

Original Article



Loneliness as a Predictor of Hypertension in Older Adults: The TOPS Study

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Abstract

Objectives: To investigate the relationship between loneliness and hypertension in older people.

Design: Cross-sectional study.

Setting(s): Tabriz, the capital city of the East Azerbaijan province in northwestern Iran.

Participants: A representative sample of ≥60-year-old community dwellers. A total of 1362 participants (768 females and 594 males) were selected using the probability proportional to size (PPS) sampling method.

Outcome Measures: Blood pressure, loneliness, and social support were assessed using a standard mercury sphygmomanometer, the 6-item De Jong Gierveld Loneliness Scale, and the Duke Social Support Index (DSSI), respectively.

Results: The prevalence of hypertension was 81.0% among older adults (86.8% in women vs. 73.4% in men, $P < 0.001$). In addition, 54% of respondents felt lonely. Loneliness was more prevalent in females than in males (58.7% vs. 47.9%, $P < 0.001$). Hypertension was found to be associated with social loneliness score (OR=1.16, 95% CI=1.02 to 1.32), marital status (OR=0.49, 95% CI=0.31 to 0.78), body mass index (OR=1.11, 95% CI=1.07 to 1.15), diabetes mellitus (OR=1.56, 95% CI=1.03 to 2.31), and sleep quality score (OR=1.23, 95% CI=1.06 to 1.19).

Conclusions: Social loneliness is associated with an increased risk of hypertension in older people. This highlights the importance of addressing psychosocial factors, especially social loneliness, when managing hypertension in older adults.

Keywords: Social determinants of health, Social isolation, Hypertension, Loneliness, Aged

Introduction

Hypertension (HTN) and loneliness are common among older people. According to the global burden of disease report, HTN is one of the most common disorders affecting both low and high-income countries, with some evidence suggesting that the prevalence of HTN is increasing.¹ It is expected that the global burden of high blood pressure (BP) will increase alongside an aging population and will affect one-third of the global population by 2025.² The prevalence of HTN among older adults has been reported to reach up to 68%.²⁻⁶ HTN is a well-known risk factor for cardiovascular disease (CVD) and the leading cause of death among older men and women. It increases the risk of heart attack, heart failure,

stroke, and kidney disease.^{2,7} It has been estimated that in 2015, about 7.8 million deaths and more than 140 million disability-adjusted life years were related to systolic HTN (systolic blood pressure [SBP]) ≥ 140 mm Hg).⁸

Understanding the predictors of HTN and the factors that influence this disease is a critical task for researchers. Social determinants of health (SDH) play an essential role in the initiation and progression of HTN.⁹ Psychosocial factors, especially loneliness in old age, play a key role in the development of HTN.¹⁰ Loneliness is one of the most common and serious public health problems in modern societies, especially among older adults. Loneliness reportedly affects 43% of adults over the age of 60.¹⁰⁻¹² Loneliness can be defined as a subjective



perception resulting from an unpleasant or dissatisfactory lack of certain interpersonal relationships.^{10, 13} Social disconnectedness and feeling lonely are associated with an increased risk of all-cause mortality that rival traditional risk factors such as smoking.¹⁴⁻¹⁶

Despite this relationship between loneliness and HTN, there is a paucity of high quality research and the vast majority of studies have been conducted in Western populations. Therefore, this study aims to investigate the relationship between HTN and loneliness in older adults in Iran to provide unique insights into a modern middle eastern context.

Methods

This study was a part of the Tabriz Older People Health Survey (TOPS), which was conducted on a large representative sample of non-institutionalized older people (≥ 60 years) in Tabriz, Iran.

Study Setting

The TOPS was conducted in Tabriz, which is in the East Azerbaijan province in the northwest of Iran from July 2019 to January 2020. Tabriz is both the capital of the province and the most populated city in East Azerbaijan province.¹⁷

Study Population

The statistical population included all community-dwellers aged ≥ 60 years who were living in the city of Tabriz.

