

Multidimensional poverty index: A multilevel analysis of deprivation among Iranian older adults

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Authors' contributions

SHMK and MB conceptualized and designed the study. SHMK and MB collected and analyzed the data. SHMK, MB and SA wrote the manuscript. All authors critically reviewed the analysis and provided feedback on the manuscript. All authors read and approved the final manuscript.

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Abstract

Although elderly population faces a higher risk of poverty compared to others, there is no clear picture of elderly poverty in Iran. The aim of this study was to measure the multidimensional poverty and its related factors among Iranian elderly. This cross-sectional study was conducted from July to November 2019 and collected data by interviewing of 1280 elderly in Tehran, Iran. To compute multidimensional poverty, four dimensions were used; including health (disabilities), education, housing and standard of living. Single and multidimensional poverty and the joint distribution of deprivation were calculated. Multilevel logistic regression models were used to determine the relationship between predictor variables and outcome (multidimensional poverty). Multidimensional poverty among Tehran elderly was 59.0 per cent. The prevalence of health, housing, education and standard of living deprivations were 15.4, 25.3, 29.5 and 29.9 per cent, respectively. Furthermore, multivariate analysis shows that living with a spouse, being employed, having health and social insurance coverage were protective factors, while being a woman, was the risk factor for multidimensional poverty. Approximately 21% of multidimensional poverty variance attributed to the district-level and the remaining assigned to the individual-level factors. This study showed that the elderly living in different areas of Tehran experience different aspects of poverty. So paying attention to the dimensions of multidimensional poverty can play an important role in customizing the policies of each district. Also, the findings of this study on risk and protective factors of multidimensional poverty can be effective in designing and implementing interventions to mitigate poverty among the elderly.

Keywords: Poverty, Older adult, Deprivation, Multidimensional approach, Multilevel analysis, Iran

Introduction

Older adults are among the most vulnerable population subgroups, especially in developing countries (Berthoud, Blekesaune, & Hancock, 2009; Gasparini, Alejo, Haimovich, Olivieri, & Tornarolli, 2010; United Nations, 2019). Poverty among older adults is likely to grow among countries faced with a rapidly aging population, and will become a larger problem in the coming decades (Ku & Kim, 2020; Smeeding, 2001).

By 2050, about a quarter of Iran's population is expected to be aged 60 and above (Soltani, Pojani, Askari, & Masoumi, 2018). Data on the speed of population aging show that Iran is the second fastest aging country in the world in terms of the percentage point increase in the population age 60 and over between 2015 and 2050 (Mehri, Messkoub, & Kunkel, 2020).

Since the 1950s, various researchers have noted that the elderly are one of the largest groups living in poverty in Iran (Raghfar & Mohammadifard, 2013). The elderly population faces a higher risk of poverty compared to other age groups and they are also much less likely to escape poverty. Poverty among older adults is associated with poor health, spending a high proportion of income on out-of-pocket health care services, higher levels of functional impairment and institutionalization (Chou & Lee, 2018).

In the last few decades, the literature on multidimensional deprivation has been at the frontier of poverty research (Dhongde, 2017). In the late 1970s, Sen took the first steps toward alternative measurements of poverty by providing a capability approach (A. Sen, 2004; Amartya Sen, 2018). Today, this approach is widely accepted among international organizations, so that the Human Development Index (HDI) and the Multidimensional Poverty Index (MPI), which are published annually by the United Nations, are measured using a multidimensional poverty (Alkire, 2005;

Alkire & Foster, 2011; Alkire & Santos, 2014). The well-being of an elderly person is not determined by his or her income alone, nor is deprivation limited to income deprivation, but deprivation of health, housing, education, dignity, political and social deprivation are among the various forms of deprivation (Dhongde, 2017; McKay, 2008; Raghfar & Mohammadifard, 2013; Tsui, 2002; Yun & Ko, 2018).

Man is a multidimensional being, so he can feel poverty in different aspects of socio-economic life, and not just in terms of income. Thus, poverty becomes a comprehensive concept that encompasses the entire spectrum of human life. Therefore, income as an indicator of welfare is not a proportionate indicator and must be complemented by other factors such as housing, literacy, health, access to public goods and others. The need for such a multidimensional approach to measuring welfare inequality has recently come to the attention of economists including Bourguignon and Chakravarty (2019), Tsui (2002), and Maasoumi and Lugo (2008).

Multidimensional indicators have been widely used in the literature on poverty and even later life poverty. Dhongde (2017) estimated the multidimensional poverty with four dimensions of health (disability), education, housing, and living standards among the elderly over the age of 65 in the United States. She found that 38 per cent of the American elderly was poor at least in one dimension. Joint distribution of poverty among elderly showed that 12 per cent of the elderly in two dimensions, 3 per cent in more than two dimensions and 0.4 per cent in all four dimensions, were below the poverty thresholds. Yun and Ko (2018) designed a multidimensional elderly poverty index for Korean seniors. Their index composed of three dimensions of income, assets and housing. They found that 5.5 percent of South Korea's general population suffers from multidimensional poverty, compared with 14.3 percent for the elderly. In addition, multidimensional poverty was higher among female seniors than male seniors (70% compared to

30%). Chen and Leu (2020) assessed the dynamics of multidimensional poverty and inequality among middle-aged and older adults in Taiwan. They found older seniors confronted more multidimensional poverty. In addition, the most prominent factors of inequality among those in poverty were gender and education. Contrary to the international literature, empirical studies in Iran on elderly poverty have been very lackluster. This paper attempts to fill this research gap by using multidimensional deprivation approach in regard to the circumstances of older people in Iran.

Iranian elderly profile

According to the last census of the Statistics Center of Iran (2016a)(2016), people aged 60 and over constitute more than 9.28 per cent of Iran's population and 12.75 per cent for Tehran (Statistical Centre of Iran, 2016a). In terms of population growth, Iran will be the second fastest growing country in the world by 2050, after South Korea. As people aged more than 60 will represent about 31 percent (almost 29 million people) of Iran's population. In the same path, the share of population aged over 65 is projected to be 22 percent of total population in 2050 (Mohaqeqi Kamal, Harouni, Basakha, & Makki Alamdari, 2019).

