ISSN 2520-6303

Economics, Management and Sustainability

journal home page: https://jems.sciview.net

Scientific Platform

Aremu, O. A., Eyiolawi, S. A., & Adeoye, H. (2026). Health financing, socio-economic inequality, and household financial vulnerability in the United States: A repeated cross-sectional analysis (2018-2024) with implications for Sustainable Development Goal 3.8. *Economics, Management and Sustainability, 11*(1), 95-115. doi:10.14254/jems.2026.11-1.5.

Health financing, socioeconomic inequality, and household financial vulnerability in the United States: A repeated cross-sectional analysis (2018-2024) with implications for Sustainable Development Goal 3.8

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Article history:
Received: February 27, 2026
1st Revision: March 02, 2026
Accepted: April 10, 2026

JEL classification:
I13
D14
I18
J10

DOI:
10.14254/jems.2026.11-1.5

Abstract: *Purpose*: This study examines how health insurance coverage and medical cost burden, alongside key socioeconomic and demographic factors, predict financial vulnerability in the United States, with implications for sustainable household financial protection aligned with SDG 3.8. *Methodology*: A repeated cross-sectional design was employed, using three waves of the US National Financial Capability Survey (NFCS: 2018, 2021, 2024), covering the pre-pandemic, post-pandemic, and recovery periods, respectively. A multidimensional Financial Vulnerability Index (FVI) was constructed following a three-dimensional framework (sensitivity, resilience, exposure) and operationalised as a binary variable using a composite standardised scoring approach. Binary logistic regression models with pairwise comparisons among all predictor categories were estimated for each survey wave. *Results:* Uninsured individuals face 37-50% higher odds of financial vulnerability relative to uninsured counterparts, while individuals with high medical cost burdens face over four times the odds (OR = 4.18-5.34) across the survey waves. Household income emerges as the single most powerful predictor, with individuals earning less than $25,000 being 8.83 to 16.0 times more likely to be financially vulnerable than those earning $200,000 or more. Education, financial literacy, and household dependency exhibit threshold effects: meaningful protective differences emerge only upon attainment of university-level education or reduction to zero dependents. *Theoretical contribution*: The study extends

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Grossman's (1972) Health Capital Model into the domain of financial vulnerability by demonstrating that market-based health financing structures interact with socioeconomic position to generate structural exposure to financial hardship. Rather than adopting a unidimensional index, the application of multidimensional FVI in this study advances methodological practice in financial vulnerability research and reveals threshold effects previously masked in the literature. *Practical Implications*: The findings call for health and fiscal policy frameworks that extend beyond aggregate economic metrics to address distributional consequences of health financing arrangements. Targeted interventions, including expanded insurance coverage, income support for low-income households, financial literacy programmes, and strengthened social protection for working-age adults, are identified as critical for reducing persistent financial vulnerability and advancing financial sustainability.

Keywords: health financing, socioeconomic, demographics, financial vulnerability, household income, financial security, welfare

Sustainable Development Goals (SDGs): SDG 3: Good Health and Well-being; **SDG 10:** Reduced Inequalities; **SDG 1:** No Poverty

1. Introduction

The rising demand for health financing has become a defining feature of contemporary health systems worldwide. As out-of-pocket (OOP) spending, particularly in low-income countries, absorbs an increasing share of household income, access to essential healthcare remains particularly constrained for low-income families (Voto, Voto & Ngepah, 2025; World Health Organization, 2021, hereafter, WHO), with more chances of exposing people to the risk of falling into financial hardship. In response to these inequities, the WHO's global call for Universal Health Coverage (UHC), framed within Sustainable Development Goal (SDG) target 3.8, has pushed governments to prioritise equitable access to healthcare and expanded financial protection (WHO, 2026).

While many high-income countries have made substantial progress toward achieving UHC, low-income countries and the United States (US) continue to lag in implementation (WHO, 2025; Olufadewa, Adesina & Ayorinde, 2021; Orach, 2009; WHO, 2006). This persistent disparity has been attributed to differences in health financing reforms implemented across countries and the effectiveness of tax-financed systems (WHO, 2025; WHO, 2006). However, one profound implication of failing to achieve SDG 3.8 (UHC) is that progress toward SDG 10 (reduced inequalities) and SDG 1 (no poverty) becomes increasingly difficult to sustain. Evidence from the financial vulnerability and sustainability literature suggests that private health spending leads to financial hardship, which worsens and undermines efforts to eradicate poverty (WHO & World Bank, 2023). Global monitoring has shown that over 1 billion people spend more than 10% of their budget on health, pushing 1.3 billion people further into poverty through OOP payments, undermining SDG 1 and SDG 10 (WHO & World Bank, 2023; Chen et al., 2023). Although most high-income countries, such as the United Kingdom (UK), have attained UHC, the US remains an exception and appears to be drifting further from the universal model of health coverage. This is evident in recent US public policy aimed at eliminating government-funded health insurance programmes for vulnerable groups.

The COVID-19 pandemic further heightened the urgency of health financing policy. Since its emergence in late 2019, the pandemic has exposed the structural weaknesses in national health systems, triggering widespread rationing of services and substantial reorganisation of healthcare delivery (Arnault, Jusot & Renaud, 2022; Hanson et al., 2021). Even advanced economies struggled to reconcile unprecedented surges in healthcare demand with rising fiscal pressures (Hanson et al.,

2021). Most high-income countries entered the pandemic with established national or social health insurance systems, which offered varying degrees of financial protection. In contrast, the US, despite decades of incremental reforms, continues to operate a fragmented, predominantly market-based model (employment-based health insurance) without universal healthcare entitlement (Anandaciva, 2023; Smółka, 2022). This structural divergence has left the US facing persistent coverage gaps and significant unmet medical need, challenges that are further exacerbated for people without employment, leading to financial vulnerability (Aborode et al., 2025). However, household financial vulnerability feeds and worsens income and social inequalities (Kara, Zhou & Zhou, 2021; De Vita & Luo, 2020), making the accomplishment of SDG 3.8 and 10 even more difficult.

For instance, during the 2008 global financial crisis, both the demand for and utilisation of routine and non-emergency healthcare services declined among those who experienced losses in financial assets in the US (Kaplan, 2012), reflecting a tendency toward financial vulnerability. Importantly, such a decline in utilisation occurred not because underlying health needs diminished, but because unexpected income losses constrained affordability and access and increased exclusion. Since income shocks are often difficult to hedge against, it could be argued that a market-based model of health financing exposes individuals in the US and in any country that adopts it to financial vulnerability. Consequent upon this background, *this research is aimed at providing empirical evidence on health financing and socioeconomic and demographic factors affecting financial vulnerability (FV) with implications for sustainable household financial security as aligned in SDG 3.8 (Universal Health Coverage) and SDG 10 (Reduced Inequalities) using data from the US National Financial Capability Survey (NFCS).* The data were collected every 3 years: 2018 (pre-pandemic), 2021 (post-pandemic), and 2024 (recovery). The gap bridged by this work is synthesising health financing and financial vulnerability as a multidimensional, subjective construct, and applying logistic regression to compare in-group factors in predicting the likelihood of financial vulnerability. This study is divided into six sections. Section 2 focuses on the theoretical framework and empirical literature review; Section 3 addresses the methods and materials; Section 4 presents the results; Section 5 discusses the findings; and Section 6 concludes the research.

2. Theoretical framework and empirical evidence

Theoretically, this study is anchored on Grossman's (1972) Health Capital Model, which views health as a durable capital stock that yields both direct utility and indirect returns through enhanced productivity and earnings capacity. According to Grossman (1972), individuals invest in health through medical care, preventive behaviour, and insurance coverage to maintain or improve this stock. However, there is an inverse relationship between age and health as health tends to depreciate over time and is subject to stochastic shocks. Meanwhile, the assumption of stochastic shocks has been criticised as Case and Deaton (2005) argued from the Life Course Perspective that the depreciation of health is non-linear, rapid, and cumulative, such that early-life or work-related socioeconomic disadvantages accelerate the rate of depreciation (δ) in later years. This further aggravates the existing health inequalities and imposes a constrain on achieving SDG 3 (Good Health and Well-being) and SDG 1 (No Poverty). The intuition behind this is that adopting a market-based health financing system is analogous to excluding people with low incomes from accessing health care, which further widens inequalities rather than reducing them, as aimed at in SDG (10).

While many nations, particularly European countries, are striving towards maintaining universal health coverage through public investment in health care for citizens to ensure the continuous supply of health, which has been identified to influence human capital (Capatina & Keane, 2024; Albert, 2021), the US adopts a different approach to health financing (Donnelly et al., 2019). Health financing in the US is characterised by substantial cost-sharing, fragmented insurance arrangements, and significant out-of-pocket exposure, which makes the cost of maintaining health capital uneven across households (Shmerling, 2021). Consequently, the sustainability of health investment is inherently conditioned by socioeconomic position, rendering financial outcomes endogenous to both health shocks and financing structures. For instance, a loss of employment means a loss of health insurance, since employers contribute substantially to employees' coverage, which could increase an individual's financial exposure. More so, government-funded healthcare programmes such as Medicare, Medicaid, and CHIP are targeted at senior/disabled, low-income earners, and children, respectively, indicating that the health of these groups was prioritised over others.

Therefore, financial vulnerability in this framework arises when households are unable to optimally adjust consumption in response to health-related expenditure shocks. Moreover, Grossman's (1972) Health Capital Model assumption of rational lifetime optimisation has been contested by behavioural economics. According to Mullainathan and Shafir (2013), the cognitive burden of financial resource scarcity and ill-health impairs financial decision-making, leading

financially vulnerable people to secure high-interest loans despite knowing the cost of borrowing. Consequently, their financial vulnerability pushes them further into debt, which often translates into increased income and social inequalities and poverty levels. Moreover, in the absence of comprehensive insurance or adequate precautionary savings, medical spending competes directly with other forms of consumption, forcing households to deplete assets, accumulate debt, or forgo essential expenditures. The Health Capital Model implies that individuals maximise expected lifetime utility subject to income and time constraints; yet this optimisation is constrained by liquidity, credit access, and wealth holdings (Grossman, 1972). Socioeconomic predictors such as income, education, employment status, and wealth, therefore, influence not only the level of health investment but also individuals' vulnerability to the financial consequences of health depreciation.

