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Demographic and socioeconomic factors affecting relative poverty level of older adults in Türkiye

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Abstract

Background As Türkiye's older adult population grows rapidly, poverty among older adults has become a pressing social issue. This study aims to guide policymakers by examining the sociodemographic and economic factors influencing poverty levels among older adults.

Methods Data from the Income and Living Conditions Survey (ILCS) of the Turkish Statistical Institute (TurkStat) were utilized in this study. Poverty thresholds were set at 40% and 50% of median household income, categorizing households into three distinct poverty levels. Accordingly, a generalized ordered logistic regression analysis was conducted to explore factors impacting poverty among older adults.

Results Variables such as marital status, education level, age, gender, household size, homeownership, and social assistance usage were found to have significant relationships with relative poverty. Older adults, especially those aged 75 and older, exhibit a higher poverty risk. Moreover, older adults living in Türkiye's eastern regions experience higher poverty levels compared to those in the western regions.

Conclusion Policies aiming to reduce poverty among older adults should not be limited to financial aids but should also adopt multidimensional approaches that improve older adults' access to healthcare services and strengthen social security networks. The high poverty risk in Türkiye's eastern regions and among individuals with lower education levels underscores the importance of targeted social policies that account for regional disparities. Policies addressing older adults should incorporate flexible solutions based on household structure, prioritize health issues, and enhance community support. In this context, it is recommended to develop comprehensive social support programs involving local governments and non-governmental organizations.

Keywords Poverty among older adults, Türkiye, Sociodemographic factors, Relative poverty, Social aids

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Introduction

Old age is considered one of the final stages of human life, during which individuals undergo significant biological, psychological, and social changes [1]. On the other hand, ageing is a dynamic process that begins at birth and continues throughout an individual's life [2]. Globally, declining birth rates and increasing life expectancy are rapidly raising the proportion of older adults in the total population. The World Health Organization (WHO) defines older adults as those aged 60 and above, and this age threshold is widely referenced in many countries' social policy frameworks [3]. As of 2022, approximately 12% of the world's population comprises older adults, which is projected to reach 22% by 2050 [4]. Similarly, in 2017, one in every eight people worldwide was 60 or older; by 2030, this ratio is expected to rise to one in six [5]. The increasing older population pressures healthcare access, social security systems, and retirement policies [6]. Moreover, with longer life expectancy, individuals face a higher risk of income loss and increased healthcare expenses [7]. The future, the prevalence of low-wage employment and reduced contributions to formal retirement systems are expected to lead to lower pension incomes [8]. Therefore, maintaining the well-being of older adults, preventing social exclusion, and ensuring economic security have become priority issues for sustainable social policy approaches.

Poverty is a multidimensional phenomenon encompassing economic, social, and cultural aspects, affecting individuals' living conditions in various ways [9]. Although poverty is classified differently in the literature, income-based measures are generally structured around absolute and relative poverty [10]. Absolute poverty refers to a lack of the minimum resources necessary for survival. In contrast, relative poverty is defined as having an income level lower than the general living standards of a given society [11]. An individual with an income below \$1.90 per day at purchasing power parity is considered to be in extreme poverty [12]. However, this threshold is generally set as a measure for meeting basic needs in the poorest countries, while in high-income countries, relative poverty serves as a more prominent analytical tool [13]. Income levels and factors such as health status, access to social support mechanisms, and household composition shape the risk of poverty among older adults. In this context, focusing on relative poverty is crucial when examining it among older adults, as it determines their economic status, social integration, and quality of life [14]. Pension incomes, social assistance systems, and household income levels are among the most significant factors influencing the relative poverty level of older adults. For instance, rising housing costs in Germany have led to an increased risk of poverty among older adults due to income inadequacy [8].

In recent years, poverty among older adults has been affected by demographic and economic factors and global crises. The COVID-19 pandemic, in particular, has had severe economic and social consequences for older adults [15]. During the pandemic, increased healthcare expenses, limited employment opportunities for older adults, and disruptions in access to social assistance exacerbated poverty among older adults on a global scale [16]. In many countries, the post-pandemic recovery process has revealed that older adults have become economically more vulnerable and that social security systems have struggled to adapt to these new risks [17, 18]. Globally, poverty among older adults remains a significant social issue, varying greatly between countries. In developed countries, where social security systems are more comprehensive, poverty rates among older adults tend to be relatively lower [19]. However, poverty rates among older adults remain higher in developing countries, where access to social assistance is more limited [20]. For example, in Mexico, factors such as income distribution inequalities and local language use have been critical in determining poverty levels among older adults [20]. Likewise, a study conducted in China revealed that older adults living in rural areas face a significantly higher risk of poverty compared to those in urban regions [21].

In Türkiye, the issue of poverty among older adults is further exacerbated by regional inequalities. Older adults living in the eastern and southeastern regions of Türkiye face a higher poverty risk than those in the western regions [22]. According to data from the Turkish Statistical Institute [23], as of 2023, the proportion of the older population in the total population reached 10.2%, which is expected to rise to 25.6% by 2080. In the context of regional disparities, older adults in eastern provinces experience higher poverty rates due to lower education levels and limited employment opportunities than those in western provinces [24]. In particular, low education levels and restricted labour force participation among women increase the risk of poverty among older women [25].

The study presents a unique value by examining the poverty level of the older adult population in Türkiye from a multidimensional perspective. Considering both demographic and socioeconomic factors together provides important clues about the poverty risk of the older adults. In addition, the model built using the median income threshold at different percentiles goes beyond traditional poverty measures and provides more precise results.

Understanding the factors affecting poverty among older adults helps identify economic hardships at the individual level and provides valuable insights into enhancing the effectiveness of social policies. Analyzing the impact of social assistance programs and pension

systems on older adults will contribute to developing sustainable social policy strategies in the long run. This study aims to identify the determinants of old-age poverty in Türkiye, providing a scientific foundation for policymakers to develop more targeted solutions.

Therefore, this study aims to answer the question “What are the main demographic (age, gender, marital status) and socioeconomic (education level, income, home ownership, etc.) variables associated with the poverty level of older adults in Türkiye?” For this purpose, factors influencing the poverty level of older adults were modeled for Türkiye by using a rich dataset.

Literature review

The rapid increase in the number and proportion of older adults is attributed to the sharp decline in birth and death rates, increasing life expectancy linked to economic and social developments, and improvements in healthcare systems [26, 27]. According to the United Nations’ 2017 report, World Population Aging, one in eight people was aged 60 or older in 2017, and this ratio is projected to reach one in six by 2030 and one in five by 2050, encompassing 2.3 billion people [5]. Furthermore, data from the World Population Prospects: 2022 Summary of Results indicate that in some countries, the rapid increase in the older adult population is a result of previously high fertility rates, while it originates from ongoing reductions in premature mortality in others [26]. The issues of aging and poverty among older adults have become central policy concerns in developed countries today [28].

A literature review reveals that the relationship between ageing and poverty was examined across various countries using diverse variables. It shows that individual characteristics, household composition, and the demographic structure of the region of residence emerge as three critical factors influencing poverty among older adults. In line with this general framework, a significant portion of the research focuses on variables at the individual level. In studies focusing on individual characteristics, factors such as gender, age, marital status, education level, behavioural habits, pension status, homeownership, unemployment, and occupational status were linked to poverty among older adults in various respects.