A careful look at the socio-demographic status of the elderly in Iran shows that 72.37 per cent of the Iranian seniors live in urban areas and about 22 per cent of all them were employed. The employment rate of urban seniors was less than 16 percent, compared to 37 percent for rural seniors (Statistical Centre of Iran, 2016a). Based on the World Bank statistics, the old-age dependency ratio of Iran reached from 6.43 per cent in 1990 to 9.21 per cent in 2019, representing the increasing number of the elderly compared to the active middle-aged population (World Bank, 2020).

Gender disparity is another challenge for Iranian elderly community. Women comprised only 17.5 per cent of the work force in 2019 (Kiani, Bayanzadeh, Tavalaei, & Hogg, 2010), whereas

they constitute more than half of the total population in Iran (Statistical Centre of Iran, 2016b). Women retire five years earlier than men in Iran (Kiani et al., 2010). Regarding that the life expectancy of women is three years more than that of men in Iran (World Bank, 2020), retired women may face more economic problems in later life (Kiani et al., 2010). Inequality in education has exacerbated gender disparity among the elderly in Iran. The literacy rate of the elderly in Iran has grown significantly over the past four decades, from 12.9 per cent to 46.4 per cent. But, an important part of this improvement has been due to high literacy rates for men (59.2%) than women (33.9%) (Secretariat of the National Council of the Elderly, 2020). Besides, the divorce rate for the Iranian elderly was considerably different in terms of gender. It is easier for men than women, to remarry after a divorce or being widowed. Women face more social barriers to remarriage (Foroutan, 2002). Thus, the proportion of the single old women is higher than that of single men and consequently, older women are more at risk of poverty.

Despite the mentioned challenges, there is no comprehensive system of protection for Iranian elderly, as there is in developed countries, like state pension in Europe or social security in the US. However, there is a range of employment-related pension plans that are managed either by the social security organizations. The formal pension plans cover principally men given the male dominated structure of the formal employment in Iran, but women do inherit the pension of their deceased husbands. However, the majority of pensioners struggle to cover their basic needs and in recent years (Mehri et al., 2020).

Considering the outlined challenges, awareness of the poverty situation among the elderly will be one of the most important prerequisites for social policy in Iran.

The basic approach in poverty studies in Iran is to focus on income poverty, but this approach cannot provide a holistic overview of the poverty and can be misleading. Information on economic poverty in Iran is limited to research studies conducted in this field (Mahoozi, 2015; Mohaqeqi Kamal, Harouni, Basakha, et al., 2019; Raghfar & Mohammadifard, 2013) and there are no official statistics on the extent and severity of poverty in Iran. To our best knowledge, very few studies have been conducted on the income status and poverty of the elderly in Iran. According to Zanjari and Sadeghi (2020), 25 per cent of the Iranian elderly live in poverty, while this rate is 13 per cent for non-elderly people. So, older people are about twice as likely as others to be poor. In the elderly sub-groups, the poverty rate among older women (39.5%) was almost 20 percent higher than among older men (19.2%). Their results also showed that increasing age in the elderly was more likely to be associated with poverty; such a way that 36.9 per cent older seniors (80 years and older) were below the poverty line with compared to the 18.7 per cent for 60-69 years old seniors. In another study, Moghadam (2016) estimated the poverty rate of the Iranian elderly and its related factors. He found that 34.72 per cent of the elderly live in poverty. Older women are more likely to be poor than men and seniors with a spouse are 16 percent less likely to be in poverty.

In Iran, like many developing countries, there is no study on multidimensional poverty in older adults, but few studies have been conducted in the general population. For example, Ali-Maddadi (2008) presented for the first time an estimate of the multidimensional poverty index in Iran. In this study, the multidimensional poverty index in rural and urban areas has been compared between 2004 and 2006. This study considered income, housing, sustainable assets, health, social security, leisure and education as dimensions of the poverty index. It found that in 2004, 18.3 per cent of urban households and 19.6 per cent of rural households suffered from multidimensional poverty. The results of 2006 showed that the poverty rate decreased slightly to 18.1 per cent for urban

households and 19.3 per cent for rural households. In another study, Raghfar and Mohammadifard (2013) measured the multidimensional poverty index for Tehran consisted of income, housing, education, and public health. According to their results, the highest and lowest multidimensional poverty rates were in districts 14 and the 1, respectively.

Given the complexity of poverty, it is essential to provide policymakers a more comprehensive and clear picture of the multiple deprivations experienced by the elderly. This paper attempts to calculate the multidimensional poverty for the elderly population in all municipal districts of Tehran, Iran. Tehran is a metropolis with a large socio-economic gap between its different geographical areas. Previous studies have shown this gap in the general population (Mohaqeqi Kamal, Harouni, & Basakha, 2019), but this gap has not been studied among the elderly. The study of multidimensional poverty among the elderly will help to spatial distribution of poverty and its dimensions. This approach facilitates the adoption of cost-effective and specific anti-poverty policies to bridge the gap.

The theoretical framework (the dimensions and the indicators) of the study have been selected based on previous empirical research specially, the Multidimensional Poverty Index (MPI) of the United Nations Development Program. Of course, in applying this theoretical framework, we have faced data availability constraints for Iran. The MPI, developed in collaboration with the University of Oxford, and includes three dimensions of health, education, and living standards that are most applicable to the general population (Alkire, 2007). The previous studies on elderly's multidimensional poverty, added the "housing quality" as the fourth dimension. The rare empirical studies on multidimensional elderly poverty (Dhongde, 2017; Yun & Ko, 2018) have addressed the issue based on the same four dimensions but with different indicators.