Vulnerability is commonly understood as an individual's inherent tendency to encounter undesirable outcomes (e.g., financial hardship) or adverse situations due to exposure to stressors (O'Connor et al., 2019; Ingram & Luxton, 2005; Hammen, 2005). Following O'Connor et al. (2019) conceptualisation of vulnerability and application to an individual financial condition, financial vulnerability refers to "*the (conditional) likelihood to experience financial hardship (in case of financial shock)*" (Voith & Mauser, 2024: 7). Although the constructs of financial vulnerability in scientific literature have often adopted a unidimensional framework (Song et al., 2025; Arnault et al., 2022; Salignac et al., 2019; Hacker et al., 2018; Lusardi, Mitchell, & Oggero, 2018), Voith and Mauser (2024) definition suggests a multidimensional construct that covers sensitivity, resilience and exposure dimensions of financial vulnerability. This broader perspective enables a more detailed understanding of the factors that determine an individual's risk of encountering financial hardship, particularly under systemic shocks such as pandemics, inflationary pressures, labour market disruptions, and unexpected adoption of contractionary fiscal policy.

While financial vulnerability has been shown to result from several factors in the literature, it has also been linked to social sustainability frameworks and welfare-state resilience. This indicates that factors affecting household financial vulnerability are indirectly related to social sustainability and welfare-state resilience. In understanding social sustainability, socioeconomic vulnerability, which concerns exposure to shocks and low coping capacity at the state level, has been a core dimension alongside inclusion and equity (Biswas & Nautiyal, 2023; Lee, Dodge & Chen, 2022).

Moreover, the direction of influence among household financial vulnerability, social sustainability, and welfare-state resilience appears bidirectional. Lee et al. (2022) and Kind, Botzen and Aerts (2019) showed that high social/financial vulnerability leads to increased fiscal burden, while Matsaganis (2011) and Matsaganis (2020) revealed that the poorly structured welfare state in Greece contributes to fiscal crisis and financial vulnerability. This also aligns with Donoghue (2021), who argued that liberal welfare states often justify welfare-state resilience by shifting risk from the state to individuals. This is typical of countries like the US, where the financial responsibility for achieving UHC is shifted to households, thereby increasing both household and social vulnerability. The implication for sustainability is that it makes it difficult to achieve UHC, as income and social inequalities increase further, leading to a higher poverty rate.

While the links between financial vulnerability and social sustainability are established through social vulnerability, empirical research on financial vulnerability has identified a broad constellation of economic, social, demographic, and health-related determinants. Collectively, these factors reflect persistent structural inequalities and the behavioural constraints that may predispose individuals to adverse financial outcomes. Household income, unemployment, migration status, financial assets, years of education, financial literacy, health, private insurance, household size, and a host of other predictors have been identified to impact financial vulnerability (Guo et al., 2025). Lower household income, unemployment, and a migration background were identified as predictive factors of high financial vulnerability (Voith & Mauser, 2024). This is quite plausible, as a lack of income or unemployment is very likely to affect an individual's financial capability. Anderloni et al. (2011) also attest to this finding in their study, which used panel data from CHARLS-inspired Italian surveys, revealing that financial vulnerability is highly common among low-income and liquidity-constrained households but less common among those with greater real and financial assets, more education, and better insurance coverage.

Furthermore, He and Zhou (2022), within the Chinese context, found that higher risk of medical expenditure and income shocks, and greater financial vulnerability, are significantly higher among rural households, larger households, those with weaker labour force participation, and those with lower educational attainment. In contrast, employee and commercial medical insurance are associated with lower financial vulnerability and lower risk of medical expenditure shocks. Prior studies by Lusardi et al. (2011) and Hasler et al. (2018) on financial fragility in the US context also identified socio-demographic and economic determinants of financial fragility. Even within the working-age population in the US who were supposed to have a stable income, it was revealed that about one-third of the population probably could not cope with a $2,000 emergency expense using

their savings or short-term credit, which was further exacerbated to the extent of inability to confidently cater for a $400 emergency bill (Hasler et al., 2018). The fragility of this population within the US was revealed to be frequent among women, non-white respondents, those with an education below a bachelor's degree, single individuals, and those with dependent children, despite adjusting for income level (Hasler et al., 2018).

However, this result appears to be prevalent among low-income earners, with a lower incidence of financial fragility among middle-income earners, indicating the significant role of income in determining people's financial vulnerability. Nevertheless, these findings indicate that employment and moderate income provide only partial protection for households, as liabilities, household composition, and other factors shape financial vulnerability. Though this evidence is provided by Hasler et al. (2018), it is quite expository. The comparison of financial vulnerability likelihood among different socio-demographic factors was not evaluated; therefore, this research analysed these factors, determined their likelihoods, and compared them with recent US survey datasets.

Voith and Mauser (2024) and He and Zhou (2022) showed that age profiles of financial vulnerability differ across outcomes and contexts. Findings from Austrian and Chinese studies revealed that younger and early middle-aged households with accumulated debt and no substantial assets are more financially vulnerable, especially in rural areas where social insurance is weaker (Voith & Mauser, 2024; He & Zhou, 2022). Hasler et al. (2018) confirmed these findings by showing that young adults in the US are more financially vulnerable than adults aged 50 years and above. This implies that effective retirement plans, timing, and policies are key to ensuring the financial security of households in the US.

A recent study by Bialowolski et al. (2025) argued, based on its findings, that financial strain or 'difficulty in making ends meet' is more strongly associated with health outcomes than income or wealth, contrary to earlier findings that identified income as the most important economic factor. For instance, poor mental and functional health was found to reduce net worth and increase indebtedness, suggesting a bidirectional relationship between health and finances over time (Bialowolski et al., 2025). This indicates that financial hardship, a subset of financial vulnerability as argued by Voith and Mauser (2024), may therefore be a bi-directional relationship or a vicious cycle. However, this is beyond the scope of our study as we have rather evidenced its determinants. Nonetheless, Choi and Lee (2023) argued that older Americans' sense of control over life circumstances could moderate the relationship between financial hardship and changes in emotional well-being.

Findings from Sommet and Spini (2022) align more closely with the argument of Bialowolski et al. (2025), as they revealed that financial scarcity or perceived resource insufficiency is associated with poorer self-rated health and greater unhappiness. Therefore, the possibility that financial vulnerability predicts individuals' health outcomes cannot be entirely ruled out; however, this is beyond the scope of this study, which is to establish the role of health financing and demographic factors in explaining individuals' financial vulnerability in the US. The evidence from this study aims to provide lessons for the United Kingdom, as there appears to be less extensive direct research linking health-financing exposures to multidimensional measures of financial vulnerability. Much European work relies on SHARE and EU-SILC and either omits the UK or centres on settings with higher out-of-pocket expenditure. This is quite understandable, as the United Kingdom provides universal health coverage (UHC) through the National Health Service (NHS), making it difficult to collect the required data on out-of-pocket medical expenditure and health insurance. Although Aremu, Eyiolawi and Ojewumi (2025) established that ethnicity, gender, marital status, household income, education, employment, and locations shape individual financial well-being in the UK, this is quite dissimilar to the current research, as Aremu et al. (2025) were unable to analyse how health financing could impact the financial vulnerability.

Moreover, Greek studies of the financial crisis and subsequent austerity have linked increased unemployment and reduced incomes to rising unmet financial needs, with low-income, unemployed, and uninsured individuals most likely to report cost-related barriers to healthcare (Zavras et al., 2016; Economou et al., 2014). Nordic evidence on the medicines burden shows that, even in universal systems, households with low income and poor health encounter appreciable subjective financial pressure from pharmaceutical costs (Aaltonen & Vaalavuo, 2024). Findings from Arnault, Jusot, and Renaud (2022) indicated significant differences in access to healthcare during the pandemic, particularly by economic vulnerability. The effect of economic vulnerability was stronger among individuals with poor health prior to the outbreak, particularly among the oldest individuals (Arnault et al., 2021).

3. Methods and materials

3.1. Study design and data source

In conducting this research, a cross-sectional research design was adopted to examine the predictors of financial vulnerability among United States (U.S.) adults. We employed publicly available repeated cross-sectional data (waves: 2018, 2021, and 2024) from the National Financial Capability Study (NFCS), funded by the FINRA Investor Education Foundation in the United States. These surveys are nationally representative and use a non-probability quota sampling technique to include over 25,000 participants in each survey across the U.S. Each survey was independently representative of the U.S. adult population and thus fit for this study. These surveys were targeted at adults in the U.S. aged 18 or older.

3.2. Population, sample and sampling techniques

This study utilises data from the NFCS funded by the FINRA Investor Education Foundation. The study population consists of individuals aged 18 and above in the US. As noted earlier, a non-probability quota sampling technique was used during the survey. Except for two states, Oregon and Washington in 2018 and Oregon and California in 2021, where oversampling of 1,250 participants each occurred, sample quotas were determined based on census distributions of key demographic factors like age, gender, ethnicity, education level, and income in accordance with the U.S. Census Bureau's American Community Survey. Therefore, a quota of approximately 500 participants per state, including the District of Columbia, was utilised. The quota sampling method was used to select respondents for the surveys, drawing from established online panels of millions of individuals who were initially recruited to join the study, with incentives offered to encourage their participation. For each wave of NFCS data, different agencies conducted state-by-state surveys. Panels for the 2018 survey were provided by SSI (Survey Sampling International), EMI Online Research Solutions, and Research Now, using industry-standard techniques to verify respondents' identities, while ARC Research conducted the survey. In 2021, FGS Global surveyed the Dynata and EMI Online Research Solutions panels, while Meridian Research & Insights conducted the 2024 NFCS survey on the same panels. These survey data were collected via online self-administered questionnaires available on the FINRA website.