Among these factors, gender is among the most consistent and significant determinants in different contexts. In a gender-based assessment of older female poverty in Slovenia in 2018, it was concluded that women’s lower wages in comparison to men and their reduced employment opportunities serve as significant indicators that exacerbate poverty among older women [29]. Similar results on the higher poverty risk for older women compared to men were reported in studies covering various OECD countries [30, 31]. Additionally, studies carried out in Serbia, the United Kingdom, China, and Türkiye

that examine the role of gender reported comparable conclusions [25, 32–34]. Additionally, a study carried out in Mexico revealed that being a female household head, alongside the gender variable, stands out as a significant determinant of poverty among older adults [20].

In addition to gender, studies examine the relationship between age and poverty among older adults. A study carried out in Vietnam analyzed the poverty levels of older adults living in urban and rural areas separately and found that age increases the risk of poverty among the older adults [35]. Similarly, studies encompassing countries such as the United Kingdom, China, Türkiye, and several OECD nations revealed that poverty among older adults increases with age, thereby positioning age as a significant determinant of poverty among older adults [30, 33, 34, 36]. However, another study carried out in Thailand, which investigated the relationship between poverty and age using multivariate regression analysis, concluded that age plays a minimal role in explaining a household’s likelihood of being impoverished, showing that the determinants of poverty remain consistent across different age groups [37]. There are also studies that reveal a negative relationship between age and poverty [38–40]. When examining previous studies on age-related aspects, it was emphasized that poverty risk within households decreases in adulthood but forms a U-shaped curve by increasing again as old age progresses [41–43].

In addition to gender, age, education level, and other individual characteristics are also emphasized in the literature as significant determinants of poverty among older adults. Regarding education level, studies carried out in Hong Kong and Türkiye identified education level as a crucial determinant of poverty among older adults, with lower education levels emerging as a significant factor in reducing poverty among older adults [24, 44, 45]. Another study, utilizing Eurostat data, highlighted retirement pensions and homeownership among the older adults [46], unemployment in Hong Kong [45], behavioral habits in Latvia [47], and occupational status in Türkiye [24] as key determinants of poverty. Finally, in studies examining poverty among older adults in relation to individual characteristics, factors such as the absence of a partner and marital status were also found to be significant determinants of poverty among older adults [33, 35, 45]. Similarly, a study conducted by Zhao, Li [48] in the United States found that low education levels, low income, widowhood, and chronic diseases (such as diabetes and hypertension) reduce cognitive performance in women aged 60 and over. These findings suggest that these individual variables pose a risk for cognitive decline and poverty among older adults. A study by Dalecka, Bartoskova Polcrova [49], conducted using NHANES (National Health and Nutrition Examination Survey)

data representing the U.S. population, found that low income and low education levels accelerate biological aging. This effect increases health risks in old age, positioning these factors as structural determinants of poverty among older adults.

Beyond individual factors, household characteristics are also significant determinants of poverty among older adults. When examining various studies investigating the demographic structure of households and its impact on poverty among older adults, factors such as household size, single-parent family structures, the presence of individuals with disabilities or chronic illnesses within the household, and living alone were shown to correlate with poverty among older adults from different perspectives. Studies conducted in Hong Kong and Mexico identified household size as a significant indicator of poverty among older adults [20, 44], highlighting that as the number of older adults within a household increases, so does the risk of poverty [41]. Additionally, as stated by Garza-Rodriguez, Ayala-Diaz [20], living in a single-parent household is also an important indicator of poverty among older adults. Furthermore, another study carried out in Hong Kong revealed that the presence of family members with disabilities or chronic illnesses serves as a risk factor for poverty among older adults, positioning it as a critical determinant [45].

Poverty among older adults is not only limited to individual or household-level factors. Still, it is also significantly influenced by the demographic and socio-economic structure of the region where individuals live. Moreover, studies correlating household demographics with poverty among older adults in Australia, Canada, Finland, Germany, Poland, Taiwan, and the United States revealed that individuals living alone are at a higher risk of poverty when compared to those living with spouses or others. From this perspective, living alone emerges as a significant determinant of poverty among older adults [50–53]. When examining studies that consider the demographic structure of the area in relation to poverty among older adults, factors such as the region's level of development, social class, residence in public housing, cultural attributes, use of a local language, rural versus urban residence, and income distribution among the impoverished are associated with poverty among older adults in various ways. Studies carried out by Cai, Giles [54], Giang and Pfau [35], Tufan [24], and Zhang, Luo [27] demonstrated that regional development levels and disparities across regions increase the risk of poverty among older adults, making them essential determinants. Similarly, studies conducted in Mexico and China showed that living in urban or rural areas is also a critical determinant of poverty among older adults [20, 34]. Another study carried out in Mexico identified income distribution among the poor and the use of a local language as

significant determinants of poverty among older adults [20]. Furthermore, a study carried out in Hong Kong identified public housing, while a study in the United Kingdom highlighted social class [33], and another study in Latvia emphasized cultural influences [47] as impactful on poverty among older adults. Additionally, a study conducted by Hernández-Moreno, Vásquez-Palma [55] on the rural Mapuche older adult population in Chile found that factors such as migration, environmental degradation, lack of access to water, and inadequate culturally appropriate public policies increase food insecurity among indigenous older adults, indirectly exacerbating poverty among older adults. These factors are considered fundamental determinants of poverty among older adults in the context of disadvantaged indigenous communities [55].

Data source, study sample and research method

Data

For the application phase of this study, official procedures were undertaken to obtain the Income and Living Conditions Survey (ILCS) microdata sets for the period from 2014 to 2019.

The survey's geographical coverage includes all settlements within the borders of the Republic of Türkiye, encompassing all household members residing within these areas. However, individuals residing in institutional settings - such as university dormitories, guesthouses, orphanages, nursing homes, specialized hospitals, prisons, barracks, and military residences - are excluded. In the ILCS sampling design, the first stage involves the selection of clusters based on block sizes determined by settlement sizes, and final sampling units is households selected using the National Address Database. Thus, TurkStat employs a stratified two-stage cluster sampling method for the ILCS [56].

The first stage of sampling involved the selection of blocks from the National Address Database. Blocks were chosen from among urban areas, rural areas with a municipal organization, and villages, with a probability weighting proportionately to the size of the settlement. Next, the specific addresses from each block were systematically selected. The household at the selected address was defined as the final sampling unit. The stratified two-stage cluster sampling method was used. In case the data could not be obtained from the selected household, the "non-response form" was filled and the weight coefficients were calculated. The sampling structure of the ILCS was fitted to provide nationwide estimates. The applied weight coefficients were calculated according to current projections of the future population [57].

