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Determinants of Microinsurance Uptake Among Small-Scale Miners in Taita Taveta County, Kenya

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ABSTRACT: This study examined the determinants of microinsurance uptake among small-scale miners in Taita Taveta County, Kenya. The research aimed to assess the influence of risk vulnerabilities, household income, and microinsurance awareness on uptake intentions. Grounded in Risk Society Theory, Affordability Theory, Diffusion of Innovations Theory, and the Theory of Planned Behavior, the study employed a cross-sectional descriptive survey design. Data were collected from small-scale gemstone miners in Kasighau, Kamtonga, and Mkuki zones using structured questionnaires. A sample of 99 respondents was targeted, with 71 completed responses obtained (71.7% response rate). The survey instrument was validated through a pilot study, and reliability was confirmed using Cronbach's Alpha (all scales ≥ 0.70). Data were analyzed using descriptive statistics, Pearson correlations, and multiple linear regression in Python (statsmodels). The findings revealed that risk vulnerabilities ($\beta = 0.372$, $p = 0.023$) and household income ($\beta = 0.408$, $p = 0.030$) were statistically significant positive predictors of microinsurance uptake, while awareness showed a significant bivariate correlation but was not independently significant in the multivariate model ($p = 0.681$). The regression model explained 26.6% of the variance in uptake intentions. Miners demonstrated moderate uptake intentions (overall $M = 3.43$), with strong preference for flexible payment options ($M = 4.13$) and mining-specific risk coverage ($M = 3.59$). The study concludes that economic capacity and perceived risk exposure are the primary drivers of microinsurance uptake in this population. It offers actionable recommendations for insurers, cooperatives, and policymakers to design tailored, flexible microinsurance products to enhance financial protection for this vulnerable and underserved group.

KEYWORDS: Microinsurance Uptake, Small-Scale Miners, Risk Vulnerability, Household Income, Insurance Awareness

INTRODUCTION

Background of the Study

Small-scale mining (SSM) is an important source of livelihood for millions of people worldwide, particularly in developing countries where formal employment opportunities are limited. Globally, approximately 40.5 million people are directly engaged in small-scale mining, while an estimated 150 million others depend on the sector indirectly for their livelihoods. The sector contributes significantly to the production of minerals and gemstones, accounting for a substantial share of global gold, sapphire, and diamond output. Despite its economic significance, SSM is characterized by hazardous working conditions, environmental degradation, and limited access to social protection mechanisms. Miners are frequently exposed to occupational injuries, mine collapses, toxic substances, respiratory diseases, and income volatility resulting from fluctuating commodity prices. Consequently, small-scale mining communities remain among the most vulnerable populations globally (World Bank, 2020; Delve, 2020; IGF, 2021; ILO, 2021).

Across many developing countries, the risks faced by small-scale miners are compounded by low levels of financial inclusion. In countries such as Indonesia, the Philippines, and Peru, miners operate in highly informal environments with limited access to insurance and other financial services. Although microinsurance has emerged as a promising mechanism for protecting low-income populations against financial shocks, its adoption among mining communities remains extremely low. Common barriers include affordability constraints, low awareness of insurance products, geographic remoteness, limited trust in formal financial institutions, and the absence of insurance products tailored to mining-related risks. Consequently, microinsurance penetration among miners in many countries remains below 5 percent despite their high exposure to occupational and economic risks (UNEP, 2022; Spiegel et al., 2020; Bersales & Mapa, 2020; Lahiri-Dutt, 2020; Salo et al., 2021).

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In contrast, developed countries such as Canada and Australia have established comprehensive social protection and insurance systems that provide miners with workers' compensation, healthcare coverage, and other forms of risk protection. These frameworks are supported by strong regulatory environments, mandatory insurance requirements, and extensive awareness programs. As a result, insurance uptake among miners in these countries approaches universal coverage. This contrast highlights the critical role of institutional support, awareness, and affordability in promoting insurance adoption among vulnerable populations (Mining Association of Canada, 2021; Natural Resources Canada, 2020; Minerals Council of Australia, 2022).

Sub-Saharan Africa hosts one of the largest concentrations of small-scale miners globally, with an estimated 12 to 13 million people directly involved in the sector. Mining activities in countries such as Ghana, South Africa, and Tanzania are largely informal and characterized by poor occupational safety standards and limited access to financial services. Miners frequently face risks such as pit collapses, toxic substance exposure, environmental degradation, and unstable incomes. Despite these challenges, awareness and uptake of insurance products remain low due to affordability issues, limited physical access to insurance providers, mistrust of financial institutions, and inadequate product design. In many African countries, insurance products are primarily designed for agriculture or general informal sector activities, leaving mining-specific risks largely uncovered (Hilson & Garforth, 2023; World Bank, 2020; Buxton, 2021; Nyame & Blocher, 2020; TIRA, 2021).

Within East Africa, Tanzania has made notable progress in expanding microinsurance coverage through regulatory reforms, mobile money integration, and partnerships between insurers and cooperatives. However, uptake among small-scale miners remains relatively low despite increased awareness. Challenges such as income instability, administrative complexities, and product mismatches continue to hinder broader adoption. These experiences suggest that awareness alone may not be sufficient to drive uptake without addressing affordability and relevance of insurance products to miners' unique circumstances (TIRA, 2021; Fisher et al., 2021; Lange, 2021).