Sample Size and Sampling Method

Details on this descriptive cross-sectional study and the sampling methodology have been described elsewhere.¹⁸ In brief, a community-based representative sample (1362 participants including 594 males and 768 females) of free-living older adults was randomly selected using the probability proportional to size (PPS) sampling method. In the first stage, 140 blocks were randomly selected from the 11778 urban blocks in Tabriz. Then, 10 older adults were randomly selected from each selected block. A total of 1362 participants were included in the original study; however, data related to loneliness were available in 1351 cases (257 normotensive and 1094 hypertensive participants).

Data Collection Tools

Data collection was undertaken by trained interviewers. To investigate socio-demographic variables, a structured questionnaire was used. Additionally, to collect the specific data of the study, standard scales were used as described below.

Procedure and Measurements

Blood Pressure Measurement

After participants had rested for five minutes, BP measurements were taken from the left and right arms

using a standard mercury sphygmomanometer. HTN was defined as SBP ≥ 140 mm Hg and/or diastolic blood pressure ≥ 90 mm Hg in the right and/or left arm.¹⁹ Participants using anti-hypertensive medications were also classified as having HTN, regardless of their measured BP.

The 6-item De Jong Gierveld Loneliness Scale

This scale is a valid and reliable measurement instrument for assessing social, and emotional loneliness that is suitable for community-based surveys.²⁰ The short 6-item version of the scale has been developed because the previous longer version had problems for use in large surveys. The scale consists of 6 items scored on a 5-point Likert scale. The scale has two subscales including emotional and social loneliness. The reliability and validity of the Persian version of the scale have been previously confirmed by psychometric research.²¹

Pittsburgh Sleep Quality Index

The Pittsburgh Sleep Quality Index (PSQI) measures sleep quality and patterns in older people. It consists of 18 items measuring 7 components. The PSQI total score ranges from 0 to 21. The higher score shows lower quality of sleep.²² A previous psychometric study evaluated the reliability and validity of the Persian version of the PSQI and confirmed it as a reliable and valid measure of sleep quality in Iranian older adults.²³

Socioeconomic Status Questionnaire for Urban Households

Socioeconomic status (SES) is the position of individuals or groups on the socioeconomic scale, which is determined by a combination of social and economic factors such as occupational prestige, income, and education.²⁴ This scale was developed in Iran and was determined as a valid and reliable index of SES.²⁵

Statistical Analysis

Descriptive data were presented as frequencies and percentages for categorical data and median and interquartile range (IQR) for continuous variables considering the non-normality of body mass index (BMI) and PSQI scores. The Mann-Whitney U test was used to compare the median of two independent groups. Furthermore, multiple logistic regression was used to determine the predictors of HTN among older people. All statistical analyses were conducted using SPSS version 23.0 and the level of significance was set at $P < 0.05$.

Results

Table 1 provides characteristics of the studied population. The mean age of the total population was 70.1 ± 7.9 (70.7 ± 8.0 for mean vs. 69.6 ± 7.8 for women). The prevalence of HTN was 81.0% in the total population. HTN was more prevalent among females (86.8% in females vs. 73.4% in males).

Table 1. Basic Characteristics of Older Adults in Tabriz in Terms of Blood Pressure Status