3.3. Study variables

This study aims to assess the role of healthcare financing and other socio-demographic factors in determining individuals' financial vulnerability in the U.S. To achieve the aim of this research, specific responses related to the study were extracted from the U.S. NFCS datasets. The response variable, financial vulnerability, is a dichotomous variable with two values: 0 (financially secure) and 1 (financially vulnerable). To develop the binary indicator of financial vulnerability, we created a Financial Vulnerability Index (FVI) using a multidimensional approach.

This approach was premised on our adoption of the financial vulnerability definition of Voith and Mauser (2024: 7), who defined it as "*the (conditional) likelihood to experience financial hardship (in case of a financial shock)*." Consequently, we desist from synonymising financial vulnerability with financial hardship. This definition also aligns with O'Connor et al. (2019), who showed that, irrespective of wealth or income level, no individual is completely immune to vulnerability. Therefore, financial vulnerability is not a state of being or living in poverty, but the risk of falling into hardship (O'Connor et al., 2019), which, in the long run, could culminate in poverty. We therefore followed the three-dimensional framework of financial vulnerability (sensitivity, resilience, and exposure) adopted by Anderloni et al. (2011), Fernandez-Lopez et al. (2023), and Voith and Mauser (2024) to create the index using five items from NFCS datasets. This enables us to create an index that captures the sensitivity dimension (objective), resilience dimension (subjective), and the exposure dimension of financial vulnerability, a more robust index compared to the unidimensional index in previous studies (Song et al., 2025; Arnault, Jusot, & Renaud, 2022; Hasler, Lusardi, & Oggero, 2018).

We employed the description of these dimensions as used by Voith and Mauser (2024) as a guide for item selection in developing FVI. These items include "emergency savings", "monthly bill payment difficulty", "income uncertainty", "confidence to meet up with unexpected expenses of up to $2,000 within the next month", and "having health or medical bill debt", all of which satisfy the three dimensions of FVI. Although these items were in different response scales, some with binary responses, others with at least three response choices, we first re-code these responses for

realignment to the same direction, such that a higher value for each item depicts financial vulnerability before testing for the reliability of the items. The reliability test results ($\alpha_{2018} = 0.71$; $\alpha_{2021} = 0.74$; $\alpha_{2024} = 0.74$) showed that the items are internally consistent. We therefore proceed to standardise each item, from which an overall index is computed and rescaled to values between 0 and 1. Respondents with index values greater than the median index of 0.188 were classified as "Financially vulnerable" (1) and those below the median as "Financially secure" (0).

$$FV = \begin{cases} 1, Financially\ vulnerable \\ 0, otherwise \end{cases} \quad (1)$$

We chose the standardised composite index approach over Principal Component Analysis (PCA) for constructing FVI because PCA assumes continuous variables with linear relationships (Voith & Mauser, 2024), whereas our items are categorical and binary. Although Kolenikov and Angeles (2004 & 2009) and Voith and Mauser (2024) in their respective studies have shown that PCA can be applied to ordinal variables, there is yet no consensus on its adoption; thus, we restrict our analysis to the composite approach.

The key predictors for the study are health insurance coverage and medical cost burden. Health insurance coverage was captured in the data as a single binary item with responses "Yes" or "No," which we re-coded as "Insured" and "Uninsured," respectively. The measurement of Medical Cost Burden (MCB) differs across waves: in 2024, there is only one binary indicator, whereas in earlier waves, three binary indicators ("Yes" or "No") were standardised and combined into a single binary indicator. First, we confirm the internal consistency ($\alpha_{2018} = 0.81$; $\alpha_{2021} = 0.8$) of the indicators before proceeding to repeat the process adopted in developing the financial vulnerability binary indicator, except for the 2024 NFCS data. In 2024, two of the three items from earlier surveys (2018, 2021) were deprecated, leaving only one retained. Consequently, we used only the indicator to capture MCB. The challenge with this approach is that results generated with this unharmonised MCB might affect comparability across waves; however, to ensure comparability, we performed sensitivity analyses using the common MCB indicator across waves 2018, 2021, and 2024. For year 2018 and 2021, respondents with values above the median unharmonised MCB were categorised as "High medical cost burden" and those with lower than the median MCB were categorised as "Low medical cost burden" while in 2024 the binary responses were re-coded from "Yes" to "High medical cost burden" and "No" to "Low medical cost burden".

Furthermore, the financial literacy score was derived from three items, even though five were provided in the surveys. Only three of the items received sufficient responses, while the remaining two received no responses; hence, they were excluded from the measurement of respondents' financial literacy. The financial literacy items test respondents' knowledge of interest rates, inflation, and mortgages, and use definitive answers to score them. Financial literacy scores therefore range from 0 to 3, with 0 coded as "Low financial literacy", 1 and 2 coded as "Moderate financial literacy ", and 3 coded as "High financial literacy". Furthermore, gender, age group, education, employment status, household income, dependents, homeownership, and race/ethnicity were included as control variables. The details of the predictors' categories after re-coding and further grouping were presented in Table 1, which comprised the descriptive analysis of the variables.

After excluding all non-responses across the datasets, a total of 17,176 out of 27,091 responses were retained for 2018, 16,091 out of 27,118 for 2021, and 15,481 out of 25,539 for 2024. Although the number of responses declined due to filtering criteria applied to ensure data suitability, the resulting datasets contain high-quality responses suitable for analysis.

3.4. Methods of data analysis

To commence the analysis, a descriptive analysis was performed to summarise the sample characteristics across the 2018, 2021, and 2024 survey waves. Cross-tabulations presenting frequency counts and percentages were used to illustrate the distribution of respondents across categories of each variable by financial vulnerability status. For ease of comparison, a row-sum approach was applied, ensuring that the percentage distribution of respondents across financial vulnerability categories for each variable totals 100% per year. Given that the dependent variable is a binary indicator, we estimated a binary logistic regression model to identify the determinants of financial vulnerability per survey year.

Since the survey is a repeated cross-sectional survey, separate logit models were estimated for each survey year to examine the temporal consistency in the effects of the key predictors. Odds ratios (OR) with corresponding 95% confidence intervals were computed for interpretability. Furthermore, the empirical results were presented in a distinctive, rigorous format, with pairwise

comparisons conducted across all covariate categories. All analyses were conducted in R from data preparation to results presentation.

3.5. Model specification

A binary logistic regression model was estimated to identify the determinants of financial vulnerability. Although alternative estimation techniques, such as the Linear Probability Model (LPM) and the Probit Model (Wooldridge, 2013), could have been employed, the Logit Model adopted in this study is justified by its methodological advantages. Specifically, the Logit Model overcomes the major limitations of the LPM and yields results comparable to those of the Probit Model while maintaining a simpler mathematical formulation (Wooldridge, 2013; Gujarati & Porter, 2010). The LPM is known to produce fitted probabilities that may fall outside the logical [0,1] interval, thereby violating the fundamental properties of probability. Moreso, the marginal effects of covariates derived from LPM remain constant across all values of the explanatory variables, which is an unrealistic assumption in most empirical contexts (Wooldridge, 2013). The development of the Logit and Probit models addressed these deficiencies by constraining the predicted probabilities within the valid range and allowing for non-constant marginal effects (Wooldridge, 2013). Consequently, the Logit Model provides a more theoretically sound and empirically robust framework for modelling binary outcomes such as financial vulnerability. Prior financial vulnerability studies (Song et al., 2025; Arnault et al., 2022) have adopted a probit model; we employed a logit model, as it facilitates easier interpretation through odds ratios, which provide intuitive insights into the likelihood of falling into financial hardship based on the explanatory factor.

Following Equation (1), we specify the logit model for this study as presented in Equation (2). Equation (2) indicates the conditional probability of being financially vulnerable as

$$\Pr(FV_i = 1 \mid X_i) = \frac{e^{X_i\beta}}{1+e^{X_i\beta}} \tag{2}$$

where X_i is a $1 \times K$ vector of covariates and β is the $K \times 1$ parameter vector.

Equivalently, the log-odds (logit) form of Equation (2) is presented in Equation (3) and its exponentiating form in Equation (4):

$$log\left(\frac{\Pr(FV_i=1 \mid X_i)}{1-\Pr(FV_i=1 \mid X_i)}\right) = X_i\beta \tag{3}$$

$$\frac{\Pr(FV_i=1 \mid X_i)}{1-\Pr(FV_i=1 \mid X_i)} = e^{X_i\beta} \tag{4}$$

Where the odds-ratio form is presented in Equation (5) as:

$$\frac{\frac{\Pr(FV_i=1 \mid X_i)}{1-\Pr(FV_i=1 \mid X_i)}}{\frac{\Pr(FV_i=0 \mid X_i)}{1-\Pr(FV_i=0 \mid X_i)}} = e^{\beta_i} \tag{5}$$

3.6. Robustness test

Estimating a single model, particularly in binary logistic regression, can yield biased estimators that are sensitive to the threshold used to define the dependent variable. For this study, we conduct a sensitivity analysis using the 75th percentile to capture severe/high vulnerability among US households. Using the 75th percentile threshold rather than the 50th percentile (median) adopted for the baseline model, we can model the probability of belonging to the most financially vulnerable group, which comprises the top 25% of vulnerable people. The new binary outcome is as specified in Equation (6):

$$FV^{(75)} = \begin{cases} 1, & if\ FVI \geq Q_{75} \\ 0, & otherwise \end{cases} \tag{6}$$

4. Results

4.1. Descriptive analysis

The distribution of financial vulnerability across the predictors and the three survey periods (2018, 2021, and 2024) is presented in Table 1. A clear and consistent pattern emerged in which socioeconomic advantage and demographics, such as health insurance coverage, low medical cost burden, higher education, stable employment, homeownership, and higher household income, are associated with financial security across all years. Moreover, respondents with indicators of financial fragility, such as lack of health insurance, high medical cost burden, unemployment, lower educational attainment, multiple dependents, or low household income, are substantially financially vulnerable.