In Kenya, approximately 200,000 individuals are directly engaged in small-scale mining, with the sector contributing significantly to gemstone and mineral production. Mining activities are concentrated in counties such as Taita Taveta, Kwale, Migori, Kakamega, and Vihiga. Small-scale miners face numerous occupational, environmental, and economic risks, including tunnel collapses, exposure to harmful substances, respiratory illnesses, and fluctuating incomes. Despite these vulnerabilities, awareness and uptake of microinsurance remain critically low. Studies indicate that fewer than 20 percent of miners possess basic insurance knowledge, while actual microinsurance penetration remains below 3 percent in many mining communities. Factors such as low financial literacy, irregular incomes, limited access to insurance services, and lack of mining-specific insurance products contribute significantly to this low uptake (Ministry of Petroleum and Mining, 2021; Kenya Chamber of Mines, 2023; Kenya ASGM NAP, 2022; FSD Kenya, 2024; Musau, 2023).

Taita Taveta County is one of Kenya's most important gemstone mining regions, hosting deposits of tsavorite, ruby, sapphire, garnet, and tourmaline. Mining activities provide employment and income to a large proportion of the local population, particularly in Mwatate and Voi sub-counties. However, mining operations are characterized by deep underground shafts, manual extraction methods, and limited safety measures. Miners face frequent tunnel collapses, flooding, rock falls, respiratory illnesses caused by silica dust, heat exhaustion, and injuries resulting from the use of rudimentary tools. Environmental degradation and water pollution further threaten the sustainability of local livelihoods. Economic vulnerabilities are equally severe, as miners contend with unpredictable gemstone discoveries, fluctuating market prices, exploitation by middlemen, and the absence of formal employment contracts (Taita Taveta CIDP, 2018–2022; Centre for Sustainable Mining, 2021; Ministry of Mining Kenya, 2025; Mutembei, 2021).

Although microinsurance has the potential to mitigate these risks by providing financial protection against unexpected losses, awareness and uptake among Taita Taveta miners remain extremely low. Surveys indicate that fewer than 15 percent of miners understand basic insurance concepts, while product-specific awareness is below 8 percent. Geographic isolation, poor infrastructure, low financial literacy, and limited insurance marketing efforts have constrained information dissemination. Additionally, miners often perceive existing insurance products as irrelevant because they are primarily designed for agricultural or health risks rather than mining-related hazards. Affordability challenges, trust deficits, and limited access to insurance providers further discourage uptake. As a result, fewer than 2 percent of mining households possess any form of insurance coverage, leaving thousands of households vulnerable to catastrophic shocks and persistent poverty (County Government of Taita Taveta, 2022; Centre for Sustainable Mining, 2021; Britam Connect, 2025; FSD Kenya, 2024; AKI, 2023).

Globally and locally, microinsurance has increasingly been recognized as an effective tool for enhancing financial inclusion and resilience among low-income populations. However, the continued exclusion of small-scale miners from insurance protection highlights the need to understand the factors influencing uptake. Consequently, this study sought to examine the determinants of microinsurance uptake among small-scale miners in Taita Taveta County, focusing on the influence of risk vulnerability, household income, and insurance awareness on adoption decisions (AKI, 2023; FSD Kenya, 2024; Microinsurance Network, 2024).

Statement of the Problem

Small-scale miners in Taita Taveta County face numerous occupational, environmental, and economic risks that threaten their livelihoods and well-being. These risks include tunnel collapses, flooding, rock falls, respiratory illnesses caused by silica dust, heat exhaustion, injuries from rudimentary mining tools, environmental degradation, and unstable incomes resulting from fluctuating gemstone prices and exploitation by middlemen. The predominantly informal nature of the sector further excludes miners from formal social protection systems, healthcare coverage, and financial safety nets, leaving households highly vulnerable to livelihood shocks and persistent poverty (Musau, 2023; World Bank, 2020).

Although the Kenyan government, through the Mining Act 2016 and county development initiatives, has promoted the formalization of small-scale mining and improved access to financial services, implementation challenges such as limited funding, weak institutional capacity, bureaucratic processes, and low community awareness continue to hinder progress. At the same time, microinsurance has been identified as a potential risk-management tool for vulnerable informal workers, yet its uptake among small-scale miners remains extremely low (Ministry of Mining Kenya, 2025).

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Previous studies have examined microinsurance within Kenya's informal sector but have largely overlooked the unique context of small-scale gemstone miners in Taita Taveta County. Consequently, there is limited empirical evidence on how risk vulnerability, household income, and insurance awareness influence microinsurance uptake among this population. This study therefore sought to address this knowledge gap by investigating the determinants of microinsurance uptake among small-scale miners in Taita Taveta County, Kenya.

Objective of the Study

The study was guided by three objectives:

i). To analyze the relationship between risk vulnerabilities and microinsurance uptake among SSM in Taita Taveta County.
ii). To analyze the influence of household income on the microinsurance uptake among SSM in Taita Taveta County.
iii). To assess the influence of insurance awareness on microinsurance uptake among SSM in Taita Taveta County.

Research Hypotheses

The study sought to answer the following research Hypotheses:

i). **H_{01}**: There is no significant influence of risk vulnerabilities on microinsurance uptake among SSM in Taita Taveta County.
ii). **H_{02}**: There is no significant influence of household income on microinsurance uptake among SSM in Taita Taveta County.
iii). **H_{03}**: There is no significant influence of the level of microinsurance awareness on microinsurance uptake among SSM in Taita Taveta County.

REVIEW OF LITERATURE

This study was anchored on four complementary theories: Risk Society Theory, Affordability Theory, Diffusion of Innovations Theory, and the Theory of Planned Behavior (TPB). These theories collectively explained how risk exposure, financial capacity, awareness, and behavioral intentions influenced microinsurance uptake among small-scale miners in Taita Taveta County.