Characteristics		Blood pressure		Total	P Value
		Normotensive	Hypertensive		
Gender	Male	158 (26.6%)	436 (73.4%)	594 (43.6%)	<0.001 ^a
	Female	101 (13.2%)	666 (86.8%)	767 (56.4%)	
Marital status	Single	40 (10.8%)	332 (89.2%)	372 (27.3%)	<0.001 ^a
	Married	219 (22.1%)	770 (77.9%)	989 (72.7%)	
Education	Illiterate	94(14.3%)	563 (85.7%)	657 (48.3%)	<0.001 ^a
	Primary education	69 (19.1%)	292 (80.9%)	361 (26.5%)	
	Secondary education	70 (27.2%)	187 (72.8%)	257 (18.9%)	
	Higher education	26 (30.2%)	60 (69.8%)	86 (6.3%)	
Anxiety	Normal	146 (19.6%)	599 (80.4%)	745 (54.7%)	0.712 ^a
	borderline	49 (17.9%)	224 (82.1%)	273 (20.1%)	
	Abnormal	56 (17.7%)	260 (82.3%)	316 (23.2%)	
Depression	Normal	56 (23.2%)	185 (76.8%)	241 (18.1%)	0.073 ^a
	borderline	89 (19.5%)	368 (80.5%)	457 (34.4%)	
	Abnormal	105 (16.6%)	527 (83.4%)	632 (47.5%)	
Loneliness	Not lonely	134 (21.5%)	488 (78.5%)	622 (46.0%)	0.031 ^a
	Lonely	123 (16.9%)	606 (83.1%)	729 (54.0%)	
Social loneliness	Not socially lonely	157 (21.6%)	571 (78.4%)	728 (53.8%)	0.010 ^a
	Socially lonely	100 (16.0%)	524 (84.0%)	624 (46.2%)	
Emotional loneliness	Not emotionally lonely	37 (16.9%)	182 (83.1%)	219 (16.2%)	0.452 ^a
	Emotionally lonely	220 (19.4%)	913 (80.6%)	1133 (83.8%)	
Diabetes	DM-	217 (21.6%)	786 (78.4%)	1003 (73.7%)	<0.001 ^a
	DM+	42 (11.7%)	316 (88.3%)	358 (26.3%)	
Age decade	60-69	156 (21.1%)	584 (78.9%)	740 (54.4%)	0.035 ^a
	70-79	65 (15.1%)	366 (84.9%)	431 (31.7%)	
	≥80	38 (20.0%)	152 (80.0%)	190 (13.9%)	
Smoking	Not smoker	191 (16.9%)	940 (83.1%)	1131 (83.1%)	<0.001 ^a
	Quitting smoking	26 (27.4%)	69 (72.6%)	95 (7.0%)	
	Current smoker	42 (31.1%)	93 (68.9%)	135 (9.9%)	
SES	Very low level	28 (10.5%)	238 (89.5%)	266 (20.2%)	<0.001 ^a
	Low level	40 (15.8%)	213 (84.2%)	253 (19.3%)	
	Middle level	63 (21.9%)	225 (78.1%)	288 (21.9%)	
	High level	47 (19.3%)	197 (80.7%)	244 (18.6%)	
	Very high level	67 (25.5%)	196 (74.5%)	263 (20.0%)	
BMI, median (IQR)		27.5 (6.3)	29.4 (6.4)	29.0 (6.4)	<0.001 ^b
Sleep quality index, median (IQR)		4.0 (3.0)	5.0 (4.0)	5.0 (4.0)	<0.001 ^b

SES, socioeconomic status; BMI, body mass index; IQR, interquartile range.

^a P value calculated by the Mann-Whitney U test; ^b P value calculated by the chi-square test.

In the total population, 54.0% of respondents felt lonely. Loneliness was more common in females than in males (58.7% vs. 47.9%). Emotional loneliness was more common than social loneliness (83.8% vs. 46.2%).

Results showed that hypertensive and normotensive people were significantly different in terms of sex, level of education, social and total loneliness scores, diabetes mellitus (DM), age, smoking, BMI, and sleep quality score.

As shown in Table 2, HTN was associated with sex, marital status, BMI, educational level, smoking status,

DM, total loneliness score, social loneliness subscale of De Jong Gierveld Loneliness Scale, SES, depression score, and sleep quality score.

