European Geriatric Medicine (2025) 16:1055–1061
https://doi.org/10.1007/s41999-025-01189-w

RESEARCH PAPER

Impact of geriatric syndrome burden on healthcare services utilization and mortality among community-dwelling older adults: is it still too late to do something?

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Received: 5 January 2025 / Accepted: 8 March 2025 / Published online: 22 March 2025

Key summary points

Aim This study aimed to explore the effects of geriatric syndromes and multimorbidity on health service utilization and all-cause mortality among adults aged 80 and older in the YASAM project.

Findings Community-dwelling older adults had higher rates of multimorbidity and geriatric syndrome burden. Multimorbidity increased the risk of outpatient, emergency, and hospital admissions, while higher geriatric syndrome burden and older ages were associated with fewer outpatient admissions.

Message This study highlights the urgent need for healthcare strategies that specifically address the complex health needs of the older adult, particularly those dealing with multimorbidity and geriatric syndromes. Even at advanced ages, targeted interventions can make a meaningful difference in reducing healthcare utilization and mortality. It is not too late to implement proactive, personalized care approaches to improve outcomes for these vulnerable individuals.

Abstract

Purpose The increasing longevity of the population emphasizes the need for a deeper understanding of geriatric syndromes and their implications for healthcare usage and mortality among older adults. This study aimed to identify risk factors associated with healthcare service utilization and mortality of community-dwelling adults aged 80 and older in YASAM project.

Methods This prospective cohort study was part of the HEAT–YASAM trial, which focused on the community-based integrated healthy aging program for individuals aged 80 years and older in Balıkesir, Türkiye. The burden of geriatric syndromes was assessed based on a comprehensive evaluation at least two domains of the nutrition, cognitive, physcological and locomotor capacities. The study outcome was healthcare services utilization (inpatient, outpatient, emergency admission) and all-cause mortality data obtained during follow-up period (9 months).

Results The cohort consisted of 5018 participants with a mean age of 85.8 years, predominantly female (53.1%). On the multivariable analysis, geriatric syndrome burden and Deyo Charlson Comorbidity index (D-CCI) score significant on independent predictors of 9-month mortality ($p=0.01$). Higher geriatric syndrome burden was linked to an approximately 10% lower risk for outpatient admissions ($p=0.01$) and every point increase in the D-CCI score was associated with a 1.3-fold increased risk of utilizing outpatient services ($p=0.01$). For multimorbidity, every point increase corresponded to a 2.6-fold higher risk of inpatient admissions ($p=0.01$) and a 1.2-fold higher risk of emergency admissions ($p=0.01$).

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Conclusions This study demonstrate that a geriatric syndrome burden and multimorbidity has a significant impact on healthcare utilization and mortality in adults aged 80 years and older. Integrated comprehensive, coordinated, and patient-centered care models for this population facing multiple geriatric syndromes could positively impact the healthcare system.
Trial registration The trial was prospectively registered at ClinicalTrials.gov. Identifier: NCT05993572 Registered on 15 July 2023.

Keywords Frailty · Geriatric assessment · Healthcare · Malnutrition · Mortality · Multimorbidity

Introduction

The number of older individuals has significantly increased over the past few decades [1]. This demographic shift has brought to the forefront the growing prevalence of geriatric syndromes, such as cognitive, mood, nutrition, and mobility impairments, among this vulnerable population [2]. The synergistic effect of these multiple geriatric syndromes, commonly referred to as the "geriatric syndrome burden," presents a significant public health challenge [3]. Numerous studies have shown that the presence of geriatric syndromes, either individually or together, is a strong predictor of negative health outcomes, including an increased risk of death [4, 5]. Regarding the higher mortality rate observed in the older population, it remains challenging to determine the precise collective or individual impact of geriatric syndromes and/or comorbidities on this outcome [6].

The healthcare system faces a complex challenge in addressing the healthcare utilization of the older population with a significant burden of geriatric syndromes [7]. Research has consistently shown that the presence of geriatric syndromes, such as frailty, is a strong predictor of increased healthcare utilization, including more frequent hospitalizations, longer lengths of stay, and higher rates of emergency department visits and nursing home admissions [8, 9]. Furthermore, outpatient clinics can be inaccessible for the older individuals due to mobility issues, further exacerbating the challenges in providing comprehensive and accessible healthcare [10]. In light of these concerns, the question arises: is it still too late to do something about the impact of geriatric syndromes on healthcare services utilization and mortality among community-dwelling older adults?