Risk Society Theory, developed by Beck (1992), explained how modern societies generated and distributed risks that disproportionately affected vulnerable populations. In the context of small-scale mining, miners were exposed to occupational, environmental, and economic hazards such as tunnel collapses, respiratory diseases, environmental degradation, and income instability. The theory suggested that individuals who perceived themselves as highly exposed to risks were more likely to seek protective mechanisms such as insurance. Consequently, the study used the theory to explain why heightened risk vulnerability among miners could increase the demand for microinsurance products.

Affordability Theory (Stone, 2006) provided a framework for understanding how household income influenced the ability to purchase insurance. The theory argued that affordability depended on the relationship between service costs and household income. Low-income households often faced competing needs such as food, shelter, healthcare, and education, making it difficult to allocate resources to insurance premiums. Among small-scale miners with irregular and unpredictable earnings, affordability was considered a critical determinant of insurance uptake. The theory therefore suggested that miners with higher and more stable incomes were more likely to adopt microinsurance.

Diffusion of Innovations Theory, developed by Rogers (1962), explained how new ideas and products spread through a social system. The theory emphasized that adoption of innovations depended on awareness, communication channels, perceived benefits, and social influence. In the case of microinsurance, awareness of insurance products, understanding of their benefits, and exposure to relevant information were essential for adoption. The theory was therefore useful in explaining how limited financial literacy and inadequate communication channels in mining communities could hinder microinsurance uptake.

The Theory of Planned Behavior (TPB), developed by Ajzen (1991), explained how behavioral intentions influenced actual behavior. According to the theory, intentions were shaped by attitudes toward a behavior, subjective norms, and perceived behavioral control. Applied to this study, miners were more likely to adopt microinsurance if they perceived it as beneficial, received support from influential community members, and believed they possessed the resources and ability to enroll and maintain coverage. The theory therefore provided an integrated explanation of how perceptions, social influences, and perceived control affected microinsurance uptake decisions. Collectively, these theories provided a comprehensive framework for understanding how risk vulnerability, household income, and insurance awareness influenced microinsurance uptake among small-scale miners in Taita Taveta County.

The conceptual framework illustrated the relationship between three independent variables—risk vulnerability, household income, and microinsurance awareness—and the dependent variable, microinsurance uptake among small-scale miners. Risk vulnerability was measured through occupational, economic, and environmental risks; household income through affordability, income stability, and income adequacy; while awareness was assessed using insurance literacy, product awareness, and information exposure. Microinsurance uptake was measured through perceived importance, payment flexibility preference, mining-risk coverage preference, and willingness to participate in collective insurance schemes.

Empirical studies consistently showed that small-scale miners faced significant occupational, environmental, and economic vulnerabilities that increased their need for risk protection. The Centre for Sustainable Mining (2021) found that miners in Taita Taveta experienced frequent accidents, respiratory illnesses, environmental degradation, and unstable incomes. Studies by Adero (2025) and the Kenya Chamber of Mines (2023) similarly highlighted health risks and livelihood insecurity among mining communities. Household income was also found to significantly influence microinsurance uptake, with higher and more stable incomes increasing the likelihood of insurance participation (Magambo et al., 2022; JMSR, 2025). Furthermore, awareness emerged as a critical determinant, as low levels of insurance literacy and product knowledge limited adoption among informal workers (FSD Kenya, 2024; AKI, 2023). Despite the high-risk nature of mining, microinsurance penetration remained extremely low due to affordability constraints, limited awareness, mistrust, and lack of mining-specific insurance products (Musau, 2023; IRA, 2022; Microinsurance Network, 2024).

