmes that may be supported by the public. Other benefits of utilising WTP as an outcome measure include the need for information, the usefulness of the process, the value of the options and the altruistic value.

Research methodology

The State is one of the 36 States in the country that shares common boarders with Kano State and Katsina State border to the West, Bauchi State to the East and Yobe State to the Northeast. The State has a shared international border with the Zinder Region of the Republic of Niger to the north, which presents a special possibility for cross-border trade activity (Jigawa State Government (JSG), 2017). It is located in the country's Northwestern region between latitudes 11°N and 13°N and longitudes 8°E and 10.15°E Greenwich meridian time. It is the eighth most populous state in terms of ethnic composition, with a predominance of Hausa and Fulani residents (JSG, 2017). Rainfall volume normally varies between 600 and 1000 millimetres during the rainy season, which runs from May to September, according to Sadiq and Sani (2022). The province's southern region has a heavier rainfall than its northern region does (Sadiq and Sani, 2022). The State's overall land area is about 22,410 square kilometres, and the estimated population is 4,361,002 (National population Commission (NPC), 2017), with a current projection of 4,884,322 million people at a 3% growth rate. Sand dunes of varied sizes that extend several kilometres in some areas of the state add to its undulating geography. The Hadejia, Kafin-Hausa, and Iggi Rivers are the primary rivers, and other tributaries in the state's northeast feed large marshlands. The Hadejia and Kafin-Hausa Rivers traverse the state from the west to the east through the Hadejia-Nguru wetlands before emptying into the Lake Chad Basin. The state's economy is still heavily dependent on agriculture, and because of its semi-arid climate, workers frequently migrate to nearby states like Kano State in search of seasonal work (JGS, 2021). One of the state's most valuable natural resources is its large tracts of lush arable land, to which nearly all tropical crops may adapt. A large portion of the Sudanese savannah vegetation zone consists of grazing areas that are ideal for raising livestock.

Using a multi-stage sampling technique, a total of 283 selected active wheat farmers were used to elicit farm survey data. Firstly, given that wheat production cut across all the agricultural strata of the state, the saturated sampling frame of the stratified Jigawa State

Agricultural and rural development Agency (JARDA) zones, namely, Zone I (Birnin-Kudu), Zone II (Hadejia), Zone III (Gumel) and Zone IV (Kazaure) was taken. Secondly, the major producing Local Government Areas (LGAs) in each of the zone were purposively selected. The selected LGAs in Zones I, II, III and IV were: Jahun, Ringim, Hadejia and Kazaure, respectively. Thirdly, from each of the selected LGAs, three (3) villages were randomly selected, thus giving a total of 12 selected villages. Lastly, based on the sampling frame obtained from JARDA and reconnaissance survey (Table 2), a Krejcie and Morgan formula (Equation 1) was used to determine the representative sample size for the study. Thus, a total of 283 active wheat farmers were randomly selected. Using an easy cost-route approach, farm survey data of the 2022 wheat production season were collected with the aid of a well-structured questionnaire coupled with an interview schedule. Objectives I, III and V were achieved using the livelihood index, cost of morbidity technique and Tree regression model, while objectives II and IV were achieved using descriptive statistics and the contingent valuation method.

Table 2. Sampling frame of wheat farmers in the study area

Zones	LGAs	Villages	Population	Sample size
Birnin Kudu Zone (Zone I)	Jahun	Harbo Tsohuwa	134	16
		Harbo Sabuwa	149	18
		Jama'a	137	17
Gumel Zone (Zone II)	Ringim	Ringim Town	130	16
		Gabarin	143	18
		Dabi	198	24
Hadejia Zone (Zone III)	Hadejia	Sunamu	178	22
		Mai Alkama	258	31
		Hago	184	23
Kazaure Zone (Zone IV)	Kazaure	Farin Daba	321	39
		Gada	230	28
		Tudun Wayo	250	31
Total 4	**4**	**12**	**2312**	**283**

Source: Reconnaissance survey, 2021; Jigawa State Agricultural and Rural Development (JARDA), 2021.

$$n_p = \frac{N(X)}{X+(N-1)} \quad \text{..... (5)}$$

$X = \frac{Z^2 \ x \ P(1-P)}{e^2}$

n = Sample size; N = Population size; e = Acceptable sampling error; X= Finite sample size; and, P = Proportion of the population.

Model specification

Livelihood indexes

Before specifying the indexes, the preamble steps for generating the composite indexes viz. minimum normalization measure (Equation 6) and dimension index (Equation 7) are presented below:

$$I = \frac{I_i - I_{min}}{I_{max} - I_{min}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Where, *'I'* is the indicator index, I_i is the value of the i^{th} indicator; $I_{min}$is the minimum value of the i^{th}indicator; and, I_{max} is the maximum value of the i^{th}indicator.

$$D_i = \sum_{i=1}^{n=0} \left(\frac{w_i * I_i + \ldots\ldots w_n * I_n}{w_i + \ldots . w_n} \right) \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where, D_i is the dimension index of i^{th} households and *w* is the weight of i^{th} Indicator index.

$$LSI_i = \frac{H+N+S+F+P}{w_H + w_N + w_S + w_F + w_P} \quad \ldots\ldots\ldots\ldots\ldots (8)$$

Where, LSI_i is the Livelihood strategy index of i^{th} households; *w* is the weight of i^{th} dimension.