Method

Design

This cross-sectional study was conducted from July to November 2019. The required sample size was estimated to be 1066 using Cochran's formula, taking into account the 95 per cent statistical confidence interval, the population size (N=1000000), 0.03 desired level of precision (d) and $p = q = 0.5$. Considering the type of sampling (clustered sampling), 20 per cent was added to the sample size because of the design effect and the final volume was increased to 1280 people.

$$n = \frac{Nz^2 pq}{Nd^2 + z^2 pq} = 1066$$

The samples were selected by using a multi-stage probability-proportional-to-size (PPS) sampling method to obtain a sample representative of the municipality. A total of 1280 people aged 60 years and above were sampled from 22 municipal districts and 367 neighborhoods in Tehran. The sampling occurred in following four steps: Stage 1: 22 Districts of Tehran metropolitan were considered as the primary sampling units. Samples were selected from all 22 districts of Tehran metropolitan. Stage 2: For each district, the required sample size was determined in proportion to the number of elderly people in each region by considering the distribution of the elderly population in each region (based on the URBAN HEART study in Tehran (Asadi-Lari et al., 2013). Stage 2: Two neighborhoods were selected by chance and by lot from each region. Stage 3: The samples were then randomly selected within each neighborhood. The first sample was the first house on the right side, when entering the alley. If the selected household did not have any eligible respondents, the “the next house” was chose and the houses one by one surveyed to find older adults 60 years and older in each neighborhood, until we had an enough sample. Stage 4: Individuals were chosen to participate in the study from a list of all eligible persons residing in the

selected households. One eligible participant was surveyed from each household. If more than one eligible participant was present in the household, the eldest participant was interviewed. In order to obtain maximum diversity in the samples, the distribution of the samples was considered based on gender (male, female), employment (employed and unemployed, housewife), level of education and housing status (owner and tenant). Finally Individuals who consented to participate were interviewed face-to-face at home by trained staff via computer-assisted personal interviewing.

The inclusion criteria were: (a) Iranian citizenship, (b) being aged 60 and over, and (c) ability to speak and understand Persian language. The exclusion criterion also included seniors who lived in nursing homes or were unable to understand the questions.

Data

Data were collected using a closed-ended questionnaire included three sections: demographic characteristics, economic status and health status.

The demographic section included questions about age, gender, education, marital status, and life arrangements. The economic section included questions about family income, personal income, employment status, house ownership status, residential unit area, and health, social, and supplementary insurance. Finally, the health section included questions about self-reported health status, diseases diagnosed by a physician, taking medication, use of assistive devices such as glasses and hearing aid, glasses number, ability to walk for 15 minutes, ability to take a bath and wear clothes, and ability to shopping and visit a doctor.

Independent variables in the regression model were age (continuous), gender (male, female), marital status (married; divorced; widowed; never married), employment status (working; retired; not employed; housewife), possessing health, social and supplementary insurance, (no, yes), living

arrangement (living together with spouse, living with children, living with another person, living alone), smoking in the past month (yes, no), and substance use in the past month (yes, no).

The survey was carried out through face-to-face interview with elderly in their homes. The face validity of this questionnaire was approved by 5 experts in the fields of aging, health, and social welfare. A pilot study was conducted among 20 elderly people and based on their responses, the questionnaire was revised and necessary adjustments made before administration of main survey.

Measurement

Adapted from Dhongde (2017) theoretical and analytical framework, the four dimensions of health (disabilities), education, housing, and standard of living were considered to compute multidimensional elderly poverty.

Due to the different needs, indicators of each dimension should be chosen based on the elderly's situation and their needs. For instance, getting high-school diploma is widely used as a criteria for educational attainment (Alkire & Foster, 2011; Dhongde, 2017). But in the past, there was no proper educational infrastructure for Iranian elderly to complete their education at their young age. Hence, this study considered a senior as deprived in education if he/she has not been able to successfully complete her eighth grade.

Health may also be a different concept for the elderly. So, disability metrics have been used to measure the health deprivation of the elderly. There are six known areas of disability: vision, hearing, cognition, ambulation, self-care, and independent living (Dhongde, 2017). Due to the fact that the study was conducted as a self-report survey of seniors, the cognition dimension was excluded to prevent bias. In this study, any elderly person experiencing two or more disabilities is considered deprived.

In this study, standard of living is measured by comparing an individual's total family income in the last 12 months with the poverty threshold. A person is deprived in this dimension if her/his income is less than the poverty threshold.

Floor area per person is one of the key housing indicators approved by the Commission on Human Settlements (CHS). Floor area per person is defined as the median floor area (in square meters) of the housing unit divided by the average household size. The average floor area per person varies among countries; But for many countries e.g. Italy, the UK, Japan, Spain, Sweden, France and Greece, it is between 30 and 45 square meters (Mesthrige Jayantha & Lau, 2008). Based on the criteria and standards of residential space of the Ministry of Roads and Urban Development of Iran, here a person considered as deprived in this dimension if her/his house was smaller than 39 square meters (DHUD, 2021). Table 1 shows the dimensions, indicators, and poverty thresholds for the elderly.

Table 1. Dimensions, indicators and thresholds of elderly poverty

Dimension	Indicator	Poverty threshold
Standard of living	Comparing household income over the past 12 months with the poverty line	The income of the family being less than 1dollar (250 thousands Iranian Rials) per day/per member
Education	Years of education	Having less than 8 years of education
Disabilities *	Vision problems	Having glasses or lens equal or more than 3 diopters
	Hearing problems	Using hearing aids
	Physical-motor problems	Unable walk for 15 minutes without fatigue
	Self-care	Unable to dress or bathe alone
	Independent living	Unable to go shopping or visit a doctor alone
Housing	Per capita residential area	If a person has a per capita living area of less than 39 square meters, he /she is considered poor

* Presence of two or more disabilities regarded as threshold for having health poverty. People with mental disability excluded because they may not understand the questions correctly or give incorrect answers.

A multidimensional measure of poverty can incorporate a range of indicators to capture the complexity of this phenomenon. Depending on the context and the purpose of measurement, different dimensions and indicators can be chosen to create a multidimensional poverty index. On the other hand, people describe their situation differently according to what they have in mind. For instance, empirical studies show that poor people describe ill-being to include poor health, nutrition, lack of adequate sanitation and clean water, social exclusion, violence and much more (OPHI, 2020). Generally, using composite indicators can summarize complex, multi-dimensional realities to support decision-makers. They also reduce the visible size of a set of indicators without dropping the underlying information. Another advantage of multidimensional indicators over single indicators is their appropriate capacity for facilitated communication with general public (i.e. citizens, media, etc.) and enabling them to compare complex concepts effectively (Nardo et al., 2008).

