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Prevalence of geriatric syndromes and associated factors in Iranian older adults with type 2 diabetes: A population-based correlational study

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ABSTRACT

Background & Aim: Geriatric syndromes are known as a major obstacle in the treatment and care of older adults with diabetes. This study aimed to determine the prevalence of geriatric syndromes and associated factors in community-dwelling older adults with diabetes in the south of Tehran, Iran, in 2022.
Methods & Materials: A population-based correlational study was conducted among 392 older adults with diabetes, covered by selected health centers in the south of Tehran, Iran, using the multistage sampling method. Persian forms of geriatric assessment tools were used, including Mini-Mental State Examination, Activities of Daily Living, Instrumental Activities of Daily Living, Mini Nutritional Assessment, and Geriatric Depression Scale. The obtained data were analyzed by descriptive and chi-square test in SPSS-26.
Results: The mean age of the participants was 69.5±6 years (63% female, 37% male). About 54.6% of the older adults with diabetes studied had three or more Geriatric syndromes. Polypharmacy was the most prevalent geriatric syndrome (76.5%). The number of geriatric syndromes had a significant association with female gender ($p<0.001$), lower education ($p<0.001$), loss of the spouse ($p= 0.004$), and lower-income ($p=0.019$). Also, with the increase in the number of diabetes comorbidities, the occurrence of all geriatric syndromes increased significantly ($p<0.001$).
Conclusion: The prevalence of geriatric syndromes in older adults with diabetes in the south of Tehran is very high and warning. Due to the increasing population of older adults in Iran, policymakers and healthcare providers should take appropriate actions to confront the issue with a comprehensive understanding of the present condition.

Introduction

Diabetes is the most common long-term metabolic condition in older adults, and it is associated with a high rate of vascular complications and subsequent disability and hospitalization (1). In addition to the known complications of diabetes, most of the common Geriatric Syndromes (GSs) may also be caused by diabetes or aggravated by it (2). Geriatric Syndromes are common clinical conditions such as pressure ulcers, urinary incontinence, falls, delirium, etc. in older people, which are often not classified into separate disease categories (3). Geriatric Syndromes are known as phenotypic manifestations of accumulated dysfunctions related to aging in different body organ systems, which influence the ultimate clinical outcome by pointing away the patient's chief complaint from the underling pathologic condition (4,5). In older adults with diabetes, the occurrence of GSs may increase due to the accumulation of advanced glycation end products (6).

Geriatric Syndromes can disrupt the care of diabetics and make it difficult to comply with the diet and treatment (6,7). Since GSs are multifactorial and share risk factors, healthcare providers should use a common concentric strategy for treatment and care of older adults with diabetes and any of these conditions (7).

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According to studies, falls, polypharmacy, depression, cognitive impairment, functional decline, nutritional impairment, and urinary incontinence are among the most related GSs to diabetes in older adults (7,8). Therefore, to assess GSs in diabetics, a comprehensive assessment of the physical, psychological, and functional dimensions of health is needed. Determining the prevalence of GSs can help to have a comprehensive view of the health problems, and it can be a very effective approach in prioritizing care needs and planning therapeutic interventions in older adults with diabetes.

On the other hand, identifying factors related to GSs can help to design appropriate interventions to reduce the occurrence of these problems in older adults with diabetes. Sociodemographic factors such as age, gender, marriage, education, and income are associated with general health and they can affect diabetes self-management (9,10). Moreover, different types of comorbidities can cause additional and complex impairments in old patients, and they can affect diabetics' abilities to successfully manage the disease and prevent hypoglycemia (11,12). Therefore, regarding the association between diabetes self-management and occurrence of GSs in older patients (4), these factors (Sociodemographic factors and diabetes comorbidities) can be related to the occurrence of GSs in older adults with diabetes, and they should be included in geriatric assessment.