The livelihood capital assets' classification (Sadiq and Sani, 2022): < 20% = very poor; ≥ 20% = poor; ≥ 40% = moderate; ≥ 60% = good; ≥ 80% = very good.

The livelihood strategy classification is: < 1 = survival strategy, ≥1 = coping strategy, ≥2 = adaptation strategy, ≥3 = accumulation strategy (four-scale) (Morris *et al*., 2001); <1 = survival strategy, ≥1 = coping strategy, ≥2 = adaptation strategy, ≥3 = consolidation and ≥4 = accumulation strategy (five-scale).

Livelihood assets

The household's livelihood may be constructed on a foundation that is represented by the assets accessible for generating income. The five categories listed below serve as representations of these assets in the DFID framework (Table 3a).

Natural capital (N): refers to the stocks of natural resources that provide resource flows necessary for subsistence (such as land, water, animals, biodiversity, and environmental resources);

Human capital (H)**:** refers to the abilities to work, learn, and maintain good health, all of which are necessary for pursuing a variety of livelihood options;

Physical capital (P)**:** includes production machinery and tools that allow individuals to pursue their livelihoods, as well as essential infrastructure (transportation, housing, water, energy and communications);

Social capital (S): the social assets (networks, group membership, trust-based relationships and access to larger institutions of society) that people rely on to support themselves,

Financial capital (F): the available financial resources that enable people to choose from a variety of sources of income, such as savings, credit, regular remittances, or pensions.

These assets include both intangible resources more commonly studied by sociological and anthropological research, such as social capital, health and educational status and

tangible productive resources more commonly linked with economic studies, such as land, labour, capital and stocks.

Table 3a. Livelihood assets

Dimension	Indicator	Dimension	Indicator
Human capital	Farming knowledge	Financial capital	Income
	Farming skills		Savings
	Farming experience		Assistance / Subsidies
	Health		Individual Credit
	Household size		Credit from Credit Institutions
	Other business skills		Remittances
	Other business experiences	Physical capital	Access to transportation and ICT
Natural capital	Land fertility		Production facilities
	Irrigation water sources		Infrastructures
	Climate suitability		Working equipment
	Farm production		Accessibility to institutions
Social capital	Community Organizations		
	Social Networking		
	Mutual cooperation		
	Trust		

Source: modified from Illu *et al*.(2021); Sadiq and Sani (2022).

Livelihood strategy

Among others, Devereaux (1993) and Davies (1996) have distinguished between survival, coping, adaptive, and accumulative strategies (Table 3b). In response to an opportunity, accumulative techniques boost asset stocks and consumption results. Adaptive strategies aim to disperse consumption failure risk in response to foreseen negative trends. This could be achieved by expanding into new activities or by intensifying current livelihood methods. Coping mechanisms involve lowering consumption and depleting assets in order to lessen the effects of a negative shock. In the absence of respite, coping may result in survival tactics. In an effort to avoid poverty and death, survival methods not only dramatically cut back on consumption but also significantly, and most frequently irreparably, deplete household assets.

Table 3b. Typology and examples of different livelihood strategies

Livelihood strategy	Internal livelihood system component		
	Change to assets	Strategies	Consumption outcomes
Accumulative	Increased asset stock. Increased flexibility across asset base.	As for adaptive	More income. Better nourishment. Increased security.
Adaptive	Altering the mix of assets. Prudently preserving money and other assets.	Extensification (cultivation of more land). On-farm & off-farm diversification (e.g. change in cropping mix, wage labour). Intensification of cash cropping. Investments in social capital. Migration.	Consumption and income smoothing Lowering of risk Spreading of risk. smoothening of labor
Coping	Increased livestock sales Calling down impromptu claims (for instance, via kin networks).	Farm labor, piecework Temporary migration Youngsters being taken out of school.	Reduced meal frequency, size, and quality. Use where available of relief food. Less social and ceremonial duties.
Survival	Selling of useful assets (like bicycles and land). Sale of furniture and other home items.	Illicit behavior. Begging.	Permanent out-migration Poverty and starvation.

Source: Morris *et al*.(2001); Davies (1996); Devereaux (1993).