In the context of our recent research project-related integrated healthy aging program (YASAM), we have provided evidence that a substantial proportion of community-dwelling older adults within the study population is affected by geriatric syndromes, such as cognitive impairment, possible sarcopenia, and frailty [11]. Furthermore, these community-based integrated healthy aging program for the older participants has the potential to significantly reduce emergency admissions and may also reduce outpatient visits, although this effect has not yet reached statistical significance [11]. Given the vulnerability of older population, it is crucial to investigate the geriatric syndrome burden and their influence on healthcare services utilization and mortality. According to the World Health Organization (WHO), emphasizing especially four key domains of geriatric syndrome burden including nutritional, cognitive, psychological and locomotor capacity of older adults with helps create a more holistic view of aging, guiding clinicians and caregivers in developing better, individualized care plans that enhance quality of life and independence for older adults [12]. Therefore, we aimed to identify geriatric syndrome burden and multimorbidity to demonstrate their potential impact on healthcare utilization and mortality, as well as to define characteristics among community-dwelling older adults in YASAM project.

Methods

Study design and study population

The current study was a secondary analysis of data from the HEAT–YASAM trial conducted in Balıkesir, Turkey. The data set used in this analysis includes the information of older adults who participated in the project between 2023 and 2024 under the supervision and guidance of the YASAM project coordinator center in Balıkesir [11]. All 80 years and older adults in this program were included in this study and no exclusion criteria were employed. The informed consent was obtained from participants or primary relatives. This study was approved by the Clinical Research Ethics Committee of the Hospital, University of Health Sciences, and was conducted in accordance with the Declaration of Helsinki (Decision number: 2023-3-24, Clinical Trials.gov: NCT05993572).

Comprehensive geriatric assessment in older adults

To assess physical performance in activities of daily living (ADL), we used the ADL scale, which includes tasks, such as bathing, dressing, transferring, toileting, urinary control, and feeding. Participants were scored on a scale from 0 to 6, with lower scores indicating poorer functional performance. Scores of 5 or 6 indicated full functional capacity, 3 or 4 reflected moderate functional impairment, and 2 or below indicated severe functional impairment in daily activities [13].

In addition, we used the Instrumental Activities of Daily Living (IADL) scale to assess more complex tasks such as using the telephone, shopping, preparing meals, housework, and medication administration. IADL scores ranged from 0 to 8, with lower scores indicating greater difficulty in performing these tasks. Scores from 6 to 8 indicated full functionality, while scores between 4 and 6 show moderate dependency. Scores of 4 or less reflected a high level of dependency [14].

Frailty status was determined using the Clinical Frail Scale (CFS), which assigns a score between 1 and 9 depending on the degree of frailty, ranging from very fit to terminally ill. This scale provided valuable insights into the general state of health and vulnerability of the participants [15].

Geriatric syndrome burden, which defined as at least two problems in to main domain of comprehensive assessment which include nutrition, cognitive, physcological and locomotor capacities. These domains have been emphasized in the integrated care for older people (ICOPE) according to the WHO [12].

1. Nutrition: nutritional status was assessed using the Mini Nutrition Assessment–Short Form (MNA-SF), which examines factors, such as food intake, weight loss, mobility, mental stress, and body mass index. An MNA-SF score 11 or lower points indicated a risk of malnutrition [16].
2. Cognitive capacity: cognitive function was assessed using the Mini-Cog test, which assesses cognitive impairment using tasks involving memory and accuracy in drawing a clock [17]. In addition, the mini-mental state examination (MMSE) was used to assess various cognitive domains, such as orientation, attention, memory, and visuospatial abilities. Participants score 24 or lower indicated cognitive impairment in the participants [18].
3. Psychological capacity: depressive symptoms were measured using the PHQ-2 and the Yesavage Geriatric Depression Scale. The PHQ-2 questionnaire assessed the frequency of depressed mood and anhedonia, with scores ≥ 1 indicating a risk of depression [19]. The GDS-15 provided a comprehensive assessment of depressive symptoms in older adults using 15 items and helped identify individuals affective disorder. GDS-15 score higher from 5 indicated depression in participants [20].
4. Locomotor capacity, sarcopenia (possible), and fall (risk): physical mobility was assessed using the Chair Stand test (CST). This test measured the time it took participants to stand up five times with their arms crossed, providing valuable information about the participants' strength, balance and mobility. According to the Asian Working Group for Sarcopenia (AWGS) 2019, possible sarcopenia is defined as the chair-stand test (CST) five times taking ≥ 12 s [21]. Time-Up and Go (TUG) test was used for assessed of balance and physical performance. The TUG test measured the time it took them to walk to a 3 m, turn around, and return to a sitting position and TUG > 13.5 s indicated fall risk [22].