The ILCS contains three separate data sets (Household, Individual, and Individual Registry). All variables from the Individual and Individual Registry datasets

were merged into the Household dataset. From the total household disposable income variable in the Household dataset, an equivalent household disposable income per capita variable was derived. To create the equivalent household disposable income per capita, the equivalent household size variable was first created, using the age variable in the Individual Registry dataset. Age information for each individual within households is provided in this dataset, and based on the number of individuals in each household, an equivalent household size variable was established. In calculating the equivalent household size variable, the weight of each household member varies by age: the head of household receives a weight of 1; adults (aged 14 and older) receive a weight of 0.5, and individuals aged 13 and younger receive a weight of 0.3. For instance, in a household of four with two children, the equivalent household size would be 2.1 ($1 + 0.5 + 0.6$). The equivalent household disposable income per capita variable was then derived by dividing the total household disposable income variable by the equivalent household size variable.

In our study, we intentionally used the median income instead of the mean income as a benchmark for calculating relative income. The rationale behind this choice is grounded in the literature that highlights the limitations of using the mean in the context of income distribution, especially in settings where income is highly skewed.

The mean income can be significantly affected by a small number of very high-income individuals, leading to a benchmark that does not represent the experience of the majority. On the other hand, the median income is more robust to outliers and provides a better reflection of the income level of a “typical” individual in the distribution. This makes it a more appropriate benchmark in studies focusing on perceived income inequality, subjective social status, and relative deprivation.

Consequently, the median value of the equivalent household disposable income per capita variable was calculated for all individuals in the Individual Registry dataset. The median takes the value in the middle when the entire population (or households) is ranked. Therefore, it feels the impact of extremely low or extremely high incomes much less than the average and more accurately reflects the “typical” income situation of the society [58].

The scope of this study is limited to older adults aged 60 and above residing within Türkiye.

Measures and variables

In its poverty studies, TurkStat uses ILCS data to set the income-based poverty threshold by using a certain percentage (40%, 50%) of the median equivalent income per capita [56]. Previous studies have also established the income-based poverty threshold using 40% and 50% of the median equivalent income per capita [58]. For this

study, poverty levels, which will be used as dependent variables in all models, were constructed in line with these ratios. Households were grouped into three categories based on their income level relative to the median: below 40% of the median income (poorest group), between 40% and 50% of the median income (second poverty category), and above 50% of the median income (non-poor group). Households below 40% of the median are considered the poorest, whereas households above 50% of the median are considered non-poor. The generalized ordered logistic regression model is used in this study to examine the relationship between each poverty category and various factors in the ILCS dataset.

The independent variables in the study were determined based on variables available in the ILCS. Variables regarding the socio-demographic and economic characteristics of the older adults include marital status (married, single), education level (illiterate, primary school, middle school, high school, university), general health status (very good/good, neither good nor bad, bad/very bad), age (60–74, 75 and above), gender (male, female), equivalent household size (1–2.5, 2.6 and above), child composition (household with no children, household with only daughters, household with only sons, household with both sons and daughters), number of working individuals in the household (none, 1 worker, 2 or more workers), statistical regional unit classification (west, central, east), homeownership (no, yes), number of rooms (2 or fewer, 3, 4 or more), main heating fuel type (traditional, other/no heating system, transitional, advanced), material deprivation (yes, no), receipt of monetary or in-kind social assistance (yes, no), and income from real estate or financial assets (yes, no).

The study’s data for 2014–2019 was employed, as TurkStat started to provide data based on geographical regions as of 2014. The Statistical Regional Unit where individuals live is given in the Statistical Regional Units. Türkiye is divided into 26 regions at Level 2 under the Classification of Statistical Regional Units [59]. The present study grouped these regions as Western, central, and Eastern. These regions and the provinces in these regions are shown in Table 1.

As explained here, all analyzed variables were categorical and bi-stable or ordinary scales. Ordinal and nominal variables were described as dummy variables to observe the impact of the categories belonging to all the variables that would be integrated into the generalized ordered logistic regression model [60].

Research method

Survey statistics were analyzed using Stata 13 (Stata Corporation) to account for the complex sampling design and weighting. A weighted analysis was conducted.

Table 1 Statistical classification of territorial units-level 2

Area	Code	Province
Western Region (1)	TR10	İstanbul
	TR21	Tekirdağ, Edirne, Kırklareli
	TR22	Balıkesir, Çanakkale
	TR31	İzmir
	TR32	Aydın, Denizli, Muğla
	TR33	Manisa, Afyon, Kütahya, Uşak
	TR41	Bursa, Eskişehir, Bilecik
	TR42	Kocaeli, Sakarya, Düzce, Bolu, Yalova
	TR61	Antalya, Isparta, Burdur
	Central Region (2)	TR51
TR52		Konya, Karaman
TR62		Adana, Mersin
TR63		Hatay, Kahramanmaraş, Osmaniye
TR71		Kırıkkale, Aksaray, Niğde, Nevşehir, Kırşehir
TR72		Kayseri, Sivas, Yozgat
TR81		Zonguldak, Karabük, Bartın
TR82		Kastamonu, Çankırı, Sinop
TR83		Samsun, Tokat, Çorum, Amasya
Eastern Region (3)		TR90
	TRA1	Erzurum, Erzincan, Bayburt
	TRA2	Ağrı, Kars, Iğdır, Ardahan
	TRB1	Malatya, Elazığ, Bingöl, Tunceli
	TRB2	Van, Muş, Bitlis, Hakkâri
	TRC1	Gaziantep, Adıyaman, Kilis
	TRC2	Şanlıurfa, Diyarbakır
	TRC3	Mardin, Batman, Şırnak, Siirt

Initially, frequencies and percentages based on participants' relative poverty levels were obtained.

Bivariate analysis was also performed to identify relationships between the dependent variable (relative poverty level) and various factors. We predicted bivariate relationships by evaluating significant differences using Pearson's chi-square tests for categorical variables. Pearson's chi-square (χ^2) provides information about the significance of observed differences and detailed information about the categories of any differences found [61, 62].

The parallel lines assumption was applied to standard ordered models, and for the standard ordered logistic regression model, which did not satisfy the Brant test, alternative ordered models that do not require this assumption were estimated. Multicollinearity among independent variables was assessed, and no significant multicollinearity issues were detected [59]. Subsequently, a generalized ordered logistic regression analysis was applied to identify risk factors associated with relative poverty levels.

Regression methods examine the relationship between dependent and explanatory variables. Simple and multiple linear regression methods, which are used when the dependent variable is quantitatively measured, are the most common among them.

However, when the dependent variable is categorical, such as in multinomial logistic regression, the assumptions of Ordinary Least Squares method are not met [63]. Alternatively, logistic regression is suitable for predicting a categorical variable from a set of predictor variables. Similar to linear regression, logistic regression is more appropriate when the dependent variable is categorical with two or more unordered (nominal) categories [64, 65].

In logistic regression, the methodology used depends on the number of categories of the qualitative dependent variable and whether these categories are unordered (nominal) or ordered (ordinal). Logistic regression analysis is categorized into binary, multinomial, and ordinal logistic regression based on the nature of the dependent variable [63, 65]. The ordered logit model, also known as the proportional odds model proposed by McCullagh [66], is considered a significant extension of the binary logit model when the dependent variable is measured on an ordinal scale with categorical values [67].