As shown in Table 3, social loneliness, low sleep quality, being single, lower levels of SES, DM, and higher levels of BMI increased the prevalence of HTN. In the multivariable model, after adjusting for age, sex, educational level, BMI, DM, and sleep quality, the association between social loneliness and HTN persisted. After adjusting the studied variables, social loneliness score (OR=1.16, 95% CI=1.02–1.32), BMI (OR=1.11, 95% CI=1.07–1.15),

Table 2. Univariate Logistic Regression Analysis for Determinants of Hypertension in Older Adults

Variables	OR	95% CI		P Value
		Lower	Upper	
Age	1.02	0.99	1.03	0.111
Gender (female)	2.39	1.81	3.15	<0.001
Marital status (married)	0.42	0.30	0.61	<0.001
BMI	1.10	1.07	1.14	<0.001
Education				
Illiteracy (Ref.)				
Primary	0.71	0.50	0.99	0.046
Secondary	0.45	0.31	0.63	<0.001
Higher	0.39	0.23	0.64	<0.001
Smoking				
Non-smoker (Ref.)				
Quitting smoking	0.54	0.34	0.87	0.011
Current smoker	0.45	0.30	0.67	<0.001
DM ⁺	2.08	1.46	2.96	<0.001
Total loneliness	1.12	1.02	1.23	0.019
Emotional loneliness	1.02	0.86	1.20	0.854
Social loneliness	1.15	1.04	1.29	0.010
SES				
Very low level (Ref.)				
Low level	0.63	0.37	1.05	0.076
Middle level	0.42	0.26	0.68	<0.001
High level	0.49	0.30	0.82	0.006
Very high level	0.34	0.21	0.56	<0.001
Anxiety	1.01	0.98	1.04	0.538
Depression	1.05	1.0	1.1	0.033
PSQI score	1.15	1.1	1.2	<0.001

OR, odds ratio; CI, confidence interval; PSQI, Pittsburgh Sleep Quality Index; DM, diabetes mellitus; BMI, body mass index; SES, socioeconomic status.

Table 3. Final Multivariable Logistic Regression Analysis for Determinants of Hypertension in Older Adults

Variables	OR	95% CI		P Value
		Lower	Upper	
Global PSQI score	1.23	1.06	1.19	<0.001
Marital status (married)	0.49	0.31	0.78	0.003
DM ⁺	1.56	1.03	2.31	0.034
Social loneliness subscale of the De Jong Loneliness Scale	1.16	1.02	1.32	0.020
BMI	1.11	1.07	1.15	<0.001
SES				
Very low level (Ref.)				
Low level	0.49	0.27	0.90	0.023
Middle level	0.47	0.26	0.85	0.010
High level	0.58	0.31	1.08	0.085
Very high level	0.44	0.24	0.80	0.006

OR, odds ratio; CI, confidence interval; PSQI, Pittsburgh Sleep Quality Index; DM, diabetes mellitus; BMI, body mass index; SES, socioeconomic status.

DM (OR=1.56, 95% CI=1.03-2.31), and sleep quality score (OR=1.23, 95% CI=1.06-1.19) were significantly associated with a higher risk of HTN. Marriage was independently associated with a decreased risk of HTN (OR=0.49, 95% CI=0.31-0.78). Additionally, higher levels of SES, compared to a very low level, reduced the chance of developing HTN (Table 3).

Discussion

The purpose of the present study was to examine the relationship between HTN and loneliness in older adults. The overall prevalence of HTN was 81.0% and it was more prevalent among older women. The prevalence of HTN in the present study was higher compared to other previous studies.^{3,6} Based on a systematic review, the prevalence of HTN in the Iranian general population was 22% (23.6% in men and 23.5% in women).²⁶ This discrepancy may be related to stricter criteria for defining HTN (BP ≥ 150/90 mm Hg)³ and the age group (≥ 50 years) of the studied population.⁶ In a large cohort study, the age-standardized prevalence of HTN was reported to be 41.8%, which is similar to our findings, and HTN was associated with sex.²⁷ Lloyd-Jones et al in a study proposed that the prevalence of HTN increased with age: 27.3% in participants aged < 60 years, 63.0% in participants aged 60 to 79 years, and 74.0% in those aged ≥ 80 years.¹¹

The pathogenesis of HTN remains incompletely understood. However, empirical evidence suggests that the SDH likely play a role. The SDH are non-biomedical factors that influence health status including the conditions in which people are born, grow, and age. SES is one of the essential components of SDH, which plays an important role in the prevalence of HTN.^{28,29}