Cost of morbidity technique

Following Oparinde et al.(2018) and Abaoba (2020), the costs of morbidity technique was used to estimate the economic burden of mortality among farm families.

$$FC = \sum_{i=0}^{n}(F_d + F_m + F_t + F_{fd}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (9)$$

$$T = \sum_{i=0}^{n}(Ts * as * w) + (Tc * ac * w) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (10)$$

$$E = \sum_{i=0}^{n}(FC + T + P) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (11)$$

Where,
FC= Total financial cost of health care during the farming season (₦);
F_d = Financial cost of drugs, herbs etc (₦);
F_m = Financial cost of medical consultancy (₦);
F_t= Financial cost transportation (₦);
F_{fd}= Financial cost of feeding (₦);
T = Total time cost (days of forgone production);
Ts = Time cost of the sick person(s) (days of forgone production);
Tc = Time cost of the care giver(s) (days of forgone production);
w = Daily wage rate of sick person/care giver (₦);
as = Age coefficient of sick person(s);

ac = Age coefficient of care giver(s);
P= Preventive cost.

According to Sauerborn et al. (1996), an individual's financial production rises from their very early 20s to roughly age 40 and gradually declines after that. This information was used to determine the value of the age coefficient "a". The values of coefficient "a" were as follows:

Age ≤ 17 years = 0.5; Age ≥ 18 = 1; Age ≥ 41=0.75; Age ≥ 56 = 0.67; Age > 65 = 0.45

Contingent valuation method (CVM)

In non-marketed commodities like health insurance, CVM is frequently used to evaluate WTP modifications (Gidey et al., 2019; Ogundeji et al., 2019; Njie et al., 2023). According to research by Njie et al. (2023), double-bounded dichotomous choice (DBDC) questions with a follow-up approach are more effective because they allow respondents to share more details about their WTP. Arithmetic mean was utilised to estimate WTP in both the present and ideal case scenarios to determine the average WTP required to pay for healthcare insurance. The following formula is used to calculate the average WTP:

$$Average\ WTP = \frac{\sum_{i=1}^{n} bidding\ amount}{\sum_{i=0}^{n} number\ of\ respondents\ who\ are\ WTP} \quad \ldots\ldots\ldots\ldots\ldots\ldots (12)$$

Tree regression

$$WTP_i = f(X_1, X_2, \ldots\ldots\ldots\ldots\ldots\ldots X_n) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

$$WTP_i = \beta_0 + X_1\beta_1 + \cdots \ldots\ldots\ldots\ldots X_n\beta_n + \varepsilon_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (14)$$

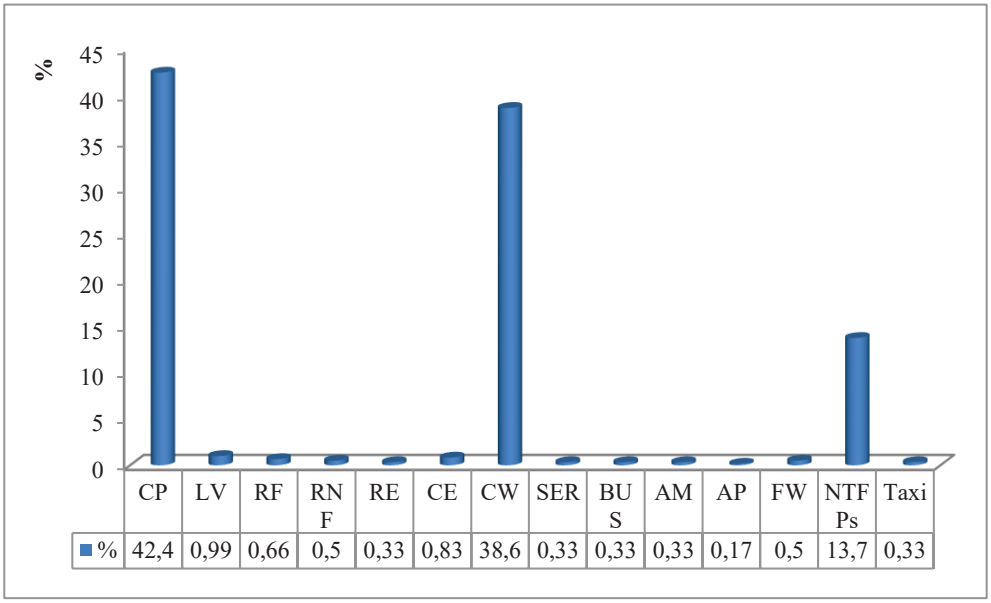
Where, WTP_i = Willingness to pay (yes =1, no=0); X_1= Age [young aged adult (< 31) =0, middle-aged adult (>= 31) =1, old-aged adult (> 45) =2]; X_2= Gender (male =1, otherwise=0); X_3 = Marital status (single =0, married =1); X_4= Education (non-formal =0, primary =1, secondary=2, tertiary=3); X_5= Household size (small= 0, moderate =1, large=2); X_6= Farming experience (small= 0, moderate =1, high=2); X_7= Extension service (yes= 1, no=0); X_8= Credit access (yes =1, no=0); X_9= Co-operative membership (yes =1, no=0); X_{10}= Agricultural holding [marginal (< 1) = 0, small (>= 1) = 1, semi-medium (>=2) =2, medium (>=3) = 3, large (>=4) =4]; X_{11}= Operational holding [marginal (< 1) = 0, small (>= 1) = 1, semi-medium (>=2) =2, medium (>=3) = 3, large (>=4) =4]; X_{12}= Income (small = 0, semi-medium =1, medium = 2, large =3]; X_{13}= Initial bidding (IBID) (yes =1, no=0); X_{14}= Livestock ownership (small= 0, moderate =1, large=2); ε_i = Noise; β_0= Intercept; and, β_{1-n}= Regression parameters.