Across all survey waves, uninsured individuals remained overwhelmingly vulnerable, with more than 80% classified as financially vulnerable. In the same vein, individuals facing high medical cost burdens consistently exhibited financial vulnerability exceeding 79% across the survey waves. Financial literacy statistics provide meaningful insights: individuals with low literacy are disproportionately financially vulnerable, while those with moderate financial literacy are more likely to be financially secure. Moreover, demographic patterns provide clear evidence of the financial vulnerability of individuals in the US. Younger cohorts, particularly those aged 18-34, have a higher prevalence of financial vulnerability than older adults, while the 65+ group consistently exhibits financial security. Employment status also revealed that at least 74% of unemployed individuals are financially vulnerable, compared with at least 70% of retired individuals who are financially secure. However, employed individuals are evenly distributed between financial vulnerability and financial security, with at most 52% financially vulnerable across the survey waves.

The results showed that household income indicators clearly differentiate individuals across the two financial conditions. Individuals earning < $25,000 are predominantly financially vulnerable (over 80% across all years), whereas those earning > $100,000 are financially secure, with financial vulnerability rates dropping as low as 15% in 2024 for the ≥ $200,000 group. These patterns remain stable across survey waves, reflecting the persistence of structural disparities in financial vulnerability. At least 70% of individuals without homeownership are financially vulnerable, while at least 60% of respondents with homeownership are financially secure across the survey waves. Lastly, the majority of white households are financially secure across all waves, with at least 52.7% of them, while the majority of non-white households are financially vulnerable, with at least 57.4% of their sample being vulnerable.

Table 1: Financial vulnerability summary by survey years: Distribution of financially secure vs financially vulnerable respondents

Characteristics	2018		2021		2024	
	Secure	Vulnerable	Secure	Vulnerable	Secure	Vulnerable
Health Insurance						
Uninsured	19.0% (233)	81.0% (991)	18.3% (213)	81.7% (950)	19.8% (199)	80.2% (804)
Insured	54.4% (8,674)	45.6% (7,278)	53.0% (7,902)	47.0% (7,006)	53.5% (7,740)	46.5% (6,738)
Medical Cost Burden						
High medical cost burden	20.7% (990)	79.3% (3,797)	16.4% (650)	83.6% (3,313)	18.9% (607)	81.1% (2,610)
Low medical cost burden	63.9% (7,917)	36.1% (4,472)	61.7% (7,465)	38.3% (4,643)	59.8% (7,332)	40.2% (4,932)
Medical Cost Burden (Harmonised)						
High medical cost burden	17.0% (583)	83.0% (2854)	13.5% (382)	86.5% (2439)	18.9% (607)	81.1% (2,610)
Low medical cost burden	60.6% (8324)	39.4% (5415)	58.6% (7733)	41.6% (5517)	59.8% (7,332)	40.2% (4,932)
Age						
18-24	32.5% (371)	67.5% (771)	25.5% (252)	74.5% (735)	30.8% (279)	69.2% (627)
25-34	32.9% (824)	67.1% (1,678)	33.4% (759)	66.6% (1,516)	33.2% (631)	66.8% (1,270)
35-44	38.3% (1,036)	61.7% (1,667)	39.9% (1,027)	60.1% (1,545)	38.9% (970)	61.1% (1,524)
45-54	45.5% (1,428)	54.5% (1,709)	43.4% (1,247)	56.6% (1,628)	43.4% (1,129)	56.6% (1,471)
55-64	60.7% (2,119)	39.3% (1,373)	55.5% (1,821)	44.5% (1,459)	54.2% (1,679)	45.8% (1,420)
65+	74.5% (3,129)	25.5% (1,071)	73.7% (3,009)	26.3% (1,073)	72.6% (3,251)	27.4% (1,230)
Dependent						
No dependent	59.2% (6,642)	40.8% (4,577)	56.2% (5,972)	43.8% (4,651)	56.7% (5,746)	43.3% (4,380)
One dependent	41.2% (1,082)	58.8% (1,544)	40.9% (949)	59.1% (1,369)	45.3% (1,034)	54.7% (1,247)
Two dependents	39.3% (799)	60.7% (1,234)	40.3% (804)	59.7% (1,193)	42.9% (815)	57.1% (1,086)
Three dependents	32.0% (256)	68.0% (544)	37.9% (278)	62.1% (455)	32.4% (244)	67.6% (510)
Four or more dependents	25.7% (128)	74.3% (370)	28.0% (112)	72.0% (288)	23.9% (100)	76.1% (319)
Education						
≤ High School	40.7% (1,495)	59.3% (2,181)	33.9% (1,046)	66.1% (2,044)	31.9% (930)	68.1% (1,988)
College	44.0% (2,801)	56.0% (3,562)	43.7% (2,578)	56.3% (3,321)	42.8% (2,304)	57.2% (3,080)
University	64.6% (4,611)	35.4% (2,526)	63.4% (4,491)	36.6% (2,591)	65.5% (4,705)	34.5% (2,474)

Characteristics	2018		2021		2024	
	Secure	Vulnerable	Secure	Vulnerable	Secure	Vulnerable
Employment Status						
Studying	31.9% (128)	68.1% (273)	27.1% (69)	72.9% (186)	30.4% (70)	69.6% (160)
Unemployed	25.3% (572)	74.7% (1,688)	23.4% (555)	76.6% (1,817)	22.8% (444)	77.2% (1,504)
Employed	48.2% (4,781)	51.8% (5,131)	47.6% (4,374)	52.4% (4,806)	48.7% (4,337)	51.3% (4,574)
Retired	74.4% (3,426)	25.6% (1,177)	73.1% (3,117)	26.9% (1,147)	70.3% (3,088)	29.7% (1,304)
Financial Literacy						
Low literacy	32.3% (1,467)	67.7% (3,071)	30.6% (1,314)	69.4% (2,977)	35.8% (1,294)	64.2% (2,319)
Moderate literacy	59.3% (7,173)	40.7% (4,918)	58.1% (6,554)	41.9% (4,721)	56.6% (6,371)	43.4% (4,890)
High literacy	48.8% (267)	51.2% (280)	48.9% (247)	51.1% (258)	45.1% (274)	54.9% (333)
Gender						
Female	46.4% (4,017)	53.6% (4,633)	46.4% (3,549)	53.6% (4,101)	46.8% (3,400)	53.2% (3,863)
Male	57.4% (4,890)	42.6% (3,636)	54.2% (4,566)	45.8% (3,855)	55.2% (4,539)	44.8% (3,679)
Homeowner						
Yes	61.7% (7,440)	38.3% (4,619)	60.5% (6,729)	39.5% (4,395)	62.4% (6,539)	37.6% (3,940)
No	28.7% (1,467)	71.3% (3,650)	28.0% (1,386)	72.0% (3,561)	28.0% (1,400)	72.0% (3,602)
Household Income						
< $25,000	19.4% (486)	80.6% (2,021)	19.1% (452)	80.9% (1,911)	18.2% (350)	81.8% (1,574)
$25,000 - < $50,000	40.5% (1,615)	59.5% (2,376)	37.1% (1,364)	62.9% (2,312)	35.9% (1,174)	64.1% (2,099)
$50,000 - < $100,000	56.4% (3,642)	43.6% (2,815)	56.9% (3,284)	43.1% (2,491)	54.6% (3,002)	45.4% (2,500)
≥ $100,000	75.0% (3,164)	25.0% (1,057)	-	-	-	-
$100,000 - < $200,000	-	-	69.7% (2,509)	30.3% (1,091)	68.1% (2,615)	31.9% (1,227)
≥ $200,000	-	-	77.0% (506)	23.0% (151)	84.9% (798)	15.1% (142)
Ethnicity						
White	55.0% (7381)	45.0% (6033)	52.7% (6639)	47.3% (5965)	54.9% (6493)	45.1% (5334)
Non-White	40.6% (1526)	59.4% (2236)	42.6% (1476)	57.4% (1991)	59.6% (1446)	60.4% (2208)

4.2. Empirical analysis

The results generated from the estimation of Equation (5) are presented in Tables 2a and 2b (Appendix). Table 2a reports the estimated odds ratios for each predictor category relative to its respective reference category. Table 2b presents the full set of pairwise comparisons across all categories within each predictor. To improve readership, the results presented in Table 2a are interpreted, while references to some pairwise comparisons are made to Table 2b in the Appendix. The results in these tables reveal a consistent and economically meaningful relationship between healthcare financing structures and household financial vulnerability, with notable temporal differences.

Lack of health insurance is a persistent and statistically significant predictor of financial vulnerability across all periods. In 2018, uninsured individuals had 50% higher odds of financial vulnerability than insured individuals (OR = 1.50, 95% CI: 1.27–1.78). The higher odds of financial vulnerability among the uninsured relative to the insured decreased by only 4% in 2021 (OR = 1.46, 95% CI: 1.22–1.75), suggesting that pandemic-era policy responses did not fully mitigate the risk of financial hardship faced by the uninsured. Moreover, the magnitude of the effect declined modestly by 12% during the recovery period (OR = 1.38, 95% CI: 1.14–1.66) in 2024 relative to the baseline model (pre-COVID). This consistent significance indicates a prevalent structural exposure to financial vulnerability among uninsured households.

The result further showed that the medical cost burden is statistically significant and a stable predictor of financial vulnerability. Individuals with high medical cost burdens were over four times or 323% more likely to be financially vulnerable in 2018 (OR = 4.23, 95% CI: 3.87–4.62), with this risk intensifying to more than five times or 542% in 2021 (OR = 5.42, 95% CI: 4.89–6.00). The amplification during the post-COVID period suggests that elevated out-of-pocket expenditures may have responded to income and employment shocks, further exacerbating financial distress. Although the odds ratio declined in 2024 (OR = 4.24, 95% CI: 3.81–4.72), it remains substantially above the baseline level, suggesting that income and employment shocks experienced by individuals during the pandemic have yet to be fully absorbed.