The ordered logistic regression model is written as:

$$Pr(Y \leq y_j | x) = \left[\frac{\exp(a_j - x' \beta)}{1 + \exp(a_j - x' \beta)} \right] \quad j = 1, 2, \dots, J - 1 \quad (1)$$

This equation represents the natural logarithm of the odds ratios of the model, and when written as Eqs. 2 and 3:

$$\text{logit}(\pi_j) = \log\left(\frac{\pi_j}{1 - \pi_j}\right) \quad (2)$$

$$\log = \left[\frac{\text{Pr}(Y \leq y_j | x)}{\text{Pr}(Y > y_j | x)} \right] = a_j - x' \beta \quad (3)$$

Here, y_j represents the ordered categorical dependent variable, x' denotes the vector of independent (explanatory) variables, a_j s are intercepts corresponding to $J-1$ estimators, $a_1 \leq a_2 \leq \dots \leq a_{j-1}$, β s represent a vector of regression coefficients corresponding to $\beta = (\beta_1, \dots, \beta_k)' x'$. In ordered logistic regression, the assumption of parallel lines is known as the parallel slopes assumption, asserting that the parameter estimates do not vary across intercepts, testing the adequacy of identical parameters for all categories [68].

When dealing with dependent variables that have an ordinal structure and multiple categories, the ordered logistic regression model is typically employed. This model is suitable when the dependent variable is categorical and ordinal. Alternatively, the generalized ordered logistic model was developed as an extension of the ordered logistic model to address situations where the assumption of parallel curves is not met [69].

Results

Descriptive statistics and chi-square tests

The results regarding sociodemographic and economic factors potentially related to the relative poverty levels of the older adults in Türkiye are presented in Table 2. According to the chi-square independence test results, a significant relationship was found between the relative poverty level of individuals and the sociodemographic and economic variables included in the study.

As can be seen in Tables 2 and 64.8% of the older adults in this study are married. It was observed that 44.7% of the older adults have completed primary school. Moreover, 73.9% are aged 75 or older, 70.3% are male, 88.2% belong to a household with an equivalized household size between 1 and 2.5, and 85.6% have no children. Furthermore, 85.6% of the older adults do not have an employed household member. The data also showed that 43.2% of the older adults reside in the western region, 80.5% are homeowners, 46.5% live in households with four or more rooms, 58.8% experience material deprivation, 89.8% receive social assistance, and 53.2% have income from movable or immovable assets.

Estimation of models

To identify factors associated with the relative poverty levels among the older adults, a generalized ordered logistic regression model was employed. The estimated model results for the sociodemographic and economic factors associated with the relative poverty levels of the older adults are presented in Table 3. As shown in Table 3, significant factors include marital status (married), educational attainment (elementary, middle, high school, university), overall health status (very good/good, neither good nor bad), age [60–74], gender (female), equivalized household size (2.6 or more), child combination (households without children, those with only daughters, or only sons), number of employed household members (one employed, two or more), regional classification (central, eastern), homeownership (yes), number of rooms in the residence (two or fewer, three), primary heating fuel used (transitional - coal, advanced - natural gas, LPG, fuel oil, electricity, or renewable sources), material deprivation (yes), receipt of social assistance (yes), and presence of income from real estate or securities (yes).

The marginal effects of factors associated with the older adults' relative poverty levels and multicollinearity among independent variables are provided in Table 4.

The model was tested for multicollinearity among independent variables. Variance inflation factor (VIF) values of 5 or more suggest moderate collinearity, while values of 10 or more indicate high collinearity [70, 71]. Given the VIF results in Table 4, no variables in the model exhibit a multicollinearity issue.

The marginal effect is the partial derivative of the regression equation concerning each independent variable. In the linear regression model, the slope coefficient equals the marginal effect for each variable. It is interpreted as the change in the dependent variable in response to a unit change in the independent variable. In nonlinear regression models such as the generalized ordered logistic regression, the slope is not constant at all points but changes according to the observation points; that is, the marginal effect changes according to the observation points. In nonlinear regression models, the average marginal effects are interpreted since the interpretation according to any point will not be meaningful.

Marginal effects can be calculated differently: marginal effects for means (MEMs) and average marginal effects (AMEs). When calculating the marginal effects for the means, the mean of each variable is calculated, and the marginal effects are obtained for these means. Since the mean for dummy variables is statistically invalid, the marginal effects for the means are not appropriate in models with dummy variables among the independent variables. When calculating the average marginal effects, marginal effects are calculated for all units in the data set, that is,

Table 2 Results regarding sociodemographic and economic factors associated with the relative poverty levels of the elderly individuals

Variables	Relative poverty level		n (%)	X ²	P		
	Less than 40+ of the median income	Between 40 and 50% of the median income				Higher than 50% of the median income	
Marital status	Single	942(41.0)	787(45.2)	11,657(34.3)	13,386(35.2)	123.59	0.000 ^a
	Married	1354(59)	953(54.8)	22,349(65.7)	24,656(64.8)		
Education	Illiterate	1543(67.2)	1142(65.6)	10,630(31.3)	13,315(35)	2085.83	0.000 ^a
	Elementary	640(27.9)	520(29.9)	15,844(46.6)	17,004(44.7)		
	Middle school	53(2.3)	34(2)	2295(6.7)	2382(6.3)		
	High school	35(1.5)	20(1.1)	2428(7.1)	2483(6.5)		
Health status	University	25(1.1)	24(1.4)	2809(8.3)	2858(7.5)	799.39	0.000 ^a
	Very good/good	367(16)	327(18.8)	10,485(30.8)	11,179(29.4)		
Age	Neither good nor poor	773(33.7)	619(35.6)	14,119(41.5)	15,511(40.8)		
	Poor/very poor	1156(50.3)	794(45.6)	9402(27.6)	11,352(29.8)	275.48	0.000 ^a
	60–74 years	864(37.6)	626(36)	8438(24.8)	9928(26.1)		
	75 and older	1432(62.4)	1114(64)	25,568(75.2)	28,114(73.9)		
Gender	Male	1472(64.1)	1068(61.4)	24,209(71.2)	26,749(70.3)	121.38	0.000 ^a
	Female	824(35.9)	672(38.6)	9797(28.8)	11,293(29.7)		
Number of equal individuals in the household	1–2.5	1752(76.3)	1381(79.4)	30,411(89.4)	33,544(88.2)	490.9	0.000 ^a
	2.6 and higher	544(23.7)	359(20.6)	3595(10.6)	4498(11.8)		
Children	No child	1700(74)	1318(75.7)	29,535(86.9)	32,553(85.6)	675.95	0.000 ^a
	Only girl	138(6)	103(5.9)	1394(4.1)	1635(4.3)		
	Only boy	123(5.4)	116(6.7)	1607(4.7)	1846(4.9)		
	Boy and girl	335(14.6)	203(11.7)	1470(4.3)	2008(5.3)	808.32	0.000 ^a
Number of working individuals	None	1700(74)	1318(75.7)	29,535(86.9)	32,553(85.6)		
	1	323(14.1)	255(14.7)	3555(10.5)	4133(10.9)		
Region	2 and more	273(11.9)	167(9.6)	916(2.7)	1356(3.6)	879.69	0.000 ^a
	West	643(28)	541(31.1)	15,247(44.8)	16,431(43.2)		
	Middle	714(31.1)	550(31.6)	12,107(35.6)	13,371(35.1)		
	East	939(40.9)	649(37.3)	6652(19.6)	8240(21.7)		
Owner of the home	No	525(22.9)	384(22.1)	6524(19.2)	7433(19.5)	25.96	0.000 ^a
	Yes	1771(77.1)	1356(77.9)	27,482(80.8)	30,609(80.5)		
Number of rooms in the house	2 and below	831(36.2)	572(32.9)	4027(11.8)	5430(14.3)	1739.45	0.000 ^a
	3 rooms	898(39.1)	678(39)	13,336(39.2)	14,912(39.2)		
	4 and above	567(24.7)	490(28.2)	16,643(48.9)	17,700(46.5)		
	Traditional	1127(49.1)	734(42.2)	8639(25.4)	10,500(27.6)	1652.84	0.000 ^a
Heating fuel	Transition	959(41.8)	824(47.4)	11,358(33.4)	13,141(34.5)		
	Advanced	210(9.1)	182(10.5)	14,009(41.2)	14,401(37.9)	2558.98	0.000 ^a
Material deprivation	Yes	450(19.6)	431(24.8)	21,489(63.2)	22,370(58.8)		
	No	1846(80.4)	1309(75.2)	12,517(36.8)	15,672(41.2)		