Results and discussion

Livelihood activities, assets and strategy of the farmers

The results in Figure 1 showed crop production (CP) to be the major livelihood activity undertaken by most (42.4%) of the respondents, followed by craft work (CW) (38.6%) and then non-timber forest products (NTFPs) activity (13.7%). Nevertheless, the proportions of participation in other livelihood activities in the study area were marginal, as

evident by their respective percentages that were less than one percent. These findings justified the earlier results that showed farming to be the major primary and secondary occupations undertaken by the respondents in the study area. Therefore, as suggested earlier with regard to the findings on occupations, there is a need to sensitise and encourage the farmers to diversify their enterprises to boost their income stream and as a measure against risks and uncertainty that affect livelihoods.



	CP	LV	RF	RNF	RE	CE	CW	SER	BUS	AM	AP	FW	NTFPs	Taxi
%	42,4	0,99	0,66	0,5	0,33	0,83	38,6	0,33	0,33	0,33	0,17	0,5	13,7	0,33

Fig. 1. Distributions of livelihood's activities of the respondents

Source: Authors' own research.

Furthermore, on average, the empirical evidence showed that the statuses of human (80.19%), natural (65.13%) and social (62.24%) livelihood capital assets in the study area were good, while those of financial and physical capital assets were moderate (50.02%) and poor (-218.55%), respectively (Figure 2). By implication, it can be inferred that most of the farmers had good possession of human, natural and social livelihood capital assets, while possession of financial and physical assets was poor. The moderate status of financial asset may be attributed to poor supply of credit facilities and a low income base. However, the poor physical asset is attributed to poor access to institutions, inadequate working implements, poor production facilities, inadequate provision of infrastructural facilities – such as public commodities like poor feeder road networks, social amenities, etc. – and poor access to transportation and information and communication technology. Therefore, the study advises policymakers to address the challenges that affected the livelihood's financial and physical capital assets to avoid jeopardising the good statuses of the three livelihood capital assets, thus containing the near likelihood of livelihood vulnerability of

most of the respondents to shocks and stresses, especially those caused by weather-induced extremities in the study area.

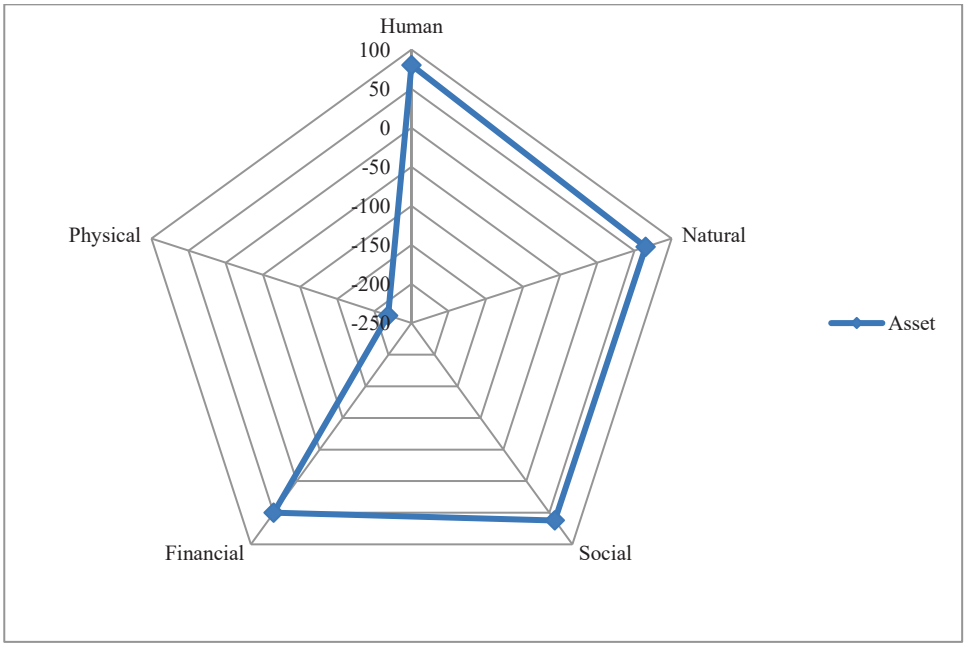


Fig. 2. Livelihood's capital assets distribution of the respondents

Source: Authors' own research.