Statistical methods

First, the uncensored deprivation headcount ratios in health, housing, education and standard of living were calculated using poverty thresholds and the share of poor elderly in the population was determined. Afterwards, presuming equal weights and a union identification approach, the average multidimensional poverty intensity (A) or average percentage of simultaneous deprivations suffered by the poor elderly calculated by using Alkire and Foster (2011) methodology, as expressed as follows:

$$A = c(k) / q(d)$$

where $c(k)$ is the share of deprivations experienced by all poor people in k dimension, q is the number of multidimensionally poor people and d is the maximum number of deprivation

dimensions. Final step was calculating the multidimensional headcount ratio (incidence) ($H = q/Population\ size$) and the adjusted headcount ratio ($M0 = H \times A$), which accounts for both the incidence of poverty among the elderly and the intensity of their multidimensional poverty.

The joint distribution of deprivations was then estimated and illustrated in the Venn diagram. Multilevel logistic regression models were used to determine the relationship between predictor variables and multidimensional poverty. All predictor variables was aggregated from individual-level data at the districts-level. Independent variables were selected for inclusion in the model based on their significance as determined by the χ^2 test. A p-value of <0.05 was considered statistically significant. All tests were run using SPSS version 21 and STATA version 14.

Ethical Consideration

Each elderly was approached and interviewed separately and was told he/she could refuse to participate. They were informed that information would be anonymous and confidential and he/she could stop talking at any time without penalty. Sampling was performed on all of elderly who were verbally consenting to participate in the study. In addition, written informed consent was obtained from all participants. The study was approved by the Research Ethics Committee of the University of Social Welfare and Rehabilitation Sciences, Tehran, Iran (IR.USWR.REC.1398.068).

Results

Participants' profile

The age range of the elderly was 60 to 95 years with an average of 70.9 (SD= 8.06) years. Among the sample elderly, 50.1 per cent lived with their spouses and 13.4 per cent were illiterate. In terms of employment status, the majority were retired (40.3%) or housewives (34.5%). The

household income level of 20-30 million Iranian Rials (IRR) has been the most frequent response.

The profile of elderly people in terms of socio-demographic variables is reported in Table 2.

Table 2. Socio-demographic characteristics of the elderly

Variables	Variable dimensions	Frequency	% Frequency
Gender	Male	641	50.1
	Female	639	49.4
Age category	60 to 74 years	898	70.1
	75 to 90 years	362	28.3
	> 90 years	20	1.6
Age	Mean (70.90), SD(8.07)		
Marital status	Married, living with a spouse	899	70.2
	Widowed	335	26.2
	Divorced	28	2.2
	Never married	18	1.4
Educational status	Illiterate	171	13.4
	Elementary - Middle	478	37.4
	Secondary education	384	30
	University	247	19.3
Employment status	Employed	252	19.7
	Unemployed	71	5.5
	Retired	515	40.3
	Housewife	442	34.5
Income level	< 10 million IRR	54	4.2
	10 to less than 20 million IRR	272	21.3
	20 to less than 30 million IRR	366	28.6
	30 to less than 50 million IRR	362	28.3
	> 50 million IRR	226	17.7
Smoking	Yes	205	16
	No	1075	84
Drug use	Yes	144	11.3
	Do not covered	1136	88.7
Health insurance	Covered	701	54.8
	Do not covered	579	45.2
Social insurance	Covered	843	65.9
	No	437	34.1
Supplementary insurance	Covered	756	59.1
	Do not covered	524	40.9
Life arrangement	Only with spouse	459	35.9
	With spouse and single children	410	32
	Single	159	12.4
	No spouse with married children	93	7.3
	No spouse with single children	80	6.3
	With spouse and children	62	4.8
	With relatives	10	0.8
	Others	7	0.5

Multidimensional poverty and joint distribution of deprivations

According to the deprivation cutoffs that mentioned in Table 1, the highest per cent of deprivation was related to the standard of living poverty (54.1%). Slightly more than half of the elderly (50.7%) did not complete education beyond grade 8; and 50.2 per cent of the elderly experienced housing poverty. Also, 29 per cent of elderly had two or more disabilities; and about 1 in 3 elderly adults had multiple disabilities. 5.

As there were four dimensions, equally weighted, it is convenient to use Venn diagrams to depict some of the overlaps, although all overlaps cannot be visually. The Venn diagram in Figure 1 presents the share of poor elderly found in each dimension in addition to the overlaps among these dimensions. It shows that 16.3 per cent of the elderly with income poverty experienced

Figure 1. Venn diagram of joint distribution of deprivations in the multidimensional framework

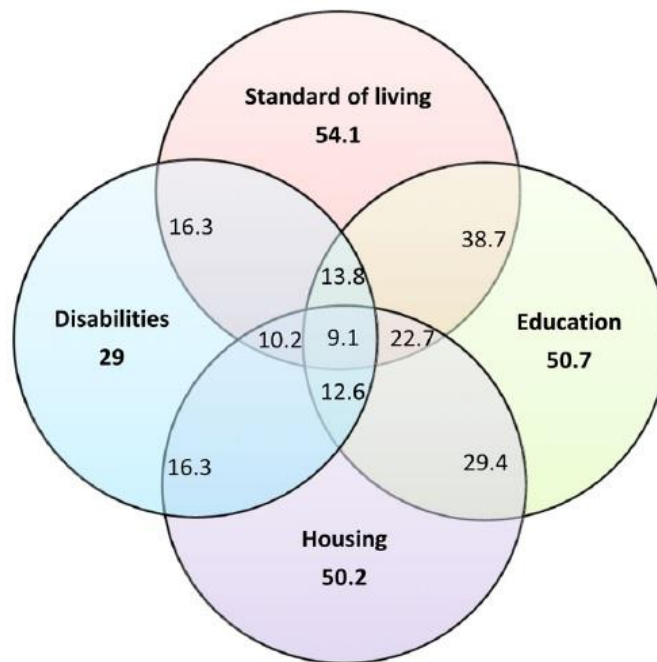


Figure 1. Venn diagram of joint distribution of deprivations in the multidimensional framework.

disabilities and 38.7 per cent were deprived of a high-school education. Among the elderly with housing poverty, 16.3 per cent were disabled and 29.4 per cent deprived of a high-school education. Obviously, there are other overlaps between dimensions (e.g. disabilities and education joint poverty (19.5%) and standard of living and housing joint poverty (30.8%)) that cannot be shown in the van diagram. The figure also shows the percentage of the population that experience deprivation in more than two dimensions. For example, 13.8 per cent of the elderly were deprived in three dimensions of disabilities, standard of living, and education. Among elderly adults, 9.1 per cent were deprived in all four dimensions.