Limited studies have been conducted on the prevalence of GSs through a comprehensive evaluation of older adults with diabetes, and the results obtained are different. In these studies, the prevalence of certain GSs and related factors have been investigated using geriatric assessment tools (13-15). For example, in a study conducted by Moon et al. (13) in South Korea, the prevalence of polypharmacy was 64.1% in older adults with diabetes and 31.6% in non-diabetic older people. After that, functional decline, falls, cognitive impairment, and urinary incontinence had a high prevalence in older adults with diabetes compared to non-diabetics. Vu et al.'s (14) study in Vietnam showed a high prevalence of visual impairment (94.2%) and multiple geriatric conditions (89.3%) in older adults with diabetes. However, in most studies (except Moon et al.'s (13) study), a clinical environment is often used for sampling and evaluating older adults with diabetes, while patients are usually referred to medical centers in the acute phase of disease and only hospitalized patients cannot represent the entire population of older adults with diabetes. On the other hand, such studies often depend on place and time, and the information obtained can differ in various geographical regions and periods.

Specifically, there is very limited information on the prevalence of GSs and related factors in older people with diabetes in Iran and other Middle Eastern countries. Considering the advantages of Comprehensive Geriatric Assessment (CGA), conducting research in this way could help healthcare providers adopt appropriate strategies for better management of diabetes in older adults and identify factors associated with negative outcomes. Therefore, the aim of the present study was to determine the prevalence of GSs and their associated factors in older adults with type 2 diabetes covered by health centers in the south of Tehran, Iran, in 2022. The objectives of the study were to determine: 1) The prevalence of GSs, 2) The association between GSs and sociodemographic factors and 3) The association between GSs and diabetes comorbidities.

Methods

The present research was a population-based correlational study that was conducted from June 1 to November 30, 2022. The study sample included 392 older adults with diabetes selected by a multistage sampling method from 16 comprehensive health centers covered by South Tehran Health Center (STHC). The STHC covers five municipal regions with a population of 1,530,122 people. About 100 health service units, including 28 active comprehensive health centers, are under the supervision of the STHC. The services provided in these centers include general medical services, nursing, mental health counseling, nutrition counseling, environmental and occupational health, etc.

For sampling, in the first stage, we considered five south municipal regions of Tehran as our primary sampling units. In the second stage, we selected three

comprehensive health centers randomly from each region as our secondary sampling units (In one of the regions, due to the impossibility of continuing sampling in one center, another one was added, and sampling was done from 4 centers).

In the third stage, we obtained a list of all older people with diabetes within those centers. Then, we randomly invited them to attend the centers during phone calls. This continued to the extent that about 25 older adults with diabetes were evaluated from each center, bringing the total number of samples to 392 (ultimate sampling units).

The inclusion criteria were: age 60 years and older, physician-diagnosed diabetes, not having an acute illness and the ability to communicate with the researcher, not having severe psycho-cognitive disorders that make it impossible to communicate and conduct an interview, not having a severe vision-hearing problem that would lead to disruptions in conducting tests.

The potentially eligible older adults were selected using the information available in the integrated system of the Ministry of Health in each center. Then, they were invited to attend the health centers through a phone call. In order to reach the sample size (n= 392, calculated by the statistics professor), about 1500 phone calls were made to the older adults or their family members, of which about 550 eligible diabetic older adults expressed their readiness to participate in the study, and finally, 392 older adults with diabetes were enrolled and evaluated by referring to the selected comprehensive health centers. The researcher conducted the evaluation process and completed the questionnaires through face-to-face interviews.

Reviewing the previous similar studies, we defined seven multifactorial conditions/impairments as GSs related to diabetes in older adults, including falls, polypharmacy, depression, cognitive impairment, functional decline, nutritional impairment, and urinary incontinence (7,8). To evaluate GSs, we used Persian forms of geriatric assessment tools, including Mini-Mental State Examination (MMSE), Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL), Mini Nutritional Assessment-Short Form (MNA-SF) and the Geriatric Depression Scale (GDS), which have been proven to be valid and reliable in past studies (16-20).