Moreover, the results in Figure 3a (five-dimension, modified) showed that the majority (51.9%) of the respondents adopted a consolidation strategy for livelihood sustenance, 31.8% used an accumulation strategy and 2.5% adopted an adaptive strategy, while 9.2% and 4.6%, respectively, resorted to coping and survival strategies for livelihood sustenance. On the four-dimension, the majority (71%) of the farmers adopted an accumulation strategy for livelihood sustenance, while a handful of 14.1%, 8.1% and 6.7%, respectively, used adaptive, coping and survival strategies for livelihood sustenance (Figure 3b). Generally, it can be inferred that in response to opportunities, the majority of the respondents adopted strategies (accumulation and consolidation) that increased their stocks and consumption outcomes. Nevertheless, for those that adopted the adaptive strategy, it can be concluded that in response to anticipated adverse trends, they tend to spread their risks of consumption failure. However, for those that adopted coping, it can be inferred that in order to absorb the impact of adverse shocks, they draw down their assets and reduce consumption. For those that were caught in the survival strategy, it can be concluded that the respondents not only cut down consumption drastically, but their household's assets were extensively, most often irreversibly eroded in an attempt to ward off destitution and mortality.

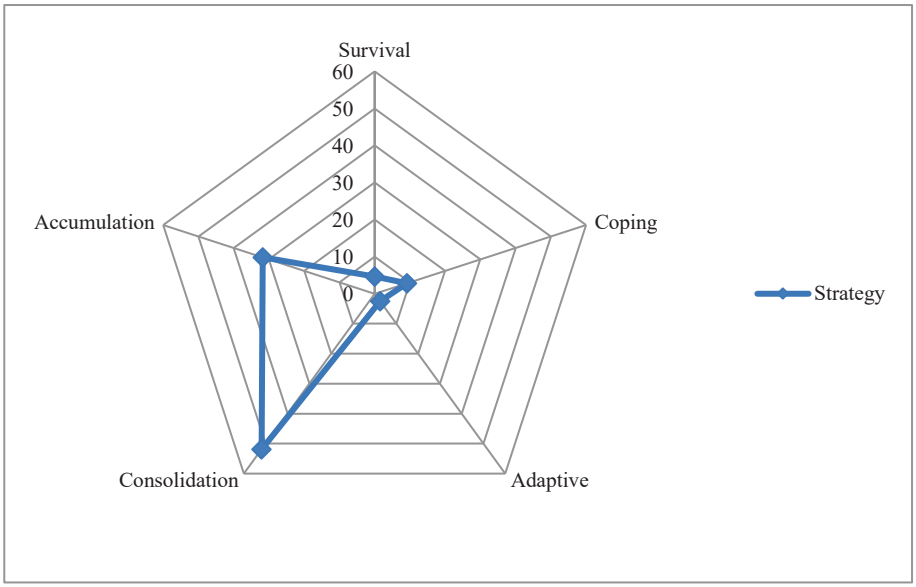


Fig. 3a. Distribution of the respondents based on livelihood strategies

Source: Authors' own research.

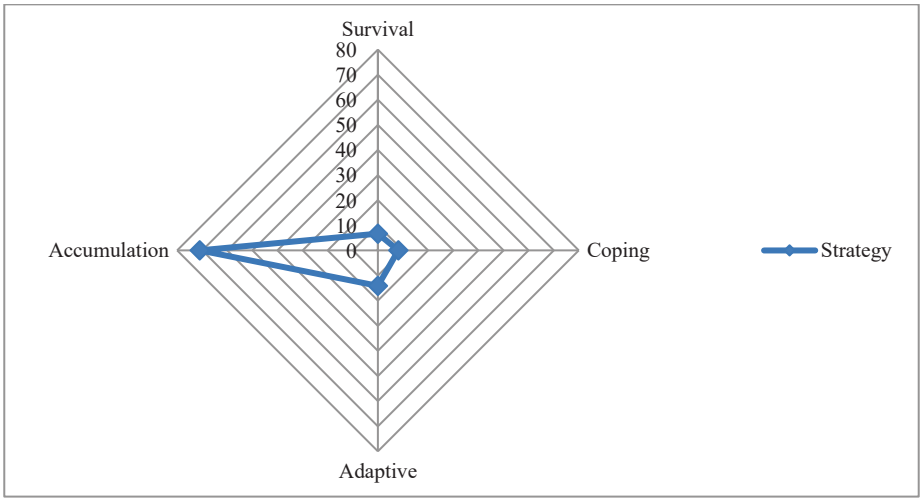


Fig. 3b. Distribution of the respondents based on livelihood strategies

Source: Authors' own research.