The next step is to identify who is poor according to different poverty cutoffs (k). Any specific choice for k value is somewhat arbitrary and should be subject to robustness tests — say, by evaluating poverty levels for a grid of nearby cutoffs (Alkire & Foster, 2011). Considering that, the study reports multidimensional poverty according to the different k values. Table 3 shows the per cent of elderly adults who were deprived at least in k dimensions. Here we have defined four different dimensions of poverty. Due to the use of questionnaire data, poverty coefficients are reported 95 per cent confidence interval. It should be noted that equal weights are assumed for the four dimensions of poverty. Table 3, presents poverty levels for different values of k and shows that 84 per cent of the elderly were deprived in at least one dimension. As the deprivation criteria increases to at least 2 and 3 dimensions, the poor elderly headcount ratio change to 59 per cent and 31.7 per cent of the population. Results show that only about 9.1 per cent of elderly were deprived in all four dimensions. The study chose to consider multidimensional poverty as being poor in at least two dimensions ($k=2$). Hence, the poverty headcount ratio is 59.0 per cent ($SD=1.4$), and the value of adjusted multidimensional poverty (M_0) is 39.7 per cent ($SD=1.0$).

Table 3. Headcount (H) and Intensity Adjusted multidimensional poverty (M₀) for at least n-dimensions

Deprivation cutoff	Index	Coefficient	Standard Error	95% Confidence Interval	
				Lower Bound	Upper Bound
At least in 1 dimension	H	84.0	1.0	82.0	86.0
	M ₀	46.0	0.8	44.3	47.6
At least in 2 dimension	H	59.0	1.4	56.3	61.7
	M ₀	39.7	1.0	37.7	41.7
At least in 3 dimension	H	31.7	1.3	29.1	34.2
	M ₀	26.1	1.1	23.9	28.2
At least in 4 dimension	H	9.1	0.8	7.5	10.7
	M ₀	9.1	0.8	7.5	10.7

Table 3 shows the per cent of one and multidimensional poverty among the elderly in the 22 districts of Tehran. According to table 3, the lowest and highest health deprivation rates are in districts of 10 (5.3%) and 19 (59.5%), respectively. The lowest and highest housing deprivation rates are in districts 2 (22.4%) and 12 (82.7%), respectively. The lowest and highest education deprivation rates are in districts 2 (22.4%) and 18 (94.1%), respectively. The lowest and highest standard of living deprivation rates are in districts 1 (16.7%), and districts 10 and 18 (100%), respectively.

Contribution of dimensions in multidimensional poverty

Table 4 presents multidimensional poverty across Tehran municipal districts. As mentioned earlier, the elderly who were deprived in at least two dimensions were considered as a people with multidimensional poverty. According to table 4, the lowest and highest multidimensional poverty headcount ratios were in districts 6 (30.8%) and 18 (97.1%), respectively. Taking the intensity of poverty into account and calculating adjusted multidimensional poverty, the situation in different regions changes significantly. For instance, in district 5, where the headcount multidimensional poverty rate is 72.9 per cent, the M₀ was calculated at 0.441. In other words, the poor elderly in this area experience 44 per cent of the deprivations that would be experienced if everyone was

poor and deprived in all dimensions. Therefore, despite the high rate in headcount poverty, the severity of poverty in this district has not been very high. The situation is completely different for districts 20. The headcount multidimensional poverty rate for this region is 78 per cent, which is slightly different from the district 5. Considering the intensity of poverty, shows that 72 per cent of these people have been deprived in exactly two dimensions. This figure, compared to the 44 per cent ratio in district 5, indicates that the intensity of poverty among the elderly in this district was much higher than in district 5. Results show that the incidence of multidimensional poverty is disproportionately high for the elderly in the southern districts.

Table 4. Multidimensional poverty and contribution of its dimensions in Tehran (%)

District	H	M ₀	Per cent contribution of each dimension to M ₀			
			Health	Housing	Education	Standard of living
1	43.1	27.1	28.2	26.9	30.8	14.1
2	31.6	20.4	24.2	21.0	25.8	29.0
3	37.0	22.8	27.4	20.2	33.3	19.0
4	51.7	32.3	21.3	32.0	25.3	21.3
5	72.9	44.1	9.6	18.3	31.7	40.0
6	30.8	20.6	34.7	17.3	28.0	20.0
7	71.2	45.1	5.9	19.3	35.3	39.5
8	73.7	46.7	4.9	26.8	31.7	36.6
9	56.5	39.3	27.1	35.4	21.9	15.6
10	86.0	55.7	2.4	25.2	33.9	38.6
11	83.6	54.5	3.8	28.6	30.8	36.8
12	71.2	50.5	24.8	31.4	20.0	23.8
13	50.0	31.5	8.6	20.7	37.9	32.8
14	46.7	30.0	8.3	29.2	36.1	26.4
15	63.2	44.7	25.0	32.4	22.1	20.6
16	81.5	59.4	19.8	26.2	26.2	27.8
17	42.2	26.1	8.5	23.4	38.3	29.8
18	97.1	75.7	13.6	23.3	31.1	32.0
19	89.2	72.3	20.6	27.1	23.4	29.0
20	87.0	72.3	18.0	24.8	27.1	30.1
21	61.4	36.9	6.2	20.0	32.3	41.5
22	37.0	23.6	11.8	19.6	31.4	37.3
Total	59.0	39.7	15.4	25.3	29.5	29.9

In table 4, we break the poverty levels down by its dimension. In fact, we have calculated the per cent contribution of the each dimension to the multidimensional poverty. The sum of the share of these dimensions is equal to one and shows that in each district, which dimension has played a more important role in its multidimensional poverty. In 2019, health poverty, housing poverty, education poverty and poverty in living standards have contributed 15.4 per cent, 25.3 per cent, 29.5 per cent and 29.9 per cent to Tehran multidimensional poverty, respectively. Health poverty in districts 10 and 11 has the least and in districts 6 and 1 has the most impact on multidimensional poverty. It is quite obvious that housing poverty in districts 9 and 15, education poverty in districts 17 and 13, and poverty in living standards in districts 21 and 5, have had the largest contribution in their multidimensional poverty.