Table 2 (continued)

Variables	Relative poverty level			n (%)	χ ²	P
	Less than 40 + of the median income	Between 40 and 50% of the median income	Higher than 50% of the median income			
Social assistance in cash or in kind	1388(60.5) 908(39.5)	1085(62.4) 655(37.6)	31,670(93.1) 2336(6.9)	34,143(89.8) 3899(10.2)	3984.3	0.000 ^a
Real estate (rental) or movable income	1695(73.8) 601(26.2)	1198(68.9) 542(31.1)	17,360(51) 16,646(49)	20,253(53.2) 17,789(46.8)	626.62	0.000 ^a

^ap<0.01

for each observation point, and these marginal effects are averaged. Since categorical independent variables are used in the models, average marginal effects were calculated [72].

Considering the generalized ordered logistic regression model in Table 4, while holding other variables constant, married individuals are 38.10% and 19.12%, respectively, more likely to experience poverty than their unmarried counterparts. Elementary school graduates are respectively 40.69% and 41.47% less likely to be poor when compared to those who are illiterate or have no formal education. Middle school graduates are respectively 34.43% and 91.19% less likely to experience poverty than illiterate individuals. High school graduates are 55.56% and 96.02% less likely to be poor than those with no formal education, while university graduates are 70.89% and 25.27% less likely. The likelihood of poverty decreases among the older adults as education levels increase. Individuals with very good/good health are 27.97% and 20.81% less likely to experience poverty compared to those with poor/very poor health, while those with average health are 20.81% and 12.50% less likely to be poor than those with poor/very poor health. The 60–74 age group is 11.78% and 11.17% less likely to experience poverty compared to the 75+ age group. Those with an equalized household size of 2.6 or more are 87.74% and 54.06% more likely to be poor compared to those in the 1-2.5 group. Households without children are respectively 49.01% and 73.68% less likely to be poor compared to those with both sons and daughters. Households with only daughters are 33.23% and 51.12% less likely to experience poverty than those with both sons and daughters, while households with only sons are 46.59% and 44.67% less likely. Households with one employed member are respectively 62.62% and 89.71% less likely to experience poverty than those without employed members. Those living in the central region are 16.80% and 13.32% more likely to be poor compared to those in the western region, while those in the eastern region are 35.58% and 36.08% more likely. Homeowners are respectively 15.04% and 17.81% less likely to experience poverty than non-homeowners. Households with two or fewer rooms are respectively 67.56% and 57.31% more likely to experience poverty than those with four or more rooms, while households with three rooms are 24.71% and 11.73% more likely. Those using transitional fuels (coal) for heating are 51.22% and 17.97% less likely to experience poverty than those using traditional fuels, while those using advanced fuels (natural gas, etc.) are respectively 96.31% and 95.43% less likely. Older adults in materially deprived households are 96.31% and 95.43% more likely to be poor compared to others. Those receiving financial or in-kind social assistance are respectively 97.34% and 112.41% more likely to be poor than those who do not.

Table 3 Estimated model results for sociodemographic and economic factors related to the relative poverty levels of the elderly individuals

Variables	Less than 40 + of the median income				Between 40 and 50% of the median income			
	β	Std. Error	95% CI		β	Std. Error	95% CI	
			Lower	Upper			Lower	Upper
Marital status (reference: single)								
Married	-0.403 ^a	0.099	-0.598	-0.207	-0.324 ^a	0.079	-0.479	-0.169
Education (reference: illiterate)								
Elementary	0.429 ^a	0.071	0.290	0.569	0.455 ^a	0.055	0.348	0.563
Middle school	0.364 ^b	0.190	-0.009	0.736	0.634 ^a	0.147	0.346	0.921
High school	0.584 ^a	0.224	0.146	1.023	0.797 ^a	0.179	0.447	1.147
University	0.743 ^a	0.264	0.225	1.261	0.513 ^a	0.189	0.143	0.883
Health status (reference: poor/very poor)								
Very good/good	0.295 ^a	0.085	0.129	0.462	0.169 ^a	0.065	0.042	0.297
Neither good nor poor	0.220 ^a	0.626	0.097	0.343	0.190 ^a	0.050	0.091	0.288
Age (reference: 75 and older)								
60–74	0.125 ^b	0.063	0.001	0.248	0.128 ^a	0.049	0.031	0.224
Gender (reference: male)								
Female	-0.036 ^c	0.100	-0.232	0.160	-0.045 ^c	0.080	-0.201	0.111
Number of equal individuals in the household (reference: 1-2.5)								
2.6 and higher	-0.942 ^a	0.137	-1.210	-0.674	-0.831 ^a	0.110	-1.048	-0.615
Children (reference: boy and girl)								
No child	0.523 ^a	0.149	0.231	0.815	0.694 ^a	0.122	0.455	0.932
Only girl	0.356 ^b	0.147	0.068	0.644	0.484 ^a	0.123	0.242	0.725
Only boy	0.497 ^a	0.153	0.198	0.797	0.523 ^a	0.123	0.281	0.764
Number of working individuals (reference: none)								
1	0.661 ^a	0.082	0.500	0.823	0.676 ^a	0.066	0.546	0.805
2 and more	0.942 ^a	0.103	0.740	1.144	0.962 ^a	0.081	0.803	1.120
Region (reference: west)								
Middle	-0.177 ^b	0.068	-0.311	-0.043	-0.167 ^a	0.053	-0.272	-0.063
East	-0.376 ^a	0.070	-0.514	-0.239	-0.398 ^a	0.055	-0.507	-0.290
Owner of the home (reference: no)								
Yes	0.159 ^b	0.068	0.027	0.292	0.182 ^a	0.053	0.077	0.286
Number of rooms in the house (reference: 4 and above)								
2 and below	-0.716 ^a	0.079	-0.870	-0.561	-0.700 ^a	0.062	-0.822	-0.578
3 rooms	-0.259 ^a	0.072	-0.401	-0.117	-0.204 ^a	0.055	-0.313	-0.096
Heating fuel (reference: traditional)								
Transition	0.545 ^a	0.061	0.425	0.665	0.396 ^a	0.048	0.301	0.491
Advanced	1.015 ^a	0.100	0.819	1.210	1.054 ^a	0.074	0.909	1.198
Material deprivation (reference: no)								
Yes	-1.008 ^a	0.071	-1.147	-0.868	-0.975 ^a	0.052	-1.076	-0.873
Social assistance in cash or in kind (reference: no)								
Yes	-1.044 ^a	0.066	-1.173	-0.915	-1.202 ^a	0.053	-1.306	-1.098
Real estate (rental) or movable income (reference: no)								
Yes	0.523 ^a	0.062	0.401	0.646	0.489 ^a	0.048	0.393	0.583