Financial literacy exhibits a robust and time-varying relationship with financial vulnerability. Among individuals with low literacy, those with moderate or high literacy consistently have lower odds of financial vulnerability across all periods. Individuals with moderate and high literacy are 50% and 48% less likely to be financially vulnerable in 2018, respectively (OR = 0.50, 95% CI: 0.40-0.63; OR = 0.52, 95% CI: 0.38-0.70). Although the moderate and high literate individuals face lower odds of being financially vulnerable compare to low financial literate individuals, the advent of unexpected events like pandemic seems to increase their respective probabilities of financial vulnerability with moderate literacy facing a 55% (OR = 0.45, 95% CI: 0.36-0.55) and high literacy facing 56% (OR = 0.46, 95% CI: 0.34-0.62). However, this declines significantly: highly financially

literate individuals face only a 34% probability of being financially vulnerable in 2024, and moderately financially literate individuals face a 36% probability. Moreover, from Table 2b (see Appendix), the comparisons between high and moderate financial literacy across the years are not statistically significant.

Furthermore, the result revealed that gender differences in financial vulnerability exist in the US. Compared with males, females had significantly higher odds of financial vulnerability across the survey periods. In 2018, females are 20% (OR = 1.20, 95% CI: 1.11-1.29) more likely to be financially vulnerable. Although the likelihood of financial vulnerability among females relative to males declined in the early post-COVID period (11%; OR = 1.07, 95% CI: 0.98-1.15), its strong re-emergence during the recovery phase in 2024 exceeds that of the baseline period. Females face 31% higher odds than males (OR = 1.31, 95% CI: 1.22-1.42). This rebound indicates a persistent structural gender inequality in the US.

The result also revealed that age is a significant predictor of financial vulnerability with a non-linear effect. Although individuals within the age range 25-54 generally have higher odds of financial vulnerability compared with those within the age range 18-24, the increasing odds of being financially vulnerable tend to peak at the age group 35-44 where the highest odds of being financially vulnerable is 59% (OR = 1.59, 95% CI: 1.32-1.92) higher. However, individuals aged 45-54 are 39% (OR = 1.39, 95% CI: 1.16-1.67) more likely to be financially vulnerable than young adults in 2018. While only the older age group (65+) has statistically significant lower odds (OR = 0.66, 95% CI: 0.53-0.82) of being financially vulnerable relative to younger adults in 2021, the other age groups lack statistical power. Moreover, in 2024, the 2018 pattern is repeated, with the oldest age group showing statistical significance at 27% probability of being financially vulnerable relative to younger adults.

Table 2a: Logistic regression of financial vulnerability

	2018			2021			2024		
Characteristic	**OR[1]**	**95% CI**	**p-value**	**OR[1]**	**95% CI**	**p-value**	**OR[1]**	**95% CI**	**p-value**
Healthcare Insurance									
Insured	—	—		—	—		—	—	
Uninsured	1.50***	1.27, 1.78	**<0.001**	1.46***	1.22, 1.75	**<0.001**	1.38***	1.14, 1.66	**<0.001**
Medical cost burden									
Low MCB	—	—		—	—		—	—	
High MCB	4.23***	3.87, 4.62	**<0.001**	5.42***	4.89, 6.00	**<0.001**	4.24***	3.81, 4.72	**<0.001**
Financial Literacy									
Low literacy	—	—		—	—		—	—	
High literacy	0.52***	0.38, 0.70	**<0.001**	0.46***	0.34, 0.62	**<0.001**	0.66**	0.49, 0.89	**0.007**
Moderate literacy	0.50***	0.40, 0.63	**<0.001**	0.45***	0.36, 0.55	**<0.001**	0.64***	0.50, 0.80	**<0.001**
Gender									
Male	—	—		—	—		—	—	
Female	1.20***	1.11, 1.29	**<0.001**	1.11**	1.03, 1.20	**0.008**	1.31***	1.22, 1.42	**<0.001**
Age									
18-24	—	—		—	—		—	—	
25-34	1.51***	1.26, 1.82	**<0.001**	1.04	0.85, 1.28	0.691	1.44***	1.17, 1.77	**<0.001**
35-44	1.59***	1.32, 1.92	**<0.001**	1.07	0.87, 1.32	0.502	1.52***	1.24, 1.86	**<0.001**
45-54	1.39***	1.16, 1.67	**<0.001**	1.08	0.89, 1.32	0.437	1.46***	1.19, 1.78	**<0.001**
55-64	1.06	0.88, 1.27	0.562	0.86	0.70, 1.05	0.135	1.12	0.91, 1.36	0.285
65+	0.87	0.71, 1.07	0.187	0.66***	0.53, 0.82	**<0.001**	0.73**	0.59, 0.91	**0.005**
Education									
≤ High School	—	—		—	—		—	—	
College	0.96	0.86, 1.06	0.387	0.90	0.80, 1.00	0.054	0.91	0.81, 1.02	0.102
University	0.59***	0.53, 0.66	**<0.001**	0.58***	0.52, 0.64	**<0.001**	0.52***	0.46, 0.58	**<0.001**
Employment									
Unemployed	—	—		—	—		—	—	
Employed	0.77***	0.68, 0.87	**<0.001**	0.65***	0.57, 0.74	**<0.001**	0.67***	0.58, 0.76	**<0.001**
Retired	0.43***	0.36, 0.50	**<0.001**	0.36***	0.31, 0.43	**<0.001**	0.48***	0.41, 0.57	**<0.001**
Studying	0.69*	0.52, 0.92	**0.012**	0.67*	0.47, 0.95	**0.025**	0.50***	0.35, 0.72	**<0.001**
Household Income									
< $25,000	—	—		—	—		—	—	
≥ $25,000 - < $50,000	0.41***	0.36, 0.47	**<0.001**	0.53***	0.46, 0.60	**<0.001**	0.50***	0.43, 0.58	**<0.001**
≥ $50,000 - < $100,000	0.23***	0.20, 0.27	**<0.001**	0.26***	0.23, 0.30	**<0.001**	0.24***	0.21, 0.28	**<0.001**
≥ $100,000	0.12***	0.11, 0.14	**<0.001**	—	—		—	—	
≥ $100,000 - < $200,000	—	—		0.16***	0.13, 0.18	**<0.001**	0.16***	0.13, 0.18	**<0.001**
≥ $200,000	—	—		0.11***	0.09, 0.14	**<0.001**	0.06***	0.05, 0.08	**<0.001**
Dependent									
Four or more dependents	—	—		—	—		—	—	
No dependent	0.38***	0.30, 0.48	**<0.001**	0.45***	0.34, 0.58	**<0.001**	0.30***	0.23, 0.40	**<0.001**
One dependent	0.62***	0.49, 0.80	**<0.001**	0.77	0.59, 1.01	0.063	0.46***	0.35, 0.61	**<0.001**
Two dependents	0.75*	0.58, 0.96	**0.025**	0.86	0.66, 1.14	0.298	0.57***	0.43, 0.75	**<0.001**
Three dependents	0.81	0.61, 1.08	0.152	0.86	0.63, 1.17	0.341	0.74	0.54, 1.01	0.061
Homeowner									
Yes	—	—		—	—		—	—	
No	1.94***	1.77, 2.12	**<0.001**	1.79***	1.63, 1.96	**<0.001**	2.00***	1.82, 2.22	**<0.001**

	2018			2021			2024		
Characteristic	**OR[1]**	**95% CI**	**p-value**	**OR[1]**	**95% CI**	**p-value**	**OR[1]**	**95% CI**	**p-value**
Ethnicity									
White	—	—		—	—		—	—	
Non-White	1.15**	1.05, 1.27	**0.002**	1.17**	1.06, 1.29	**0.001**	1.12*	1.02, 1.23	**0.020**

[1]*p<0.05; **p<0.01; ***p<0.001

Abbreviations: CI = Confidence Interval, OR = Odds Ratio || Tjur's Pseudo R-squared: 2018 [0.336]; 2021 [0.334]; 2024 [0.324]

Furthermore, relative to individuals with high school as their highest educational attainment, individuals with a college degree have no statistically significant difference in financial vulnerability across all survey waves. As expected, individuals with university degrees have 41% lower odds of financial vulnerability in 2018 (OR = 0.59, 95% CI: 0.53-0.66), 42% in 2021 (OR = 0.58, 95% CI: 0.52-0.64), and 48% in 2024 (OR = 0.52, 95% CI: 0.46-0.58). The pairwise comparison between university graduates and college degree holders indicates that college degree holders have higher odds of financial vulnerability. In contrast, college education is not statistically significantly different from < high school education (for the full pairwise comparison, see Table 2b). This suggests that education has a threshold effect, providing a strong and durable buffer against financial vulnerability. This might be because the earning rate and level of financial exposure of university graduates are considerably higher than those of other groups.

As shown in Table 2a, individuals from households with no dependents have lower odds of being financially vulnerable than those from households with four or more dependents. In 2018, individuals from no dependents households have 72% lower odds (OR = 0.38, 95% CI: 0.30-0.48), 55% lower odds (OR = 0.45, 95% CI: 0.34-0.58) in 2021, and 70% lower odds (OR = 0.30, 95% CI: 0.23-0.40) in 2024 relative to those with four or more dependents. Similarly, individuals from households with one or two dependents had statistically significantly lower odds of financial vulnerability than those with four or more dependents. In comparison, those with three dependents were not statistically significantly different from those with four or more dependents.

It can also be observed from Table 2a that employed, retired, and students have significantly lower odds of financial vulnerability than unemployed individuals across the survey waves, confirming the disincentive nature of unemployment or a lack of a stable income source. Across the waves, retirees have the lowest odd ratios (0.36≤OR≤0.48, 95% CI: 0.31-0.57) relative to unemployed individuals. Similarly, employed individuals and students have lower odds of financial vulnerability than unemployed individuals. From Table 2b (see Appendix), relative to retirees, employed individuals do not appear to be exempt from financial vulnerability risk despite their employment income. Although the odds ratio for employed individuals compared to retirees is slightly lower than that for unemployed individuals, there appears to be a strong protective effect of retirement income streams. For instance, employed individuals have higher odds of facing financial vulnerability than retirees, with 80% higher odds in 2018 (OR = 1.80, 95% CI: 1.52-2.13), 79% in 2021, and 39% higher odds in 2024 (see Table 2b).