Data sources

In Türkiye, the person who is admitted to a healthcare utilization registered in the Turkish National Patient Registry [23]. These national registries included all data on hospital admission [24]. It can be found a detailed description of used databases from previous research [11].

Covariates

Existing comorbidities were used for the calculation of the modified Deyo–Charlson Comorbidity Index (D-CCI) score which assigns a weighted score to possible comorbid conditions based on the relative 1-year risk of mortality [25, 26].

Multimorbidity burden was defined as a individual having two or more concurrent chronic health conditions [27].

Study outcomes

The study outcome was healthcare services utilization (inpatient, outpatient, emergency admission) and all-cause mortality data obtained during follow-up period (9 months).

Statistical analysis

Continuous variables that are not normally distributed are presented as the median and 25th–75th interquartile range (IQR), whereas categorical data are presented as numbers and proportions. Univariate Cox regression analysis evaluated the association between the study variable and the outcomes. Subsequently, a multivariable Cox regression model was constructed to adjust for potential clinically and statistically significant variables. To avoid multicollinearity and interactions among study variables, geriatric syndrome burden including nutrition, cognitive, physcological, and locomotor capacities was considered as one of the structural variables of the study. The results were reported as hazard ratio (HR) and 95% confidence interval (95% CI). All statistical tests were two-tailed, and an alpha error of up to 5% was considered acceptable. All analyses were performed using SPSS (Statistical Package for Social Sciences) version 22.

Results

Basic characteristics

The study sample comprised 5018 individuals that 80 years and older with median age was 87 (25th–75th IQR: 84–90 years) years with a predominance of women in the total group (n: 2667, 53.1%). The prevalence of hypertension was 60.8%, diabetes mellitus was %15.3, coronary artery disease was 21.7% in the entire population. Cerebrovascular disease and chronic obstructive pulmonary disease was less than %10, respectively (5.4% and 6.6%). Individuals that 80 years and older with multimorbidity burden which defined as at least two comorbidies was aproximately half of the entire population (47.9%). Table 1 shows the baseline characteristics of the study population.

Over the course of the 9-month follow-up period, 49.1% of the older individuals visited the outpatient clinic, 29.9% visited the emergency department, and 4.9% were hospitalized. After the follow-up, 270 participants (0.05%) were determined to have dropped out, and mortality rate was 3% (Table 1).

Table 1 Characteristics of the study population

Variables	5018 (100%)
Demographic and clinical data	
Age (90 years and older), *n* (%)	1344 (26.8)
Gender, *n* (%)	
Female	2667 (53.1)
Geographical regions (Balikesir), *n* (%)	
Marmara	1253 (25.0)
Aegean	1104 (22.0)
Central	847 (16.9)
Eastern	931 (18.5)
Southern	884 (17.6)
Hypertension, *n* (%)	3014 (60.8)
Diabetes mellitus, *n* (%)	772 (15.3)
Coronary artery disease, *n* (%)	1088 (21.7)
Cerebrovascular disease, *n* (%)	273 (5.4)
Chronic obstructive pulmonary disease, *n* (%)	333 (6.6)
Modified D-CCI score, median (min–max)	2 (0–8)
Multimorbidity burden (≥ 2), *n* (%)	2406 (47.9)
Functional impairment (moderate or severe), *n* (%)	3440 (68.5)
Dependency (moderate or high), *n* (%)	2643 (52.7)
Frailty (moderate or severe), *n* (%)	1247 (24.8)
Sarcopenia (possible), *n* (%)	3984 (79.4)
Malnutrition, *n* (%)	1358 (27.1)
Fall (risk), *n* (%)	4024 (80.2)
Cognitive impairment, *n* (%)	1860 (37.1)
Affective disorder (depression), *n* (%)	423 (8.4)
Geriatric syndrome burden[1] (≥ 2), (%)	2830 (56.4)
Outcomes	
Hospital admissions[2]	
Outpatient clinic, *n* (%)	2333 (49.1)
Emergency room, *n* (%)	1412 (29.9)
Inpatient clinic, *n* (%)	248 (4.9)
Mortality (9 months)[2], *n* (%)	144 (3.0)