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Conceptual Framework

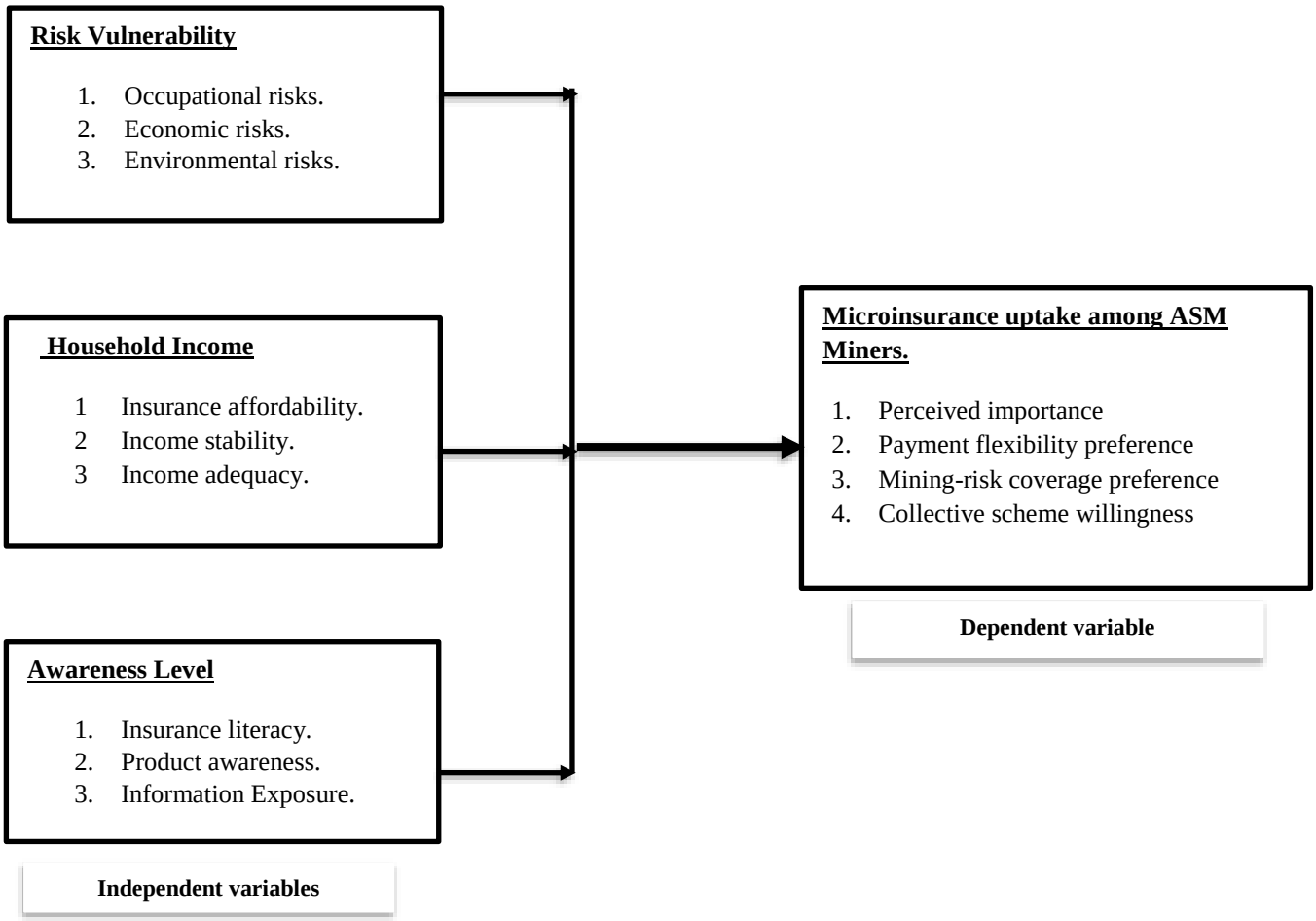


Figure 1: Conceptual Framework

MATERIALS AND METHODS

Research Design

The study adopted a descriptive cross-sectional survey design within a quantitative research paradigm. The design enabled the collection of data at a single point in time to examine the determinants of microinsurance uptake among small-scale miners. Inferential statistics and multiple linear regression analysis were used to test the study hypotheses and establish relationships among variables (Creswell & Creswell, 2018; Magambo et al., 2022).

Target Population and Sampling Technique

The target population comprised approximately 10,000 small-scale gemstone miners operating in the Kasighau, Kamtonga, and Mkuki mining zones of Taita Taveta County. These zones were selected because they represented the county's most active gemstone mining areas (Barreto et al., 2018). The study employed a combination of stratified and simple random sampling techniques to ensure adequate representation of miners across the three mining zones, with a sample of 99 respondents selected using Yamane (1967) formula. Stratification was based on geographical location, while respondents within each stratum were selected through random procedures. This approach minimized sampling bias and enhanced the representativeness and generalizability of the findings (Kenya ASGM NAP, 2022; Creswell & Creswell, 2018).

Instrumentation and Data Collection Procedure

Primary data were collected using a structured questionnaire designed to gather information on risk vulnerabilities, household income, microinsurance awareness, and uptake intentions among small-scale miners. The instrument consisted mainly of closed-ended Likert-scale questions. Before the main survey, a pilot study was conducted to evaluate the validity and reliability of the instrument. Data collection involved administering questionnaires directly to sampled respondents within the mining zones. Participants were informed about the purpose of the study and assured of confidentiality before completing the questionnaire. Completed questionnaires were checked for completeness and consistency prior to analysis (Creswell & Creswell, 2018).

Data analysis

Data were coded, cleaned, and analyzed using quantitative statistical techniques. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize respondents' demographic characteristics and study variables. Inferential statistics were employed to examine relationships among variables. Pearson correlation analysis was conducted to determine the strength and direction of associations between risk vulnerability, household income, microinsurance awareness, and microinsurance uptake. Multiple linear regression analysis was then applied to assess the influence of the independent variables on microinsurance uptake and to test the study hypotheses. Diagnostic

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tests, including normality, linearity, homoscedasticity, and multicollinearity tests, were performed to verify that the assumptions underlying regression analysis were met (Creswell & Creswell, 2018; Field, 2018).

Ethical Considerations

Approval to conduct the study was obtained from the Ethics Review Committee of Taita Taveta University. Participation was entirely voluntary, and all respondents provided informed consent before taking part in the research. To protect participants' privacy and confidentiality, unique identification codes were assigned instead of personal identifiers. All research data were securely maintained and made accessible only to authorized personnel. Furthermore, the data collection process was carried out by trained enumerators who adhered to the principles of professionalism, integrity, respect, and confidentiality throughout the study.

RESULTS

A total of 99 questionnaires were issued to respondents, with 71 filled and returned. The returned questionnaires formed a response rate of 71.7% as shown in Table 1.