Among the predictors of financial vulnerability in the US, household income appears to be the most statistically significant socioeconomic predictor, with large, linear effects. Based on Table 2a and 2b, in 2018, households with earnings below $25,000 were more financially vulnerable than other income groups. For instance, the results showed that individuals with household income less than $25,000 have 704% higher odds (OR = 8.4, 95% CI: 6.55–9.87) of being financially vulnerable than those with household income of $100,000 or more. Likewise, individuals with household income less than $25,000 have 325% higher odds (OR = 4.25, 95% CI: 3.55–5.10) of being financially vulnerable than those with household income between $50,000 and $100,000. Similarly, they have 143% higher odds (OR = 2.43, 95% CI: 2.03–2.92) compared to those earning between $25,000 and $50,000 in 2018. This result is similar across survey waves, but there is a significant difference in the odds of financial vulnerability between high- and low-income groups in 2021 and 2024. The odds ratios for financial vulnerability between the highest-income group (≥ $200,000) and the < $25,000 group in both 2021 and 2024 are 9.07 and 16.4, respectively (see Table 2b). These findings suggest the existence of a polarised financial resilience with the recovery phase disproportionately favouring individuals from high-income households.

Lastly, homeownership was also revealed to be a strong and stable protective factor against financial vulnerability. Non-homeowners faced 94% higher odds (OR = 1.94, 95% CI: 1.77-2.12) of financial vulnerability in 2018, 79% higher odds (OR = 1.79, 95% CI: 1.63-1.96) in 2021, and 100% higher odds (OR = 2.00, 95% CI: 1.82-2.22) in 2024 relative to homeowners. The persistence of this effect suggests that housing tenure captures both wealth accumulation and exposure to rising housing costs, which intensified during the post-pandemic period. Results on ethnicity also showed that non-white individuals are more financially vulnerable compared to their white counterparts, with at least 12% higher odds within the survey waves.

4.3. Robustness/sensitivity analysis

Since the results presented in Table 2a and 2b were estimated using an unharmonised measure of MCB and a median cutoff for FVI, we conducted a sensitivity analysis using harmonised MCB and the 75th percentile as the FVI threshold. The result of this analysis is presented in Table 3, which remains widely consistent with the main result. Statistical power and predictor direction were retained as found in the main result, except for health insurance, which lost statistical power in 2018 but retained statistical significance in 2021 and 2024. This indicates that our results on the determinants of financial vulnerability are fundamentally robust even when focusing on the most vulnerable segment of the US population.

Table 3. Logistic regression of financial vulnerability (2018 - 2024)

	2018			2021			2024		
Characteristic	**OR[1]**	**95% CI**	**p-value**	**OR[1]**	**95% CI**	**p-value**	**OR[1]**	**95% CI**	**p-value**
Healthcare Insurance									
Uninsured	—	—		—	—		—	—	
Insured	1.05	0.91, 1.20	0.528	1.30***	1.12, 1.52	**<0.001**	1.38***	1.19, 1.61	**<0.001**
Medical cost burden (harmonised)									
Low MCB	—	—		—	—		—	—	
High MCB	4.76***	4.35, 5.26	**<0.001**	5.56***	5.00, 6.25	**<0.001**	4.55***	4.17, 5.00	**<0.001**
Financial Literacy									
Low literacy	—	—		—	—		—	—	
High literacy	0.57***	0.42, 0.76	**<0.001**	0.57***	0.42, 0.76	**<0.001**	0.93	0.70, 1.24	0.631
Moderate literacy	0.62***	0.51, 0.75	**<0.001**	0.54***	0.45, 0.64	**<0.001**	0.83	0.67, 1.02	0.069
Gender									
Male	—	—		—	—		—	—	
Female	1.09	1.00, 1.19	0.059	1.23***	1.12, 1.35	**<0.001**	1.32***	1.20, 1.45	**<0.001**
Age									
18-24	—	—		—	—		—	—	
25-34	1.90***	1.58, 2.28	**<0.001**	1.43***	1.18, 1.73	**<0.001**	1.91***	1.57, 2.33	**<0.001**
35-44	2.06***	1.70, 2.48	**<0.001**	1.71***	1.41, 2.08	**<0.001**	2.02***	1.66, 2.47	**<0.001**
45-54	1.66***	1.38, 2.00	**<0.001**	1.66***	1.37, 2.01	**<0.001**	1.94***	1.59, 2.37	**<0.001**
55-64	1.32**	1.09, 1.61	**0.005**	1.16	0.95, 1.42	0.141	1.67***	1.36, 2.04	**<0.001**
65+	1.06	0.84, 1.34	0.604	0.85	0.67, 1.08	0.190	1.19	0.94, 1.51	0.139
Education									
≤ High School	—	—		—	—		—	—	
College	1.0	0.90, 1.11	0.925	0.90	0.80, 1.00	0.059	1.03	0.92, 1.15	0.666
University	0.55***	0.49, 0.62	**<0.001**	0.58***	0.51, 0.66	**<0.001**	0.63***	0.56, 0.71	**<0.001**
Employment									
Unemployed	—	—		—	—		—	—	
Employed	0.70***	0.62, 0.79	**<0.001**	0.62***	0.55, 0.69	**<0.001**	0.69***	0.61, 0.78	**<0.001**
Retired	0.45***	0.38, 0.54	**<0.001**	0.38***	0.31, 0.45	**<0.001**	0.44***	0.37, 0.53	**<0.001**
Studying	0.44***	0.33, 0.59	**<0.001**	0.46***	0.33, 0.64	**<0.001**	0.44***	0.31, 0.62	**<0.001**
Household Income									
< $25,000	—	—		—	—		—	—	
≥ $25,000 - < $50,000	0.41***	0.36, 0.47	**<0.001**	0.55***	0.48, 0.62	**<0.001**	0.72***	0.63, 0.83	**<0.001**
≥ $50,000 - < $100,000	0.21***	0.19, 0.24	**<0.001**	0.26***	0.23, 0.30	**<0.001**	0.35***	0.31, 0.40	**<0.001**
≥ $100,000	0.09***	0.08, 0.11	**<0.001**	—	—		—	—	
≥ $100,000 - < $200,000	—	—		0.15***	0.13, 0.18	**<0.001**	0.22***	0.19, 0.26	**<0.001**
≥ $200,000	—	—		0.11***	0.07, 0.15	**<0.001**	0.08***	0.05, 0.11	**<0.001**
Dependent									
Four or more dependents	—	—		—	—		—	—	
No dependent	0.40***	0.32, 0.51	**<0.001**	0.39***	0.30, 0.50	**<0.001**	0.29***	0.23, 0.37	**<0.001**
One dependent	0.78*	0.62, 0.98	**0.036**	0.68**	0.52, 0.88	**0.003**	0.46***	0.36, 0.59	**<0.001**
Two dependents	0.76*	0.59, 0.96	**0.022**	0.70**	0.54, 0.91	**0.008**	0.52***	0.41, 0.68	**<0.001**
Three dependents	0.98	0.75, 1.29	0.893	0.69*	0.51, 0.93	**0.015**	0.69*	0.52, 0.92	**0.011**
Homeowner									
Yes	—	—		—	—		—	—	
No	1.64***	1.49, 1.82	**<0.001**	1.79***	1.64, 1.96	**<0.001**	1.89***	1.69, 2.08	**<0.001**
Ethnicity									
White	—	—		—	—		—	—	
Non-White	1.15**	1.05, 1.27	**0.002**	1.17**	1.06, 1.29	**0.001**	1.12*	1.02, 1.23	**0.020**

[1]*p<0.05; **p<0.01; ***p<0.001

Abbreviations: CI = Confidence Interval, OR = Odds Ratio || Tjur's Pseudo R-squared: 2018 [0.313]; 2021 [0.314]; 2024 [0.278]

Note: Harmonised MCB and 75th percentile threshold of FVI were used in this estimation.

5. Discussion

Regarding health-related risks, the positive relationship between medical cost burden and financial vulnerability is understandable within the health capital framework. Based on the health capital model, substantial out-of-pocket medical expenditures hurt household resources. However, households are subject to a finite budget constraint, such that an increase in their medical cost burden reduces the amount allocated to consumption and future investment in health. This is consistent with prior evidence demonstrating that heightened exposure to medical expenditure shocks increases financial vulnerability (He & Zhou, 2022). They are also broadly aligned with Bialowolski et al. (2025), who found a strong relationship between financial strain and adverse health outcomes, although the analytical focus differs.

While Bialowolski et al. (2025) emphasise health outcomes as the primary consequence of financial vulnerability, it could be argued that household income exerts a stronger and more stable influence on financial vulnerability than health outcomes across all periods analysed. Nonetheless, the possibility of a bidirectional relationship between financial vulnerability and medical cost burden cannot be overlooked, particularly in settings characterised by high out-of-pocket medical expenditures. Consequently, a lack of access to health care due to limited financial resources can reduce an individual's capacity to generate income, thereby reducing their health. This cycle will be more pronounced in an economy like the US, where individuals often face high medical costs due to a lack of universal health coverage, an important sustainability development goal (3.8), which aims at ensuring nations prioritise health coverage. The proliferation of financial vulnerability among those facing high medical costs reveals that the US market-based health financing framework promotes structural inequalities rather than reducing inequalities and poverty, as outlined in the United Nations Sustainable Development Goals for nations.

Besides the medical cost burden, health insurance plays a critical role in determining financial vulnerability among individuals in the US. A loss or lack of health insurance can have a tremendous impact on individuals, as it is the most viable means through which individuals in the US can improve and sustain their health and labour supply. Hence, it is apparent that lacking health coverage can be worrisome, as uninsured individuals face high medical costs, thereby increasing their financial vulnerability. Our findings align with the health capital model, in which health stock is generally found to be inversely related to age (Grossman, 1972), and with Case and Deaton's (2005) findings that early-life socioeconomic disadvantages, such as work type, have a non-linear, depreciating effect on health stock. Furthermore, we provide an objective view of the concerns raised by Sommet and Spini (2022) regarding the possibility that resource bias could influence individuals' self-rated health. This objective and empirical evidence demonstrate that the lack of health insurance is itself significantly associated with financial vulnerability and underscores the need for more sustainable health financing systems, rather than the existing market-based systems.