Types of morbidity suffered by the farmers

A cursory review of the results showed that malaria disease was the most prevalent morbidity suffered by the farmers (44%), followed by typhoid/yellow fever (22%) and then catarrh at a rate of 10% (Table 4). However, the least common morbidities suffered by the farmers in the study area were tuberculosis and guinea worm, each at a proportion of 1%. By implication, malaria remains a threat in the study area despite government and non-governmental interventions aimed at eradicating the disease. This could be linked to the pathogen's mutation resistance to the antidote and the poor utilisation of insecticide-treated nets. Additionally, the farmers have reported adverse reactions on their skin and eyes due to the use of these nets. Therefore, the study urges policymakers to intensify their efforts to address malaria and typhoid fever in the study area.

Table 4. Distribution of morbidity suffered by the farmers

Disease	Frequency	Percent
Catarrh	28	0.10
Malaria	125	0.44
Typhoid/Yellow fever	62	0.22
Measles	6	0.02
Cholera/Diarrhea	14	0.05
Stomach ache	11	0.04
Waist pain	11	0.04
Back pain	14	0.05
Rheumatism	6	0.02
Tuberculosis	3	0.01
Guinea worm	3	0.01
Total	283	100.00

Source: Field survey, 2022.

Cost of morbidity among farmers

On the average, the incurred economic cost of morbidity in the study area was N6, 809.59k while the financial, timing and preventive costs were N3,611.05, N2,548.04 and N650.50k respectively (Table 5). Of the incurred economic cost, the financial cost had the highest contribution (53.03%) while preventive cost had the least contribution (9.55%). Nevertheless, decomposition-wise, in descending order, the cost of drugs, timing cost of the sick and timing cost of the caregiver accounted for the highest proportion of the economic cost. Generally, it can be inferred that financial cost is the major cost incurred by the farmers on morbidity. This finding is contrary to the findings of Aboaba (2020) and Adekunle et al. (2016) who in their various study areas established that timing cost contributed most to incurred economic cost of morbidity.

Table 5. Cost estimates of morbidity

Items	Average	Percent
Cost of drugs/herbs etc	1947.00	28.59
Consultancy medical fees	500.01	7.34
Cost of travel	164.03	2.41
Cost of feeding	1000.02	14.69
TCS	1319.77	19.38
TCG	1228.27	18.04
TFC	3611.06	53.03
TTC	2548.04	37.42
PC	650.50	9.55
EC	6809.59	100.00

Note: TCS= time cost of the sick person; TCG= time cost of the caregiver; TFC= total financial cost; TTC= total time cost; PC= preventive cost; EC= economic cost; ₦ = Naira (Nigerian currency); $1 = ₦ 417 as at the period (2022) of study.

Source: Field survey, 2022.

Farmers' willingness to pay for healthcare insurance

A perusal of the results showed that the majority (58.7%) of the farmers were willing to pay for healthcare services insurance, while 41.3% were not willing to pay for health insurance (Table 6a). Thus, it is evident that the farmers were willing to participate in social healthcare services as a measure towards enhancing their farm family livelihood. Furthermore, of the farmers who indicated their interest in paying for health insurance, slightly more than half (50.5%) were willing to pay 5% of their income as a premium in the initial bidding, while the remaining 49.5% declined the initial bidding. Therefore, this study calls on policymakers to extend the social health service scheme to wheat farmers rather than restricting it to formal labourers, but they should be meticulous about the premium charge to ensure broader acceptability and sustainability.

Table 6a. Willingness to pay and IBID of the farmers

Items	Frequency	Percent
WTP		
Yes	166	58.7
No	117	41.3
Total	283	100
IBID		
Yes	143	49.5
No	140	50.5
Total	283	100

Source: Field survey, 2022.

Furthermore, in the ideal situation, the average WTP for the healthcare insurance at ideal situation was N 119528.31, while at the present situation, the average positive (IBID) WTP for health insurance was N 138753.15 (Table 6b). The lower WTP in the ideal situation compared to the present situation indicates that farmers would not be willing to pay more even if the healthcare insurance scheme improves.

Table 6b. WTP for health insurance at ideal and present situations

Item	Condition	Mean	Difference
WTP present	Non-truncated	₦ 138753.15	₦ 19224.83
WTP ideal	Truncated	₦ 119528.31	

Source: Field survey, 2022.

Determinant(s) of farmers' WTP for healthcare insurance

Of the fourteen specified variables, only three variables – initial bidding (IBID), livestock ownership (LIV) and extension services – were retained in the final model, while the rest were automatically discarded because their contributions to the model were insignificant. The tree's depth is three (3), meaning it has three levels below the root node, four (4) terminal nodes and a total of seven (7) nodes. The gain chart indicates that the model fits the specified equation well, as shown by the cumulative gain chart steeply rising towards 100% and then levelling off (Figure 4a). However, the index chart shows the best fit of the model, as demonstrated by its cumulative index chart starting above 100% and gradually descending until it reaches 100% (Figure 4b). Furthermore, with a risk index of 0.071, the risk of misclassifying farmers' WTP is approximately 7.1%. Consequently, about 92.9% of farmers willing to pay for health insurance in the study area are correctly predicted by the model.