The Persian-validated version of ADL and IADL were used, presenting a sensitivity of 0.75 and specificity of 0.96, respectively, for both instruments in a sample of 300 older Iranian adults (16). Cronbach's alpha and Internal Correlation Coefficient were more than 0.75. The items of ADLs include personal hygiene, eating, dressing, transferring, walking, bathing, controlling the excretion of feces and urine, and using the toilet. The items of IADLs include using the phone, taking medicine, preparing food, housekeeping, shopping, using transportation, and handling finances (16). The ADL score ranges from 0 to 16 (0-7 as dependent, 8-11 as needing assistance, and 12-16 as independent). The IADL score ranges from 0 to 14 (0-6: dependent, 7-10: needing assistance, and 11-14: independent). Participants who were classified as "dependent" or "needing assistance" in the standard ADL and/or IADL classification were considered older adults with functional decline.

The validity and reliability of the Persian version of MMSE have been proven in previous studies (sensitivity: 90% and specificity: 84-93.5%, α= 0.78-0.81) (17, 18). Considering the high importance of correctly distinguishing older adults with cognitive impairment from those with normal cognitive status, after reviewing validity and reliability studies conducted in Iran and other countries, three different MMSE cut-off points were selected, taking into account the education of individuals: For the illiterate older adults, the cut-off point is 18, which has been approved to be the optimal screening cutoff for illiterate patients in mild cognitive impairment (22); for the older adults with primary education, the cut-off point is 22, according to the Seyedian's (18) study, which was conducted on literate older people; and for whom with secondary or higher education, the cut-off point is 23, which is recommended in western countries with a minimum of eight years education (17). Obtaining a score of $\leq$ cut-off point was considered as cognitive impairment.

The 11-item validated Persian version of GDS, which could be considered as a short form of the scale (α= 0.92), has significant correlation with the main scale (r=0.58) (19). GDS-11 was used to evaluate depression, and a score of 6 or above was considered as depression (sensitivity: 90% and specificity: 83%, in cut-off-point 6) (19).

The MNA-short form was used to evaluate the nutritional status of older adults. The Persian version of MNA was proved to be a valid and reliable tool for nutritional assessment in a study on 143 patients with Parkinson's disease (PD) as a chronic disease and 467 healthy individuals (20). Cronbach's α coefficient of the entire MNA was 0.66 and 0.70 in healthy individuals and PD patients, respectively (20). A score of less than 12 in the MNA-SF (undernourished and malnourished) was considered as nutritional impairment.

Three other GSs were evaluated by self-reported questionnaires according to previous studies (15,21). Taking 5 or more drugs per day was considered as polypharmacy (15). Falls were defined as one or more injurious fall experiences during the past 6 months (21), and urinary incontinence was defined as having mild to severe urine leakage (21).

Sociodemographic factors were investigated using a researcher-made questionnaire including information about age, gender, education, housing status, occupation, income, smoking, and type of diabetes treatment.

For comorbidities, 11 diseases or disorders that were considered as diabetes comorbidities in previous studies, were selected (23,24); which were evaluated by self-reporting as the main criterion or by reviewing medical records if available. They include arthritis, cardiovascular disease (history of angina or heart attack), history of stroke, heart failure, hypertension, hyperlipidemia, Chronic Obstructive Pulmonary Disease (COPD), cancer, obesity (BMI ≥ 30), vision or hearing impairment and Chronic Kidney Disease (CKD). To determine BMI, standard calibrated scales and stadiometers were used in selected health centers.

Data were described as means and standard deviation for continuous variables and as frequency and percentage for categorical variables. For the general prevalence of GSs, the study units were classified into three groups (having 2≥GSs, 3-4 GSs, and 5≤GSs) and the same was done for diabetes comorbidities (2≥ comorbidities, 3-5 comorbidities, and 6≤comorbidities). The chi-square test was used to examine the associations between sociodemographic factors and GSs, as well as the associations between diabetes comorbidities and GSs. Also, we determined the prevalence of each condition (GSs) and its association with sociodemographic factors separately for study units. In cases where the conditions of the chi-square test were not met, Fisher's exact test was used. For all tests, *P*-values< .05 were considered statistically significant. Data processing and analysis were carried out using IBM SPSS Statistics for Windows, version 26.