Under the current market-oriented approach in the US, individuals may rationally opt out of health insurance when the perceived benefit of the coverage is low relative to the premium charged. However, such decisions, which may be economically rational in the short term, expose individuals to significant health and financial risks in the event of adverse health shocks. In this respect, our findings align with those of Arnault et al. (2022), who found that uninsured individuals in the US faced reduced access to healthcare services, thereby increasing exposure to unmet medical needs and financial distress. This implies that the lack of implementation of universal health coverage and the persistent push towards a fully market-oriented health financing system will widen the existing structural inequalities experienced in health accessibility and exposure of vulnerable groups to financial hardship and health poverty.

Moreover, these findings reinforce the existing evidence that a high medical cost burden is associated with financial vulnerability, often creating cost-related barriers to healthcare access (Zavras et al., 2016; Economou et al., 2014). Although we held other factors constant in our analysis, our results still align with those of Aaltonen and Vaalavuo (2024), who found that households with low income and poor health remain subject to financial pressure from pharmaceutical costs even in a system with universal health coverage.

Heterogeneity across demographic factors indicates that exposure to financial vulnerability varies by age, reflecting structural inequalities within the US population. While younger adults and the elderly are less financially vulnerable, this can be understood through the lens of the financial commitments and responsibilities of different age groups. For instance, it is expected that younger and older adults have little to no financial responsibilities, while mid-age adults are saddled with various family financial responsibilities. This finding is consistent with earlier evidence (Voith & Mauser, 2024; He & Zhou, 2022) on the importance of age in determining financial vulnerability. It is also partly consistent with evidence from Austrian and Chinese studies showing that younger and early middle-aged households often accumulate debt without commensurate asset buffers,

particularly in rural settings, thereby increasing their exposure to financial distress (Voith & Mauser, 2024; He & Zhou, 2022). Moreover, Hasler et al. (2018) found that young adults are more financially vulnerable than adults aged 50 years and above in the US, and their findings also align with ours. This suggests that older adults have relatively stable pension income, little or no family financial responsibility, and possibly accumulate wealth over the years. These factors could provide a strong buffer against financial hardship for older adults compared with young or middle-aged adults who mostly rely on employment income.

Similarly, while prior studies have identified education as a key determinant of financial vulnerability (He & Zhou, 2022; Hasler et al., 2018; Anderloni et al., 2011), the existing literature has largely focused on the presence of educational attainments rather than the magnitude and threshold effects across different levels of education. This study not only affirms education as a determinant of financial vulnerability but also identifies the threshold at which education reduces it. Education improves an individual's earning capacity and exposure to health investment efficiency. However, the benefit of an additional education can only be attained if the level of education attainment is at least a university degree. It could be argued that the quantity and quality of opportunities a graduate is exposed to will be substantially greater than those of individuals with lower levels of education.

Closely related to educational attainment, we showed that unemployment reinforces individuals' exposure to financial vulnerability. Specifically, our findings extend beyond prior evidence by demonstrating that financial vulnerability among employed individuals is relative rather than absolute, and that being employed does not imply financial security, as implicitly assumed in parts of the existing literature (Voith & Mauser, 2024; Hasler, 2018). Consistent with prior evidence, unemployment is associated with significantly higher financial vulnerability (Aborode et al., 2025; Zavras et al., 2016; Economou et al., 2014). However, we established the stabilising role of retirement income streams, such as pensions and social security benefits, which are less exposed to labour-market volatility and income shocks. The implication of this is that employment alone is likely insufficient to guarantee financial security, particularly in contexts characterised by low wages, insecure contracts, and limited opportunities for precautionary saving. Working-age individuals often face substantial financial obligations, including housing costs, family healthcare expenditures, and dependent care responsibilities, which can strain household finances despite active labour-market participation. In contrast, retirees may benefit from reduced financial responsibilities, such as completed mortgage payments and fewer dependent-related expenses, alongside predictable income flows, thereby reducing their exposure to financial vulnerability.

At the core of these findings, a substantial body of literature has documented the central role of income in shaping financial vulnerability (Aaltonen & Vaalavuo, 2024; Voith & Mauser, 2024; He & Zhou, 2022; Hasler et al., 2018; Zavras et al., 2016; Anderloni et al., 2011). Our findings not only corroborate this evidence but also extend it by demonstrating income inequality among US residents. This implies that the rising income inequality is likely due to unequal access to economic opportunities, which intensifies financial vulnerability. Moreover, since the US adopts a market-oriented approach to health financing, it is succinct to argue, based on the health capital model, that individual investment in health is a function of employment, income, and wealth. Therefore, job loss can lead to reduced income and diminished capacity to invest in health, including access to insurance. This, in turn, increases susceptibility to health shocks, reinforcing financial vulnerability. Notably, our findings diverge from those of Bialowolski et al. (2025), who argued that health outcomes exert stronger predictive power over financial vulnerability than income. A possible explanation for this divergence is that our study did not focus on health outcomes but on health financing in explaining financial vulnerability; however, we acknowledge the possibility of bidirectional relationships between income, health, and financial vulnerability.

Our findings also indicate that larger household dependency burdens are associated with increased financial vulnerability. These findings align with prior evidence that showed that US households with dependent children are financially fragile (Hasler et al., 2018). This finding implies that the marginal cost of having an additional household member increases pressure on limited financial resources, thereby increasing exposure to financial hardship. Theoretically, individuals from larger households are likely to face competing demands between high consumption needs and health investments, which could lead to lower health stocks and greater exposure to financial hardship. Consequently, the importance of adopting a sustainable approach to health financing, such as universal health coverage, is non-negotiable. This will provide social support for households with dependents by reducing poverty prevalence and inequality, and by enhancing access to essential healthcare services in the US.

Our findings explicitly showed that homeownership status affects financial vulnerability. Owning a house reduces exposure to recurring housing costs and provides a form of wealth accumulation that enhances individuals' financial stability. Following the health capital model, asset ownership supports the capacity to invest in health by relieving individuals' budget constraints,

thereby providing sufficient resources. The implication of this finding is that asset and wealth inequality shape financial vulnerability, and that wealth inequality in the US necessitates a sustainable approach to health financing to reduce existing inequalities. Lastly, our findings confirm the existence of racial/ethnic inequality where non-White individuals are more financially vulnerable. This finding indicates that financial vulnerability is not only determined by individuals' economic characteristics, but is also shaped by established social and institutional inequalities in the US. The implication for sustainability is that social and institutional inequalities, if left unaddressed, will expand, making it impossible to achieve the SDG 10 objective of reducing inequalities and the SDG 1 objective of no poverty.

6. Conclusion

This study provides robust empirical evidence that financial vulnerability in the United States is structurally determined and persistently shaped by income inequality, health financing arrangements, labour market conditions, educational attainment, ethnicity, and housing tenure rather than being merely a product of transient individual circumstances. Drawing on three nationally representative waves of the NFCS (2018, 2021, 2024), the findings demonstrate remarkable temporal stability in these structural predictors, even as the magnitude of income-related disparities widened substantially during the post-pandemic recovery period.

From a scientific perspective, this study advances the literature in three ways. First, it operationalises financial vulnerability as a multidimensional index that captures sensitivity, resilience, and exposure, yielding richer insights than the unidimensional measures common in prior US-focused studies. Second, the pairwise logistic regression framework uncovers threshold effects in education (only university-level education provides statistically significant protection) and household dependency (financial strain escalates disproportionately with four or more dependents), evidence obscured in aggregate-level analyses. Third, the consistent finding that household income (OR = 16.4 in 2024 for the lowest vs the highest income group) overshadows all other predictors, including health insurance status and medical cost burden, advances the theoretical debate about the relative primacy of income versus health exposure in determining financial vulnerability.

From a practical and sustainability perspective, the findings have direct implications for achieving SDG 3.8 (Universal Health Coverage and financial risk protection) and SDG 10 (Reduced Inequalities). The study demonstrates that the US market-based health financing model, characterised by employment-tied insurance and high out-of-pocket costs, systematically exposes low-income, uninsured, and educationally disadvantaged populations to heightened financial vulnerability. Pandemic-era policy responses (e.g., expanded Medicaid, enhanced insurance subsidies) did not substantially reduce the financial risk gap between the insured and uninsured. Policymakers should therefore pursue structural reforms: expanding insurance coverage and reducing premium burdens for low-income households; strengthening unemployment and income support programmes; and integrating financial literacy education within universal public systems. These measures represent investments not only in individual financial security but in the long-term social sustainability of the economy.

7. Limitations and future research

This study is subject to several limitations. The cross-sectional design precludes causal inference, and the endogeneity of the relationships among insurance status, employment, and income remains unresolved. Additionally, the absence of health status as a covariate represents an important omission. Future research should address these limitations through longitudinal panel designs, instrumental-variable approaches to address endogeneity, and the explicit integration of health-status dimensions into the modelling framework.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of interest

The authors declare no conflicts of interest.

Declaration of generative AI and AI-assisted technologies in the writing process

AI-assisted technologies were employed solely to support language refinement, including improvements in grammar, clarity, and overall readability. All core elements of the research, such as the conceptualisation of the study, methodological design, data analysis, interpretation of findings, and formulation of conclusions, were conducted independently by the author.

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Citation information

Aremu, O. A., Eyiolawi, S. A., & Adeoye, H. (2026). Health financing, socioeconomic inequality, and household financial vulnerability in the United States: A repeated cross-sectional analysis (2018-2024) with implications for Sustainable Development Goal 3.8. *Economics, Management and Sustainability, 11*(1), 95-115. doi:10.14254/jems.2026.11-1.5.