Factors predicting multidimensional poverty

One of the questions that poverty-related studies have always sought to answer has been to identify the factors associated with multidimensional poverty. A significant part of this study also sought to identify the related and influential factors on multidimensional poverty of the elderly in Tehran. In the first step, the correlation between multidimensional poverty index and each of its dimensions was appraised. Spearman correlation test show that multidimensional poverty had the highest significant correlations with education poverty (74.3%) and poverty in living standards (66.2%), respectively. This finding emphasizes the role of education in various aspects of the elderly's lives.

After a simple correlation test, bivariate analyses were conducted to assess the relationship between potential independent variables and multidimensional poverty (Table 5). According to regression results, all significant variables were entered in to the multilevel logistic regression models (except for drug use).

Table 5. Bivariate analyses of variables associated with multidimensional poverty

Variables	Dimension of variables	Multidimensional poverty		P-value
		Yes (756)	No (524)	
Sex	Male	329	312	0.00
	Female	427	212	
Marital status	Never married	3	15	0.00
	Married, living with a spouse	467	432	
	Widowed	271	64	
	Divorced	15	13	
Employment status	Employed	49	79	0.00
	Unemployed	23	11	
	Retired	327	349	
	Housewife	357	85	
Smoking	Yes	114	91	0.02
	No	642	433	
Drug use	Yes	97	47	0.07
	No	659	447	
Health insurance	Covered	356	345	0.00
	Do not covered	400	179	
Social insurance	Covered	462	381	0.00
	Do not covered	294	143	
Supplemental insurance	Covered	361	395	0.00
	Do not covered	395	129	
Life arrangement	Only with spouse	173	286	0.00
	With spouse and single children	268	142	
	With spouse and married children	51	11	
	No spouse with single children	61	19	
	No spouse with married children	90	3	
	Single	101	58	
	With relatives	7	3	
	Others	5	2	

The determinants of multidimensional poverty at the district level is presented in Table 6. All studied variables were measured at the individual level and then aggregated at the level of 22 districts. This model had suitable condition for multilevel analysis based on intra-class correlation coefficient (Peugh, 2010; Sajjadi et al., 2020) justifies that 21.2% of the variance of multidimensional poverty explained through the district level differences (ICC=0.212, 95% CI: 0.118-0.352). The multilevel logistic regression results indicated that gender, health insurance

Table 6. Descriptive statistics of variables at the district level

Determinants at district level	N	Minimum	Maximum	Mean	SD
Women (%)	22	44.40	55.60	49.92	2.49
Age Mean	22	67.00	74.11	70.90	2.03
Never married (%)	22	0.00	6.50	1.41	2.00
Married, living with a spouse (%)	22	54.20	81.60	70.23	7.72
Widowed (%)	22	14.50	36.10	26.17	6.71
Divorce (%)	22	0.00	8.30	2.19	2.15
Employed (%)	22	0.00	33.30	10.00	7.33
Unemployed (%)	22	0.00	13.00	2.66	3.16
Retired (%)	22	0.00	19.40	9.69	5.32
Housewife (%)	22	19.40	50.00	34.53	7.20
Health insurance coverage (%)	22	0.00	91.20	45.23	24.53
Social insurance coverage (%)	22	2.20	68.40	34.14	16.12

coverage, social insurance coverage, marital status and employment status were significant factors in explaining the multidimensional poverty. That is, health insurance coverage (OR =0.69, CI 95%: 0.50-0.93), social insurance coverage (OR =0.56, CI 95%: 0.37-0.80), living with a spouse (OR=0.67, CI 95%: 0.48-0.91), and being employed (OR=0.95, CI 95%: 0.88-1.02) were protective factors, while being woman (OR=1.23, CI 95%: 1.10-1.37) was the risk factor of multidimensional poverty among elderly adults in Tehran (Table 7).

Table 7. Determinants of multidimensional poverty at the district level

Determinants at region level	AOR	Se	p-value	95 % CI for AOR	
				LB	UB
Being woman	1.23	0.07	0.001	1.10	1.37
Age (Mean)	1.00	0.04	0.09	0.91	1.10
Never married	1.62	0.19	0.51	0.48	0.91
Married, living with a spouse	0.67	0.12	0.01	0.48	0.91
Widowed	1.66	0.13	0.11	1.42	1.94
Divorced	1 (omitted)	-	-	-	-

Employed	0.95	0.03	0.001	0.88	1.02
Unemployed	1.08	0.01	0.22	1.04	1.12
Retired	1.01	0.01	0.53	0.97	1.05
Housewife	1.00	0.01	0.99	0.96	1.03
Health insurance coverage	0.69	0.01	0.001	0.50	0.93
Social insurance coverage	0.56	0.01	0.003	0.37	0.80
Supplemental insurance Coverage	0.97	0.01	0.95	0.90	1.04

Conclusion and discussion

This study was designed to measure the multidimensional poverty and its related factors among Iranian elderly. The results of the present study revealed that the prevalence of multidimensional poverty (deprived in at least two dimensions) was 59.0 per cent. Also, the prevalence of health, housing, education and standard of living deprivations were 15.5 per cent, 25.3 per cent, 29.5 per cent and 29.9 per cent, respectively. So, it is clear that educational poverty and difficulty of meeting the basic needs of life have been the most important causes of multidimensional poverty among the Iranian elderly.