Ethics permission was obtained from the Joint Ethics Committee of the Faculty of Nursing and Midwifery and Faculty of Rehabilitation of Tehran University of Medical Sciences with approval ID IR.TUMS.FNM.REC.1401.022.

All procedures performed in the study involving human participants were in accordance with the ethical standards of the institutional and national research committee. After introducing the researcher and explaining the objectives of the study and the process of the interview, informed consent was obtained from the older adults participating in the study. For illiterate participants who could not read the paper and sign it, informed consent was taken from their family members/legal guardians (199 older adults). Participants or their family members signed informed consent regarding publishing the general and collective results of the study without mentioning their name.

Results

The mean age of the participants was 69.5 ± 6 years, of whom 63% were female, and 37% were male. About 50.8% were uneducated and 31.2% were without spouses (widowed, etc.). Most of the studied older adults with diabetes had 3 to 5 comorbidities in addition to

diabetes (62%). The baseline characteristics of the study population are shown in details in Table 1.

About 54.6% of the studied older adults with diabetes had three or more GSs. Among the studied GSs, polypharmacy was the most prevalent (76.5%), followed by functional decline (45.1%), urinary incontinence (43.1%), nutritional impairment (41.1%), depression (35.5%), and cognitive impairment (29.3%). The least frequent one was falls (16.6%) (Table 2).

Table 1. Scio-demographic characteristics of the study participants (n=392)

Characteristics	N	%	Characteristics	N	%
Age			**Type of residence**		
60–69	208	53.1	Private house	331	84.4
70–79	152	38.7	Rental	36	9.2
≥80	32	8.2	Living with others	25	6.4
Gender			**Smoking**		
Male	145	37	Yes	27	6.9
Female	247	63	No	365	93.1
Marital status			**Type of diabetes treatment**		
Single	2	0.5	Oral medications	300	76.5
Married	270	68.9	Insulin therapy	41	10.5
Widowed	119	30.4	Both	51	13
Divorced/Separated	1	0.3	**Comorbidities**		
Education			Arthritis	205	53
No schooling	119	50.8	History of angina or heart attack	160	41/3
Primary	116	29.6	Heart failure	29	7/5
Secondary- Tertiary	52	13.2	History of stroke	37	9/6
Academic	25	6.4	Hypertension	284	73/4
Employment status			Hyperlipidemia	273	70/5
Jobless	245	62.5	Obesity (BMI≥30)	39	10/1
Retired	138	35.2	Chronic Pulmonary Disease	21	5/4
Freelance job	9	2.3	Cancer	6	1/6
Income level			Vision or hearing impairments	198	51/2
No income	30	7.7	Chronic kidney disease	46	11/9
Low income	214	54.6	2≥ comorbidity	120	30.6
Average income	140	35.7	3-5 comorbidity	243	62
High income	8	2	6≤ comorbidity	29	7.4

Table 2. Prevalence of geriatric syndromes in Iranian older adults with type 2 diabetes

Geriatric syndromes	N	%
Polypharmacy	300	76.5
Falls	65	16.6
Urinary incontinence	169	43.1
Functional decline	177	45.2
Cognitive impairment	115	29.3
Depression	139	35.5
Nutritional impairment	161	41.1
Number of geriatric syndromes		
2≥ GSs	178	45.4
3-4 GSs	149	38
5≤ GSs	65	16.6

The number of GSs were generally associated with female gender (p<0.001), lower education (p<0.001), loss of spouse (p=0.004), not having personal housing (p=0.040), not receiving retirement pension (p<0.001), and lower income (p=0.019) (Table 3).