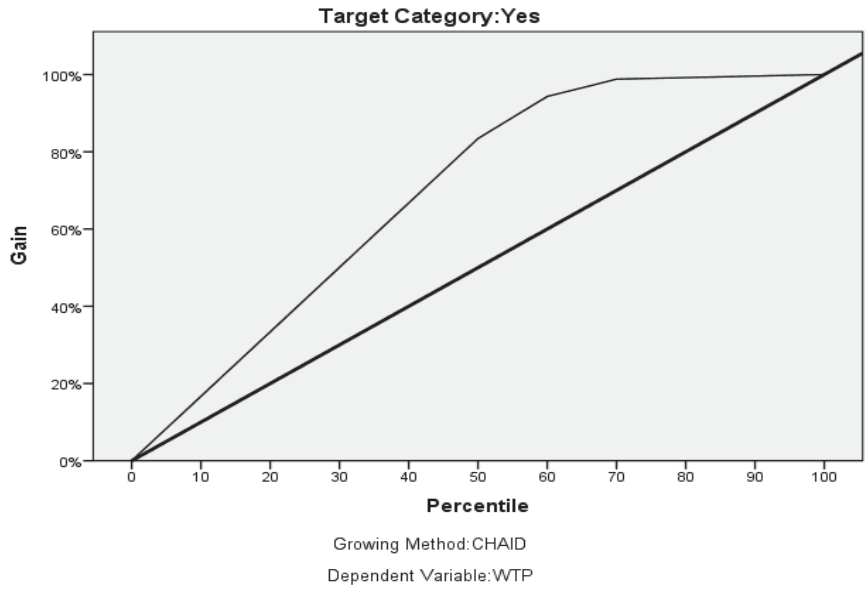


Fig. 4a. Gain chart distribution

Source: Computer print-out, 2022.

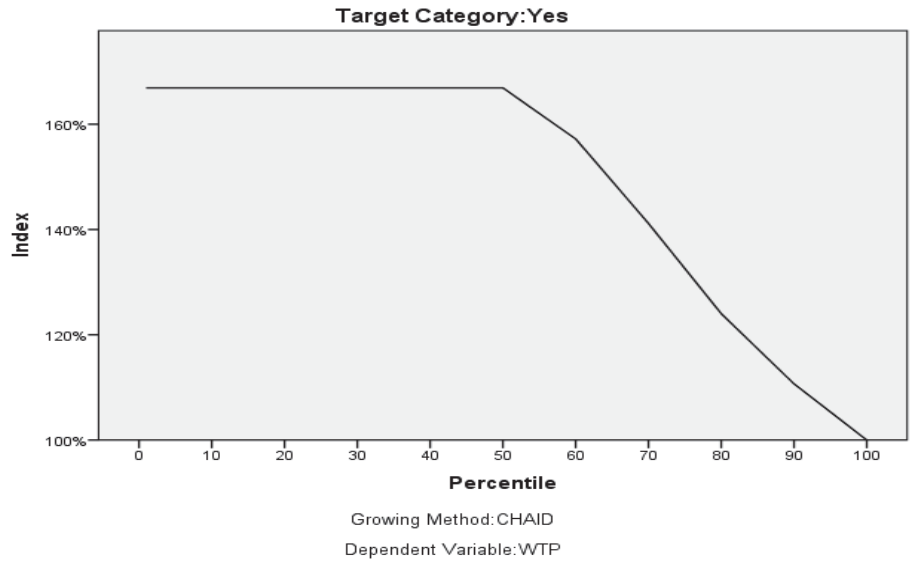


Fig. 4b. Index chart distribution

Source: Computer print-out, 2022.