Table 1: Response Rate

Location	Distributed	Returned	Response rate
Kasighau	25	20	80.0
Kamtonga	39	28	71.8
Mkuki	35	23	65.7
Overall	**99**	**71**	**71.7**

Demographic Information Analysis

Table 2: Demographic Data

Variable	Category	Frequency	Percentage (%)
Distribution of Gender	Males	51	71.8
	Females	20	28.2
Distribution by Age	18-30	5	7.0
	31-40	20	28.2
	41-50	35	49.3
	>50	11	15.5
Distribution of the level of education	No formal education	7	9.9
	Primary	36	50.7
	Secondary	19	26.8
	Certificate/Diploma	8	11.3
	Degree & above	1	1.4
Distribution of mining zones	Kasighau	20	28.2
	Kamtonga	28	39.4
	Mkuki	23	32.4
Distribution by duration of mining	<1 year	2	2.8
	1-5 years	14	19.7
	6-10 years	26	36.6
	>10 years	29	40.8
Distribution by Mining Operation Type	Individual	32	45.2
	Cooperative	25	35.2
	Both	14	19.7
Distribution of the Number of Dependents	None	2	2.8
	1-3	24	33.8
	4-6	28	39.4
	>6	17	23.9
TOTAL		**71**	**100%**

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Key Findings

The descriptive analysis examined respondents' perceptions regarding risk vulnerabilities, household income, microinsurance awareness, and microinsurance uptake among small-scale miners in Taita Taveta County. Mean scores and standard deviations were used to assess the level of agreement and variability in responses among the 71 respondents.

Regarding risk vulnerabilities, miners generally perceived themselves as moderately exposed to various risks. Environmental risks recorded the highest agreement level (M = 3.43, SD = 1.03), indicating that respondents recognized environmental threats such as land degradation and pollution as significant concerns. Occupational risks received a near-neutral rating (M = 3.33, SD = 1.12), while economic risks were also rated moderately (M = 3.07, SD = 1.11). Miners particularly agreed that they lacked adequate safety equipment and protective gear, highlighting the hazardous nature of mining activities in the county. Overall, the study found that respondents exhibited neutral perceptions of risk vulnerabilities (M = 3.28, SD = 1.08), with considerable variation among SSMs.

For household income, respondents reported moderate income adequacy and affordability challenges. The findings suggested that many miners operated under unstable and irregular income conditions, which affected their ability to meet household needs and allocate resources toward insurance premiums. Income volatility emerged as a key characteristic of the mining sector, reflecting the uncertainty associated with gemstone discoveries and fluctuating market prices. Overall, respondents agreed on perceptions of household income vulnerability (M = 3.48, SD = 1.11), with variation reflecting diverse circumstances.

Concerning microinsurance awareness, the results indicated moderate levels of awareness. While some respondents demonstrated basic knowledge of insurance concepts and products, overall awareness remained relatively limited. The findings suggested that information exposure, insurance literacy, and familiarity with available products were insufficient among many miners, potentially constraining informed decision-making regarding insurance adoption. The composite microinsurance awareness score (M = 2.25, SD = 0.81) indicated generally low levels of knowledge among small-scale miners. These findings highlight limited microinsurance awareness among miners in Taita Taveta County.

With respect to microinsurance uptake, miners exhibited moderate uptake intentions, with an overall mean score of approximately 3.43. Respondents showed a strong preference for flexible premium payment options and insurance products specifically designed to cover mining-related risks. They also expressed willingness to participate in collective insurance schemes. These findings suggest that although actual insurance coverage remained low, there was a positive attitude toward microinsurance provided that products were affordable, accessible, and tailored to miners' unique needs. Overall, the descriptive findings indicated that risk exposure, income conditions, and awareness levels played important roles in shaping miners' perceptions and intentions toward microinsurance uptake.

Table 3: Means and Standard Deviations of Risk Vulnerability Parameters

Risk vulnerability parameters	Mean	Std. Dev
Occupational risks		
Mining frequently results in injuries from accidents	3.28	1.06
Miners are exposed to respiratory diseases due to dust and poor ventilation	3.32	1.03
Tunnel/shaft collapses are common	2.51	0.86
Miners lack adequate safety equipment and protective gears	3.46	1.04
Dimension score	**3.33**	**1.12**
Economic risks		
Mining income is highly unpredictable and irregular	3.48	1.09
Fluctuations in gemstone prices severely affect earnings	2.94	1.03
Middlemen exploit miners by paying them low prices	3.39	1.14
Miners lack alternative income sources during low seasons	3.52	1.16
Dimension score	**3.07**	**1.11**
Environmental risks		
Water sources in mining areas are contaminated by sediments	3.41	1.10
Miners are concerned about exposure to toxic substances	3.18	0.98
Flooding poses a serious risk to miners during rainy seasons	3.70	0.85
Dimension score	**3.43**	**1.03**
Composite score	**3.28**	**1.08**

Scale: 1.00-1.80 (Strongly disagree), 1.81-2.60 (Disagree), 2.61-3.40 (Neutral), 3.41-4.20 (Agree), 4.21-5.00 (Strongly agree)

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Table 4: Means and Standard Deviations of Household Income

Household income	Mean	Std. Dev
Income adequacy		
Mining income is sufficient to cover basic household needs	3.25	1.12
The household has other sources of income	3.56	1.01
Presence of disposable income after covering food and shelter	1.92	0.77
Saves part of the income	2.83	1.03
Dimension score	**2.89**	**1.16**
Insurance affordability		
Paying for insurance would require sacrificing essential needs	4.23	0.68
Current income barely covers basic needs, leaving nothing for insurance	4.04	0.55
Could afford insurance if payment schedules matched income patterns	4.10	0.70
Income level significantly affects the ability to purchase insurance	4.06	0.84
Dimension score	**4.11**	**0.70**
Income stability		
Household income is unstable and inconsistent from month to month	3.52	1.07
Income fluctuations normally affect my household's ability to meet basic needs	4.10	0.42
I can reliably plan my household expenses because I know how much I will earn	2.70	0.87
Unconfident that the household can make regular payments for insurance due to current income patterns	3.42	1.17
Dimension score	**3.44**	**1.05**
Composite score	**3.48**	**1.11**