As well, regarding specific GSs: urinary incontinence was significantly associated with

older age (p=0.038), lower education (p=0.050), loss of spouse (p=0.002), not receiving retirement pension (p=0.033), and lower income (p=0.039). Falls were associated with insulin therapy (p=0.031), suggesting that older adults who used insulin to control blood sugar were more likely to report falling in the past 6 months than older adults who only took oral antidiabetic medications. Functional decline was significantly associated with older age, female gender, lower education, and not receiving retirement pension (p<0.001). Cognitive impairment had significant relationships with older age (p=0.007), female gender (p=0.004), lower education (p=0.001), loss of spouse (p=0.027) and not receiving a retirement pension (p=0.030). Surprisingly, older adults who smoke had less functional decline and cognitive impairment compared to non-smoking older adults (p=0.037, p=0.031, respectively). Depression was associated with female gender (p=0.007), lower education (p=0.001), not having personal housing (p<0.001), not receiving a retirement pension (p=0.001), and lower income (p<0.001). Nutritional impairment had a significant relationship with female gender (p=0.002), loss of spouse (p=0.016), and not receiving a retirement pension (p=0.020).

The study found a significant association between the number of diabetes comorbidities and all the studied GSs (Table 4). In a way that, with the increase in the number of comorbidities of diabetes, the occurrence of all GSs increased significantly. These findings suggest that the presence of multiple comorbidities in older adults with diabetes is associated with a higher prevalence of various GSs.

Table 3. Association between the number of geriatric syndromes and sociodemographic factors of study's subjects

Sociodemographic variable		The number of geriatric syndromes			p-value
		2≥ GS N (%)	3-4 GS N (%)	5≤ GS N (%)	
Age	60-69	106 (51.0)	75 (36.0)	27 (13.0)	0.052
	70–79	63 (41.4)	60 (39.5)	29 (19.1)	
	≥80	9 (28.1)	14 (43.8)	9 (28.1)	
Gender	Male	85 (58.6)	48 (33.1)	12 (08.3)	<0.001
	Female	93 (37.7)	101 (40.9)	53 (21.5)	
Education	No schooling	66 (33.2)	82 (41.2)	51 (25.6)	<0.001
	Primary	61 (52.6)	45 (38.8)	10 (08.6)	
	High school	31 (59.6)	18 (34.6)	3 (05.8)	
	Academic	20 (80.0)	4 (16.0)	1 (04.0)	
Marital status	Married	137 (50.7)	96 (35.6)	37 (13.7)	0.004
	Without spouse	41 (33.6)	53 (43.4)	28 (23.0)	
Residence	Private house	159 (48.0)	118 (35.6)	54 (16.3)	0.040
	Rental or other	19 (31.1)	31 (50.8)	11 (18.0)	
Employment status	Jobless	89 (36.3)	104 (42.4)	52 (21.2)	<0.001*
	Retired	82 (59.4)	43 (31.2)	13 (09.4)	
	Freelance job	7 (77.8)	2 (22.2)	0 (00.0)	
Income level	No income	8 (26.7)	15 (50.0)	7 (23.3)	0.019*
	Low income	87 (40.7)	86 (40.2)	41 (19.2)	
	Average income	77 (55.0)	46 (32.9)	17 (12.1)	
	High income	6 (75.0)	2 (25.0)	0 (00.0)	
Smoking	Yes	18 (66.7)	7 (25.9)	2 (07.4)	0.065
	No	160 (43.8)	142 (38.9)	63 (17.3)	
Diabetes treatment	Oral medications	140 (46.7)	111 (37.0)	49 (16.3)	0.657
	Insulin therapy	38 (41.3)	38 (41.3)	16 (17.4)	

Chi-square test results for the relationship between the number of geriatric syndromes and sociodemographic factors
*p-value of Fisher's exact test where the conditions of chi-square test were not met

Table 4. Association between geriatric syndromes and number of comorbidities among Iranian older adults with type 2 diabetes