According to our results, 54.0% of respondents felt lonely, and similar to earlier studies, loneliness was more common in females. In the study by Abolfathi Momtaz et al, about 30% of studied older adults reported a high level of loneliness.¹⁰ The prevalence of loneliness among U.S. Chinese older adults was 26.2% and higher in the older age and females.³⁰

The results of logistic regression showed the association between social loneliness and HTN after adjusting for age, sex, BMI, DM, and sleep quality. Research to date has demonstrated that loneliness is linked to several chronic physical health conditions like CVDs, including atherosclerosis and HTN.¹⁵ A 5-year cross-lagged analysis revealed that the feeling of loneliness increases the risk of negative health outcomes, including increased SBP.¹⁵

The mechanisms by which loneliness leads to HTN are not completely clear.¹⁵ Loneliness is complex and is likely mediated by psychological, health-related, and biological factors.³¹ Individuals' responses to stress and perceived stress are important in explaining the association between loneliness and CVD. Indeed, individuals with loneliness might cope less adaptively with stress, which may result in adverse effects on self-esteem and self-efficacy. This may in turn make them more prone to the pathogenic

influence of stress.^{13,31} Increased stress leads to a cascade of hormones that affect the cardiovascular system, blood pressure, and inflammatory responses.³²

According to the findings of observational studies, loneliness is associated with elevated cortisol levels which may contribute to HTN through its effects on the renin-angiotensin system as well as adrenergic receptors.^{10,15} Cortisol is also related to several clotting factors, such as fibrinogen and von Willebrand factor, which have also been shown to increase the risk of HTN.¹⁰ Moreover, it has been suggested that endothelial function, renal function, blood lipids, and inflammation are other mechanisms by which loneliness may affect BP.¹⁴ Another factor that may influence the relationship between BP and loneliness is the threat to one's sense of safety and security with others, which is known as an important component of loneliness. Additionally, hypervigilance to social threats can lead to physiological changes, including increased blood pressure.¹⁵

Sleep quality was significantly associated with a higher risk of HTN after adjusting for age, sex, BMI, DM, and social loneliness. The high global PSQI score was also associated with an increased risk of HTN.³³ The cross-sectional study conducted by Wang et al reported that short sleep duration is associated with HTN.³⁴ The results of the study by Yang et al showed that poor subjective sleep quality is associated with higher HTN prevalence.³⁵

Although the causal mechanisms of the relationship between sleep and BP are not clearly understood, it has been reported that sympathetic nerve activity plays a key role in the relationship between sleep and HTN.³⁶ Because of the decrease in the activity of the sympathetic system in the vasculature continuously during the non-rapid eye movement (NREM) sleep, stage of sleep, and the activity of the parasympathetic system in this stage, BP and heart rate decrease during the NREM sleep, especially during slow wave sleep. The existence of any problem in the quantity or quality of sleep can interfere with the activity of the parasympathetic system and cause an increase in the activity of the sympathetic system, which may result in the development of blood pressure or an increase in its intensity.³³

The findings of this study are in line with the findings of previous studies and confirm the concept that loneliness is closely related to high blood pressure, but more studies are needed to identify the mechanisms involved, and treatments should be provided accordingly.

Study Limitations

This study has several strengths, such as the use of a large sample size and representative sampling method. However, the present study had a number of limitations as well. First, given the reliance on survey data, these results are impacted by recall and non-response bias. Second, as a cross-sectional study, it is not possible to make reliable causal inferences.

Conclusions

The results of this study suggest that in Iranian older

adults, loneliness is independently associated with an increased risk of HTN. This finding raises important questions about the role of intervention programs in the comprehensive management of HTN in the older adult.

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Data availability statement

Data gathered for the study are available from the corresponding author upon reasonable request.

Ethical approval

The study protocol was reviewed and approved by the Research Ethics Committee of Tabriz University of Medical Sciences (TBZMED.REC.1395.684).

Consent for publication

Not applicable.

Conflict of interests

The authors declare that they have no conflict of interests.

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