Scale: 1.00-1.80 (Strongly disagree), 1.81-2.60 (Disagree), 2.61-3.40 (Neutral), 3.41-4.20 (Agree), 4.21-5.00 (Strongly agree)

Table 5: Means and Standard Deviations of Microinsurance Awareness

Microinsurance awareness parameters	Mean	Std. Dev
General insurance knowledge		
Understands how insurance works	2.10	1.02
Knows how to file an insurance claim	2.41	0.71
Understands the rights and obligations of policyholders	2.21	0.86
Understands terms like premium, coverage, and claim	2.15	0.71
Dimension score	**2.22**	**0.84**
Product awareness		
Aware of insurance companies operating in Taita Taveta County	2.34	0.79
Knows where to obtain information about microinsurance products	2.45	0.75
Familiar with mobile-based insurance products	2.24	0.78
Dimension score	**2.34**	**0.78**
Information exposure and sources		
Information about insurance reaches our mining community regularly	2.27	0.77
Trusts sources providing information about insurance	2.41	0.75

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Information about insurance is provided in a language that they understand	1.96	0.78
Dimension score	**2.21**	**0.79**
Composite score	**2.25**	**0.81**

Scale: 1.00-1.80 (Strongly disagree), 1.81-2.60 (Disagree), 2.61-3.40 (Neutral), 3.41-4.20 (Agree), 4.21-5.00 (Strongly agree)

Table 6: Means and Standard Deviations of Microinsurance Uptake

Microinsurance uptake parameters	Mean	Std. Dev.
Microinsurance is important for protecting my income and livelihood as a miner	3.00	1.08
Prefer insurance with flexible payment options that match income patterns	4.13	0.38
Would buy insurance if it specifically covers mining risks	3.59	1.04
Would trust insurance more if facilitated through mining cooperatives	3.00	1.13
Overall	**3.43**	**0.55**

Scale: 1.00-1.80 (Strongly disagree), 1.81-2.60 (Disagree), 2.61-3.40 (Neutral), 3.41-4.20 (Agree), 4.21-5.00 (Strongly agree)

Correlation Analysis

Pearson correlation analysis was conducted to determine the strength and direction of the relationships between risk vulnerability, household income, microinsurance awareness, and microinsurance uptake among small-scale miners in Taita Taveta County. The findings revealed that all three independent variables were positively and significantly correlated with microinsurance uptake. Microinsurance awareness recorded the strongest positive association with uptake, suggesting that miners with greater insurance literacy, product knowledge, and information exposure were more likely to embrace microinsurance. Household income also exhibited a positive relationship with uptake, indicating that miners with more stable and adequate incomes were better positioned to afford insurance premiums. Similarly, risk vulnerability was positively correlated with uptake, implying that miners who perceived higher occupational, environmental, and economic risks were more inclined to seek insurance protection. Overall, the correlation results provided preliminary support for the study hypotheses and justified further regression analysis to determine the independent effect of each variable on microinsurance uptake. (Pearson's r, $p < 0.05$).

Table 7: Correlation Matrix for Study Variables

Variable		Y	X_1	X_2	X_3
Microinsurance uptake	Pearson Correlation	1			
	Sig. (2-tailed)	-			
Risk vulnerabilities	Pearson Correlation	**0.428**	1		
	Sig. (2-tailed)	0.000	-		
Household income & microinsurance affordability	Pearson Correlation	**0.427**	0.381	1	
	Sig. (2-tailed)	0.000	0.001	-	
Awareness	Pearson Correlation	**0.372**	0.528	0.57	1
	Sig. (2-tailed)	0.001	0.000	0.000	-

Pearson's correlation analysis was conducted to examine the strength and direction of the relationships between risk vulnerabilities, household income, microinsurance awareness, and microinsurance uptake among small-scale miners in Taita Taveta County. The findings revealed that all three independent variables had positive and statistically significant correlations with microinsurance uptake, indicating that increases in each factor were associated with higher levels of microinsurance uptake (Field, 2018).

The results showed that risk vulnerabilities had the strongest relationship with microinsurance uptake ($r = 0.428$, $p = 0.000$), indicating a moderate positive and statistically significant association. This finding suggests that miners who perceived themselves to be more vulnerable to occupational, environmental, and economic risks were more likely to express interest in or adopt microinsurance products. The result supports the propositions of Risk Society Theory, which postulates that exposure to risks increases the demand for protective mechanisms such as insurance (Beck, 1992). The finding further implies that perceived risk exposure serves as a key motivation for insurance adoption among small-scale miners. Similar findings were reported by Cia Jin and Song (2015), who found that a higher perceived probability of risk occurrence significantly increased insurance uptake.

Similarly, household income and microinsurance affordability exhibited a moderate positive correlation with microinsurance uptake ($r = 0.427$, $p = 0.000$). The statistically significant relationship indicates that miners with relatively higher and more stable incomes were more likely to participate in microinsurance schemes. This finding is consistent with Affordability Theory, which argues that individuals' purchasing decisions are influenced by their financial capacity and ability to meet premium obligations (Stone, 2006). Comparable findings were reported by Magambo et al. (2022), who established that household income significantly influenced participation in microinsurance programs among low-income populations.

Furthermore, microinsurance awareness demonstrated a positive and significant relationship with uptake ($r = 0.372$, $p = 0.001$). Although the correlation was relatively weaker than those of risk vulnerability and income, it remained statistically significant, indicating that miners with

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greater insurance literacy, product knowledge, and information exposure were more likely to embrace microinsurance. This finding supports the Diffusion of Innovations Theory, which emphasizes the role of awareness and communication in promoting innovation adoption (Rogers, 2003). Similar observations were reported by FSD Kenya (2024) and the Association of Kenya Insurers (2023), who found that awareness and financial literacy positively influenced insurance uptake among informal-sector workers.