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Appendix

Table 2b: Logistic regression of financial vulnerability (2018 - 2024): Pairwise comparison

	2018			2021			2024		
Characteristic	**OR[1]**	**95% CI**	**p-value**	**OR[1]**	**95% CI**	**p-value**	**OR[1]**	**95% CI**	**p-value**
Healthcare Insurance									
Uninsured / Insured	1.50***	1.27, 1.78	**<0.001**	1.46***	1.22, 1.75	**<0.001**	1.38***	1.14, 1.66	**<0.001**
Medical Cost Burden									
High MCB / Low MCB	4.23***	3.87, 4.62	**<0.001**	5.42***	4.89, 6.00	**<0.001**	4.24***	3.81, 4.72	**<0.001**
Financial Literacy									
Low literacy / High literacy	1.93***	1.33, 2.80	**<0.001**	2.18***	1.51, 3.13	**<0.001**	1.51*	1.05, 2.17	**0.020**
Low literacy / Moderate literacy	1.98***	1.51, 2.61	**<0.001**	2.23***	1.72, 2.90	**<0.001**	1.57***	1.19, 2.08	**<0.001**
High literacy / Moderate literacy	1.03	0.79, 1.33	>0.999	1.02	0.79, 1.33	>0.999	1.04	0.82, 1.33	>0.999
Gender									
Female / Male	1.20***	1.11, 1.29	**<0.001**	1.11**	1.03, 1.20	**0.008**	1.31***	1.22, 1.42	**<0.001**
Age									
(18-24) / (25-34)	0.66***	0.50, 0.87	**<0.001**	0.96	0.71, 1.30	>0.999	0.70**	0.51, 0.95	**0.010**
(18-24) / (35-44)	0.63***	0.47, 0.83	**<0.001**	0.93	0.69, 1.27	>0.999	0.66***	0.48, 0.89	**<0.001**
(18-24) / (45-54)	0.72**	0.54, 0.94	**0.006**	0.92	0.68, 1.25	>0.999	0.69**	0.51, 0.93	**0.004**
(18-24) / (55-64)	0.95	0.72, 1.25	>0.999	1.17	0.86, 1.57	>0.999	0.90	0.66, 1.21	>0.999
(18-24) / (65+)	1.15	0.84, 1.56	>0.999	1.51**	1.09, 2.10	**0.004**	1.37	0.99, 1.90	0.068
(25-34) / (35-44)	0.95	0.78, 1.17	>0.999	0.97	0.79, 1.20	>0.999	0.94	0.76, 1.18	>0.999
(25-34) / (45-54)	1.09	0.89, 1.32	>0.999	0.96	0.78, 1.18	>0.999	0.98	0.79, 1.23	>0.999
(25-34) / (55-64)	1.43***	1.17, 1.76	**<0.001**	1.21	0.98, 1.50	0.104	1.29*	1.03, 1.61	**0.014**
(25-34) / (65+)	1.74***	1.36, 2.22	**<0.001**	1.57***	1.23, 2.02	**<0.001**	1.97***	1.52, 2.54	**<0.001**
(35-44) / (45-54)	1.14	0.95, 1.37	0.597	0.99	0.82, 1.20	>0.999	1.04	0.86, 1.27	>0.999
(35-44) / (55-64)	1.50***	1.23, 1.83	**<0.001**	1.25*	1.02, 1.53	**0.018**	1.36***	1.11, 1.67	**<0.001**
(35-44) / (65+)	1.82***	1.43, 2.32	**<0.001**	1.62***	1.27, 2.06	**<0.001**	2.08***	1.64, 2.65	**<0.001**
(45-54) / (55-64)	1.32***	1.10, 1.58	**<0.001**	1.26**	1.05, 1.52	**0.004**	1.31***	1.08, 1.59	**<0.001**
(45-54) / (65+)	1.60***	1.28, 2.00	**<0.001**	1.63***	1.30, 2.05	**<0.001**	2.00***	1.59, 2.51	**<0.001**
(55-64) / (65+)	1.21*	1.00, 1.47	**0.047**	1.30**	1.07, 1.57	**0.001**	1.53***	1.26, 1.85	**<0.001**
Education									
≤ High School / College	1.05	0.92, 1.18	>0.999	1.11	0.97, 1.27	0.162	1.10	0.96, 1.26	0.305
≤ High School / University	1.69***	1.49, 1.92	**<0.001**	1.73***	1.51, 1.99	**<0.001**	1.93***	1.68, 2.22	**<0.001**
College / University	1.61***	1.45, 1.79	**<0.001**	1.56***	1.40, 1.73	**<0.001**	1.76***	1.58, 1.95	**<0.001**
Employment									
Unemployed / Employed	1.30***	1.10, 1.54	**<0.001**	1.54***	1.30, 1.82	**<0.001**	1.50***	1.25, 1.80	**<0.001**
Unemployed / Retired	2.34***	1.89, 2.90	**<0.001**	2.75***	2.22, 3.40	**<0.001**	2.09***	1.67, 2.61	**<0.001**
Unemployed / Studying	1.44	0.98, 2.12	0.072	1.50	0.93, 2.41	0.150	1.99**	1.22, 3.24	**0.001**
Employed / Retired	1.80***	1.52, 2.13	**<0.001**	1.79***	1.51, 2.12	**<0.001**	1.39***	1.18, 1.65	**<0.001**
Employed / Studying	1.11	0.77, 1.58	>0.999	0.98	0.62, 1.54	>0.999	1.33	0.84, 2.12	0.635
Retired / Studying	0.62**	0.42, 0.91	**0.006**	0.55**	0.34, 0.88	**0.005**	0.95	0.58, 1.56	>0.999
Household Income									
< $25,000 / (≥ $25,000 / < $50,000)	2.44***	2.03, 2.92	**<0.001**	1.90***	1.55, 2.33	**<0.001**	2.02***	1.62, 2.51	**<0.001**
< $25,000 / (≥ $50,000 / < $100,000)	4.31***	3.60, 5.16	**<0.001**	3.79***	3.11, 4.63	**<0.001**	4.10***	3.31, 5.08	**<0.001**
< $25,000 / ≥ $100,000	8.17***	6.66, 10.0	**<0.001**	-	-	-	-	-	-
≥ $100,000 / (≥ $25,000 / < $50,000)	0.30***	0.25, 0.35	**<0.001**	-	-	-	-	-	-
≥ $100,000 / (≥ $50,000 / < $100,000)	0.53***	0.46, 0.60	**<0.001**	-	-	-	-	-	-
(≥ $25,000 / < $50,000) / (≥ $50,000 / < $100,000)	1.77***	1.55, 2.01	**<0.001**	1.99***	1.72, 2.31	**<0.001**	2.03***	1.75, 2.37	**<0.001**
< $25,000 / (≥ $100,000 / < $200,000)	-	-	-	6.34***	5.06, 7.95	**<0.001**	6.42***	5.07, 8.14	**<0.001**
< $25,000 / ≥ $200,000	-	-	-	9.07***	6.37, 12.9	**<0.001**	16.4***	11.5, 23.2	**<0.001**
(≥ $100,000 / < $200,000) / ≥ $200,000	-	-	-	1.43*	1.05, 1.95	**0.013**	2.55***	1.90, 3.42	**<0.001**
(≥ $100,000 / < $200,000) / (≥ $25,000 / < $50,000)	-	-	-	0.30***	0.25, 0.36	**<0.001**	0.31***	0.26, 0.37	**<0.001**
(≥ $100,000 / < $200,000) / (≥ $50,000 / < $100,000)	-	-	-	0.60***	0.52, 0.69	**<0.001**	0.64***	0.55, 0.74	**<0.001**
≥ $200,000 / (≥ $25,000 / < $50,000)	-	-	-	0.21***	0.15, 0.29	**<0.001**	0.12***	0.09, 0.17	**<0.001**
≥ $200,000 / (≥ $50,000 / < $100,000)	-	-	-	0.42***	0.31, 0.57	**<0.001**	0.25***	0.19, 0.34	**<0.001**
Dependent									
Four or more dependent / No dependent	2.62***	1.86, 3.70	**<0.001**	2.24***	1.54, 3.26	**<0.001**	3.28***	2.24, 4.82	**<0.001**
Four or more dependent / One dependent	1.60**	1.12, 2.29	**0.002**	1.30	0.88, 1.91	0.626	2.17***	1.46, 3.22	**<0.001**
Four or more dependent / Three dependent	1.23	0.82, 1.86	>0.999	1.16	0.75, 1.80	>0.999	1.35	0.86, 2.12	0.614
Four or more dependent / Two dependent	1.33	0.93, 1.92	0.254	1.16	0.78, 1.71	>0.999	1.76***	1.18, 2.62	**<0.001**
No dependent / One dependent	0.61***	0.52, 0.71	**<0.001**	0.58***	0.49, 0.68	**<0.001**	0.66***	0.56, 0.78	**<0.001**
No dependent / Three dependent	0.47***	0.36, 0.61	**<0.001**	0.52***	0.40, 0.68	**<0.001**	0.41***	0.31, 0.54	**<0.001**
No dependent / Two dependent	0.51***	0.43, 0.61	**<0.001**	0.52***	0.43, 0.62	**<0.001**	0.53***	0.45, 0.64	**<0.001**
One dependent / Three dependent	0.77	0.58, 1.02	0.093	0.90	0.67, 1.20	>0.999	0.62***	0.46, 0.84	**<0.001**
One dependent / Two dependent	0.83	0.68, 1.02	0.108	0.89	0.72, 1.10	>0.999	0.81*	0.66, 1.00	**0.048**
Three dependent / Two dependent	1.08	0.81, 1.44	>0.999	1.00	0.74, 1.33	>0.999	1.30	0.97, 1.75	0.132
Homeowner									
No / Yes	1.94***	1.77, 2.12	**<0.001**	1.79***	1.63, 1.96	**<0.001**	2.00***	1.83, 2.20	**<0.001**
Ethnicity									
Non-White / White	1.15**	1.05, 1.27	**0.002**	1.17**	1.06, 1.29	**0.001**	1.12*	1.02, 1.23	**0.020**

[1]*p<0.05; **p<0.01; ***p<0.001

Abbreviations: CI = Confidence Interval, OR = Odds Ratio || Tjur's Pseudo R-squared: 2018 [0.336]; 2021 [0.334]; 2024 [0.324]