Geriatric syndromes		The number of diabetes comorbidities			p-value
		2≥comorbidities N (%)	3-5comorbidities N (%)	6≤ comorbidities N (%)	
Polypharmacy	Yes	66 (22.0)	207 (69.0)	27 (09.0)	<0.001
	No	54 (58.7)	36 (39.1)	2 (02.2)	
Urinary incontinence	Yes	31 (18.3)	119 (70.4)	19 (11.2)	<0.001
	No	89 (39.9)	124 (55.6)	10 (04.5)	
Falls	Yes	13 (27.1)	42 (60.5)	10 (12.4)	0.008
	No	72 (32.7)	136 (61.5)	19 (05.8)	
Functional decline	Yes	48 (27.1)	107 (60.5)	22 (12.4)	0.002
	No	72 (33.5)	136 (63.3)	7 (03.3)	
Cognitive impairment	Yes	34 (29.6)	65 (56.5)	16 (13.9)	0.006
	No	86 (31.0)	178 (64.3)	13 (04.7)	
Depression	Yes	32 (23.0)	89 (64.0)	18 (12.9)	0.001
	No	88 (34.8)	154 (60.9)	11 (04.3)	
Nutritional impairment	Yes	41 (25.5)	103 (64.0)	17 (10.6)	0.044
	No	79 (34.2)	140 (60.6)	12 (05.2)	

Chi-square test results for the relationship between the number of diabetes comorbidities and geriatric syndromes

The first objective of the present study was to determine the prevalence of GSs in community-dwelling older adults with type 2 diabetes in the south of Tehran, Iran. According to the results, 38% of the studied older adults with diabetes had 3-4 of the studied GSs and 16.6% of them had 5 or more GSs. We tried to compare these results with the findings of some studies conducted in this field in Asian countries. In the study of Moon et al. (13), in South Korea, only 13.9% of older adults with diabetes had more than 2 GSs; whereas in the present study, 54.6% of older adults with diabetes had more than 2 GSs. The more advanced healthcare system and better socioeconomic status in South Korea can be among the reasons for this egregious difference. In a study by Liu et al. (15), in China, 59.1% of older people with type 2 diabetes had more than 2 GSs. The higher prevalence of GSs in the mentioned study is probably due to the difference in the research setting and its conduct on hospitalized older adults with diabetes, who are usually in the acute phase of the disease and have worse health conditions than non-hospitalized older people with diabetes. In another study by Yang et al. (25), on community-dwelling older adults with diabetes in Taiwan, among the eight GSs examined, polypharmacy was the most common condition with a prevalence of 46.6%, while in the present study, 76.5% of older adults with diabetes had polypharmacy.

Despite the similarity of the geriatric assessment tools used to investigate GSs in most studies, there are also some differences in the methods of investigation and types of GSs investigated. Also, there are not enough statistics and information about the prevalence of GSs in older adults with diabetes in the Middle Eastern countries. Therefore, it seems a bit difficult to compare the results of the present study with other studies conducted in this field. However, the general review of the results obtained from the present study indicates a very high prevalence of GSs in community-dwelling older adults with diabetes in the south of Tehran, Iran, compared to the average prevalence in previous studies. This indicates the inappropriate condition of various aspects of health (physical, mental, psychological, social, etc.) experienced by this population, which requires the consideration of health care providers to take necessary actions to address these common health problems in older adults with diabetes and improve their health status.

The second objective of the study was to determine the associations between GSs and sociodemographic factors. To confront or prevent any problem, the factors related to it must be identified to manage them. According to the results of the present study, female gender, lower level of education, loss of spouse, lower income, lack of personal housing, and not receiving a retirement pension were associated with GSs in older adults with

diabetes. These findings show the great influence of socioeconomic factors on the development of GSs in older people.

Liang et al.'s (21) study among Swedish older adults showed that factors such as older age, being widowed, unfavorable accommodation, financial stress, and chronic disease increase the risk of developing GSs. The study by Rausch et al. (10) also showed the relationship between the presence of GSs and various aspects of social position, including civil status, country of origin, level of education, type of housing, and financial stress. The study of Taheri Tanjani et al. (26), in Iran, showed that the geriatric-specific complications of older people were more common in females than in males, which is consistent with the findings of the present study. The higher prevalence of GSs in female older adults can be due to the fact that, compared to men, women usually have fewer physical and social activities and have a more negative attitude about their health status, so they express their physical and mental problems more severely than men. However, there is a need for more investigations and research to determine the role of sex hormones and other factors in this field.