The analysis also revealed positive interrelationships among the independent variables. Awareness was positively correlated with risk vulnerability ($r = 0.528$, $p = 0.000$) and household income ($r = 0.570$, $p = 0.000$), suggesting that better-informed miners were more likely to recognize risks and appreciate the benefits of insurance products. Overall, the correlation analysis provided strong preliminary evidence that risk exposure, household income, and awareness were important determinants of microinsurance uptake among small-scale miners in Taita Taveta County, thereby providing support for the study hypotheses (Field, 2018).

Regression Analysis

The regression analysis results indicated that perceived risk vulnerabilities had a positive and statistically significant relationship with microinsurance uptake ($\beta = 0.372$, p-value = 0.023). The coefficient indicated that a one-unit increase in the risk vulnerability score measured on a five-point Likert scale is associated with a 0.372-unit increase in the microinsurance uptake score, holding household income and awareness constant. Since the p-value (0.023) is less than the alpha threshold of 0.05, this relationship is statistically significant. Therefore, the null hypothesis (H_{01}) is rejected, providing empirical evidence that mining-related vulnerabilities have a statistically significant positive influence on microinsurance uptake among SSM. This finding suggests that miners who perceive greater exposure to occupational risks are more likely to adopt microinsurance as a protective mechanism. These results are consistent with the findings of Cia Jin and Song (2015), who reported that a higher perceived probability of risk occurrence increases the likelihood of insurance uptake.

Household income emerged as a statistically significant predictor of microinsurance uptake ($\beta = 0.408$, p-value = 0.030). The coefficient indicated that a one-unit increase in the household income score is associated with a 0.408-unit increase in microinsurance uptake, controlling for risk vulnerabilities and awareness. Since the p-value (0.030) is below the established alpha threshold of 0.05, this relationship is statistically significant. Therefore, the null hypothesis (H_{02}) is rejected, confirming that household income has a statistically significant positive influence on microinsurance uptake among SSM miners in Taita Taveta County. The magnitude and significance of this coefficient underscore the critical role of economic capacity in insurance adoption, suggesting that improved financial standing substantially enhances the likelihood of microinsurance enrolment within this population. These results are consistent with the findings of Jose Miguel et al. (2024), who, in their study on subsidizing inclusive insurance to reduce poverty, determined that improvements in economic capacity led to increased insurance uptake.

The regression results showed that awareness had a positive but statistically non-significant relationship with microinsurance uptake ($\beta = 0.084$, p-value = 0.681). The coefficient suggested that a one-unit increase in the awareness score would be associated with a 0.084-unit increase in the microinsurance uptake score, holding risk vulnerabilities and household income constant. This finding is similar to that reported by IJRISS (2025), where the authors established that knowledge and awareness, including financial literacy, are important factors in improving insurance uptake among rural households.

However, since the p-value (0.681) substantially exceeded the alpha threshold of 0.05, this effect is not statistically significant. Consequently, the null hypothesis (H_{03}) is not rejected, indicating that insurance awareness does not have a statistically significant independent influence on microinsurance uptake among small-scale miners in Taita Taveta County when accounting for other predictors in the model. This finding was particularly noteworthy given that awareness exhibited a significant bivariate correlation with microinsurance uptake ($r = 0.372$, $p = 0.001$). The lack of independent predictive power suggests that while awareness may be associated with uptake at the bivariate level, its effect is likely mediated or confounded by other factors, particularly risk vulnerabilities and household income. This implies that knowledge alone may be insufficient to drive insurance adoption when economic constraints or risk perceptions play more decisive roles. This finding is consistent with Chimuka Leo (2021), who reported that although insurance awareness had improved in Zambia, uptake remained low despite increased sensitization. This suggests that awareness alone may not drive insurance adoption, as other barriers also play a significant role in limiting uptake.

Table 8: Model Summary

Multiple R-squared	Adjusted R-squared	F-statistics	Degree of freedom	P-value
0.266	0.233	8.101	67	0.0001

Table 9: Regression Coefficient Results

Coefficients	Estimate(β)	Std Error	t-value	p-value
Intercept	0.614	0.594	1.035	0.305
Risk vulnerabilities	0.372	0.160	2.332	0.023*
Household income	0.408	0.185	2.211	0.030*
Awareness	0.084	0.202	0.413	0.681

The model yielded an R-squared value of 0.266, indicating that approximately 26.6% of the variance in microinsurance uptake among artisanal miners in Taita Taveta County was explained collectively by risk vulnerabilities, household income, and awareness. The remaining 73.4% variance was attributable to other factors not included in the model, suggesting that additional variables might have played important roles in determining microinsurance adoption behavior.

In testing for the significance of the model, the null hypothesis stated that all regression coefficients were zero. The p-value in the model summary was compared against the alpha value of 0.05 to decide whether to accept or reject the null hypothesis. Since the p-value was 0.0001, which was

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less than 0.05, the null hypothesis was rejected, and it was concluded that the coefficients differed from zero. In other words, the model was statistically significant. This confirmed that the set of predictor variables collectively had a significant relationship with microinsurance uptake among SSM miners. The statistical significance of the model validated the inclusion of these factors in understanding insurance adoption decisions. It demonstrated that the model offered substantially better prediction of microinsurance uptake than would have been achieved by chance.