Std. Error Standard Error, 95% CI 95% Confidence Interval

^a $p < 0.01$ ^b $p < 0.05$ ^c $p < 0.10$

Table 4 Marginal effects of sociodemographic and economic factors related to relative poverty levels of the elderly individuals

Variables	Less than 40 + of the median income		Between 40 and 50% of the median income		VIF
	ME (%)	Std. Error	ME (%)	Std. Error	
Marital status (reference: single)					
Married	38.10 ^a	0.094	19.12 ^c	0.104	2.46
Education (reference: illiterate)					
Elementary	-40.69 ^a	0.068	-41.47 ^a	0.074	1.74
Middle school	-34.43 ^c	0.181	-91.19 ^a	0.244	1.29
High school	-55.56 ^b	0.215	-96.02 ^a	0.263	1.36
University	-70.89 ^a	0.256	-25.27	0.246	1.58
Health status (reference: poor/very poor)					
Very good/good	-27.97 ^a	0.081	-0.85	0.093	1.75
Neither good nor poor	-20.81 ^a	0.059	-12.5 ^c	0.075	1.55
Age (reference: 75 and older)					
60–74	-11.78 ^b	0.06	-11.17	0.071	1.23
Gender (reference: male)					
Female	3.40	0.095	4.89	0.109	2.49
Number of equal individuals in the household (reference: 1-2.5)					
2.6 and higher	87.74 ^a	0.124	54.06 ^a	0.152	2.91
Children (reference: boy and girl)					
No child	-49.01 ^a	0.138	-73.68 ^a	0.14	4.69
Only girl	-33.23 ^b	0.137	-51.12 ^a	0.155	1.74
Only boy	-46.59 ^a	0.143	-44.67 ^a	0.149	1.86
Number of working individuals (reference: none)					
1	-62.62 ^a	0.078	-59.11 ^a	0.092	1.22
2 and more	-89.71 ^a	0.099	-85.39 ^a	0.106	1.56
Region (reference: west)					
Middle	16.8 ^b	0.065	13.32 ^c	0.077	1.15
East	35.58 ^a	0.066	36.08 ^a	0.08	1.27
Owner of the home (reference: no)					
Yes	-15.04 ^b	0.064	-17.81 ^b	0.077	1.06
Number of rooms in the house (reference: 4 and above)					
2 and below	67.56 ^a	0.074	57.31 ^a	0.089	1.43
3 rooms	24.71 ^a	0.069	11.73	0.079	1.25
Heating fuel (reference: traditional)					
Transition	-51.22 ^a	0.058	-17.97 ^a	0.067	1.62
Advanced	-96.31 ^a	0.096	-95.43 ^a	0.108	2.06
Material deprivation (reference: no)					
Yes	96.08 ^a	0.068	80.88 ^a	0.076	1.29
Social assistance in cash or in kind (reference: no)					
Yes	97.34 ^a	0.06	112.41 ^a	0.066	1.18
Real estate (rental) or movable income (reference: no)					
Yes	-49.73 ^a	0.06	-38.2 ^a	0.068	1.09

ME Marginal Effect, Std. Error Standard Error, VIF Variance Inflation Factor

^ap<0.01^bp<0.05^cp<0.10

Lastly, those with income from real estate or securities are 49.73% and 38.20% less likely to experience poverty than those without such income.

Discussion

Poverty among older adults has become an increasingly pressing social and economic concern as the global population of older adults continues to grow. In Türkiye, the proportion of older individuals in the total population is likewise expanding rapidly, with projections indicating that this trend will persist in the coming years [73]. Such demographic shifts underline the urgency of developing and implementing robust policies to address the challenges posed by poverty in later life. Identifying the main drivers of poverty among older adults provides policymakers with valuable insights into priority areas. Parallel to global studies, several recent works have examined these factors, reflecting a growing academic focus on strategies to reduce economic hardship among older adults [8, 74–78]. These findings highlight the diversity and significance of determinants shaping poverty among older adults, underscoring the need for further in-depth investigations.

For example, a Hong Kong-based study assessed absolute and relative poverty levels among older adults over 13 years, prompting the government to implement substantial policy measures. Interviews with 4,306 older individuals revealed that women, widows, those living alone, and people with limited formal education face a higher risk of poverty, emphasizing the need for targeted strategies [79]. Similarly, research in rural China's Shizhu county evaluated changes in relative poverty risk from 2010 to 2020, examining heterogeneity and spatial patterns. The findings indicated a 19.3% increase during this period, primarily due to health and natural disaster vulnerabilities, especially in mid-altitude mountainous areas [80].

Inspired by such evidence, our study explored the determinants of relative poverty among older adults. The concept of “relative poverty,” introduced by Townsend in 1979 [81], stresses that living standards, in addition to consumer prices, influence poverty [82]. We analyzed ILCS micro-data from 2014 to 2019, a period marked by major sociopolitical events in Türkiye: the attempted coup in 2016 and the shift to a presidential government system following the 2017 referendum [83]. One key aspect highlighted in our research is the issue of regional disparity. Numerous studies have observed that Türkiye's eastern regions face relative disadvantages compared to western regions in terms of living standards and socio-economic conditions [59, 84, 85]. Accordingly, we investigated how these regional disparities influence relative poverty among older adults.

In this study, we identified the sociodemographic, economic, and other relevant factors that shape relative poverty among older adults across various regions of Türkiye. By doing so, it aims to inform more targeted and effective policy measures to reduce poverty among older adults. To determine the variables associated with poverty risk, we employed generalized ordered logistic regression analysis. This statistical approach facilitated the identification of factors that increase or decrease poverty risk among older populations.

Our analysis indicates that various factors, including education level, health status, household size, number of employed individuals, and homeownership, have significant associations with the relative poverty levels of older adults, while gender was found to have no statistically significant effect on poverty among older adults. Contrarily, other studies in the literature highlight the influence of gender on poverty levels [30, 31, 86]. Similar to the present study, some studies in the literature noted the difficulty in empirically linking gender equality with poverty reduction and macro-level economic growth [87]. Furthermore, previous studies emphasized that poverty risks may produce comparable outcomes for both working men and women [88], suggesting that the effect of gender on poverty may vary based on context and cultural factors. In a study on the care of older Ethiopian refugees resettled in Australia, it was noted that significant gender inequalities may exist, and policies should be developed to address this [89]. In another survey conducted in Cambodia, the Philippines and Vietnam, it was noted that older women are more vulnerable to poverty [90]. Another important factor, along with gender, is marital status; a significant difference was found in the research findings.