D-CCI Deyo Charlson comorbidity index

[1]Geriatric syndrome burden includes at least two domains of the nutrition, cognitive, physcological and locomotor capacities

[2]Loss of follow-up = 270 participants

Predictors of mortality and healthcare utilization including outpatient, inpatient and emergency admission

We analyzed the predictors for 9-month mortality using Cox regression model. The omnibus test confrmed that the model was highly significant ($-2LL = 1795.039$, $\chi^2(2) = 49.854$, $p = 0.01$). On the univariate Cox regression analysis, age, gender, D-CCI score, and geriatric syndrome burden were found independent risk factors for the 9-month mortality ($p < 0.01$). On the multivariable analysis, Geriatric syndrome burden (HR = 1.56; 95% CI 1.31–1.85; $p = 0.01$) and D-CCI score (HR = 1.24; 95% CI 1.07–1.44; $p = 0.01$) remained significant on independent predictors of 9-month mortality. Per each 1 point increase in baseline geriatric syndrome burden was associated with 1.6 times and D-CCI score was associated with 1.2 times increased risk of 9-month mortality (Table 2). Age, ($p = 0.02$) and gender ($p = 0.01$) also reach statistical signifcance in the multivariate Cox regression analysis.

We analyzed the predictors for outpatient clinic using Cox regression model. The omnibus test confrmed that the model was highly significant ($-2LL = 29{,}697.375$, $\chi^2(2) = 153.521$, $p = 0.01$). On the univariate Cox regression analysis, age, gender, multimorbidity, and geriatric syndrome burden were found independent risk factors for this outcome ($p < 0.01$). On the multivariable analysis, Geriatric syndrome burden ($p = 0.01$) and multimorbidity ($p = 0.01$) remained significant on independent predictors of utilization outpatient clinic. Per each 1 point increase in baseline geriatric syndrome burden was associated with aproximatly %10 lower risk for outpatient admission and for each 1 point increase D-CCI score was associated with 1.3 times increased risk of this outcome (Table 2). Age also reach statistical signifcance in the multivariate Cox regression analysis ($p = 0.01$).

We analyzed the predictors for inpatient clinic and emergency admission using Cox regression model. The omnibus test confrmed that the model was highly significant, respectively ($-2LL = 2644.940$, $\chi^2(2) = 44.433$, $p = 0.01$),

Table 2 Predictors of outcomes in the study population

Variables	9-month mortality		Outpatient clinic		Inpatient clinic		Emergency admission	
	Hazard ratio (95% CI)	*p* value	Hazard ratio (95% CI)	*p* value	Hazard ratio (95% CI)	*p* value	Hazard ratio (95% CI)	*p* value
Age (years)	1.06 (1.01–1.10)	**0.02**	0.66 (0.59–0.74)	**0.01**	–		–	
Gender (male)	3.86 (1.97–7.58)	**0.01**	–		1.72 (1.06–2.78)	**0.03**	–	
Multimorbidity burden	–		1.30 (1.19–1.42)	**0.01**	2.64 (1.91–3.64)	**0.01**	1.21 (1.08–1.36)	**0.01**
D-CCI score	1.24 (1.07–1.44)	**0.01**	–		–		–	
Geriatric syndrome burden[1]	1.56 (1.31–1.85)	**0.01**	0.91 (0.87–0.95)	**0.01**	1.13 (0.98–1.30)	0.08	0.98 (0.93–1.04)	0.52

Values given in bold indicate statistically significant results ($p < 0.05$)

CI confidence interval; *D-CCI* Deyo–Charlson comorbidity index

[1]Geriatric syndrome burden includes at least two domains of the nutrition, cognitive, physcological and locomotor capacities

($-2LL = 17{,}088.571$, $\chi^2(2) = 9995$, $p = 0.007$). Per each 1 point increase in multimorbidity burden was associated with aproximatly 2.6 higher risk for outpatient admission and 1.2 higher risk for emergency admission ($p = 0.01$) and ($p = 0.01$). Geriatric syndrome burden did not reach statically significance for these outcomes ($p > 0.05$).