Evidence showed that elderly population faces a higher risk of poverty compared to other age groups. On the other hand, Iranian elderly experience higher multidimensional poverty than in developed countries such as the United States and South Korea. For example, Dhongde (2017) reported that around 38 per cent of the United States elderly were deprived in at least one dimension and 12 per cent in at least two dimensions. In another study, Yun and Ko (2018) revealed that 21.1 per cent of South Korea seniors are multidimensionality poor.

Furthermore, living with a spouse, being employed, having health and social insurances were protective factors of multidimensional poverty among the older adults. household composition and their socio-demographic characteristics are associated with poverty risk in old age (Tai & Treas,

2009). Women who are not currently married and widows are more likely to be poor than women who are married with spouse present (Agarwal, Lubet, Mitgang, Mohanty, & Bloom, 2020; Chan & Chou, 2016). According to the human capital theory, the poverty status of older adults is depended by their human capital characteristics, such as educational level (Becker, 2007), skills and eventually employment status. Also, the older workers who were still working have labor market protection. Furthermore, insurance status captures many aspects of health-related disadvantage that we want to capture. Lacking insurance exposes people to greater health and financial risks in the event of illness. Research also suggests that the uncertainty associated with un-insurance creates ongoing psychological stress for people (Frey, 2018; Reeves, Rodrigue, & Kneebone, 2016).

On the other hand, being women was the risk factor of multidimensional poverty among older adults. Old or female older adults are at a higher risk of poverty (Gasparini et al., 2010; Kakwani & Subbarao, 2007; Yun & Ko, 2018). Women were expected to leave paid employment after marrying or – at least – for the period of childcare. Therefore, women's situation was affected by their lower pension contributions and eventually resulted in lower income in old age. In addition, the poverty risk gender gap in older cohorts is far greater than that in the working age population (Antczak & Zaidi, 2016).

Generally, headcount multidimensional poverty of the municipal districts of Tehran was divided into 5 main categories: (a) very high (district 18); (b) high (districts 10, 11, 16, 19 and 20); (C) medium (districts 5, 7, 8, 12, 15 and 21); (d) low (1, 4, 9, 13, and 17); and (e) very low (districts 2, 3, 6, and 22). Overall, the percentage of multidimensional poverty at the south of the city was higher than those of in north districts. Previous evidence suggests that there is a large gap in socioeconomic variables between the northern and southern parts of the city (Harouni et al., 2017;

Mohaqeqi Kamal, Harouni, & Basakha, 2019). Thus, some policies such as invest in a diverse range of affordable housing and insurance options can help to closing this gap.

The policy implications of the study can be noted as follows. First, to design effective anti-poverty policies, it is crucial to provide policymakers with a big picture of the multiple deprivations experienced by the older adults. Second, in line with the activity theory and the findings of this study, policy makers should invest in the field of employment and return to the work of the elderly. Planning for voluntary employment in accordance with the abilities of the elderly can help them to maintain their physical and mental health to have an independent lifestyle. Given the high importance of education, the policy of facilitating formal and informal education can empower the elderly for this goal. Aging policies and programs should support the lifelong learning of the elderly. Creating community-based educational opportunities for the elderly is a pillar of any active aging strategies. Third, in line with the protective role of insurance on poverty, policymakers should expand affordable insurance options in the elderly population. Fourth, according to the high elderly poverty rate, policymakers should improve economic security by further enhancing direct and indirect support for low-income seniors.

As with many other studies, this study has its limitations. First, given that there is no official poverty line in Iran, we used the conventional poverty line based on previous studies. In addition, due to the lack of official statistics and reports on poverty in Iran especially for the elderly, the present study was conducted using a survey method and with limited samples; therefore, although the number of samples in the whole population has been representative of the elderly, but the disaggregation of multidimensional poverty in districts of Tehran was certainly for illustrative purposes. Further, due to the lack of data transparency in severe housing burden, the per capita

standard of living space was used instead. Eventually, because poverty data is based on elderly self-report, the results may be prone to social desirability bias.

Statement of conflict of interest

The authors report no conflict of interest concerning this study or the findings specified in this paper.

Statement of ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the Committee of Ethics in Research in the University of Social Welfare and Rehabilitation Sciences and approved by ethical code: IR.USWR.REC.1398.068.

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References

- Agarwal A, Lubet A, Mitgang E, Mohanty S and Bloom DE** (2020). Population aging in india: facts, issues, and options. In *Population Change and Impacts in Asia and the Pacific* (pp. 289-311): Springer.
- Ali-Maddadi** (2008) *Measuring Multidimensional Indicators of Poverty in Iran in 2004 and 2006*. (MSc). Sharif University of Technology, Tehran, Iran.
- Alkire S** (2005) Why the capability approach? *Journal of human development* **6**, 115-135.
- Alkire S** (2007) The Missing Dimensions of Poverty Data: Introduction to the Special Issue. *Oxford Development Studies* **35**, 347-359. doi:10.1080/13600810701701863
- Alkire S and Foster J** (2011) Counting and multidimensional poverty measurement. *Journal of public economics* **95**, 476-487.
- Alkire S and Santos ME** (2014) Measuring acute poverty in the developing world: Robustness and scope of the multidimensional poverty index. *World Development* **59**, 251-274.
- Antczak R and Zaidi A** (2016) Risk of poverty among older people in EU countries. *CESifo DICE Report* **14**, 37-46.
- Becker GS** (2007) Health as human capital: synthesis and extensions. *Oxford Economic Papers* **59**, 379-410.