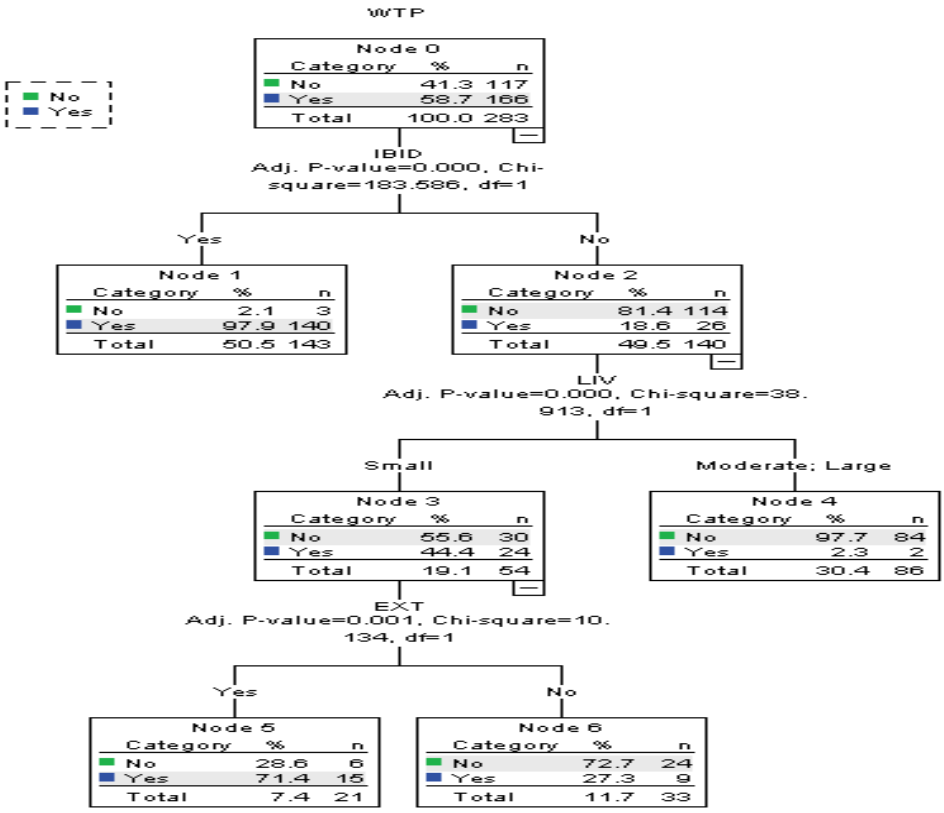


Fig. 4c. Key drivers of WTP for healthcare insurance

Source: Computer print-out, 2022.

Empirically, IBID is the most important predictor of willingness to pay (WTP) for healthcare insurance among the farmers (Figure 4c). For the farmers that accept the IBID of 5% of their income as a premium, IBID is the only predictor of WTP as it has no child node, thus a terminal node. Of the farmers in this category, 97.8% are willing to pay for healthcare insurance. For the farmers that indicated "no" to IBID, LIV is the best next predictor. For those with a large livestock value, given that it is a terminal node, LIV is the only predictor of WTP. In this category, very few (2.3%) of the farmers indicated their WTP and the possible reason may be attributed to large augmented deferred income value, a contingency which can enable them to cope with their family medical challenge when the need arises, thus the less or no need for formal anticipated future social health plan programme. For the farmers with small LIV, the extension service is the next predictor of WTP for healthcare insurance. The majority (71.4%) of the farmers with access to extension services are WTP, while only a few (27.3%) of those who didn't have access to

extension services indicated willingness to pay for healthcare insurance. Therefore, it can be inferred that the social aspect of advisory services is crucial in enlightening farmers to key into the social health insurance programme to cushion their farm family livelihood health risk challenges. As a rider, the onus lies on policymakers on the need to extend social health insurance to farmers in the study area rather than restricting it to formal employees, thus strengthening growth and development in the rural economy. By making farmers stakeholders in health expenditure, this singular act can go a long way in reducing high government capital expenditure on healthcare services, consequently entrenching a more balanced livelihood in the study area in particular and the country in general.

Table 7. Diagnostic test of gain and index

Node	Node		Gain		Response (%)	Index (%)
	Frequency	%	Frequency	%		
1	143	50.5	140	84.3	97.9	166.9
5	21	7.4	15	9.0	71.4	121.8
6	33	11.7	9	5.4	27.3	46.5
4	86	30.4	2	1.2	2.3	4.0

Source: Computer print-out, 2022.

Furthermore, a summary of the index values shows that the observed percentage of farmers willing to pay for health insurance in the target category of the terminal nodes viz. 1 and 5 are more than the expected percentage in the target category (willing to pay) of the root node. This is evident from their respective index values, which are greater than 100% (Table 7). In contrast, the observed percentage of farmers in the terminal nodes viz. categories 4 and 6 is lower than the expected percentage in the root node category, as indicated by their respective index values being less than 100%.

Conclusions and recommendations

Based on these findings, it was inferred that accumulation was the major livelihood sustenance strategy used, vis-à-vis diversification activities, to increase stock and consumption outcomes for farm families. Additionally, the farmers have good possession of human, natural and social livelihood capitals, while possession of financial capital, a catalyst for growth and development, was not impressive. Sadly, there is poor possession of physical livelihood capital in the study area, mainly due to inadequate infrastructural facilities. Furthermore, the morbidity affecting the livelihood of most farmers was malaria disease. Consequently, for a better livelihood, slightly more than half of the sampled population were willing to participate in social health insurance, primarily driven by the social aspects of advisory services, which receive less attention. Therefore, the study recommends the need for enhanced institutional support to ensure a better livelihood for wheat farmers in the study area.

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