The overall multiple regression model was expressed as:

$$\mathbf{Y= 0.614+0.372X_1+0.408X_2+0.084X_3}$$

Interpretation of Findings

The multiple regression analysis revealed that risk vulnerabilities ($\beta = 0.372$, $p = 0.023$) and household income ($\beta = 0.408$, $p = 0.030$) had positive and statistically significant effects on microinsurance uptake among small-scale miners. This implies that miners who perceived higher levels of risk and those with greater financial capacity were more likely to adopt microinsurance. However, microinsurance awareness ($\beta = 0.084$, $p = 0.681$) did not have a statistically significant independent effect when other variables were controlled. The findings suggest that while awareness is important, actual uptake is primarily driven by perceived risk exposure and affordability. Consequently, the null hypotheses for risk vulnerability and household income were rejected, while the hypothesis for awareness was not rejected. (Field, 2018; Cia Jin & Song, 2015).

Practical Implications

The findings of this study have important implications for policymakers, insurance providers, mining associations, and development agencies. Since risk vulnerability and household income emerged as significant predictors of microinsurance uptake, insurance providers should design products that specifically address mining-related risks such as accidents, injuries, occupational illnesses, and loss of income. Flexible premium payment schedules aligned with miners' irregular income patterns would enhance affordability and participation. Policymakers should strengthen financial inclusion initiatives and support partnerships between insurers, mining cooperatives, and mobile money service providers to improve accessibility. Mining associations can facilitate group-based insurance schemes to reduce premium costs and increase coverage among members. Additionally, awareness campaigns should be complemented by practical interventions that improve miners' economic capacity, as awareness alone was found insufficient to drive uptake. Collectively, these measures can enhance financial resilience, reduce vulnerability to shocks, and improve the welfare of small-scale mining households in Taita Taveta County (FSD Kenya, 2024; AKI, 2023).

THEORETICAL IMPLICATIONS

The study contributes to the growing body of knowledge on microinsurance adoption by providing empirical support for several theoretical perspectives. The significant influence of risk vulnerability on microinsurance uptake validates the assumptions of Risk Society Theory (Beck, 1992), which posits that individuals exposed to higher risks are more likely to seek protective mechanisms. The positive effect of household income supports Affordability Theory (Stone, 2006), demonstrating that financial capacity remains a critical determinant of insurance adoption. Although awareness showed a significant bivariate relationship with uptake, its non-significant effect in the multivariate model suggests that knowledge alone may not translate into actual adoption when affordability and risk perceptions are considered. This finding extends the Diffusion of Innovations Theory (Rogers, 2003) by highlighting the interaction between awareness and economic factors. The study therefore enriches existing literature on insurance behavior among vulnerable informal-sector populations.

Limitations of the Descriptive Analysis

The descriptive analysis was limited by its reliance on self-reported perceptions and opinions of respondents, which may have been influenced by recall bias or social desirability bias. The cross-sectional nature of the study captured responses at a single point in time and therefore could not account for changes in perceptions or behaviors over time. Additionally, descriptive statistics provided insights into patterns and trends but did not establish causal relationships between variables. The relatively small sample size and focus on selected mining zones in Taita Taveta County may also limit the generalizability of the findings to other mining communities within Kenya or beyond.

CONCLUSIONS AND RECOMMENDATIONS

The study concluded that microinsurance uptake among small-scale miners in Taita Taveta County is significantly influenced by risk vulnerability and household income. Miners who perceived greater exposure to occupational, environmental, and economic risks were more inclined to adopt microinsurance as a protective mechanism. Similarly, miners with higher and more stable incomes demonstrated a greater likelihood of participating in microinsurance schemes due to improved affordability. While microinsurance awareness was positively associated with uptake, it did not independently predict adoption when risk vulnerability and income were considered simultaneously. These findings indicate that actual uptake is driven more by economic realities and perceived risk exposure than by awareness alone.

Based on these findings, the study recommends that insurance providers develop affordable and flexible microinsurance products tailored to the specific risks faced by small-scale miners. Premium payment structures should accommodate irregular income patterns common in the mining sector. Government agencies, insurers, and mining cooperatives should collaborate to establish group insurance schemes that lower costs and improve accessibility. Financial inclusion initiatives aimed at enhancing miners' incomes and economic stability should also be strengthened. Furthermore, awareness programs should focus not only on educating miners about insurance products but also on demonstrating their practical value in mitigating mining-related risks. These interventions would contribute to increased microinsurance uptake and improved financial resilience among mining households.

Future Research Directions

Future studies should examine additional factors that may influence microinsurance uptake among small-scale miners, including trust in insurance providers, financial literacy, cultural beliefs, and institutional support mechanisms. Longitudinal studies would be useful in assessing how insurance adoption behaviors evolve over time and in response to policy interventions. Researchers could also investigate the effectiveness of mobile-based microinsurance platforms and cooperative insurance schemes in improving uptake among informal-sector workers. Comparative

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studies involving mining communities in different counties or countries would provide broader insights into contextual factors influencing microinsurance adoption and enhance the generalizability of findings.

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RECOGNITIONS OF THE AUTHOR CONTRIBUTION

Donald Odhiambo Oloo - Conceptualization, methodology, data collection, data analysis, writing.

Peter Misango Shibairo - Supervision, refining methodology, cross-checking data analysis and model

Christopher Kitali Masila - Supervision, validation, editing, cross-checking data analysis and reviewing.

DATA AVAILABILITY

To protect participant confidentiality and privacy, the complete dataset used in this study is not publicly accessible. Nevertheless, de-identified data and relevant supporting documentation can be made available by the corresponding author upon reasonable request and subject to applicable ethical considerations.

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