- Berthoud R, Blekesaune M and Hancock R** (2009) Ageing, income and living standards: evidence from the British Household Panel Survey. *Ageing & Society* **29**, 1105-1122.
- Bourguignon F and Chakravarty SR** (2019). The measurement of multidimensional poverty. In *Poverty, social exclusion and stochastic dominance* (pp. 83-107): Springer.
- Chan LS and Chou KL** (2016) Poverty in old age: evidence from Hong Kong. *Ageing and Society* **38**, 37-55. doi:10.1017/S0144686X16000817
- Chen KM and Leu CH** (2020) Multidimensional perspective of the poverty and dynamics of middle-aged and older adults in Taiwan. *International Social Work*, 0020872819892674.
- Chou KL and Lee SY** (2018) Superimpose Material Deprivation Study on Poverty Old Age People in Hong Kong Study. *Social Indicators Research* **139**, 1015-1036. doi:10.1007/s11205-017-1740-z
- Dhongde S** (2017). Assessing Multidimensional Deprivation Among the Elderly in the USA. In (pp. 255-270).
- DHUD** (2021) Criteria and standards of residential spaces. Department of Housing and Urban Development. Retrieved from <https://shahrhayejadid.com/blogs/ZezmobNE/>
- Foroutan Y** (2002) *Changes in the aging population-a case study: Iran (1956-1996)*. Paper presented at the Australian population association conference.
- Frey WH** (2018) *Diversity explosion: How new racial demographics are remaking America*: Brookings Institution Press.
- Gasparini L, Alejo J, Haimovich F, Olivieri S and Tornarolli L** (2010) Poverty among older people in Latin America and the Caribbean. *Journal of International Development: The Journal of the Development Studies Association* **22**, 176-207.
- Harouni GG, Sajjadi H, Rafiey H, Mirabzadeh A, Vaez-Mahdavi M and Kamal SHM** (2017) Current status of health index in Tehran: A multidimensional approach. *Medical journal of the Islamic Republic of Iran* **31**, 29.
- Kakwani N and Subbarao K** (2007) Poverty among the elderly in Sub-Saharan Africa and the role of social pensions. *The journal of development studies* **43**, 987-1008.
- Kiani S, Bayanzadeh M, Tavalaei M and Hogg RS** (2010) The Iranian population is graying: are we ready?
- Ku I and Kim C** (2020) Decomposition analyses of the trend in poverty among older adults: the case of South Korea. *The Journals of Gerontology: Series B* **75**, 684-693.
- Maasoumi E and Lugo MA** (2008). The information basis of multivariate poverty assessments. In *Quantitative approaches to multidimensional poverty measurement* (pp. 1-29): Springer.
- Mahoozi H** (2015) Gender and spatial disparity of multidimensional poverty in Iran.
- McKay S** (2008) Measuring material deprivation among older people.
- Mehri N, Messkoub M and Kunkel S** (2020) Trends, determinants and the implications of population aging in Iran. *Ageing International* **45**, 327-343.
- Mesthrige Jayantha W and Lau SSY** (2008) Floor space per person and housing development: an urban growth approach to estimate housing supply in Hong Kong. *Urban Policy and Research* **26**, 177-195.
- Moghadam N** (2016) *Study of the dimensions of poverty of the elderly and the factors affecting it in Iran in 2016*. (MSc). University of Tehran, Tehran.
- Mohaqeqi Kamal SH, Harouni GG and Basakha M** (2019) Spatial pattern of well-being in Tehran: The north-south gap. *Medical journal of the Islamic Republic of Iran* **33**, 112.
- Mohaqeqi Kamal SH, Harouni GG, Basakha M and Makki Alamdari S** (2019) Multidimensional Child Poverty Index in Iran: Distribution of Deprivation across Provinces. *Journal of Poverty* **23**, 353-364. doi:10.1080/10875549.2019.1596195
- Nardo M, Saisana M, Saltelli A, Tarantola S, Hoffman A and Giovannini E** (2008) Handbook on constructing composite indicators: methodology and user guide. Retrieved from <http://www.oilis.oecd.org/oilis/2005doc.nsf/.AccessedJuly2009>.

- OPHI** (2020) What is multidimensional poverty? Oxford poverty and human development initiatives. Retrieved from <https://ophi.org.uk/policy/multidimensional-poverty-index/>
- Peugh JL** (2010) A practical guide to multilevel modeling. *Journal of school psychology* **48**, 85-112.
- Raghfar H and Mohammadifard Z** (2013) The Measurement of Multidimensional Poverty in Tehran. *The Economic Research* **13**, 1-16.
- Reeves R, Rodrigue E and Kneebone E** (2016) Five evils: Multidimensional poverty and race in America. *Economic Studies at Brookings Report* **1**, 1-22.
- Sajjadi H, Harouni GG, Rafiey H, Vaez-Mahdavi M, Vameghi M and Kamal SHM** (2020) Contextual and Individual Determinants of Mental Health: A Cross-sectional Multilevel Study in Tehran, Iran. *Journal of Preventive Medicine and Public Health* **53**, 189.
- Secretariat of the National Council of the Elderly** (2020) *National document of the country's elderly*. Tehran.
- Sen A** (2004) Elements of a Theory of Human Rights. *Philosophy & Public Affairs* **32**, 315-356.
- Sen A** (2018) *Collective choice and social welfare*: Harvard University Press.
- Smeeding TM** (2001) *Income maintenance in old age: What can be learned from cross-national comparisons*. Retrieved from
- Soltani A, Pojani D, Askari S and Masoumi HE** (2018) Socio-demographic and built environment determinants of car use among older adults in Iran. *Journal of transport geography* **68**, 109-117.
- Statistical Centre of Iran** (2016a) Population and housing census. Tehran, Iran.
- Statistical Centre of Iran** (2016b) The Statistical Yearbook of Iran 2016 Retrieved from Available from: <https://www.amar.org.ir/english/Iran-Statistical-Yearbook>.
- Tai T and Treas J** (2009) Does household composition explain welfare regime poverty risks for older adults and other household members? *Journals of Gerontology Series B: Psychological Sciences and Social Sciences* **64**, 777-787.
- Tsui Ky** (2002) Multidimensional poverty indices. *Social choice and welfare* **19**, 69-93.
- United Nations** (2019) *World Population Ageing 2019*. Retrieved from New York:
- World Bank** (2020) Age dependency ratio (% of working-age population). In: World Development Indicators.
- Yun S and Ko K** (2018) Multidimensional Elderly Poverty Index. In: 한국보건사회연구원.
- Zanjari N and Sadeghi R** (2020) *Calculation of Elderly Watch Index in Iran 2016*. Saba Pension Strategies Institute. Tehran.