Discussion

The findings of this study on the older community-dwelling adults yielded three key insights. First, this population exhibits a higher prevalence of multimorbidity and geriatric syndrome burden. Second, our findings indicated a significant correlation between the prevalence of comorbidities and the incidence of geriatric syndromes and mortality. Furthermore, a high comorbidity burden was associated with an increased risk of admission to the outpatient clinic, emergency department, and hospitalization. Third, in contrast with the findings of previous studies, a high burden of geriatric syndromes and older age was found to be inversely related to outpatient admission [28, 29]. In other words, older individuals who have a higher burden of geriatric syndromes particularly benefit from the YASAM project in terms of healthcare utilization. Based on these findings, we can suggest that integrated care models for this population could positively impact the healthcare system. These models can provide comprehensive, coordinated, and patient-centered care, especially for older individuals facing multiple geriatric syndromes.

It is important to note that geriatric syndromes are not simply a result of the ageing process; rather, they are multifactorial conditions resulting from the interaction of biological changes associated with ageing and environmental factors [30]. Our findings prove that both geriatric syndromes and comorbidities significantly influence mortality, with geriatric syndromes being particularly critical [31]. This aligns with existing literature that emphasises the profound impact of these syndromes on overall health outcomes in older adults [32, 33]. The early identification and management of geriatric syndromes may prove an effective strategy for reducing mortality rates among this vulnerable population [34].

The current literature indicates that older adults with a greater prevalence of geriatric syndromes and comorbidities are more likely to have complex medical needs and require frequent healthcare services [35]. This is reflected in their higher rates of hospitalization, emergency department admission, and specialist consultations in comparison with individuals in better health [36]. Our comprehensive analysis indicates that older adults who experience a higher burden of geriatric syndromes, such as malnutrition, falls, sarcopenia, depression and cognitive impairment, tend to demonstrate a reduced utilization of outpatient clinic services in comparison with their counterparts with a lower syndrome burden. This trend may be influenced by a multitude of factors, including physical limitations that affect mobility, cognitive decline impacting decision-making and scheduling, as well as a lack of available social support to assist with transportation and appointment coordination [37]. It is possible to assume that due to the potential reasons mentioned earlier, these individuals might postpone seeking medical help until their conditions have worsened to a point, where they need extensive medical treatment and can no longer be managed at home [38, 39]. Furthermore, our research emphasizes the necessity for a multidisciplinary approach to address the diverse and complex needs of older adults with geriatric syndromes. It is vital to consider not only medical interventions but also social support, mental health services, and environmental modifications to ensure a comprehensive approach to the care of this vulnerable population [40].

The strengths of this study, it is notable that the sample included a substantial number of participants aged 80 years and older, reflecting a population that is representative of the general older adult population without the imposition of exclusionary criteria. This enhances the generalisability of the findings, particularly concerning healthcare service utilization and mortality predictors. However, it is important to consider the limitations of the study as well. The utilisation of existing registries for data collection may potentially introduce biases or inaccuracies, depending on the completeness and quality of the records. Furthermore, while the study captures significant predictors for mortality, the observational nature may limit causal inferences about the relationships between certain comorbidities and health outcomes over time. Moreover, we considered geriatric syndrome burden and multimorbidity in the form of a binary structural variable, it was not possible to assess the full range of geriatric syndromes or comorbidities.

In conclusion, the impact of geriatric syndromes on healthcare services utilization and mortality among community-dwelling older adults represents a significant challenge that cannot be disregarded. To effectively address this issue, a collaborative approach involving healthcare professionals, policymakers, and the community is essential.

Acknowledgements The authors thank all the participants and healthcare personnel in the YASAM center and the provincial health department involved in the study.

Author contributions Conceptualization: B.K. and S.E.K. Methodology: B.K. and S.E.K. Formal analysis and investigation: B.K. and S.E.K. Writing—original draft preparation: B.K. Writing—review and editing: B.K. and S.E.K. Supervision: B.K. and S.E.K.

Funding This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability The data that support the findings of this study are available upon reasonable request from the corresponding author.

Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Ethical approval This study was approved by the Clinical Research Ethics Committee of the Hospital, University of Health Sciences, and was conducted in accordance with the Declaration of Helsinki (Decision number:2023-3-24, Clinical Trials.gov: NCT05993572).

Informed consent Verbal and written informed consent was obtained from participants or relatives who agreed to take part in the YASAM project.

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