A higher level of education usually leads to a reduction of stressors, better coping strategies and better cognitive and problem-solving abilities to prevent adverse health outcomes by increasing socioeconomic status (27). A potential explanation for the effect of education on cognitive function is that people with a higher level of education have a higher synaptic density in the cerebral cortex, which increases the brain's storage capacity, and thus delays the symptoms of dementia (28). Living with a spouse can also be a positive feature in preventing health problems due to the increased interactions and communications between couples. The higher prevalence of GSs in unemployed or housebound older people compared to retired or employed older adults may indicate the fact that social activities and financial support have positive effects on preventing health problems in older people.

Most previous studies have shown a direct relationship between smoking and cognitive impairment and dementia (29), while in the present study, older adults who smoke had less cognitive impairment compared to non-smokers. Functional impairment was also lower in smokers than non-smokers. These unexpected results obtained from the present study may warrant further investigations to understand the underlying mechanisms. Also, older adults who used insulin to treat diabetes were more likely to report falling in the past 6 months than older people who only took oral antidiabetic medications. Insulin therapy may represent intensive glycemic control, and hypoglycemia caused by it can partially explain the excess risk of falls associated with diabetes (30).

The third objective of the study was to determine the associations between diabetes comorbidities and GSs. The study findings revealed that with the increase in the number of diabetes comorbidities, the incidence of all GSs increased significantly. The results of other studies are also consistent with the results of the present research. In the study of Moonet al. (13), the number of GSs in older adults with diabetes was significantly associated with cardiovascular diseases and CKD. In the study of Vetrano et al. (12), in 9 of the 14 diseases examined (diabetes, hypertension, ischemic heart disease, heart failure, atrial fibrillation, dementia, cancer, COPD, and thyroid dysfunction), the number of GSs increased with the degree of comorbidity, and the final conclusion was that different diseases have a different effect on the occurrence of GSs. A review study by Lewandowicz et al. (2) also determined that the bidirectional relationships between diabetic complications, comorbidities, and problems related to glycemic control exacerbate GSs with a vicious cycle mechanism and ultimately lead to the deterioration of older patients' health and performance.

Therefore, it seems necessary to take into account the comorbidities of diabetes such as hypertension, hyperlipidemia, arthritis, heart diseases, sensory deficits, etc. in the treatment and care plan of older adults with diabetes in order to reduce the risk of GSs in these individuals. The comprehensive evaluation of

older adults with diabetes in terms of comorbidities and GSs is a more effective way for health care providers who are active in the field of geriatrics, such as physicians and nurses, to contextualize diabetes management and develop more patient-centered care plans, which leads to the improvement and effectiveness of therapeutic interventions.

Limitations

The present study had some limitations that should be acknowledged. One limitation is the potential selection bias in the study population. Some older people who were willing to participate in the study may have been unable to attend health centers due to various difficulties, such as acute medical conditions, movement limitations, and a lack of transportation facilities. These individuals, who are likely to have more unfavorable health conditions, were not included in the study, which may cause the prevalence of GSs to be underestimated in the older adults with diabetes.

Another limitation is the scope of the assessment conducted in the study. While efforts were made to evaluate the most important aspects of health in the older adults, including functional, cognitive, psychological, social, nutritional, medication use, andcomorbidities, a CGA requires a more multidimensional and specialized approach. Further investigations and collaborations are needed to conduct more detailed and specialized evaluations of the health problems in older adults with diabetes.

Conclusion

The high prevalence of GSs in the older adults with diabetes in the south of Tehran, Iran, indicates the unfavorable health condition experienced by these people. Given the increasing population of older adults in Iran, it is crucial for policymakers and healthcare providers to develop plans that address and prevent these issues based on a comprehensive understanding of the current condition. Identifying and supporting the vulnerable older people (e.g., female, widowed, uneducated), improving their socioeconomic status (i.e., income, education, residence), and preventing and managing comorbidities with a holistic view can be effective ways to deal with these common health problems in older adults with diabetes.

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Conflict of interests

The authors declare that they have no competing interests.

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