The study's findings also reveal that married individuals are more likely to experience poverty than single individuals. Studies on the determinants of chronic poverty in Türkiye similarly suggest that married individuals face a higher likelihood of both temporary and chronic poverty when compared to their single counterparts [91]. Studies from other countries also reported comparable results. For instance, a study carried out in Israel shows that while divorce decreases poverty risk among men, it increases it among women [92]. This indicates that gender-based differences may influence the effect of marital status on poverty. Additionally, other studies also found that married individuals do not necessarily enjoy a social welfare advantage over single individuals [93]. These results support the notion that married individuals may experience higher poverty levels than singles. However, there are also studies indicating that singles may be at a higher risk of poverty than married individuals [33, 45, 94]. This suggests that the impact of marital status on poverty is multifaceted and context-dependent, with

poverty disparities between married and single individuals being influenced by societal and economic conditions, cultural norms, and gender roles. To fully understand the effects of marital status on poverty, comprehensive and in-depth research considering all these factors is needed. Education and marital status are among the factors that need to be examined.

Education level is another critical factor impacting the relative poverty levels of older adults. The findings indicate that as the education level increases, the relative poverty level of older adults decreases. Studies in the literature confirm that university education reduces the risk of poverty [45]. A study carried out in the USA also suggests that declining education levels could exacerbate poverty in the future [95]. Likewise, a study carried out in Hong Kong, supporting findings from the present analysis, points out that poverty among older adults has reached a perplexing level and that the number of impoverished older adults may be associated with the significant increase in the average education level of older adults over the past two decades [44]. These results demonstrate that education level is an important factor affecting the relative poverty levels of older adults, with higher education having the potential to reduce poverty risk. Education can play an essential role in enhancing older adults' economic security; thus, educational policies and lifelong learning opportunities should be considered as strategies for preventing poverty in old age.

Health status is also a significant determinant of the relative poverty levels of older adults. Empirical results suggest that older adults with good health have a lower risk of poverty among older adults in comparison to those in poorer health. In parallel with these results, the literature contains numerous studies that demonstrate a direct relationship between poverty and health status, showing that those with good health are much less likely to experience poverty than those in poor health [96, 97]. By contrast, a study carried out in Germany notes that individuals at risk of poverty are less likely to engage in healthy behaviors than their more affluent peers [98]. These results reveal that the health status of older adults is a critical factor in determining poverty levels and that health issues can increase the risk of poverty. Older adults with good health may be better equipped to cope with economic difficulties, while those with health problems may experience these challenges more acutely. Therefore, access to healthcare services and health support programs for the older adults is critically important in poverty reduction strategies for the aging population. In light of the research in the literature, it is clear that age is also an important determinant of the relative poverty of older adults.

Our analysis indicate that age significantly impacts individuals' relative poverty levels. Accordingly,

individuals aged 60–74 have a lower likelihood of being impoverished than those aged 75 and above, indicating that advancing age may exacerbate poverty. In a study on the biological determinants of ageing, the stages of ageing were characterized as 60–75 early old age stage and after 75 years of age as mature old age [99]. A study in the USA similarly indicates that the risk of acute poverty increases as individuals age [100]. Another USA-based study aligns with this perspective, noting that poverty may accelerate aging and that poverty risk escalates with age [101]. Comparable outcomes were observed in studies across various countries. For instance, a study carried out in Spain highlights that poverty risk progressively rises for those over 60 [102]. Thus, the effect of age on poverty suggests that the risk of poverty may become more pronounced in later life stages, impacting older adults' economic resilience. Consequently, older adults may increasingly rely on social security systems, economic support, and healthcare services. In this context, developing policies to bolster the economic security of older adults is crucial to mitigating age-related poverty risk.

In addition to personal characteristics, environmental factors also influence relative poverty levels among the older adults. The present results indicate that individuals residing in Türkiye's central region face a higher poverty likelihood than those in the western region. Likewise, individuals in the eastern region exhibit a greater poverty risk in comparison to those in the west. Similar results were found in various studies conducted in Türkiye [59, 84, 85, 103]. This disparity underscores the potential influence of regional differences on poverty levels. Consistent with these findings, similar results appear in other countries. For example, a study on energy poverty in Europe noted that Scandinavian countries have the lowest energy poverty rates, while the highest rates are observed in Bulgaria and the Balkans, regions further east [104]. Another study on poverty highlights that urban areas tend to provide a higher level of social and economic development, more employment opportunities, and access to a wider range and higher quality of basic services [105]. Additional research supports the direct link between environmental conditions and poverty [106]. These observations suggest that geographic regions significantly influence poverty levels, with environmental factors playing a decisive role in individuals' economic conditions. Regional disparities, economic opportunities, infrastructure, access to social services, and overall living conditions may shape individuals' poverty experiences. Therefore, addressing regional differences is essential in poverty reduction strategies.

The present results also suggest that household size influences relative poverty levels among the older adults. Specifically, households with an equivalent family size of 2.6 or more have a higher likelihood of experiencing

poverty compared to smaller households. Similar results were reported in studies carried out in different countries. For instance, a study carried out in the United Kingdom highlights the elevated poverty risk faced by larger families [107]. Moreover, a study carried out in northwest Ethiopia emphasizes that larger household size correlates with increased poverty risk [108]. These results indicate a direct relationship between poverty among older adults and household size, showing a similar trend across diverse geographies. The increased poverty risk in larger households suggests that sharing resources among more individuals may negatively affect the economic status of older adults. These findings underscore the need for social policymakers to develop more effective support mechanisms for the older adults and establish targeted strategies for older adults in larger households.

The receipt of cash or in-kind social aids by older adults can be a determinant of their relative poverty levels. Findings from the present analysis revealed that those who receive cash or in-kind social support exhibit higher levels of poverty compared to those who do not receive such assistance. Similar results can be found in studies carried out in various countries within the literature. For example, a study on poverty risk in Southern Europe emphasizes that targeted funds aimed at human capital investment are directly associated with reducing poverty risk [109]. Likewise, studies on European countries highlight that poverty rates are lower in the Netherlands, several Scandinavian countries, and some Central and Eastern European countries, where fundamental pensions are inclusive [19]. These results indicate that the support services provided to individuals with high relative poverty levels are insufficient in meeting their needs. Thus, it is essential to restructure social welfare policies to offer more comprehensive and effective solutions for mitigating poverty risk. Establishing support mechanisms that better meet the needs of older adults and ensure sustainability could enhance the effectiveness of social assistance systems and play a pivotal role in combating poverty among older adults.

The study's findings further suggest that the type of heating fuel used by older adults in their residences may also be a determinant of poverty levels. Specifically, the results indicate that individuals who use coal or natural gas for heating exhibit significantly lower poverty levels than those who rely on other traditional methods. This situation is not only related with their economic indicators but is also closely tied to the infrastructure facilities and accessibility of energy sources in their regions. Similarly, a study using a dataset from six South Asian countries linked household-level energy poverty with socioeconomic indicators and individuals' poverty levels [110]. In other words, individuals' poverty levels may also lead to energy poverty. Therefore, it is understood that

poverty levels are directly related to the energy sources used in their homes, and energy poverty may be an indicator of economic poverty. Consequently, improving access to energy and the types of fuel used should be considered an essential strategy in poverty alleviation, and policies in this area should be developed accordingly.

The relative poverty levels of older adults are not limited to the sociodemographic indicators considered in this study. Previous studies showed that if measures to address poverty among older adults are not implemented, it may lead to macro-level issues. Increased healthcare expenses [7], challenges arising from the pension system [8], and potential disruptions in the medical insurance system [111] are among several problem areas that may accompany poverty among older adults. Therefore, if timely and effective measures are not taken to address poverty among older adults, this situation may result in serious issues not only at the individual level but also at the societal and economic levels. For this reason, developing comprehensive social policies and protective mechanisms to ensure the economic security of older adults is of paramount importance.

Studies on relative poverty among the older adults remain limited, underscoring the importance of diversifying and deepening research in this area. To address this issue more comprehensively, in-depth analyses should be conducted based on demographic variables such as gender, age, and marital status. Such studies could play an important role in identifying the poverty risks faced by older adults and understanding how these risks are distributed across different groups. Additionally, examining the economic and social impacts of pandemics, such as COVID-19, on older adults would be beneficial. During the pandemic period, the economic difficulties faced by older adults intensified their existing poverty levels and had a significant impact on their quality of life [112–114]. Therefore, future research on poverty among older adults should adopt a comprehensive framework that also considers the effects of pandemics.

Conclusions

This study provides a comprehensive examination of the determinants of poverty among older adults in Türkiye, revealing the multifaceted impacts of poverty on older adults. The results indicate that factors such as education level, health status, household equivalence scale, number of employed individuals, and homeownership contribute to increased poverty among older adults. For example, it is understood that the probability of being poor decreases as the educational level of the older increases. In light of this situation, it is clear that measures should be taken to increase the level of education. In addition, those who own a house are less likely to be poor than those who do not own a house. Home ownership is an important

social policy tool and the state should develop policies to enable more home ownership. In this context, social housing is important as an integral part of the social welfare and security system [115]. Similarly, those who earn rental income are less likely to be poor than those who do not have rental income. In light of this situation, it may be useful to increase savings awareness and provide government incentives for investments that can generate rental income. Additionally, the manifestations of poverty among older adults vary across Türkiye's eastern and western regions, with the lack of social support being a particularly notable issue in the eastern regions. Many studies in the literature emphasize the need for effective measures in social policies to prevent poverty among older adults and increase the welfare level of the older adults. For example, a study conducted in Taiwan emphasized that taking into account local and cultural characteristics can increase the welfare level of the older adults [116]. Another study conducted in China drew attention to a similar situation [117]. Future research could provide more tailored and effective policy recommendations by comparing the effects of poverty among older adults across various socioeconomic groups and regions.

Limitations

This study has several limitations. First, the data used in this study are secondary data. The variables necessary for statistical analysis are derived from those available in the dataset; however, certain variables, such as occupation or homeownership status, were not included in the analysis. Second, the cross-sectional nature of the data prevents the identification of definitive causal relationships between socioeconomic factors and subjective poverty. Finally, data on relative poverty rely on individuals' self-reports, which may introduce bias in the collected data.

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Authors' contributions

ÖA conceived and led the design and development of the study proposal. ÖA, KÖ, CS and HD supervised data collection, led the data analysis and drafting the manuscript. HD, KÖ, and CS made substantial contributions to the conceptualization and design of the study, data interpretations and writing the manuscript. All authors read and approved the final version of the manuscript.

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Data availability

The data underlying this study is subject to third-party restrictions by the Turkish Statistical Institute. Data are available from the Turkish Statistical Institute (bilgi@tuik.gov.tr) for researchers who meet the criteria for access to confidential data. The authors of the study did not receive any special privileges in accessing the data.

Declarations

Ethics approval and consent to participate

We declare that all ethical guidelines for authors have been followed by all authors. Ethical approval is not required [118].

TurkStat is an institution that compiles, evaluates, and presents statistical information to decision-makers to prepare development plans and programs, make economic decisions, and address all other issues needed. TurkStat carries out internationally comparable statistical production activities according to the standards of organizations such as the European Union Statistical Office, the United Nations, OECD, ILO, etc. TurkStat collects data within the scope of the Official Statistics Program. The Official Statistics Program is prepared for five-year periods based on the Turkish Statistics Law No. 5429 to determine the basic principles and standards regarding the production and publication of official statistics and to ensure the production of up-to-date, reliable, timely, transparent and impartial data in areas of need at national and international levels [118]. The individuals included in the sample in the surveys conducted by the Turkish Statistical Institute are legally obliged to participate in the survey. According to the Turkish Statistics Law, those who do not provide the information requested within the scope of the research in the specified form and time without a valid excuse or who provide incomplete or incorrect information are warned once and asked to provide the information or correct the deficiencies and errors within seven days. An administrative fine shall be imposed on natural persons or organs and representatives of private legal entities who, despite this warning, do not provide the information or correct the deficiencies and errors as requested [118]. TurkStat also conducts the Income and Living Conditions Survey within the scope of the Official Statistics Program put into effect by law. Since the Income and Living Conditions Survey is conducted within the scope of legal responsibility by the state, ethical approval is not required [119].

The data were obtained through the joint teamwork of both the Turkish Statistical Institute (TurkStat) and the European Union Statistical Office (SOEU). We obtained this data from TurkStat in return for a contract without needing an ethics committee document and used it in our study [61].

For this study, secondary data were employed. Official approval was received from the Turkish Statistical Institute to use the microdata set from the Income and Living Conditions Survey. The Turkish Statistical Institute also received a "Letter of Undertaking" authorizing it to use the study's data.

The letter of undertaking for the use of micro data without restrictions in dissemination:

Article 1- This letter of undertaking determines the rules, principles and obligations of the use of micro data, which are safe to disclose apart from the Presidency.

Article 2- This letter of undertaking regulates the use of micro data sets of the Income and Living Conditions Survey, within the framework of the Directive on Access and Use of Micro Data in line with the purpose specified in Article 1.

Article 3- The following provisions apply for the use of micro data:

- Findings obtained by the researcher as a result of incorrect calculation only bind the researcher.
- The researcher refers to the micro data of the Institution that he uses while disclosing the results obtained from the study.
- The researcher is obliged to send a copy of the published report, article, publication etc. to the Institution Library within three months at the latest. Subsequent micro data usage requests of the researcher who is found not to fulfill this obligation are not covered.
- The researcher cannot reproduce, give to third parties, sell or transfer the micro data set he obtained.

Article 4- The researcher, by taking into account the principles of confidentiality defined in 13. and 14. articles of Turkish Statistical Institution numbered 5429 and Regulation on Procedures and Principles Regarding Data Confidentiality and Confidential Data Security in Official Statistics, is deemed to guarantee hereby that he shall not disclose the information, table, etc. violating this principle and shall only use micro data for statistical purposes.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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